Rural Health Status and Health Care in Bihar: A Case Study

Abhinav Singh Yadav[1], Vayu Tewari[2], Dr. Pulliah Cheepi[3]

[1]Masters in Economics, Department of Economic Studies, Central University of Punjab, Bathinda.
Email ID: jnu.abhinav@gmail.com   Orcid ID: 0009-0001-3638-7900

[2]Research Scholar, Department of Financial Admimistration, Central University of Punjab, Bathinda
Email ID: vayutewari@gmail.com   Orcid ID: 0009-0004-2819-7498

[3]Assistant Professor, Department of Economic Studies, Central University of Punjab, Bathinda.
Email ID: drcheepi@gmail.com

ABSTRACT

The population of rural areas face distinct health challenges due to economic conditions, cultural/behavioural factors, and health provider shortages that combine to impose striking disparities in health outcomes among them. Physician shortages persist in many rural communities and the proportion of rural hospitals under financial stress is much higher than urban hospitals. The healthcare situation in select rural areas is unfavourably compared to the rest of the country. Government policies have attempted to address some of these inequalities by encouraging network development and awareness. Public health infrastructure in rural Bihar is not well understood, but it is potentially the most fragile aspect of the rural healthcare continuum. Investing in health not only improves the performance of individuals but also supports long-run growth and prosperity. In rural Bihar, government health infrastructure and facilities are not appropriate for meeting these challenges. Rohtas district has a population of 2.96 million of which 85.54% resides in rural areas. A major priority of health service providers has been to improve the health of 'disadvantaged' rural communities, particularly the rural poor, infants, women, children and the disabled. The Ministry of Health and Family Welfare is the main healthcare provider for rural communities, with general practitioners also playing a supporting role. By using primary data and regression analysis from a case study conducted in Rohtas district, evaluate the role of socio-economic variables, particularly income, literacy and healthcare infrastructure, in shaping health expenditure behaviour among households. The study recommends that addressing Bihar's rural inequalities cannot be possible only through financial assistance, rather a holistic policy is needed, which addresses educational awareness, healthcare infrastructure and economic support mechanisms.

Keywords: Rural health expenditure, Rural health status, Socio-economic health impact, Rural health infrastructure, female literacy and health outcomes, economic burden of healthcare

1. INTRODUCTION

Rural health in Bihar faces several major challenges, including poor health status, limited availability of health services, and wide disparities between districts (Anand, 2014). The state lags behind more developed regions such as Kerala in health indices, where literacy is strongly correlated with health outcomes (Basu, 2017). Key problems include unsafe drinking water, with chemical and faecal contamination posing risks to rural communities (Mishra, 2009). Major causes of poor health in rural areas of Bihar include lack of local health clinics, neglect of diet and personal hygiene, and shortage of medical personnel (M. Hooda M. R., 2021). Although national health policies aim to address these problems, their effectiveness varies regionally (Arnab Jana, 2017). Innovations such as Internet of Things (IoT) based health monitoring systems have been suggested to increase access to healthcare services in rural areas. These systems provide the ability to monitor the health status of patients in real-time through various devices and sensors, allowing doctors to easily access patient information even at remote locations and provide timely medical assistance. This can improve the availability and quality of health services, especially in areas where medical facilities are limited and inaccessible (M. Hooda M. R., 2021). A comprehensive strategy is needed to tackle rural health challenges in Bihar, including improving infrastructure, strengthening education, and using technological solutions.

Determinants affecting health expenditure in rural areas include income, education, household characteristics, and availability of healthcare infrastructure. Income plays an important role, as higher-income groups tend to have an income-elastic response, spending more on the treatment of short-term and long-term illnesses (Mathiyazhagan, 2003). Education

also has a positive effect on health expenditure, although its effect is relatively weaker than that of income (Rout, 2008). Household factors, such as age, size, religion, caste, and whether the household is in an urban or rural area, affect health expenditure (Ram, 2021). The lack of adequate government health infrastructure in rural areas causes individuals to incur higher out-of-pocket expenses (Das, 2012). These factors influence health expenditure patterns in rural areas and emphasise the urgent need to improve access and affordability of healthcare.

Particularly in emerging countries, health expenditure has a significant impact on both influencing health outcomes and promoting economic growth (Sengupta, 2015). Most healthcare costs in rural India are paid out of pocket, placing a heavy financial burden on families. According to 2013-14 data, families accounted for 64.2% of all health expenditure, which shows how big a financial burden many people face when trying to access healthcare. However, at the same time, government spending was only 28.6% of total spending, reflecting the discrepancy between public financing and individual spending. (Gumber, Lalitha, & Dhak, 2017). Public and private health expenditures complement each other, where government spending focuses mainly on personnel salaries, while households bear the cost of medicines and diagnostic services. Low-income households rely more on public health facilities, while affluent groups prefer private health services (Musgrove, 1996). Catastrophic health expenditure (CHE) affects 57.9% of households belonging to the lower-middle and lower socio-economic classes, with a particularly higher prevalence among factory and agricultural workers (Viramgami, Upadhyay, & Balachandar, 2020). Increased use of healthcare services, particularly through more frequent visits to medical professionals, can substantially reduce the likelihood of individuals reporting unmet health needs (Barham, Bataineh, & Devlin, 2017).

2. MATERIAL AND METHODS

Objective

- To study the health status of the rural people in Bihar (Rohtas District)
- To examine the impact of health expenditure on family per capita income, consciousness, and access to safe drinking water or medical facilities in rural households of Rohtas District.

Hypothesis

- There is a significant difference in the overall health status among rural populations.
- Impact of health expenditures on medical facilities.

Sources of Data

Both primary and secondary data have been used for this study. Primary data was collected directly from the field using questionnaires. Economic Survey of Bihar published by Finance Department, Government of Bihar; the 2011 census report published by the Government of India; Sample Registration System, Office of the Registrar General, India and Economic Survey published by Ministry of Finance, Government of India is used as secondary sources of data. Some other secondary data has been downloaded from the website of the Niti Aayog, The National Medical Commission and the World Health Organisation, Global Health Expenditure Database.

Methodology

Primary data were collected directly from the field, using a multi-stage simple random sampling method, facilitated through SPSS software, to ensure a representative and unbiased sample of the district of Bihar for health economic analysis. The sampling process began with the selection of Rohtas district from among 38 districts of Bihar. In the second stage, four community development (CD) blocks were selected from the 19 blocks of Rohtas district. Sasaram, Nokha, Chenari and Dinara were randomly selected as focus blocks for the study. In the third stage, one village was selected from each block using SPSS: Mahraniya (Sasaram), Bhanpur (Dinara), Penar (Nokha) and Pakriya (Chenari). In the last stage, 25 to 30 households were randomly selected from each village, totalling 109 households.

For analysis, a comparative study is conducted between the health status of India and Bihar using tables and graphs. Next, descriptive statistics of the study variables are analysed for the case study. This cross-sectional study employed multiple linear regression analysis to identify potential determinants of rural health expenditure.

A Comparative Study on Health Status of India and Bihar.

Health expenditure in India (about 1.97 **per cent of GDP) is significantly lower than** in other developing countries such as Brazil (3.4 per cent of GDP), Sri Lanka (1.8 per cent of GDP), China (1.9 per cent of GDP), Thailand (2.1 per cent of GDP) and Malaysia (1.5 per cent of GDP). As a result, private spending on health in India, which is about 4.5 per cent of GDP, is higher than in many other countries. A recent report by the Confederation of Indian Industry shows that private spending on health care currently stands at 4.2 per cent of GDP. The market expansion for health insurance will be further aided by this trend. While public health expenditure does not become a burden for those who can afford the rising medical costs, it is a major challenge for those who are not able to spend more on health care, especially in rural areas. According to the 2011 Census, over 69 per cent of India's population resides in rural areas, where per capita family income is significantly lower

Abhinav Singh Yadav, Vayu Tewari, Dr. Pulliah Cheepi

than in urban areas.

Table 1 Public Expenditure on Health as a percentage of total expenditure from Central Government and as a percentage of GDP.

| Year | As a per cent of Total Govt Expenditure | | As a per cent of GDP | |
	Central	Bihar	Central	Bihar
2014-15	3.9	4.5	1.13	0.81
2015-16	4.7	5.2	1.18	0.81
2016-17	5	4.4	1.22	0.81
2017-18	5.4	4.4	1.35	0.74
2018-19	5.3	4.4	1.28	0.81
2019-20	5	4.6	1.35	0.94
2020-21	5	5.2	1.6	1.08
2021-22	6.9	6.3	1.84	1.04
2022-23	6.9	7.2	2.1	1.12
2023-24	6.5	7	1.97	1.17

Source: Bihar Economic Survey, Government of Bihar; National Health Accounts, Government of India.

The Bihar government has a health consumer commission running. The lack of priority given to healthcare is evident from Table 1, which projects public health expenditure from 2014-15 to 2023-24 to be only 3-7% of total government expenditure and less than 2% of Gross Domestic Product. In the context of overall economic growth, this low investment, which is spread across both rural and urban Bihar, shows that health is being overlooked.

These efforts are failing to target healthcare schemes at the rural level in Bihar, despite the fact that the current budget estimates an increase in health expenditure and that nominal and real growth rates in per capita public health expenditure have increased.

Table 2 Population and Percentage Decennial Growth Rate of Assam and Bihar.

| State | Population 2011 | | Decennial Growth Rate (In %) | | | |
	Rural	Urban	1971-81	1981-91	1991-01	2001-11
Bihar	9,23,41,436	1,17,58,016	24.06	23.49	28.62	25.4
India	83,34,63,448	37,71,06,125	24.66	23.5	21.54	17.7

Sources: Census of India, 2011

Let us now look at the actual situation in Bihar. The state's socio-economic conditions and population control policies have had a significant impact on Bihar's decadal growth rate over time. Due to high fertility rates and lack of effective population control methods, the growth over time. During 1991-01, the population growth rate again increased to 28.62%, reflecting the state's lack of education and health services and migration. The growth rate declined to 25.40% in 2001-11, reflecting to some extent the impact of population control measures and out-migration for employment. Therefore, the development of socio-economic and health services in the state is closely linked to changes in the population growth rate of Bihar.

Table 3 Administrative Division, Primary Health Centres (PHCs) and Population Density

| State | Administrative Division | | | | Population Density | PHC Functioning | Village-PHC Ratio |
	Districts	Blocks	Villages	Town			
Bihar	38	534	44,874	199	1,106	1,492	30.07
India	640	6,629	6,40,932	7,933	382	24,935	25.7

Source: Rural Health Statistics 2021-22

In the context of Bihar and India, Table 2 compares the status of various administrative and basic health infrastructures. These infrastructures are important indicators of the developmental pattern and access to health care in both regions. Bihar has 38 districts and 534 blocks, while the whole of India has 640 districts and 6,629 blocks. This shows that Bihar has a relatively smaller administrative structure, which may impact the implementation of development plans. Bihar has 44,874 villages and 199 towns, while the number in India is 6,40,932 and 7,933 respectively. Bihar has more villages but the number of towns is limited, which shows the relatively low urbanisation of the state. Bihar has a population density of 1,106 persons per square kilometre, which is three times the Indian average of 382. This high population density puts heavy pressure on the health, education and basic services of the state. Bihar has 1,492 functioning Primary Health Centres (PHCs), while the number in the whole of India is 24,935. Bihar has 30.07 villages per PHC, which is higher than the Indian average of 25.70 villages per PHC. This shows that access to health services in Bihar is low and the availability of PHCs is uneven in rural areas. Overall, this shows Bihar faces many challenges due to high population density, limited health services and small administrative structure.

Table 4 Shortfall in Health Infrastructure as per 2011 Census

State	Sub-Centre			PHC			CHC		
	R	P	S	R	P	S	R	P	S
Bihar	22,238	9,375	12,863	3,698	1,492	2,206	924	269	655
India	1,93,310	1,57,935	48,060	31,640	24,935	9,742	7,894	5,480	2,852

Source: Rural Health Statistics 2021-22

Table 4 compares the health infrastructure of Bihar and India, showing the gap between the requirements and the current status of sub-centres, primary health centres (PHCs), and community health centres (CHCs). Bihar has a requirement of 22,238 sub-centres but only 9,375 are functional, leaving a shortfall of 12,863, while the entire India has a requirement of 1,93,310 sub-centres but only 1,57,935 are available, leaving a shortfall of 48,060. Similarly, Bihar has a requirement of 3,698 PHCs but only 1,492 are functional, leaving a shortfall of 2,206, while India has a requirement of 31,640 PHCs but only 24,935 are functional, leaving a shortfall of 9,742. In terms of community health centres, Bihar has a requirement of 924 but only 269 are functional, leaving a shortfall of 655, while at the national level, there is a requirement of 7,894 and 5,480 are functional, leaving a shortfall of 2,852. This comparative study shows that the state of health services in Bihar is much weaker than the national average, and there is a shortage of a large number of health centres, especially in rural areas.

Table 5 Population Served Per Doctor in Assam and Bihar

State	Number of Doctors	Population served per Doctor
Bihar	48,192	2160.09
India	13,08,009	925.5

Source: Rural Health Statistics 2021-22

Table 5 compares the population and number of doctors treated per doctor in Bihar with the national average for India. Each of the 48,192 doctors in Bihar is responsible for caring for approximately 2,160 patients. This is much higher than the national average, where India has 13,08,009 doctors and 925 patients per doctor. This disparity suggests that Bihar, where the population-to-doctor ratio is more than twice the national average, has a severe shortage of healthcare. This suggests that the state may face greater challenges in providing healthcare, and the shortage of medical professionals per population may result in problems with quality and access to treatment.

A Case Study of Rohtas District of Bihar

In this analysis, we focus on health expenditure by studying a small cross-sectional sample of 109 observations from the Rohtas district of Bihar. This district is economically underdeveloped and is located in the southern part of Bihar. The 2011 Census indicates, the total population of Rohtas district is about three million, of which 85.55% live in rural areas and the rest in urban areas. This densely populated district (770 persons per sq. km.) has limited health facilities, which include one district hospital, three CHCs, 19 PHCs, five Gramin Kalyan Yojana centres and nursing homes that are not in good condition. As mentioned earlier, there are only 19 PHCs in 2072 villages of this district, serving 25,32,153 rural people as per the 2011 census, i.e. one PHC for every 1,33,271 persons. A brief geographical description is given in the table.

Table 6: Rohtas District Profile

Area (in sq km)	3847.82
Rural Population	25,32,153
Urban Population	4,27,765
Population Density	770
No. of Subcentres	259
No. of PHCs	19
No. of CHCs	4
No. of District Hospital	1

Source: Census of India, 2011; RHS-2023

Descriptive Statistics

Several variables are considered in this analysis, including health expenditure (MEDEXP), family income (Y), and family size. Family size is divided into several children (aged up to six years), youth group (aged 7-18 years), and adult members, which are further classified as adult male (ADULTMAL) and adult female (ADULTFEM). Literacy is taken as a variable to assess awareness, which is divided into adult literate males (AML) and adult literate females (AFL). Additionally, expenditures necessary for daily life such as food expenditure (FOODEXP) and other expenditures including education (EXP) are also taken into account. Two binary dummy variables are also included: access to essential medical facilities (MEDFACIL) and safe drinking water (DW). Other variables include per capita health expenditure (PCME), per capita income (PCY), per capita food expenditure (PCFE), and other per capita expenditure (PCE); These mainly represent generalised expenditure and income.

Table 7. Descriptive Statistics of the Variables

Variables	Mean	Std Dev.	Skewness	Kurtosis	Minimum	Maximum
MEDEXP	2.6	1.415	0.43	1.122	1	5
PCME	1.85	1.079	1.381	1.453	1	5
Y	2.97	0.995	0.286	0.169	1	5
PCY	3.29	1.328	-0.172	-1.028	1	5
FAMILY	2.57	0.685	0.45	-0.373	1	4
CHILDREN	1.07	0.295	4.357	20.372	1	3
YOUNG	1.2	0.505	2.957	10.211	1	4
ADULTFEM	1.29	0.477	1.177	0.032	1	3
AML	1.53	0.617	0.959	1.13	1	4
AFL	1.25	0.455	1.483	0.985	1	3
EXP	3.11	1.41	-0.179	-1.134	1	5
FOODEXP	3.13	1.375	-0.236	-1.105	1	5
PCFE	3.14	1.364	-0.432	-1.105	1	5
PCE	2.91	1.351	0.009	-1.013	1	5
DW	1.19	0.396	1.58	0.507	1	2
MEDFACIL	1.38	0.487	0.519	-1.764	1	2

Source: Primary data collected from field survey.

Regression Analysis

A multiple regression analysis took per capita health expenditure (PCME) as the dependent variable to identify the possible factors influencing health expenditure. The explanatory variables used in this analysis are the following: adult male literate (AML), adult females literate (AFL), per capita income (PCY), per capita food expenditure (PCFE), other per capita expenditure for living (PCE), availability of medical facilities (MEDFACIL), and availability of safe drinking water (DW). **Accordingly, the regression equation can be expressed as**:

$$PCME_i = \alpha + \beta_1 AML_i + \beta_2 AFL_i + \beta_3 PCY_i + \beta_4 PCE_i + \beta_5 PCFE_i + \beta_6 MEDFACIL_i + \beta_7 DW_i + u_i$$

where, $u_i \rightarrow$ random error $\forall$ observation

$$MEDFACIL_i = \begin{cases} 1 \ getting \ govt. health \ facilities \\ 0 \ otherwise \end{cases}$$

$$DW_i = \begin{cases} 1 \ getting \ safe \ drinking \ water \\ 0 \ otherwise \end{cases}$$

Literacy is included as a variable because it plays a role in influencing the awareness and consciousness of individuals, this awareness of diseases and ability to make decisions about treatment can influence their medical expenditure. Although per capita income is undoubtedly an important indicator of health expenditure, it is not the only determinant for medical expenditure.

Living expenditure is also an important factor, which can be divided into two categories: food expenditure and non-food expenditure. Excessive spending in these areas can reduce private health expenditures. Two dummy variables are included to capture this effect: access to adequate government health facilities, which can reduce private health expenditure, and access to safe drinking water, which is an important factor because unsafe water is a major cause of poor health.

Regression analysis is based on primary survey data. The resulting estimated regression equation is:

$$PCME_i = 0.589 + 0.012 AML_i + 0.269*AFL_i + 0.47 PCY_i + 0.091 PCE_i$$
$$\qquad\qquad (0.90) \qquad\qquad (0.004) \qquad\qquad (0.61) \qquad\qquad (0.349)$$
$$+ 0.246*PCFE_i + 0.081 MEDFACIL_i + 0.105 DW_i$$
$$\qquad\qquad (0.009) \qquad\qquad (0.42) \qquad\qquad (0.31)$$

The values in parentheses represent probability values; R Squared = 0.177, Adjusted R-squared= 0.119, F-Value= 3.093, Durbin-Watson Statistic = 1.999, with seven degrees of freedom.

Adult female literacy is statistically significant at the 0.4% level, with a positive and high coefficient. This indicates that as literacy, awareness and health consciousness among adult women increase, it has a strong effect on reducing health expenditure, possibly through increased personal care practices. Additionally, per capita food expenditure is found to have a significant relationship with health expenditure. **Of the seven variables included in the model**, only these two are statistically significant.

It is notable in the model that the per capita income variable does not have a significant impact on per capita health expenditure, which is unexpected. In contrast, education emerges as an important determinant, showing a significant impact on health expenditure.

3. CONCLUSION

The findings show that a complex situation heavily influenced by socio-economic constraints, lack of long-run investment and high population density puts immense pressure on the state's health facilities. The real impact of these challenges is manifest not only in the disparities between rural and urban health outcomes in Bihar but also in the wide gap compared to national standards. The findings suggest that while income influences health expenditure, adult female literacy emerges as a powerful determinant of health-conscious behaviour and reducing costs through preventive actions.

According to its analysis, economic resources will not be sufficient to enhance Bihar's rural health if public health knowledge and literacy do not increase at the same time. The statistically significant impact of adult female literacy makes it a valuable policy tool for improving health outcomes in rural areas and encourages support for initiatives that align health service delivery with educational understanding. Prioritising female education, combined with improvements in healthcare delivery, could have transformative benefits in health and well-being in Bihar's rural communities, laying the foundation for more equitable health standards in the region.

Abhinav Singh Yadav, Vayu Tewari, Dr. Pulliah Cheepi

REFERENCES

[1] Anand, M. (2014). Health status and health care services in Uttar Pradesh and Bihar: a comparative study. *Indian journal of public health, 58*(3), 174–179. doi:10.4103/0019-557X.138624

[2] Arnab Jana, R. B. (2017). Examining the changing health care seeking behaviour in the era of health sector reforms in India: evidence from the National Sample Surveys 2004 & 2014. *Global Health Research and Policy*, 6.

[3] Barham, V., Bataineh, H., & Devlin, R. A. (2017, November). Unmet Health Care and Health Care Utilization. *SSHRC - Social Sciences and Humanities Research Council of Canada*.

[4] Basu, J. &. (2017). Examining the changing health care seeking behaviour in the era of health sector reforms in India: evidence from the National Sample Surveys 2004 & 2014. *Global Health Research and Policy, 6*(2), 6. doi:10.1186/s41256-017-0026-y

[5] Das, S. (2012). Rural Health Status and Health Care in North-eastern India: A Case Study. *Journal of Health Management*.

[6] Gumber, A., Lalitha, N., & Dhak, B. (2017). Rising Healthcare Costs and Universal Health Coverage in India: An analysis of National Sample Surveys, 1986-2014. *Gujarat Institute of Development Research*.

[7] M. Hooda, M. R. (2021). Need Assessment and Design of an IoT-based Healthcare Solution through Participatory Approaches for a Rural Village in Bihar, India. *2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC), Bangalore, India*, 1-6.

[8] M. Hooda, M. R. (2021). Need Assessment and Design of an IoT-based Healthcare Solution through Participatory Approaches for a Rural Village in Bihar, India. *2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC)*.

[9] Mathiyazhagan, M. (2003). Rural Household Characteristics and Health Expenditure in India: An Analysis. *Journal of social and economic development*.

[10] Mishra, D. S. (2009). Safe drinking water status in the state of Bihar, India: Challenges ahead. *In 34th WEDC International Conference, Addis Ababa, Ethiopia*. Retrieved from https://repository.lboro.ac.uk/articles/conference_contribution/Safe_drinking_water_status_in_the_state_of_Bihar_India_challenges_ahead/9585437?file=17224100

[11] Musgrove, P. (1996). Public and private roles in health. *Washington^ eD. CDC: World Bank, 339*.

[12] Ram, M. (2021). Determinants of Healthcare Expenditure in Eastern Uttar Pradesh, India: Through the lens of NSSO Data. *JOURNAL OF COMMUNICABLE DISEASES*.

[13] Rout, H. S. (2008). Effects of Income and Education on Household Health Expenditure: A Rural-Urban Analysis of Orissa, India. *Asia-Pacific Journal of Rural Development*.

[14] Rout, H. S. (2008). Effects of Income and Education on Household Health Expenditure: A Rural-Urban Analysis of Orissa, India. *Asia-Pacific Journal of Rural Development*.

[15] Sengupta, K. (2015). Health Expenditure and its Impact on Health Status. *19th International Academic Conference, Florence; International Institute of Social and Economic Sciences*.

[16] Viramgami, A., Upadhyay, K., & Balachandar, R. (2020, December). Catastrophic health expenditure and health facility access among rural informal sector families. *Clinical Epidemiology and Global Health, 8*(4), 1325-1329.

[17] Menon, S. (2016). Public health issues in India and UK: Child Mortality and Survival Expectations. https://core.ac.uk/download/74374535.pdf

[18] Bhattacharjee, S. (2022). Degradation Of Urban Environment: When Residents' Expectations And Policy Implementations Do Not Coincide. https://doi.org/10.33765/thate.12.2.3

[19] Cultural Diversity Trivia Quiz Questions And Answers - Trivia & Questions. https://www.proprofs.com/quiz-school/story.php?title=mji1mty4oaiwti

[20] Sibanda, K., Qoko, A., & Gonese, D. (2024). Health Expenditure, Institutional Quality, and Under-Five Mortality in Sub-Saharan African Countries. *International Journal of Environmental Research and Public Health*, 21(3), 333.

[21] Kolios, B. (2020). Australian household debt and the macroeconomic environment. *Journal of Economic Studies.* https://doi.org/10.1108/JES-10-2019-0460