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Health Sector Studies

16th Finance Commission

2025

National Health Systems Resource Centre (NHSRC)

Health Sector Studies

Submitted to

16th Finance Commission

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2025

Details Related to Publication

The National Health Systems Resource Centre (NHSRC) has conducted three studies related to the health sector for the 16th Finance Commission. The three studies include a) Situational Analysis of Government Health Expenditure, b) Impact of Public Spending on Infant Mortality Rate, and c) Association Between Government Health Expenditure and Households' Catastrophic Health Expenditure for Inpatient Care.

Acknowledgements

We want to express our gratitude to the members of the 16th Finance Commission and their team for their valuable suggestions and observations on the studies. We would also like to thank the various divisions of NHSRC for their valuable input. We also acknowledge the support provided by Ms Pallavi Behera in the preparation of this report. Lastly, we would like to thank all the support staff of NHSRC for their constant support.

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1. Situational Analysis of Government Health Expenditure

Sandeep Sharma, E Lokesh Kumar, Abhinav Bisht, and Atul Kotwal

1.1 Background

There is a consensus at the global level on the importance of public spending on health for progress towards Universal Health Coverage (WHO, 2023). The Expert Group on Universal Health Coverage (UHC) for India observed that the government plays a crucial role in advancing progress towards UHC (Planning Commission, 2011). The National Health Policy (NHP), 2017, also acknowledges the pivotal role of the government in delivering health services (MoHFW, 2017). It advocates increasing the government health expenditure to improve access to health services in the country. One of the policy prescriptions of NHP 2017 is to increase government health expenditure as a share of GDP to 2.5% to ensure that the government has adequate resources to run various health programmes effectively (MoHFW, 2017).

Evidence from the National Health Accounts (NHA) indicates a gradual increase in public spending on health in the country (NHSRC, 2024). There has been progress in terms of the government's prioritisation of the health sector, as government health expenditure (GHE) as a share of GDP has increased from 1.13% to 1.84% and as a share of total government spending, from 3.9% to 6.12%, between 2014-15 and 2021-22 (NHSRC, 2023). For the same period, the share of Government health expenditure (GHE) in Total Health Expenditure (THE) increased from 29.0% to 48.0%.

Despite the progress, problems persist in terms of both the adequate availability of government health infrastructure and the delivery of services in government facilities. Notwithstanding the free or highly subsidised public facilities, households incur expenditure on medicines and diagnostic tests (Govil et al., 2016; Prinja et al., 2023). These additional payments by households, Out-of-Pocket Expenditure (OOPE), are for accessing services from private sources. OOPE on health are considered a regressive form of payment as it leads to economic vulnerabilities for households (Chowdhury et al., 2018).

Adequate resources are a fundamental requirement for a well-functioning health system. Resource gap analysis can be a helpful technique, as it helps us to understand the funds required for the health system and is generally based on a costing exercise. These estimates are useful not only in estimating the additional resource requirement, but they can also be used in analysing the efficiency of the health system (Chauhan et al., 2022). There are numerous methods for estimating the cost or resources required, such as top-down or bottom-up approaches (NHSRC, 2025). In India, numerous studies have been conducted to estimate resource requirements using costing exercises. Some of these studies have tried to get an estimate at the facility level (Chauhan et al., 2022). On the other hand, the report of the National Commission on Macroeconomics and Health and a study by Mor and Shukla have provided resource requirements at the national level (MoHFW, 2005; Mor & Shukla, 2023). A recent study by the National Health System Resource Centre (NHSRC) estimated the resource requirements for selected disease control programmes of the government using the normative costing approach based on the programme guidelines of these disease control programmes (NHSRC, 2025). The analysis also considered the different cost drivers associated with the service delivery of these programmes (NHSRC, 2025).

The OOPE still contributes around 45%, as per NHA 2021-22, to Current Health Expenditure, which indicates that there exists a substantial gap in health financing by the government (NHSRC, 2024). Given this background, it is crucial to estimate the government's resource requirements to ensure the provision of adequate health services to its population. This study considers both supply and demand sides to provide an estimate of the resources required to fill the gaps in the country's public health system. Specifically, it focuses on the availability of health facilities as per population norms and the realised demand of the households captured through OOPE.

1.2 Method and Data Source

This study employed a mixed approach to estimate the existing resource gap. The normative costing approach was used to assess the gaps in the country's health service delivery based on the normative guidelines of the Indian Public Health Standards (IPHS) and OOPE faced by households to ascertain the existing gaps in the health system up to the district level, with focus on both primary and secondary levels of care. The study estimated resource requirements/costs of two types: **service delivery costs** and

infrastructure costs. The service delivery costs include human resource costs and the cost of providing drugs & diagnostics. The infrastructure costs include the resources required for constructing the new buildings. The primary data sources used in the study are the Health Dynamics of India (HDI) report, 2022-23 (MoHFW, 2024a) and the National Sample Survey (NSS) Comprehensive Annual Modular (CAM) Survey 2022-23 (MOSPI, 2024).

Different sources and their use in the analysis are given as follows

1. The shortfall data on human resources and infrastructure across facilities in both urban and rural areas of the country are based on the HDI report.
2. To arrive at the human resources cost estimate, the shortfall data of all cadres of human resources from HDI and their respective salary data from NHM Programme Implementation Plans (PIPs) and Record of Proceedings (RoPs) are used (MoHFW, 2024b).
3. To arrive at infrastructure costs, the shortfall data of facilities as per the population norms from the HDI report (up to CHCs) and the unit costs/building costs as prescribed under NHM PIPs/RoPs/ 15th FC and PMABHIM guidelines are used (MoHFW, 2021a, 2021b, 2024b).
4. The NSS CAM survey, 2022-23, is used to estimate the drugs and diagnostic costs from the OOPE incurred for inpatient and outpatient care. The OOPE data is used as it provides an estimate of the realised demand. Given that this costing exercise covers up to the secondary care level, highly specialised care usually offered at tertiary-level facilities such as medical colleges is not considered. These costs are adjusted from the OOPE data using the data on specialised care from the National Health Accounts (NHA) (NHSRC, 2024).

Table 1.1: Methodology and Data Sources

S. No.	Input	Recurrent/Revenue Exp	Capital Exp	Source
1	Human Resources (HR)	HR expenditure as per IPHS norms		HDI for facility-wise cadre list as per IPHS norms & State NHM PIPs & RoPs
2	Drugs	OOPE on drugs		CAMS 2022-23 and National Health Accounts (NHA) reports.
3	Diagnostics	OOPE on diagnostics		CAMS 2022-23 and NHA reports
4	Infrastructure		Primary care facilities (SHCs, PHCs)- construction cost	HDI for the shortfall in the number of facilities as per IPHS norms. Building construction cost and per-bed cost from State NHM PIPs and RoPs 15th FC & PMABHIM guidelines
			Secondary care facilities- CHCs	

1.3 Results

Given the fact that the health service provider in the country comprises both public and private facilities, two alternative estimates were calculated. Specifically, to arrive at the overall resource requirement, two scenarios are considered. They are as follows:

a. The existing gap is limited to only those utilising public facilities. In this scenario, only the OOPE incurred while accessing the public facility is considered. This share has been taken from the NHA.

b. The existing gap is for the whole population. In this scenario, the overall OOPE on medicines and diagnostics is considered.

The infrastructure gap is estimated based on IPHS guidelines, which provide information on the norm for population coverage of health facilities (MoHFW, 2022). Given the gap in existing facilities, the total cost to fill this gap is around Rs 1.31 lakh crores (Table 1.2 and Table 1.3). Across the states, there is a wide variation, with states such as Bihar, Uttar Pradesh, Madhya Pradesh, Maharashtra, and West Bengal contributing more than 50% of the gap. In per capita terms, this gap is around Rs 945 with wide variations across states (Table 1.4).

The other component of the exercise is the estimation of the gaps in service delivery, which includes the human resource costs and the costs related to drugs and diagnostics. In scenario 1, where only the population going to public facilities is considered, the total service delivery gap is around Rs 56,594 crores (Table 1.2). In per capita terms, this amounts to around Rs 409 (Table 1.4). In scenario 2, where the whole population is considered, i.e., the gap in government expenditure for the whole population, the gap is around Rs 2.25 lakh crores, and in per capita terms, it comes to Rs 1,627 (Table 1.3 and Table 1.4). There exists a wide variation across states in terms of the resources required for ensuring adequate service delivery components.

Table 1.2: Scenario-1 Results (in Rs Crores)

Method 1- Adjusting for OOPE at Public Facilities						Infra (HF-Gap)	
States	**HR**	**Medicines**	**Diagnostics**	**Total (SD)**	**Share**		
Andhra Pradesh	630	571	213	1,414	2.50%	7,705	5.90%
Arunachal Pradesh	355	78	29	462	0.82%	25	0.02%
Assam	627	1,430	466	2,523	4.46%	3,416	2.61%
Bihar	1,176	1,521	407	3,104	5.49%	26,473	20.26%
Chhattisgarh	601	315	50	966	1.71%	1,891	1.45%
Goa	18	25	3	46	0.08%	154	0.12%
Gujarat	1,244	553	123	1,920	3.39%	2,958	2.26%
Haryana	537	528	120	1,186	2.10%	2,815	2.15%
Himachal Pradesh	1,356	1,119	119	2,595	4.58%	487	0.37%
Jharkhand	600	464	102	1,165	2.06%	5,926	4.54%
Karnataka	1,894	578	117	2,589	4.57%	5,445	4.17%
Kerala	1,436	1,622	461	3,519	6.22%	1,405	1.08%
Madhya Pradesh	2,296	1,012	230	3,537	6.25%	9,731	7.45%
Maharashtra	1,449	1,077	254	2,781	4.91%	9,054	6.93%
Manipur	252	148	52	453	0.80%	377	0.29%
Meghalaya	127	103	20	250	0.44%	349	0.27%
Mizoram	152	58	14	224	0.40%	9	0.01%
Nagaland	149	62	14	226	0.40%	167	0.13%
Odisha	1,068	1,966	333	3,367	5.95%	3,043	2.33%
Punjab	733	956	156	1,845	3.26%	2,837	2.17%
Rajasthan	1,480	1,460	324	3,264	5.77%	3,409	2.61%
Sikkim	57	17	6	80	0.14%	24	0.02%
Tamil Nadu	3,938	446	104	4,488	7.93%	2,208	1.69%
Telangana	524	283	94	902	1.59%	4,272	3.27%
Tripura	292	124	38	454	0.80%	227	0.17%
Uttarakhand	501	113	26	640	1.13%	734	0.56%
Uttar Pradesh	2,342	4,174	652	7,168	12.67%	24,858	19.03%
West Bengal	778	2,478	508	3,764	6.65%	8,337	6.38%
Delhi	40	114	55	209	0.37%	279	0.21%
Jammu & Kashmir	153	704	188	1,045	1.85%	1,873	1.43%
Puducherry	6	38	3	47	0.08%	56	0.04%
UTs	112	171	79	362	0.64%	99	0.08%
Total	**26,922**	**24,308**	**5,364**	**56,594**	**100%**	**1,30,647**	**100%**

Notes: HR: Human resources, SD: Service Delivery, HF: Health facilities

All values are rounded off.

Table 1.3: Scenario-2 Results (in Rs Crores)

Without Any Adjustment						Infra (HF-Gap)	
States	**HR**	**Medicines**	**Diagnostics**	**Total (SD)**	**Share**		
Andhra Pradesh	630	6,797	2,537	9,964	**4.43%**	7,705	5.90%
Arunachal Pradesh	355	89	33	478	**0.21%**	25	0.02%
Assam	627	3,116	1,016	4,760	**2.12%**	3,416	2.61%
Bihar	1,176	8,536	2,285	11,997	**5.33%**	26,473	20.26%
Chhattisgarh	601	2,012	322	2,935	**1.30%**	1,891	1.45%
Goa	18	95	11	124	**0.06%**	154	0.12%
Gujarat	1,244	8,132	1,810	11,186	**4.97%**	2,958	2.26%
Haryana	537	4,512	1,028	6,076	**2.70%**	2,815	2.15%
Himachal Pradesh	1,356	1,665	177	3,199	**1.42%**	487	0.37%
Jharkhand	600	3,439	753	4,792	**2.13%**	5,926	4.54%
Karnataka	1,894	5,149	1,046	8,089	**3.60%**	5,445	4.17%
Kerala	1,436	10,605	3,017	15,057	**6.69%**	1,405	1.08%
Madhya Pradesh	2,296	8,404	1,909	12,609	**5.60%**	9,731	7.45%
Maharashtra	1,449	14,104	3,327	18,880	**8.39%**	9,054	6.93%
Manipur	252	234	82	568	**0.25%**	377	0.29%
Meghalaya	127	190	37	354	**0.16%**	349	0.27%
Mizoram	152	93	23	268	**0.12%**	9	0.01%
Nagaland	149	143	33	325	**0.14%**	167	0.13%
Odisha	1,068	4,305	729	6,102	**2.71%**	3,043	2.33%
Punjab	733	7,967	1,299	10,000	**4.44%**	2,837	2.17%
Rajasthan	1,480	6,876	1,527	9,884	**4.39%**	3,409	2.61%
Sikkim	57	49	19	125	**0.06%**	24	0.02%
Tamil Nadu	3,938	9,309	2,177	15,425	**6.86%**	2,208	1.69%
Telangana	524	5,676	1,892	8,092	**3.60%**	4,272	3.27%
Tripura	292	400	124	816	**0.36%**	227	0.17%
Uttarakhand	501	939	216	1,656	**0.74%**	734	0.56%
Uttar Pradesh	2,342	29,408	4,592	36,342	**16.15%**	24,858	19.03%
West Bengal	778	17,199	3,528	21,505	**9.56%**	8,337	6.38%
Delhi	40	736	354	1,130	**0.50%**	279	0.21%
Jammu & Kashmir	153	1,100	293	1,546	**0.69%**	1,873	1.43%
Puducherry	6	300	23	329	**0.15%**	56	0.04%
UTs	112	171	79	362	**0.16%**	99	0.08%
Total	**26,922**	**1,61,753**	**36,299**	**2,24,974**	**100%**	**1,30,647**	**100%**

Notes: HR: Human resources, SD: Service Delivery, HF: Health facilities

All values are rounded off.

Table 1.4: Per Capita Expenditure* (in Rs)

States	Service Delivery Scenario-1	Service Delivery Scenario-2	Infrastructure
Andhra Pradesh	266	1877	1452
Arunachal Pradesh	2972	3072	161
Assam	709	1338	960
Bihar	246	952	2101
Chhattisgarh	322	977	630
Goa	292	789	983
Gujarat	270	1572	416
Haryana	394	2022	937
Himachal Pradesh	3482	4292	654
Jharkhand	297	1221	1510
Karnataka	383	1198	807
Kerala	985	4216	393
Madhya Pradesh	411	1464	1130
Maharashtra	221	1499	719
Manipur	1411	1769	1173
Meghalaya	749	1062	1048
Mizoram	1815	2175	72
Nagaland	1016	1463	752
Odisha	729	1322	659
Punjab	602	3263	926
Rajasthan	405	1225	423
Sikkim	1167	1823	348
Tamil Nadu	585	2009	288
Telangana	237	2130	1124
Tripura	1099	1976	551
Uttarakhand	552	1429	634
Uttar Pradesh	305	1548	1059
West Bengal	381	2175	843
Delhi	99	533	132
Jammu & Kashmir	771	1140	1381
Puducherry	286	2021	346
UTs	1125	1125	306
Total	**409**	**1627**	**945**

*Population figures for states are taken from the Population projection report, July 2020[i].

1.4 Conclusion

Health service delivery by the government can be instrumental in ensuring an accessible healthcare system for all. It can also be a powerful tool for reducing health disparities, as it will ensure that marginalised sections have access to health services without leading to financial burdens (Planning Commission, 2011).

This study estimated the existing resource gap based on two broad categories of health systems: the health infrastructure and the service delivery. The gap in health infrastructure is broadly the capital expenditure, while service delivery constitutes the revenue expenditure. The available health facilities up to the CHC level were analysed for the cost of health infrastructure across the states in the country. The study also incorporated the demand for health service delivery to identify gaps in service delivery. Based on the analysis for the year 2022-23, the gap in physical infrastructure was around Rs 1.31 lakh crores. The gap in service delivery was Rs 56,594 crores if we limit the analysis only to those going to the public health facilities, and Rs 2.25 lakh crores if we consider the whole population. The study also highlights the substantial variation in resource requirements across the states.

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2. Impact of Public Spending on Infant Mortality Rate

Sandeep Sharma, Hardeep Singh, E Lokesh Kumar, Abhinav Bisht, and Atul Kotwal

2.1 Introduction

Governments play a pivotal role in shaping the quality of life for their citizens. The role of the Government, measured in terms of public expenditure on health, is well documented both in academic literature and in the policy document (Anand & Ravallion, 1993; Farahani et al., 2010; MoHFW, 2017). There has been constant initiative in the policy discourse to improve the health status of the population. The Sustainable Development Goals (SDGs) emphasise improving health status based on certain indicators, and India, being signatory to this document, has pledged to reduce neonatal mortality, which is a part of infant mortality, to 12 per 1,000 live births and under-five mortality to 25 per 1,000 live births by 2030.[ii]

The infant mortality rate (IMR)—defined as the number of deaths of infants under one year per 1,000 live births—is regarded as a sensitive indicator of health achievement, and as a proxy measure of population health. Even though Health status comprises multiple indicators, there is ample evidence that IMR has a very high correlation with important health status measures, such as disability adjusted life years (Reidpath & Allotey, 2003). Furthermore, available evidence also suggests a significant and independent effect of government investment in IMR reduction, even after controlling for other proximate determinants that might influence the reduction of IMR (Bhalotra, 2007; Carraro, 2021). Some recent studies based on India also indicate a similar trend, as expenditure by the Government is significant in reducing IMR even after controlling for other proximates of IMR, such as mothers' education or economic development measured in terms of state domestic product (Barenberg et al., 2017; Kumar Mohanty & Behera, 2020).

There has been a considerable decline in IMR in the country from 58 deaths per 1000 live births in 2004 to 28 deaths per 1000 births in 2019-20.[iii] At the same time, Government expenditure as a share of GDP, which indicates priority given to the health sector in the overall economy, has increased from 0.8 % in 2004-05[iv] to 1.35% in 2019-20 (NHSRC, 2023). Given this background, the main objective of this study is to understand the relationship between government health expenditure and IMR across the states between 2004 and 2019-20 using panel data analysis.

2.2 Data and Empirical Strategy

Government Health expenditure in the analysis includes medical and public health, family welfare, and water supply and sanitation. Inclusion of water supply and sanitation is based on evidence from literature, which suggests that improved water supply and sanitation facilities have a considerable effect on IMR (Lu et al., 2020). To capture the role of government health expenditure on IMR, we have taken government health expenditure as a share of Net State Domestic Product (NSDP). This variable indicates the priority given to the health sector in the overall economy by the government. Women's literacy and per capita NSDP of states were taken as control variables, and both these variables are commonly used in understanding the relationship between government expenditure and IMR (Barenberg et al., 2017; Farahani et al., 2010). The data on IMR were taken from the Sample Registration System (SRS)[v], data on public spending on health were taken from the Reserve Bank of India (RBI)[vi] , and data on Net State Domestic Product (NSDP) were taken from the database of the Ministry of Statistics and Programme Implementation (MOSPI)[vii]. The literacy rates of females between the ages of 15-49 are taken from the National Family Health Survey (NFHS) 2005-06, 2015-16 and 2019-21.[viii] The literacy rates for the earlier years and in-between years are estimated indirectly, taking the growth rates in female literacy between periods 2004 to 2005-06, 2005-06 to 2015-16 and 2015-16 to 2019-21.[ix]

To explore the relationship between IMR and government health expenditure, the specification expressed in Equation (1) is used.

$$Y_{it} = \alpha_i + \delta_t + \beta GHE_{it} + \gamma X_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots (1)$$

Where, Y_{it} represents the IMR in state i in year t; GHE_{it} denotes the government health expenditure as a percentage of net state domestic product for state i in year t; and X_{it} denotes the other explanatory variables, including NSDP and female literacy rate. We have also accounted for the state-level and year-fixed effects. State fixed effects help us control for the regional characteristics that might differ across states but do not vary over time, influencing IMR and government health expenditure simultaneously. Additionally, year-fixed effects control for the changes that occur over time but do not vary across different states.

However, it is to be noted that government health expenditure might be endogenous as the level of health might influence this variable to some extent. It is well reported that high government expenditure will reduce the IMR in a region; however, it is also true that states with subpar infant mortality outcomes are more likely to increase their government health expenditure. Rao & Choudhury (2012) documented that states with worse health outcome performance also register larger government health expenditures. This bi-directional relationship between the two will bias the Ordinary Least Squares (OLS) estimates.

Several studies have recommended using an instrumental variable (IV) regression framework to address the issue of simultaneity bias between IMR and government health expenditure. An appropriate instrument must satisfy two key conditions: (i) it must be strongly correlated with the endogenous explanatory variable (government health expenditure), and (ii) it must be uncorrelated with the error term in the IMR equation, implying that it affects the dependent variable only through its impact on the explanatory variable (Angrist & Pischke, 2008). In line with these criteria, we use the revenue receipts of a state as an instrument for government health expenditure. The rationale is that higher revenue receipts expand a state's fiscal capacity, enabling greater allocation of resources to the health sector. At the same time, it is plausible that revenue receipts do not directly influence IMR, thereby satisfying the exclusion restriction. We confirm the endogeneity of government health expenditure through formal statistical tests. To reinforce the robustness of our findings, we also employ alternative instruments—specifically, a state's own tax revenue and non-tax revenue—*and find consistent results across specifications.*

2.3 Result

The correlation between various explanatory variables and the IMR indicates that all selected variables are negatively correlated with IMR, indicating that improvements in these factors are associated with lower infant mortality (Table 2.1). The negative correlation between female literacy and IMR is consistent with the previous studies. Higher female literacy can translate into better health awareness, improved childcare practices, and enhanced nutritional outcomes for children, which contribute to lower infant mortality (Alderman & Headey, 2017). Similarly, per capita NSDP is negatively correlated with IMR. This relationship is intuitive, as higher NSDP reflects stronger economic capacity at the state level, allowing for greater investments in health

infrastructure and services, which can lead to reductions in infant mortality (Barenberg et al., 2017; Ranis et al., 2000). Finally, government health expenditure as a share of NSDP also shows a negative correlation with IMR. Increased public spending on health can enhance health service delivery, which can be very effective in reducing infant mortality (Issa & Ouattara, 2012).

After examining the correlation among the explanatory variables, we employed the Hausman test to determine the appropriate model specification—fixed effects versus random effects—which is a critical consideration in panel data analysis. The Hausman test evaluates whether the unique errors (unobserved heterogeneity) are correlated with the regressors. The null hypothesis suggests that the random effects model is consistent and efficient, while the alternative hypothesis favours the fixed effects model due to inconsistency in the random effects estimator. Our results yield a Chi-square statistic of 11.95, which is statistically significant at the 1% level. This indicates that the null hypothesis can be rejected, and the fixed effects model is more appropriate for our analysis. Accordingly, we proceed with a fixed effects specification. Additionally, the Wald test for heteroscedasticity is also significant at the 1% level, suggesting the presence of heteroscedasticity in the error terms. To address this issue, we employ robust standard errors in our estimation. Although clustered standard errors would typically be the preferred approach to address both heteroscedasticity and serial correlation, the limited number of clusters in our dataset restricts the feasibility of this method.

Table 2.2 presents the results from the OLS regression. As expected, per capita net state domestic product (PCNSDP) and female literacy rate (FLR) are negatively and statistically significantly associated with the IMR. However, while the coefficient for government health expenditure as a share of NSDP is negative, it is statistically insignificant in the OLS framework. As previously discussed, the potential endogeneity of government health expenditure in the OLS model raises concerns about the reliability of these estimates. To address this, we employ an instrumental variable (IV) regression, with the results presented in Table 2.3. The relevance of the chosen instrument—state revenue receipts—is supported by a first-stage F-statistic, which exceeds the conventional threshold of 10 (Stock & Yogo, 2005), indicating that the instrument is sufficiently strong. In the IV regression results, all explanatory variables, including government health expenditure as a share of NSDP, exhibit negative and statistically significant coefficients. Notably,

government health expenditure as a share of NSDP, which was insignificant under OLS, becomes statistically significant in the IV framework (Table 2.3). This confirms that higher government health spending contributes to a reduction in IMR, once endogeneity is properly addressed. These findings underscore the importance of increasing budgetary allocations to the health sector, especially in the context of achieving SDGs related to child health. To further test the robustness of our results, we also use states' own tax and non-tax revenues as alternative instruments for government health expenditure, the results of which are shown in Table 2.4. The results remain consistent across these specifications, reinforcing the validity of our findings. Moreover, it may be argued that the log of NSDP might be correlated with the government health expenditure as a percentage of the NSDP, which, though, is only 18% in our case. However, we have performed an analysis without considering the log of NSDP as an independent variable, the results of which are shown in Appendix 2.1. The results are consistent with our previous findings, and the coefficient is higher than the previous one.

Table 2.1: Correlation statistics

Variable	Correlation
Govt Health Exp as % of NSDP	-0.1483***
Log Per Capita NSDP	-0.6182***
Female Literacy	-0.771***

Table 2.2: OLS estimates

Variable	Coeff
Govt Health Exp as % of NSDP	-0.32
	(0.54)
Log Per Capita NSDP	-9.24***
	(2.85)
Female Literacy	-0.69***
	(0.10)
Constant	185.93***
	(33.15)
Observations	510
R-squared	0.94
State FE	Yes

Year FE	Yes
Adjusted R-squared	0.936
F stat	19.13
Mean of the dependent variable	34.30

*Notes: *** p<0.01, ** p<0.05, * p<0.1; Standard errors are reported within parentheses; Coeff: Coefficient.*

Table 2.3: Instrumental variable regression: Revenue Receipts as an instrument

Variable	Coeff
Govt Health Exp as % of NSDP	-8.81***
	(2.82)
Log Per Capita NSDP	-37.68***
	(9.61)
Female Literacy	-0.43***
	(0.16)
Observations	510
State FE	Yes
Year	Yes
F stat	13.88
Mean of the dependent variable	34.30
Hausman test Chi2	11.95***
Wald Chi2	4500***

Notes: *** *p<0.01*, ** *p<0.05*, * *p<0.1; Standard errors are reported within parentheses; Coeff: Coefficient.*

Table 2.4: Instrumental variable regression: Own tax and non-tax revenue as an instrument

Variable	Coeff
Govt Health Exp as % of NSDP	-5.64***
	(1.89)
Log Per Capita NSDP	-27.04***
	(6.36)
Female Literacy	-0.53***
	(0.12)
Observations	510
State FE	Yes
Year	Yes
F stat	17.19
Mean of the dependent variable	34.30

Notes: *** *p<0.01*, ** *p<0.05*, * *p<0.1; Standard errors are reported within parentheses; Coeff: Coefficient.*

2.4 Conclusion

This study investigated the impact of government health expenditure on health. The present study uses IMR as a measure of population health. Although there are other important indicators like Maternal mortality ratio (MMR) or life expectancy, they are strongly correlated with IMR (Goli et al., 2022; Reidpath & Allotey, 2003). Moreover, these indicators have limitations due to the unavailability of data required for robust statistical analysis.

The present study uses panel data from multiple Indian states over several years, sourced from various official government databases. To establish a causal relationship, the analysis controls for key explanatory variables such as net state domestic product and female literacy rate—both critical determinants of IMR. Recognising the endogenous nature of government health expenditure, we adopt an instrumental variable (IV) regression framework to address potential biases arising from reverse causality or omitted variables. The validity and strength of the chosen instrument are confirmed through a series of statistical tests. To enhance the robustness of our results, we also implement a fixed effects regression model, accounting for both state-level and year-level unobserved heterogeneity. Our findings consistently demonstrate that higher government health expenditure is associated with a significant reduction in infant mortality. To further validate these results, we use states' own tax and non-tax revenues as alternative instruments for government health expenditure, and the estimates remain consistent with our primary findings. These results have important policy implications, emphasising the need for greater public investment in health. Increasing the share of budgetary allocations to the health sector can play a pivotal role in helping states achieve SDGs by effectively lowering IMR to more desirable levels.

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Appendix 2.1

Table 2.5: Instrumental variable regression: Revenue Receipts as an instrument

Variables	Coeff
Govt Health Exp as % of NSDP	-12.31**
	(5.39)
Female Literacy	0.12
	(0.40)
Observations	510
R-squared	-2.92
State FE	Yes
Year	Yes
Adjusted R-squared	-3.329
F stat	7.043
Mean of the dependent variable	34.30

Notes: *** *p<0.01*, ** *p<0.05*, * *p<0.1*; *Standard errors are reported within parentheses; Coeff: Coefficient.*

3. Association Between Government Health Expenditure and Households' Catastrophic Health Expenditure for Inpatient Care

Sandeep Sharma, E Lokesh Kumar, and Atul Kotwal

3.1 Background

Catastrophic Health expenditures (CHE) are said to have occurred when households incur significant health expenditures relative to their consumption expenditures (Wagstaff et al., 2018). It is an indicator of the financial hardship faced by households when accessing healthcare services (WHO & World Bank, 2023). Sustainable Development Goal (SDG) 3.8 aims for universal health coverage, ensuring access to quality healthcare, financial protection, and affordable medicines and vaccines for all.[x] Similarly, India's 2017 National Health Policy prioritises universal access to high-quality healthcare without financial burden (MoHFW, 2017). Hence, measuring financial burden is crucial. One method is assessing the prevalence of CHE.

CHE happens when healthcare costs consume a significant portion of a household's income, potentially leading to financial distress (Hadaye & Thampi, 2018). It primarily arises when out-of-pocket expenditure (OOPE) on health crosses a certain threshold. As per the joint report published by the WHO and the World Bank, the CHE is considered catastrophic if household health expenditure exceeds 10% or 25% of total household consumption expenditure (WHO & World Bank, 2023). Since this measure of CHE is based on Out-of-pocket payment undertaken by households for healthcare, it is important to have a sound public investment in the provision of health services, as it can play an important role in reducing households' spending on healthcare through OOPE (WHO, 2021; Ying & Chang, 2020).

Previous studies on CHE in the Indian context have focused on incidence based on different rounds of the National Sample Survey's (NSS) Consumer Expenditure Survey (Ghosh, 2011; Karan et al., 2014; Selvaraj et al., 2018). The focus of these studies was on the magnitude and trend of CHE at the different aggregate levels. There has been a very limited attempt to understand the relationship between the incidence of CHE and different household-level correlates. A study by Bonu et al. (2009) specifically looking at the household level correlates of catastrophic expenditure arising out of institutional delivery indicates that antenatal care and delivery care in private facilities increased the chances

of CHE. This study also highlights the challenge encountered in such studies due to the health spending appearing on both the right- and left-hand sides of the regression equation, leading to an endogeneity problem (Bonu et al., 2009).

The potential role of Government/public expenditure in reducing the CHE is another area that has not been researched in the Indian context. There is a broad consensus that effective government programmes can play an important role in reducing financial vulnerability resulting from health expenditure by households (C Garg et al., 2018; Mohanty & Srivastava, 2013). Given this background, this study aims to understand the association between government health expenditure and the incidence of CHE due to inpatient care in India.

3.2 Data Source and Methodology

3.2.1 Data and Sample size

The study used the recently released National Sample Survey (NSS) Comprehensive Annual Modular (CAM) Survey. The survey covered the period between July 2022 and June 2023 and collected information from 3,02,086 households across the country (MOSPI, 2024a). The survey collected information, inter alia, on health insurance coverage and health expenditures- separately for inpatient/hospitalisation care and outpatient/non-hospitalisation care, along with household and demographic characteristics. Other data sets used in the study are RBI's dataset on State Budgets for state-wise revenue expenditure on health for FY 2022-23, the National Health Accounts Report 2019-20, and NSS's Household Consumption Expenditure Survey (HCES) 2022-23 (MOSPI, 2024b; NHSRC, 2023; RBI, 2024). Given that this study was limited to the analysis of inpatient care, the total number of observations considered for the analysis is 73,483.

3.2.2 Rationale for Limiting the Analysis to Inpatient Care

The study was limited to the analysis of inpatient care to avoid the endogeneity problem that would have arisen if outpatient care had been chosen. As per the definition of consumption expenditure in the CAM survey, expenditure incurred for regular medical treatment or diagnosis is considered for calculating the household's usual consumption expenditure. However, any expenditure on hospitalisation, which is not of a regular nature, is excluded (MOSPI, 2022). As treatment for chronic ailments such as diabetes and

hypertension is regular and involves frequent consultations in the outpatient department (OPD) and medicine purchases, the expenditure incurred for the same would be considered under household consumption expenditure and under outpatient care. As household consumption expenditure is an important predictor of household financial hardship/catastrophic expenditure, and to avoid the endogeneity problem, only inpatient/ hospitalisation care is considered.

3.2.3 Variables

The dependent variable of the study is binary- whether the households incurred catastrophic health expenditure due to OOPE for inpatient care. Different thresholds of household consumption expenditure were used for identifying whether a household was burdened by catastrophic health expenditure- 5%, 10%, 15% and 25%. The main threshold used for analysis was 10%.

The primary variable of interest is per capita current government health expenditure on inpatient care. As current government spending on inpatient care is not directly available in the budget documents of the states, it is estimated using the RBI data on revenue expenditure on medical and public health and family welfare by the states, and the share of inpatient care in government expenditure as per the National Health Accounts (NHSRC, 2023; RBI, 2024). The other explanatory variables included in the model are place of residence (rural/urban), gender of head of household, formal education/training of head of the household (yes/no), whether any household member is covered under health insurance (yes/no), and consumption quintiles- poorest, poor, richest, and richest. Consumption quintiles are generated using equivalence scale-adjusted monthly per capita consumption expenditure (MPCE). The adjusted MPCE entailed adjustment for household size and composition using the equivalent scale calculated as $e_h = (A_h + 0.5K_h)^{0.75}$, where A_h was the number of adults in the household and K_h was the number of children aged 0–14 years (Deaton, 2018; O'Donnell et al., 2007).

3.2.4 Data Analysis

Given the hierarchical nature of variables being assessed in the study, viz, current government health expenditure at the state level on inpatient care and households' catastrophic health expenditure at the household level, a multilevel logistic regression has

been employed. The analysis included four nested levels: household (i), First Stage Unit/FSU (j), district (k), and state (l).

The functional form of the model is:

$$\text{logit}\,(Y_{ijkl}) = \beta_0 + (u_{0jkl} + v_{0kl} + f_{0l})$$

Where Y_{ijkl} is the log odds of the outcome for household i, and u_{0jkl}, v_{0kl}, f_{0l} represent the residual error terms for FSU, district, and state, respectively. The residuals were assumed to be normally distributed with a mean of 0 and a variance of $u_{0jkl} \sim N\,(0, \sigma^2_{u0})$, $v_{0kl} \sim N\,(0, \sigma^2_{v0})$, and $f_{0l} \sim N\,(0, \sigma^2_{f0})$.[xi]

3.3. Results

3.3.1. Utilisation Pattern for Inpatient Care

Accessing healthcare services from private providers is one of the main causes of incurring OOPE in the country (MOSPI, 2020). Private providers play a dominant role in delivering health services, for both inpatient and outpatient care. However, in recent times, a reversal in this trend has been observed for inpatient care. As per the NSS Health Survey rounds, the utilisation of public facilities for inpatient care has increased in both urban and rural areas (Table 3.1). This increase in utilisation also corresponds with the evidence from National Health Accounts Estimates, which have shown an increase in public spending on health (NHSRC, 2023). Corresponding to this increase in public spending on health, there has been a gradual decrease in OOPE. The OOPE is paid directly by the households and can lead to economic vulnerabilities (Chowdhury et al., 2018). Increasing public spending on health can play a pivotal role in increasing access to health care services and reducing OOPE (MoHFW, 2017; Planning Commission, 2011).

3.3.2. Multilevel Analysis

The results of multilevel regression analysis are presented in Tables 3.2 and 3.3. The results indicate a significant negative relationship between government expenditure on inpatient care and the incidence of catastrophic health expenditure (Table 3.2). This negative indicator indicates that households in states with relatively higher public spending are less likely to experience catastrophic expenses than households located in states with relatively lower public spending on health. Other significant household-level determinants, which are also negatively related to catastrophic health expenditure, are

consumption classes- particularly the rich consumption classes, insurance coverage, and the gender of the head of the household. This analysis was also done for different thresholds of catastrophic health expenditure. These results, barring the 5% threshold, hold for other thresholds of catastrophic health expenditure (Table 3.3). This analysis was also done taking the log MPCE for all the thresholds (Appendix 3.1). The results show that government health expenditure has a significant negative relationship with the incidence of catastrophic health expenditure at 10% and 25% threshold levels. The log MPCE has a significant negative relationship at all the thresholds.

Table 3.1: Trends in Utilisation of Facilities for Inpatient/Hospitalised Care

Survey Type		Facility Type	Utilisation Proportion	
			Rural	Urban
NSS Surveys on Health (as % of inpatient cases)	NSS 52nd (1995-96)	Private Facility	56	57
		Public Facility	44	43
	NSS 60th (2004)	Private Facility	58	62
		Public Facility	42	38
	NSS 71st (2014)	Private Facility	58	68
		Public Facility	42	32
	NSS 75th (2017-18)	Private Facility	54	65
		Public Facility	46	35
Household Consumption Expenditure Survey (HCES) (as % of HHDs reporting inpatient care)	HCES 2022-23	Exclusively Public Facility	44	35
		Exclusively Private Facility	36	47
		Both Public & Private facilities	20	19

Notes: Data is from the NSS Health Survey report of the 75th round (MOSPI, 2020), and the Authors' estimation using HCES 2022-23. NSS survey reports provide information on utilisation of facilities as a share of total inpatient cases, while in HCES, utilisation is taken as a percentage of total households that have used inpatient care.

Table 3.2: Association between Government Expenditure and Catastrophic Health Expenditure for Inpatient Care-10% Threshold

Variables	Catastrophic-inpatient Care (10% threshold)
Place of residence of household- Rural (Base: Urban)	0.011
	(0.016)
Formal education/training of Head of Household-Yes (Base: No)	0.157***
	(0.019)
Gender of Head of Household- Male (Base: Female)	-0.181***
	(0.024)
Whether covered under any health insurance- Yes (Base: No)	-0.425***
	(0.017)
Consumption Quintiles (Base: Poorest)	
Poor	0.010
	(0.023)
Middle	-0.022
	(0.024)
Rich	-0.045*
	(0.025)
Richest	-0.083***
	(0.025)
Log of per capita Government Current Expenditure on Inpatient Care at the state level	**-0.090*** **
	(0.028)
Constant	0.798***
	(0.174)
Observations	73,483

Notes: *** *p<0.01*, ** *p<0.05*, * *p<0.1*. Standard Errors (SE) are reported within parentheses.

3.4 Conclusion

Public spending on Health plays a crucial role in improving access to health services, especially for poor and marginalised sections of society. The importance of public spending on health has been emphasised by NHP 2017 and by academia (C Garg et al., 2018; MoHFW, 2017). In recent years, there has been an increase in public spending on health, coupled with a reduction in OOPE. This study, based on a multilevel regression analysis of the relationship between government health spending and incidence of CHE, has shown a negative relationship between the two. It also highlights that states with relatively higher per capita public spending are better placed to improve access to healthcare services. These findings correspond with the findings of authors analysing the factors behind increased utilisation of public facilities for inpatient care in rural areas of the country (Sharma et al., 2025). To sustain and increase utilisation of public facilities, there is a need for a further increase in public spending on health. This will reduce reliance on OOPE for paying for health services and improve access for all sections of society.

Table 3.3: Association between Government Expenditure and Catastrophic Health Expenditure for Inpatient Care- Different Thresholds

Variables	Catastrophic Health Expenditure-Inpatient Care			
	Threshold 5%	Threshold 10%	Threshold 15%	Threshold 25%
Place of residence of household- Rural (Base: Urban)	-0.020	0.011	0.012	0.034
	(0.029)	(0.016)	(0.026)	(0.028)
Formal education/training of Head of Household-Yes (Base: No)	0.190***	0.157***	0.200***	0.163***
	(0.025)	(0.019)	(0.024)	(0.027)
Gender of Head of Household- Male (Base: Female)	-0.173***	-0.181***	-0.212***	-0.239***
	(0.030)	(0.024)	(0.028)	(0.031)
Whether covered under any health insurance- Yes (Base: No)	-0.511***	-0.425***	-0.348***	-0.295***
	(0.025)	(0.017)	(0.023)	(0.026)
Consumption Quintiles (Base: Poorest)				
Poor	-0.051	0.010	-0.119***	-0.156***
	(0.032)	(0.023)	(0.029)	(0.032)
Middle	-0.074**	-0.022	-0.197***	-0.283***
	(0.034)	(0.024)	(0.031)	(0.034)
Rich	-0.134***	-0.045*	-0.266***	-0.423***
	(0.036)	(0.025)	(0.033)	(0.036)
Richest	-0.152***	-0.083***	-0.333***	-0.458***
	(0.039)	(0.025)	(0.036)	(0.040)

Log of per capita Government Current Expenditure on Inpatient Care at the state level	**-0.339**	**-0.090*** **	**-0.453** **	**-0.422*** **
	(0.220)	**(0.028)**	**(0.180)**	**(0.159)**
Constant	3.376**	0.798***	2.531**	1.618
	(1.466)	(0.174)	(1.199)	(1.059)
Observations			73,483	

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors (SE) are reported within parentheses.

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Appendix 3.1

Table 3.4: Catastrophic Health Expenditure for Inpatient Care-Considering Log MPCE

Variables	Catastrophic Health Expenditure-Inpatient Care			
	Threshold 5%	Threshold 10%	Threshold 15%	Threshold 25%
Place of residence of household- Rural (Base: Urban)	-0.096*** (0.029)	-0.032* (0.017)	-0.038** (0.018)	-0.147*** (0.028)
Formal education/training of Head of Household-Yes (Base: No)	0.206*** (0.025)	0.168*** (0.019)	0.181*** (0.020)	0.176*** (0.027)
Gender of Head of Household- Male (Base: Female)	-0.173*** (0.030)	-0.181*** (0.024)	-0.198*** (0.024)	-0.239*** (0.031)
Whether covered under any health insurance- Yes (Base: No)	-0.504*** (0.025)	-0.424*** (0.017)	-0.351*** (0.018)	-0.289*** (0.026)
Log MPCE	-0.197*** (0.027)	-0.107*** (0.017)	-0.174*** (0.018)	-0.411*** (0.028)
Log of per capita Government Current Expenditure on Inpatient Care at the state level	-0.331 (0.219)	-0.083*** (0.028)	0.023 (0.029)	-0.418*** (0.158)
Constant	4.933*** (1.476)	1.649*** (0.213)	1.038*** (0.220)	4.881*** (1.077)
Observations	73,483			

Notes: Using the Log MPCE variable instead of quintile categories.

*** p<0.01, ** p<0.05, * p<0.1. Standard errors are reported within parentheses.

End Notes

[i] The information and data are accessible at: https://mohfw.gov.in/sites/default/files/Population%20Projection%20Report%202011-2036%20-%20upload_compressed_0.pdf
[ii] The information and data are accessible at: https://sdgs.un.org/goals
[iii] The information and data are accessible at: https://censusindia.gov.in/census.website/node/294
[iv] The information and data are accessible at: https://apps.who.int/nha/database/DocumentationCentre/Index/en
[v] The information and data are accessible at: https://censusindia.gov.in/census.website/node/294
[vi] The information and data are accessible at: https://rbi.org.in/Scripts/AnnualPublications.aspx?head=State%20Finances%20:%20A%20Study%20of%20Budgets
[vii] The information and data can be accessed at: https://mospi.gov.in/data
[viii] The information and data are accessible at: https://www.nfhsiips.in/nfhsuser/publication.php
[ix] The information and data are accessible at: https://www.nfhsiips.in/nfhsuser/publication.php
[x] The information and data can be accessed at: https://sdgs.un.org/2030agenda
[xi] Please refer: https://www.sciencedirect.com/science/article/pii/S2772368224001549#bib17