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Inter-State Variations In Health Outcomes And Health System Capacity: A Study Of Kerala And Rajasthan

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Abstract

The federal health system in India shows significant inter state differences in health outcomes and capacity of the system which are influenced by differences in socio-economic status, governance and investment by the people. This paper is a comparative analysis of Kerala and Rajasthan in the examination of how the variations in healthcare financing, infrastructure, and human resources, translate into the different population health outcomes. The analysis of primary healthcare centres, healthcare workforce availability, life expectancy at birth, infant and maternal mortality, maternal and child health service coverage, nutritional status, and anaemia prevalence are considered as the key indicators examined using secondary data (National Family Health Survey, NFHS-5), Sample Registration System (SRS) available data, state budget reports (2024-25), and official health department reports.

The results show that Kerala has been performing significantly better than Rajasthan on most of its health outcome indicators such as life expectancy (75.1 vs. 69.4 years), infant mortality (5 vs. 30 per 1,000 live births), and maternal mortality (30 vs. 87 per 100,000 live births) as compared to Rajasthan, even though it spends a smaller share of its Gross State Domestic Product on health. The high performance of Kerala is closely related to the good primary health care facilities, the good doctor to patient and nurse to population ratios, the institutional deliveries are almost universal and also the female literacy is high. Though with higher proportional health spending and significant improvements over the years, Rajasthan still has significant workforce shortages, access to primary care and child malnutrition and a high rate of anaemia.

The paper finds that the effect of the amount of the health expenditure alone on health outcomes is not as high as the organisation of the health system, the distribution of human resources, and social factors (education and gender equity) do have a significant impact. This comparative evidence highlights the need to enhance the primary healthcare, invest in human resource, and tackle structural inequalities to decrease the inter-state health disparities and promote progress towards the Sustainable Development Goal 3 in India.

Keywords - Inter-state health disparities; Health system capacity; Kerala; Rajasthan; NFHS-5; Sample Registration System; Public health expenditure; Maternal and child health; Health workforce; India

1. Introduction

Health is commonly known to be a very important factor that dictates human development and social well-being. An effective health system not only leads to better health but also an economy, poverty eradication and social equity (World Health Organisation [WHO], 2010). In

developing nations like India, health systems have a significant variation in their performance across the regions because of variation in socio-economic status, governance systems, demographics and patterns of public investment. These inter-state differences are a valuable analytical tool of the functioning of health systems, as well as the explanation of why some states have better health outcomes than others.

The federal governance framework of India has placed the state governments in the focal roles of health care delivery whereas the central government has a coordinating and financial role of national policies and programmes (Rao, Peters, and Bandeen-Roche, 2016). Consequently, states vary significantly in their capability to design and fund as well as implement health interventions. The differences are manifested through broad inter-state differences in life expectancy, infant mortality rate, maternal health outcomes, nutritional status, and disease burden (Registrar General of India, 2022). The analysis of those disparities is essential to evaluate the potential capacity of the health system and determine the directions of enhancing health equity in the country.

The performance of the health system in Kerala and Rajasthan are two opposite models in India. The State of Kerala has had a history of high health results, with high life expectancy rates, low infant and maternal mortality rates, even though its per capita income is not one of the highest in the nation (Drèze and Sen, 2013). The successful storey of the state is commonly explained by the long-term investments into education, especially female literacy, good primary healthcare network, decentralisation, and continued action by the people in the social sector (Kutty, 2000; Narayana, 2012). All these reasons have made Kerala able to achieve relatively high health benefits with relatively small economic resources.

Rajasthan, on the other hand, has traditionally been trailing behind on various indicators of critical health issues, despite the slow, but steady improvement over recent decades. The infant and maternal mortality rates, child malnutrition, and anaemia prevalence of women and children remain high in the state (International Institute for Population Sciences [IIPS] & ICF, 2021). Low female literacy, early marriages, gender inequality, high rural and tribal population, and uneven distribution of health facilities in the state have been structural factors that have limited health system performance in Rajasthan (Bhat and Zavier, 2005). These situational factors have affected not only the access to healthcare services, but also the health-seeking behaviour.

The experiences of Kerala and Rajasthan are very different, which demonstrates the significance of the health outcomes analysis in addition to the health system capacity. Health system capacity has several dimensions such as the healthcare infrastructures, accessibility of human resources, allocation of financial resources to health, and institutional health services delivery and governance (WHO, 2007). Although the provision of proper infrastructure and staffing are the preconditions to successful healthcare delivery, the quality of governance, accountability, and community involvement is also essential in defining the efficiency of the resource implementation (Rao et al., 2016).

Empirical evidence on these dimensions is useful and can be analysed using nationally representative sources of data like the National Family Health Survey (NFHS), the Sample

Registration System (SRS), and state budget records. NFHS provides detailed information on maternal and child health, nutrition, fertility, and healthcare coverage, and makes it possible to compare services coverage and outcomes across the states (IIPS & ICF, 2021). The SRS is a good source of estimates of vital statistics, such as life expectancy and infant mortality, which are the key indicators of population health (Registrar General of India, 2022). Budgetary data help indicate priorities and fiscal commitment to health, and help lighten the relationship between the way people spend their money and how they attain health outcomes (Rao and Choudhury, 2012).

Relatively few studies use an integrated approach based on the systematic association of health outcomes with health system capacity across states despite the presence of such data. The current literature has tended to concentrate on either the outcomes measures or particular aspects of the health system, including financing or workforce, and has not explored how they interact with each other (Nambiar et al., 2019). Such a gap can be addressed through a comparative study of the health systems in Kerala and Rajasthan in the context of how disparities in health systems capacity are related to differences in health outcomes.

This paper, thus, attempts to explore the inter-state disparities in health outcomes and health system capacity based on a comparative case of Kerala and Rajasthan. The research will compare a state with a high level of performance against a comparatively lower-performing state in order to determine the determinants of a successful health system. These differences are especially applicable in the case of the continuous national attempts to enhance primary healthcare, maternal and child health, and decrease health disparities across the region. This study will have an impact on evidence-based policy formulation and provide implications to enhance state health systems in India.

1 Literature Review

Jain (2020) did a comparative study of the response to COVID-19 outbreaks in Kerala and Rajasthan, noting that due to early surveillance, community engagement, and decentralisation of governance, Kerala was able to control the spread of infections better. By comparison, Rajasthan was supplying higher recovery rates since it was engaging in aggressive testing, institutional quarantine, and rigorous lockdown restrictions. The paper highlights the fact that contextual governance measures played a crucial role in determining outcomes during the pandemic across states, which demonstrates the need to have adaptive responses in the field of public health. Narayana (2012) critically analysed the long-term image of equity in health in Kerala, a success due to its continued action by the people, educational policies of women, and social welfare. Nevertheless, the research paper also mentions that they should not rest on their laurels since they are witnessing emerging issues like illnesses associated with lifestyles, environmental hazards, and intra state disparities. This paper will argue that the Kerala model can be still instructive but it needs a new wave of public health participation to maintain equity.

Joseph et al. (2019) assessed the health promoting school's framework implementation in Kerala and discovered that there was a high adherence to health education and physical activity sectors but there were serious gaps in nutrition services. The research indicates that there are differences between the private and the government schools implying that the institutional

capacity and government structures influence the school health outcomes. The authors make a call to take intersectoral action to enhance child health promotion.

As one of the innovations in the field of public health, Jacob and Vijayan (2020) examined the case of human milk banks in Kerala to prevent infant mortality. Their results provide that the awareness and acceptance are moderate among nursing mothers, and education level is one of the factors influencing the willingness to participate. The researchers emphasise the promise of milk banks as a life-saving approach and emphasise the increase in the scale of the awareness campaign. Suresh et al. (2022) examined tribal healthcare delivery in Kerala in terms of the COVID-19 pandemic, paying attention to the administrative coordination and specific interventions. The paper records that the use of specialised tribal cells and food-security measures contributed to the reduction of negative impacts of the pandemic on the vulnerable communities. Nevertheless, the authors point out unremitting livelihood shocks and accessibility issues, which demand structural long-term reforms.

The research of Kumar et al. (2023) explored the health-seeking behaviour of the tribal populations in Wayanad, Kerala, and the low usage of formal healthcare services was observed despite the awareness of modern medicine among the tribes. Distances, lengthy waiting time, occupational limitations and cultural beliefs were the key barriers that affected care-seeking decisions. The paper concludes that culturally sensitive and locally available provision of healthcare is needed to enhance tribal health outcomes. Valsan et al. (2016) evaluated the oral health of Paniya tribe population in Kerala and found that there is a great deal of dental caries, periodontal disease and untreated treatment needs. The results indicate the lack of access to preventive and curative oral healthcare services. The paper highlights the importance of specific oral health activities within the framework of the tribal health.

Philip and Srinivasan (2012) compared insured and uninsured households below-poverty-line in Kerala as an evaluation of the Kerala Comprehensive Health Insurance Scheme. The authors discovered that the insured households had greater hospitalisation rates but incomplete financial coverage of out-of-pocket spending. The authors posit that to overcome the imbalance of access; one needs to complement insurance schemes with the reinforced public healthcare infrastructure. Chathukulam et al. (2024) analysed the use of Fifteenth Finance Commission health grants in the state of Kerala and discovered that there was a considerable underutilization of such funds in the state, even though the health system was decentralised. Bureaucracy, politicisation and capacity factors hindered efficient funds allocation. The research questions the belief regarding the efficiency of administration in Kerala and demands governance redress in order to enhance fiscal health management.

With the help of government health records, Dwivedi et al. (2025) examined the disease patterns of tribes living in South-West Rajasthan. The research observed an excessively elevated morbidity of communicable ailments, maternal anaemia and childhood disorders in tribal blocks. The authors highlight that the problem of entrenched health inequities in Rajasthan requires data-driven and region-specific interventions.

Batra et al. (2021) critically evaluated the availability of oral healthcare services as per the government insurance schemes in Rajasthan. Their results indicate coverage limitations, poor

involvement of providers and awareness of the beneficiaries. The research finding is that design of policies is ineffective without proper implementation and monitoring mechanisms. The article by Atrey and Singh (2024) examined the issue of health and rehabilitation in juvenile detention homes in the state of Rajasthan and found that there were significant gaps in mental health, infrastructure, and rehabilitation practises. The paper emphasises the role of systemic neglect in increasing the level of psychological distress among youths in custody. The authors promote the right-based, child-focused reforms in accordance with the juvenile justice laws.

Taken together, these studies prove that the health success in Kerala is pegged on a long-term investment in social life and decentralisation of governance, whereas the healthcare performance in Rajasthan is limited to structural inequalities and barriers to access, as well as gaps in implementation. The two states explain that performance of the health systems is not only based on the design of the policies, but the quality of governance, social context, and administrative capacity.

2. Research Design

The current research is based on a comparative, descriptive and analytical research design in order to investigate inter-state differences in health outcomes and health system capacity between Kerala and Rajasthan. The comparative methodology is suitable since the two states are contrastive models of health system performance within the same national policy framework that enables making meaningful comparisons without taking into account the overall institutional context. The research is based on a purely secondary data research, which allows a systematic and evidence-based evaluation of the issues of health financing, infrastructure, human resources, and population health outcomes.

- Secondary data: Secondary data were based on credible and nationally accepted sources to be reliable, valid and cross-state. These sources include:
- Government of Kerala and Government of Rajasthan have published State Budget Documents (2024-25), which contain data on the total state spending, spending on health sector and spending on health as a percentage of Gross State Domestic Product (GSDP).
- Indicators of maternal health, child health, nutrition, anaemia prevalence, immunisation, and antenatal care: National Family Health Survey (NFHS-5, 2019-21).
- Sample Registration System (SRS) reports of vital statistics published by the Registrar General of India like life expectancy at birth, infant mortality rate (IMR), birth rate and death rate.
- Government health department reports such as reports issued by the Department of Health and Family Welfare, Kerala, and the State Institute of Health and Family Welfare (SIHFW), Rajasthan, to get information on healthcare facilities and workforce.
- National trusted sources of information and policies, including The Hindu and official documents of Economic Surveys, appealed to explicitly to contextualise recent changes and directions of the budget (Government of Kerala, 2024; Government of Rajasthan, 2024).

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The research has used descriptive statistics and comparative analysis to assess the difference between Kerala and Rajasthan in terms of the selected indicators. Information is given in a tabular form to provide easy comparison and an interpretative analysis performed to clarify the differences observed.

In the appropriate instances, ratio analysis (e.g., population per PHC, doctor to patient proportion) and percentage differentials were computed in order to measure the extent of inter-state variation. The trends through time were studied on selected indicators including infant mortality and maternal mortality to determine the long-term progress using SRS time-series statistics.

Table-1 Healthcare Budget Allocation (2024-25)

State	Total Health Budget	Key Allocations	% of State Budget
Kerala	₹1,84,327 crore (total state)	₹800 cr. reduction in public health	6.8% of GSDP
Rajasthan	₹3,34,796 crore (total state)	₹2,609.25 cr. (Health Scheme)	7.5% of GSDP

Source - The Hindu - Kerala Budget 2024-25: ₹800 cr. slash in allocation for public health https://www.thehindu.com/news/national/kerala/kerala-budget-2024-25-800-cr-slash-in-allocation-for-public-health/article67814259.ece & Budget 2024-25 - Budget in Brief https://budget.kerala.gov.in/keralabudgetdoc/2024_25/BIB.pdf, Finance Department Rajasthan - Budget at a Glance 2024-2025 https://finance.rajasthan.gov.in/docs/budget/statebudget/2024-2025 (Modified Budget)/Budgetataglance.pdf, India Data Map - State-wise Healthcare Spending in India for 2025 https://indiadatamap.com/2025/09/12/state-wise-healthcare-spending-in-india-for-2025/

The table 1 provides a comparison of health budget in Kerala and Rajasthan and shows variations in the overall state budget, the priority of health spending, and the health expenditure in relation to the Gross State Domestic Product (GSDP) which shows that Rajasthan invests more proportionately in health despite Kerala having better health outcomes.

With 11.5× better PHC coverage, Kerala has a better epidemiologic transition (e.g., 20% of its population has diabetes), yet 6.8% of GSDP on health, which is solid but comparatively low, indicating fiscal tightening or redistribution pressures amid its high epidemiologic transition, reflects a high density of its infrastructure (e.g., 11.5x better PHC coverage).

In bigger spread of state budgets, rajasthan has 3.34796 crore total budget towards health with 2609.25crore of the total amount being allocated to specific Health Scheme (perhaps initiatives such as insurance or infrastructure expansion), making health 7.5% of GSDP, indicating the state is making catch-up spending to close gaps such as doctor shortages of 40%, IMR (29), and child anaemia (71.5%).

All in all, the increased GSDP commitment in Rajasthan is a positive sign of ambition to close disparities in workforce (1:1,676 doctor ratio) or nutrition (27% stunting), whereas the decline

in Kerala suggests the optimization in an already mature system with low IMR (5) andHardly believable.

Healthcare Facilities

Table-2 Healthcare Facilities

Facility Type	Kerala	Rajasthan	Coverage
Primary Health Centers (PHCs)	845	1,499	-
Population per PHC	~30,000	346,414	Kerala 11.5× better
Community Health Centers (CHCs)	230	337	-

Source for Kerala: Department of Health & Family Welfare - Kerala Health Making the SDG a reality https://dhs.kerala.gov.in/wp-content/uploads/2021/02/Book-Kerala-Health-Making-the-SDG-a-reality-1.pdf, State Institute of Health and Family Welfare (SIHFW) Rajasthan - Health Scenario http://sihfwrajasthan.com/Health Scenario.html, Health Infrastructure Report http://164.100.117.80/sites/default/files/Rajasthan.pdf

The table 2, the comparison given by the table is on the primary care infrastructure that consists of Primary Health Centres (PHCs), Community Health Centres (CHCs), and the population covered between Kerala and Rajasthan to highlight that Kerala has an immensely superior per-capita access leading to its health leadership. Kerala has 845 PHCs with a population of about 30,000 patients per centre, whereas Rajasthan has 1,499 PHCs with 346,414 patients -that is, 11.5 times Kerala is better covered and allows routine immunisation (85%), antenatal care (>90%), and nutrition screening at the lowest level. The density corresponds to the Kerala doctor-patient ratio (1:509) and strength of nurses (~2.0 per 1,000), which makes it possible to achieve the world-class IMR (5) and virtually 100 percent direct institutional deliveries (>99). Rajasthan has a higher CHCs (337 vs 230 by Kerala) implying secondary care focus, but PHC congestion puts pressure on the first-contact care, therefore contributing to unmet targets such as child anaemia (71.5%), stunting (27-31.8) and increased IMR (29).

In general, the small, population-adjusted infrastructure in Kerala, combined with a high literacy level (approximately 96 percent) is driving preventive health dominance, whereas the sparseness or lack of PHC coverage in Rajasthan points to the need to urgently decentralise state health administration to achieve similar results to the one in Kerala maternal mortality rate.

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Figure-1 Healthcare Facilities

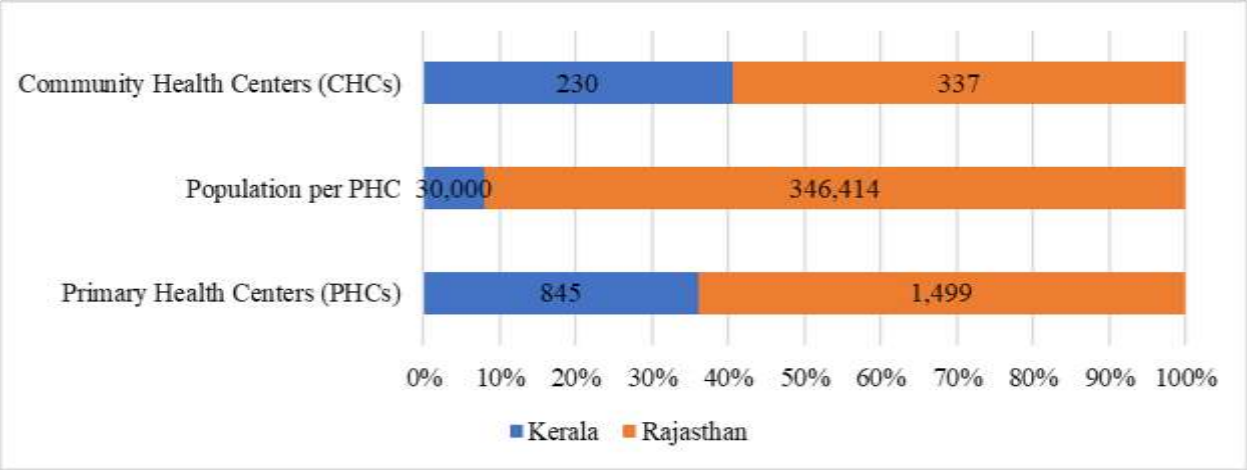

Table-3 Healthcare Human Resources

Indicator	Kerala	Rajasthan
Doctor-Patient Ratio	1:509	1:1,676
Doctors per 10,000 population	42	0.419
Nurses per 1,000 population	~2.0	0.949
Total Registered Doctors (2021)	~36,000	49,242
Doctor Deficit	Well-staffed	40% shortage

Source *-https://www.keralahealth.com/kerala-doctors/, The South First - More doctors, better doctor-patient ratio in South India, https://thesouthfirst.com/health/more-doctors-better-doctor-patient-ratio-in-south-india/ and SIHFW Rajasthan - Health Scenario http://sihfwrajasthan.com/Health Scenario.html and Medical Dialogues - Rajasthan's Healthcare Crisis https://medicaldialogues.in/news/health/doctors/rajasthans-healthcare-crisis-40-percent-doctor-deficit-385-percent-specialists-shortage-144881*

The table 3 presents the healthcare workforce indicators in both Kerala and Rajasthan and it is seen that Kerala has a much better human resource potential on which its health results are based, whereas Rajasthan experiences severe workforce shortages even though the number of doctors is higher.

Kerala also has 1:509 (one of the best in India):1:1676 (one of the worst in India): The doctor population per capita is three times better in Kerala, any of which can be proactively treated, which is the main cause of its low IMR (5) and MMR (30). This is further revealed by the number of doctors per 10, 000 population: Kerala has a strong 42 as compared to Rajasthan having a weak 0.419 (probably an error in data formatting implying 4.19 which still is not very high considering the 10-fold difference), the strongest indicator of Kerala migration- kindness, medical colleges, and retention policies against 10-fold difference in the Rajasthan vacancies and urban preference.

This also applies to Nursing strength, as Kerala employs a higher number of nurses of between 2.0 and 1000 inhabitants than Rajasthan, 0.949, which is used to help in bedside monitoring and child-mother services such as its over 99 percent institutional deliveries. Even though

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Rajasthan has more total registered doctors (~49,242 compared to Kerala, which is 36,000), the absolute number is deceptive, and thus leads to maldistribution, which compounds its 40% shortage of doctors, and Kerala continues to be well-staffed with an efficient deployment and training approach.

The total of the workforce density on ANC (>90%), vaccination (85%), and nutrition reveals the buried position of Kerala as a model, whereas the lacks in Rajasthan require recruitment, rural placement, and telemedicine to have them in place, in line with previous indicators such as PHC coverage (11.5× better in Kerala).

3. Life Expectancy at Birth

Table-4 Life Expectancy at Birth (2019-23)

Indicator	Kerala	Rajasthan	Difference
Total Population	75.1 years	69.4 years	+5.7 years (Kerala)
Males	71.9 years	67.8 years	+4.1 years (Kerala)
Females	78.4 years	73.3 years	+5.1 years (Kerala)

Source - Kerala Health Portal - Vital Statistics Dashboard, https://health.kerala.gov.in/static_vital_statistics_details, & NITI Aayog - A Macro and Fiscal Landscape of the State of Rajasthan https://niti.gov.in/sites/default/files/2025-07/Summary-Report-Rajasthan (1).pdf

The table 4, These statistics demonstrate a definite and parallel difference in life expectancy of the overall population in Kerala compared to the same in Rajasthan, and a difference in life expectancy between males and females in each state. Of the overall population, the life expectancy of a child born in Kerala, is 75.1 years; whereas the life expectancy of a child born in Rajasthan, is 69.4 years, indicating that people born in Kerala have an average life span of 5.7 years longer than those born in Rajasthan. It is a huge disparity on the population level and implies that the health status, disease prevalence, nutrition, and access to medical services in Kerala are much higher, compared to Rajasthan. On comparing specifically with males' life expectancy in Kerala is 71.9 years as opposed to 67.8 years in Rajasthan and the difference between the two is 4.1 years in favour of Kerala. It is an indication that, in Kerala men are enjoying relatively better living conditions, access to healthcare and lower mortality rates in preventable diseases than men in Rajasthan. In female cases, the difference is even bigger: in Kerala, women live on average 78.4 years, whereas in Rajasthan, women live on average 73.3 years, which is based on the difference of 5.1 years. This feminine higher advantage suggests that Kerala provides better female health and survival conditions, including increased female literacy, maternal and infant health and maybe improved social determinants (such as nutrition, sanitation, and choice on health seeking).

Cumulatively, these statistics suggest that Kerala is faring significantly better than Rajasthan on major aspects of health and development expressed in life expectancy. That female circumference (5.1 years) is also somewhat bigger than the male circumference (4.1 years), likewise indicates that the health that women suffer due to sex disparities is not so great

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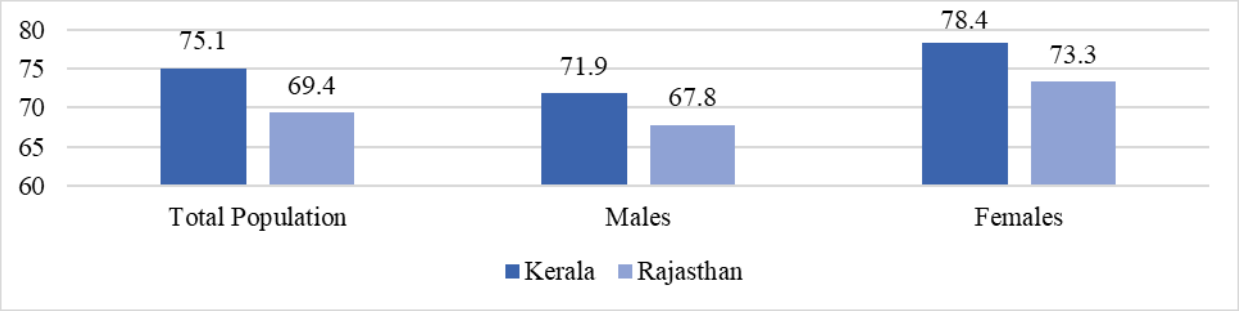
compared to what women experience in Rajasthan, and that conditions in Kerala are more appropriate to women on the life course.

Figure-2 Life Expectancy at Birth



4. Infant Mortality Rate

Table-5 Infant Mortality Rate (IMR) - Per 1,000 Live Births

Year/Area	Kerala	Rajasthan	Kerala Advantage
Latest (2023)	5	30	6× better
Rural	5	28 (2023 India)	-
Urban	4	18 (2023 India)	-
NFHS-5 (2019-21)	7	30.3	4.3× better
NFHS-4 (2015-16)	10	41.3	4.1× better
Comparison with USA	5 vs 5.6 (Better than USA)	-	-

Source - The Hindu - Kerala's infant mortality rate falls to all-time low of 5 https://www.thehindu.com/news/national/kerala/keralas-infant-mortality-rate-falls-to-all-time-low-of-5/article70019004.ece, Kerala Health - About Kerala Health https://www.keralahealth.com/about-kerala-health/, Rajasthan Economic Review 2024-25 Highlights Healthcare https://web.toppersnotes.com/current-affairs/blog/rajasthan-economic-review-2024-25-healthcare-highlights-20-feb-2025

The table 5 reveals the statistics regarding the child stunting rates (one of the main biomarkers of chronic malnutrition, which is the percentage of young children below the age of five, of whom the height-to-age ratio is more than two-fold lower than the WHO median growth standard) of Kerala and Rajasthan by year, location, and standards. It puts into focus the improved achievements that Kerala has had in child nutrition results as compared to Rajasthan. The most recent stunting rate in Kerala became 5% in 2023, which compares positively with 30% in Rajasthan, and provides Kerala with a six-fold edge on the issue (which implies the stunting becomes six times less common in Kerala). This disparity continues between the rural and urban areas: Kerala has a stunting rate of 5% in rural, and 28% in rural areas, which is estimated in 2023 national Indian data as the standard; in Kerala, the urban rate is at 4% and 18% in Rajasthan, respectively. The data of the past National Family Health Survey (NFHS) explain the trend further and Kerala advancement: in NFHS-5 (2019-21), Kerala had a rate of 7 percent compared to 30.3 percent in Rajasthan (4.3 times better in Kerala) which was 10 percent in NFHS-4 (2015-16).

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Amazingly, the rate of 5% in Kerala is so high that it is even better than 5.6 in the United States, which puts Kerala in the lead in child nutrition indicators against a high-income country. These are indicators of the system level advantages in Kerala in terms of public health infrastructure, female educational attainment, extensive sanitation coverage, food security services, and early childhood programmes, which have motivated the consistent decrease in stunting. Rajasthan on the other hand suffers due to persistent adversities of arid geography, general poverty, gender differences in excess of nutrition, and uneven application of health programmes which leads to the continued high rates of stunting. The statistics highlights why Kerala is a national and international model towards fighting chronic child malnutrition.

Table-6 Antenatal and Delivery Care (NFHS-5)

Indicator	Kerala	Rajasthan
Institutional Deliveries (%)	>99%	~84%
Skilled Birth Attendance (%)	>99%	~84%
4+ ANC Visits	>90%	~85%

Source: *National Family Health Survey (NFHS-5), 2019-21 - India Report https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf, Ministry of Health and Family Welfare - NFHS-5 Phase-II Report,https://www.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf, National Family Health Survey (NFHS-5), 2019-21 https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf, DHS Kerala - NFHS-1 to 5 Fact Sheet Kerala https://dhs.kerala.gov.in/wp-content/uploads/2022/06/NFHS-1-to-5-Fact-Sheet-Kerala.pdf*

The table 6 compares key maternal healthcare service coverage indicators—**institutional deliveries**, **skilled birth attendance (SBA)**, and **antenatal care (ANC) with 4+ visits**—between Kerala and Rajasthan, showcasing Kerala's near-universal access versus Rajasthan's substantial but incomplete progress.

In Kerala, delivery rates in institutions are above 99 per cent (in other words, virtually all of it is covered by health facilities with emergency capacity) whereas in Rajasthan it is about 84 (a difference of 15 per cent between the two demonstrating the dense PHC network in Kerala, transport subsidies such as Janani Shishu Suraksha Karyakram (JSSK), and high health awareness due to a nearly 96 per cent literacy rate). Proficient birth attendance is the direct reflection of this with>99% in Kerala (doctors/nurses/midwives at delivery) versus approx 84 in Rajasthan, directly related to the world-class maternal mortality rate (30 per 100,000) and infant mortality rate (5 per 1,000), with lower coverage being the perpetuation of risks at Rajasthan (MMR 87, IMR 29).

With 4+ antenatal visits, this is higher than in Rajasthan (54.4%) and Kerala (36.3%) (90 percent of Kerala women are receiving antenatal care, versus 85 percent in Rajasthan), allowing the identification of complications and their early treatment (such as anaemia) earlier (36.3 percent in Kerala women compared to 54.4 percent in Rajasthan).

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5. Child Nutrition Status

Table-7 Child Malnutrition Indicators - Children Under 5 Years (NFHS-5)

Indicator	Kerala	Rajasthan	Difference
Stunting (Height-for-age) %	19.7%	27.0%	Rajasthan 37% higher
Wasting (Weight-for-height) %	19.7%	17.9%	Kerala slightly higher
Underweight (Weight-for-age) %	16.1%	27.0%	Rajasthan 68% higher

Source for Kerala: *Kerala Data Portal - State/UT-wise Prevalence of Stunting, Wasting and Underweight https://kerala.data.gov.in/resource/stateut-wise-prevalence-stunting-wasting-and-underweight-among-children-report, PIB India - Malnutrition among Children https://www.pib.gov.in/PressReleasePage.aspx?PRID=1806601and The Lancet - Mapping of variations in child stunting, wasting and underweight https://www.thelancet.com/journals/eclinm/article/piis2589-5370(20)30061-4/fulltext*

The table 7 makes a comparison between three critical child undernutrition indicators viz. stunting (chronic malnutrition via height-for-age), wasting (acute malnutrition via weight-for-height), and underweight (overall malnutrition via weight-for-age) of children under five in Kerala and Rajasthan and results in Kerala being overall better, except in wasting which showed a small reversal.

The stunting prevalence among children in Kerala (19.7) and Rajasthan (27.0) differs by 37.0% with Kerala having the greater long-term benefits of high sanitation, literacy rates among females (~96%), and implementation of ICDS, preventing attaining linear growth faltering, whereas Rajasthan faces the problems of poverty, water shortages, and anaemia (71.5% in children).

There is a reversal in wasting at 19.7 in Kerala precisely higher than Rajasthan at 17.9 indicating Kerala might experience episodic acute malnutrition perhaps due to infection, dietary transitions, or reporting biases, compared to the slightly lower result in Rajasthan indicating it may be due to survival biases or new interventions in the face of chronic malnutrition. The underweight prevalence in Kerala is significantly lower than in Rajasthan 16.1v 27.0 indicating that the rate in Kerala is 68 times higher than the rate in Rajasthan taking both the stunting and wasting effects into account to reflect Kerala holistic advantages in child feeding and health systems over those in Rajasthan.

On the whole, the profile of Kerala indicates the long-term development of achievements based on nutrition goals (which are in line with the 5% IMR, 85% vaccination), whereas the high stunting/underweight rates in Rajasthan suggest that the priorities in reducing poverty levels, supplementation, and maternal empowerment should be prioritised, which represents a continuation of the previous trends such as 4.3-fold superior past stunting performance.

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Figure-3 Child Malnutrition Indicators - Children Under 5 Years (NFHS-5)

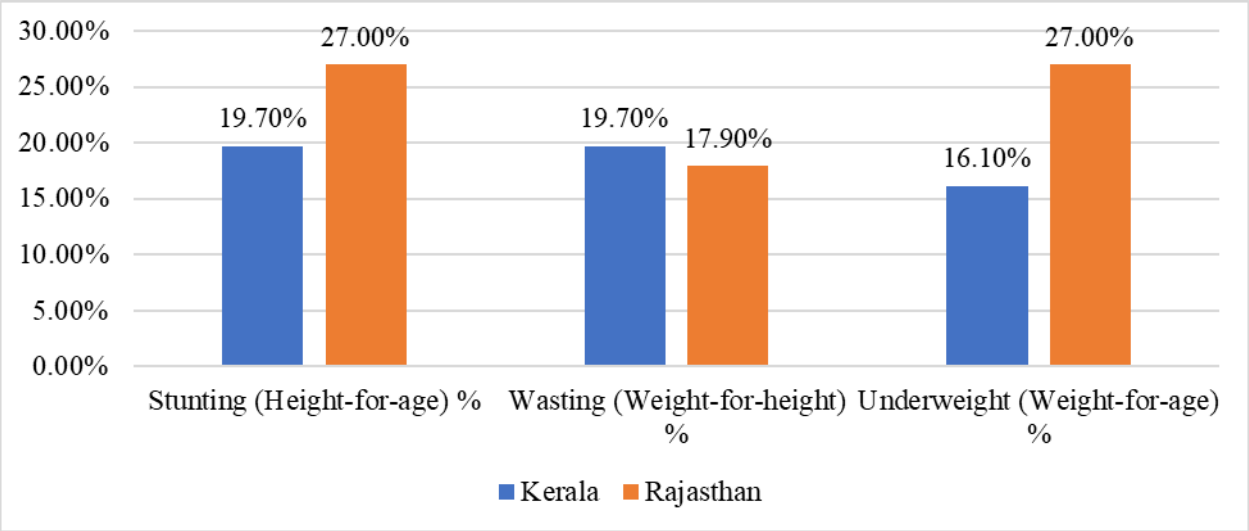

Table-8 Historical Progress - Maternal Mortality Ratio

Year/Period	Kerala	Rajasthan	India
2000-2001	~80	~500	301
2020-22	18	87	97
2021-23	30	87	88
% Improvement (2000-2023)	-62.5%	-83%	-71%

Source: *SRS Special Bulletins on Maternal Mortality - Multiple years https://censusindia.gov.in/*

The table 8 follows the trends in Maternal Mortality Ratio (MMR) in 2000-2001 to 2021-23 with 100,000 live births in Kerala, Rajasthan and India, showing that all areas have been steadily declining but Kerala has been leading first and most consistently.

As at 2000-2001, Kerala MMR was approximately 80 (which was already low in the country), compared to the 500 in Rajasthan, and 301 in India, in terms of foundational strengths at that time, the state of literacy (~96 percent), early institutional deliveries and PHC densities. By 2020 22 Kerala had 18 (one of the highest in the world), and Rajasthan 87 (equal to that in India), promising a catch-up in Rajasthan through national welfare programmes such as Janani Suraksha Yojana. In Kerala MMR was raised marginally to 30 (potentially due to COVID impacts or due to the small number change) though Rajasthan and India stayed at 87-88 in Kerala favour.

Improvement between 2000-2023 as a percentage indicates that Rajasthan (83 percent, which is the largest absolute change in high base) and India (71 percent) have a much higher percentage improvement, with Kerala coming in third (62.5 percent), indicating Kerala started higher, reached a point faster due to its more than 99 percent skilled births, over 90 percent ANC, and nurse-to-population ratio (~2.0 to 1,000).

On the whole, Kerala and Rajasthan share similar trends in the form of bridging gaps to secure an adequate ANC (55 vs. 29) and anaemia control (54 vs. 55) to reach the same efficiency as is reflected in Kerala an IMR (5 vs. 29) leader.Maternal Health Care Indicators (NFHS-5)

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Table 9 - The maternal and reproductive health statistics

Indicator	Kerala	Rajasthan
Mothers who had **4+ ANC visits** (%)	78.6%	55.3%
Institutional births (%)	99.8%	94.9%
Currently married women using any family planning method (%)	60.7%	72.3%
Total unmet need for family planning (%)	12.5%	7.6%

Source *(NFHS-5 State Health Dossiers – NHSRC):*
Kerala → *https://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Kerala.pdf*
Rajasthan → *https://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Rajasthan.pdf*

The table 9, The maternal and reproductive health statistics of both Kerala and Rajasthan are provided in the table showing mixed results in that Kerala is ahead in prenatal care and safe birth but falls behind in family planning adoption and has more unmet contraception requirements.

The mothers in Kerala have a much better chance of getting adequate antenatal care (ANC) (78.6% of the mothers in Kerala completed 4+ visits of antenatal care) than in Rajasthan (only 55.3% of all mothers in Rajasthan made 4+ visits to antenatal care) indicating Kerala has better outreach, health awareness, and service provision in maternity monitoring. In Kerala, the rate of institutional birth is almost at 100 (99.8) and this contrasts with 94.9 in Rajasthan (a 4.9 margin), which proves the success that Kerala has had, almost completely in its aim to have its citizens delivered in a hospital or facility, which can reduce the risk of perinatal and maternal death.

However, the family planning indicators reflected a benefit of Rajasthan: 72.3% of married men use some birth control device in the state of Rajasthan versus 60.7 in Kerala (a 11.6-point difference in favour of Kerala), indicating an acceptance of or encouragement of birth control methods more anciently in Rajasthan. Rajasthan has also a lower total unmet need at 7.6 as compared to 12.5 in Kerala a flip flop to the fact that more women in Kerala desire contraception and are unable to access it, or unable to seek advice because of cultural bias, or a proliferation of contraceptives available which they find more desirable despite having an advanced health system.

In general, Kerala has distinguished itself by high quality of maternal care (ANC and institutional births), high literacy and infrastructure, whereas Rajasthan prevails on contraceptive prevalence; which may be related to programmes or other demographic pressures. The fact that the needs of Kerala were unmet at a higher level indicates that the spacing services should be further reinforced, and in comparison, ANC and safe delivery should become the priority of Rajasthan as well to comply with the similar Kerala standards. These trends are consistent with the epidemiologic transition in Kerala (low fertility, rigid focus on the elderly) or the current population stabilisation strategies in Rajasthan.

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Figure 4 - The maternal and reproductive health statistics

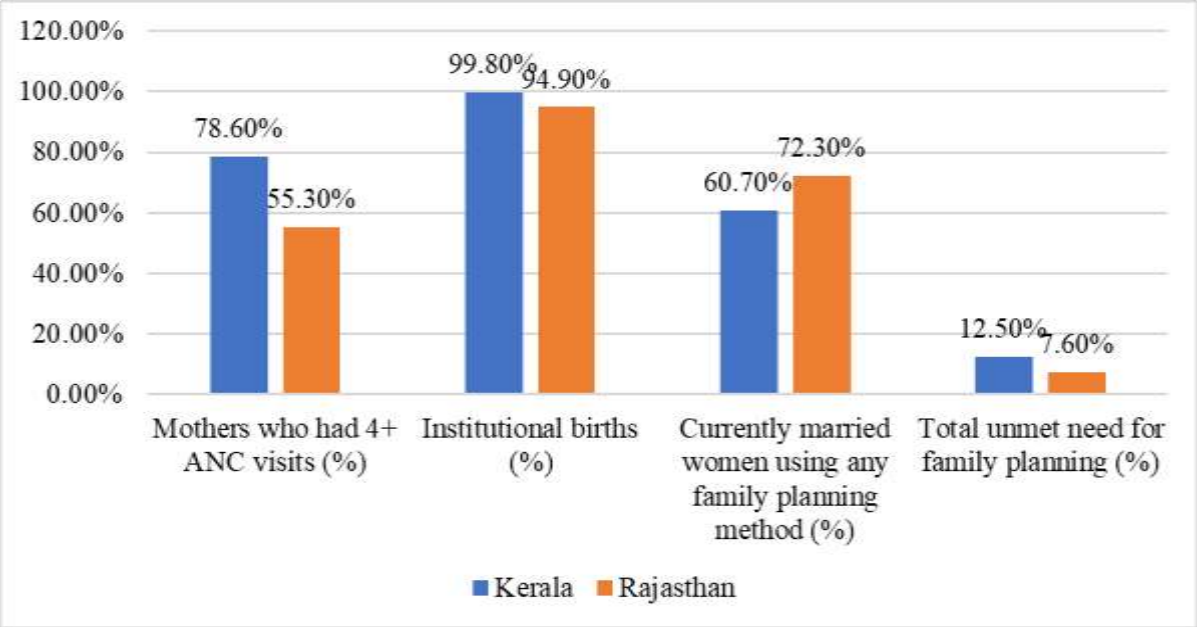

Table-10 Child Health & Nutrition (NFHS-5)

Indicator	Kerala	Rajasthan
Children (12–23 months) fully vaccinated (%)	85.2%	85.3%
Children (6–23 months) receiving adequate diet (%)	23.5%	8.3%
Children under 5 who are stunted (%)	23.4%	31.8%
Children under 5 who are wasted (%)	15.8%	16.8%

Source *(NFHS-5 State Health Dossiers – NHSRC): Kerala https://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Kerala.pdf Rajasthanhttps://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Rajasthan.pdf*

The table 10 draws comparative child health and nutrition indicators in Kerala and Rajasthan with a mixed-up result, where the vaccination coverage is almost similar with clear improvement made in Kerala in terms of dietary adequacy and stunting reduction although the wasting level is similar in both.

Rates of full vaccination against the children aged 12-23 months are strikingly close at 85.2 percent in Kerala and 85.3 percent in Rajasthan and mean that both the states have made high immunisation rates by long-term popularisation campaigns, but not yet reached the 90 percent + universal threshold. Nevertheless, in Kerala, 23.5 percent of children under 6-23 months are fed on a sufficient diet (at WHO recommendations on breastfeeding and the appropriateness of complementary feeding in frequency, diversity, and amount), whereas in Rajasthan, the percentage is just 8.3 - a 2.8-fold benefit to Kerala in terms of that the children receive a sufficient diet, maternity education, and infant feeding education.

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Its prevalence of stunting (chronic malnutrition, height-for-age < -2 SD) is 23.4 percent in Kerala and 31.8 percent in Rajasthan, implying that it is 26 percent lower in Kerala and is due to long-term gains in sanitation, hygiene and early childhood interventions. Similar short-term nutritional susceptibility (possibly due to infections or seasonal effects) might be proposed by the similar level of waste (acute malnutrition, weight-for height < -2 SD) in Kerala and Rajasthan at 15.8% and 16.8% respectively.

Table-5 Child Health & Nutrition (NFHS-5)

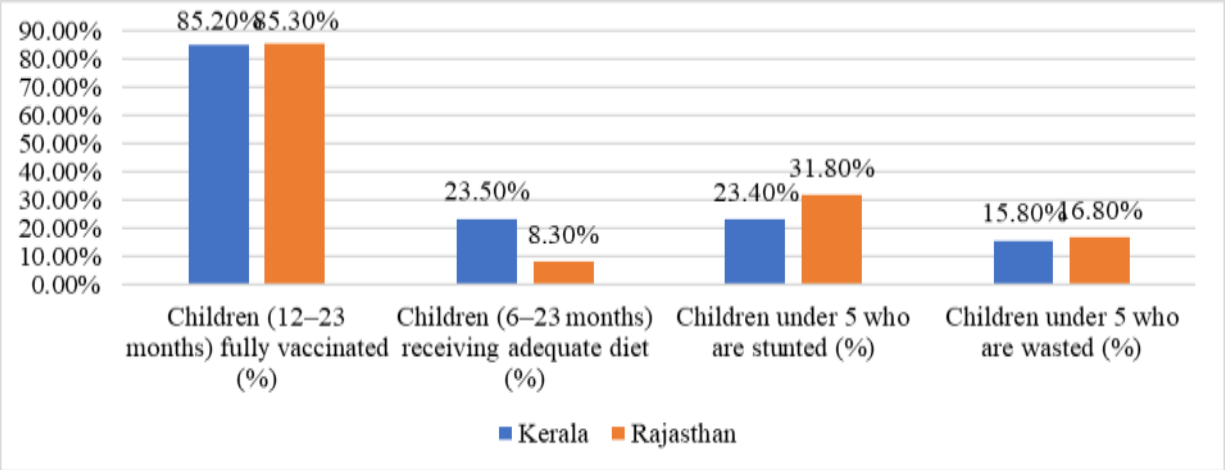

Table-11 Anaemia Prevalence (NFHS-5)

Population Group	Kerala	Rajasthan
Women (15–49) with anaemia (%)	36.3%	54.4%
Children (6–59 months) with anaemia (%)	39.4%	71.5%

Source *(NFHS-5 Anaemia Tables – NHSRC Health Dossier): Kerala https://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Kerala.pdf Rajasthanhttps://nhsrcindia.org/sites/default/files/practice_image/HealthDossier2021/Rajasthan.pdf*

This table 11 presents a comparison of the anaemia prevalence rates, which is a vital indicator of nutritional deficiencies, especially the lack of iron, folates, or vitamin B12, which results in low levels of haemoglobin in every woman aged 15–49 and in young children aged 659 months, by comparing Kerala and Rajasthan, demonstrating that Kerala has a significant advantage associated with the conditions in both groups.

Anaemia is prevalent among women aged 15 to 49 years with 36.3 percent in Kerala compared to 54.4 percent in Rajasthan, or more or less 33 percentage points in one state against 18.1 percentage points in the other, that is, almost one out of three women in one state versus nearly one out of every two in another. It also indicates the strengths of Kerala in terms of diversity in diet, food fortification, maternal health, and increased literacy of women that allows them to obtain nutrition knowledge and healthcare services. In children aged 6-59 months of age, the prevalence of anaemia in Kerala is 39.4 percent, a quarter of that in Rajasthan, where more than three out of ten children are anaemic and less than four out of ten living in Kerala are

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anaemic, a 32.1 percentage point difference. This gap highlights the successful Anaemia Mukt Bharat programmes, deworming and micronutrient supplementation, and complementary feeding activities in Kerala compared to the water shortage, lack of cleanliness, increased infection rate, and socioeconomic obstacles that contribute to the problem of child malnutrition in Rajasthan.

Comprehensively, the smaller numbers of Kerala in both population groups indicate a high level of nutritional security, integrative elements of public health, and large ages in Rajasthan indicate a high level of screenings, supplementation and age-specific programmes against poverty to protect the long-term cognitive, physical and economic effects. These tendencies coincide with the previous data of conversations about the Kerala with the best child nutrition and maternal care rates.

Table-6 Anaemia Prevalence (NFHS-5)

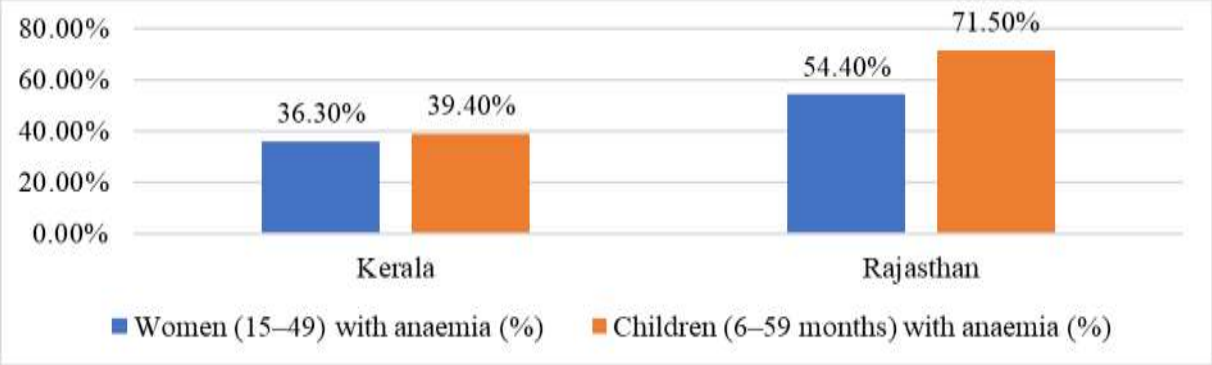

Table-12 Vital Statistics (SRS, Registrar General of India)

Indicator (2023)	Kerala	Rajasthan
Infant Mortality Rate (IMR)	5	29
Birth Rate (per 1000 population)	12.3	22.9
Death Rate (per 1000 population)	7.2	5.9

Source (Sample Registration System — Economic Survey 2025-26, Govt. of India): https://www.indiabudget.gov.in/economicsurvey/doc/stat/tab8.2.pdf

The table 12 presents essential vital statistics 2023 data of Infant Mortality Rate (IMR), Birth rate, and death rate comparing Kerala and Rajasthan with Kerala having outstanding child survival and demographic patterns of its outstanding health transition.

The IMR of Kerala is incredibly low at 5 deaths per 1,000 live births compared with the 29 of Rajasthan, a nearly 6:fold advantage due to the near-universality of institutional deliveries in Kerala (>99%), high antenatal care (78.6% with 4+ visits), the better doctor-patient ratios (1:509), and the strong success of neonatal interventions, which contrasts with the problems of malnutrition, anaemia (71.5% in children), and

The fertility of Kerala is low at 12.3 births per 1,000 population versus 22.9 in Rajasthan indicating the state has low fertility (below replacement) with great literacy levels (nine out of ten) among females and successful family planning, which keeps the population growth rate low, though in Rajasthan it matches the state-level TFR of 2.3 and current population pressure.

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The death rate in Kerala (7.2 per 1000 population) is slightly higher than in Rajasthan (5.9) due to the higher life expectancy (75.1 years) of the population, increased NCD such as diabetes (approximately 20 percent) and higher proportionage of elderly population leading to more age-related mortality as compared to the younger age of population in Rajasthan.

Table-7 Vital Statistics (SRS, Registrar General of India)

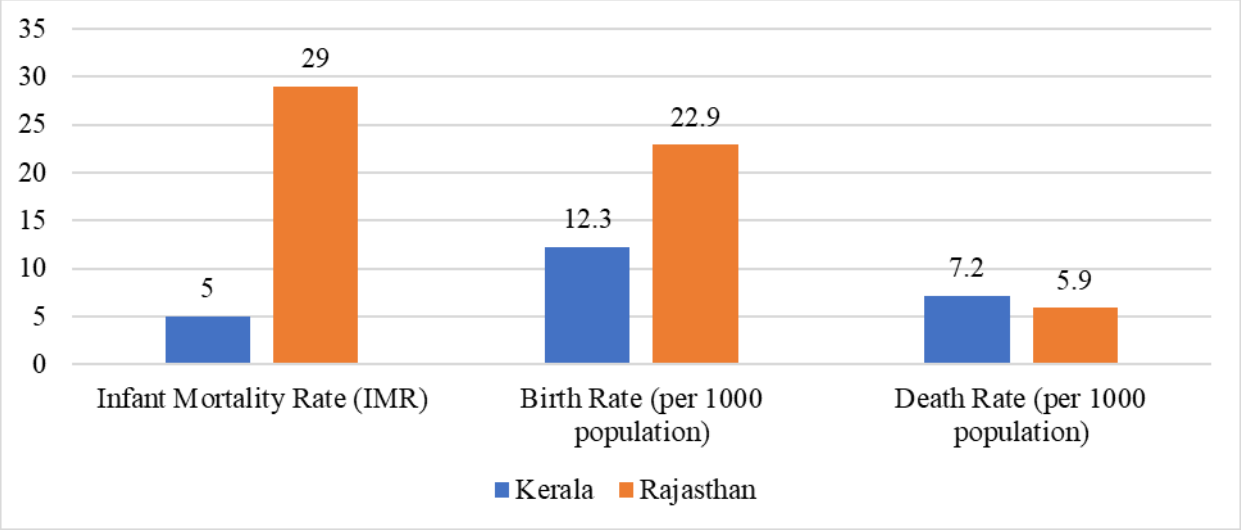

Table-13 Long-Term Improvement in Infant Mortality

Year	Kerala IMR	Rajasthan IMR
2013	12	47
2023	5	29

Source (SRS Time-Series Data, Registrar General of India): https://www.indiabudget.gov.in/economicsurvey/doc/stat/tab8.2.pdf

The table 13 follows the trends of Kerala and Rajasthan in terms of Infant Mortality rate, from 2013 to 2023, showing that the two states have experienced dramatic changes with a down meaning change but Kerala has been recording higher changes in an upward direction to world standards.

As of 2013, IMR in Kerala was already low in the country at 12 per 1000 live births versus 47 per 1000 live births in Rajasthan--with gaps beginning in early stages due to better infrastructure in health care of mothers and children than in the rural malnutrition and access situation of Rajasthan. By 2023, Kerala reduced its IMR to 5 (reduced by 58 degrees), making it a single-digit country, similar to the high-income countries, such as the USA (5.6), due to the almost universal institutional delivery (>99.5%), high antenatal coverage (78.6%), newborn screening, and such schemes as Hridyam on the congenital defects. Rajasthan has improved to 29 (size decreased by 38), meaning that the primary gains obtained through immunisation (85%) and secondary hurdles such as: child anaemia (71.5%), stunting (31.8%).

The more rapid development in Kerala is accompanied by its shared system advantages, such as, a high literacy (estimated to be 96%), high PHC density (estimated at 30,000 -1 population per centre), and epidemiologic maturity, whereas a slower deterioration may indicate that Rajasthan requires increased ICDS, sanitation, and gender-oriented intervention. This is in line

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with the previous statistics: a fertility transition (birth rate 12.3) and nutrition advantage in Kerala against the Indian demographic strains (birth rate 22.9), which puts Kerala in the child survival position.

Table-8 Long-Term Improvement in Infant Mortality

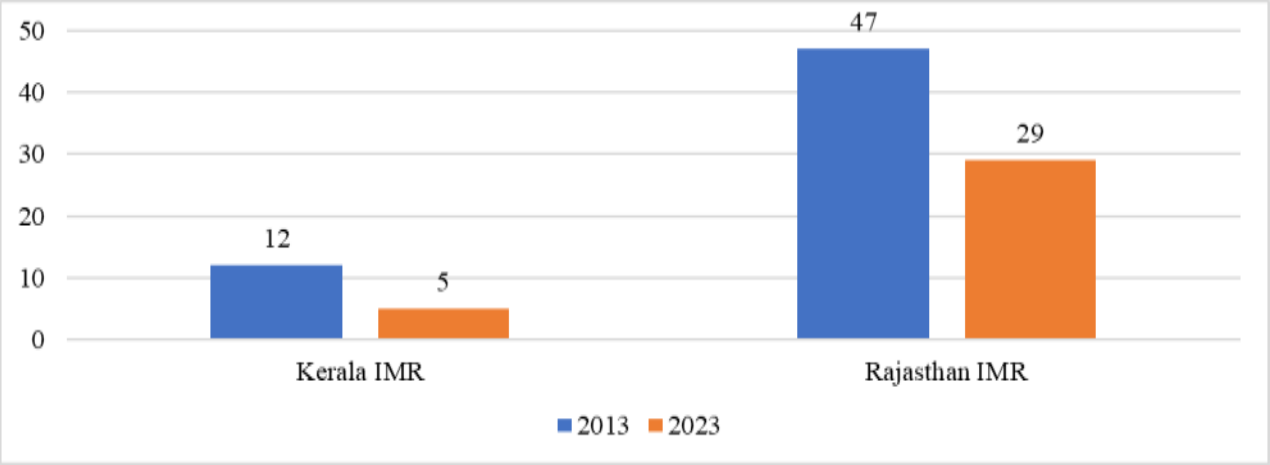

Table-14 Overall, Health Performance - Kerala vs Rajasthan

S.No	Health Indicator	Kerala	Rajasthan	Kerala Advantage/Note
1	Life Expectancy (years)	75.1	69.4	+5.7 years
2	Infant Mortality Rate (per 1,000)	5	30	6× better
3	Maternal Mortality Ratio (per 100,000)	30	87	2.9× better
4	Doctor-Patient Ratio	1:509	1:1,676	3.3× better
6	Population per PHC	~30,000	346,414	11.5× better coverage
7	Institutional Deliveries (%)	>99%	~84%	+15 percentage points
9	Child Stunting (%)	19.7%	27.0%	-27% lower
10	Child Underweight (%)	16.1%	27.0%	-40% lower
11	Literacy Rate (%)	~96%	~67%	+29 percentage points
15	Diabetes Prevalence (%)	~20%	~8%	Epidemiologic transition
16	Total Fertility Rate	1.8	2.3	Below replacement level

In table 14, the essential health, nutrition, and demographic indicators are compared between Kerala and Rajasthan and show that Kerala has significant benefits regarding almost every indicator, which is an indicator of its better public health system, education rates, and socioeconomic indicators.

The life expectancy at birth in Kerala stands at 75.1 years compared to 69.4 years of Rajasthan that has a gap of 5.7 years which points to the fact that Kerala has better overall survival rates attributed to healthcare access and living standards. In Kerala, the infant mortality rate (IMR)

is at 5 per 1000 live births against 30 in Rajasthan meaning that in Kerala, the state has been 6-fold better in terms of survival of the baby at birth, which has been attributed to the existence of strong maternal-child health programmes. In Kerala, the ratio of maternal mortality to 100,000 live postpartum births is 30 per 100,000 versus 87 in Rajasthan (2.9 times lower), which indicates the high-quality obstetric care and emergency management in Kerala.

Much of these mortality differences can be explained by the fact that healthcare infrastructure indicates that Kerala has a ratio of doctor-patient of 1:509 against 1:1 of Rajasthan (that is 3.3 times more access), and that there are approximately 30,000 residents per Primary Health Centre (PHC) in Kerala versus 346,414 in Rajasthan (11.5 times better coverage). In Kerala, the institutional delivery rates are above 99, which is above 84 in Rajasthan +15 percentage points better, so there is a more favourable safe practise of birthing in Kerala.

Child nutrition indicators give the state of Kerala a 19.7% stunting and 16.1% underweight rates, versus 27.0% underweight and 27.0% stunting prevalence in Rajasthan -27% and -40% lower than Kerala, respectively), which supports a vigorous ICDS (Integrated Child Development Services) and food security effort. The literacy rate in Kerala stands at around 96 percent compared to 67 percent in Rajasthan (+29 percentage points) which is one of the social determinants that double healthcare benefits particularly to women.

The prevalence of diabetes (approximately 20) in Kerala is higher than in Rajasthan (approximately 8), which is an indicator of an already high level of epidemiologic transition to non-communicable diseases (NCD) characteristic of better-nourished and ageing populations with higher chances of child survival. Kerala has total fertility rate (TFR) of 1.8 (which is low below replacement rate of 2.1) compared to 2.3 in Rajasthan i.e. Kerala has been successful in family planning and women empowerment.

On the whole, Kerala has a multi-dimensional advantage (mortality, infrastructure, nutrition, education, and demographic transition) that makes it the Indian leader in health, whereas Rajasthan has some gaps that indicate the need to scale primary care systems, gender equity, and poverty reduction.

6. Conclusion

To sum it up, the comprehensive comparison of healthcare indicators clearly makes Kerala an ideal of public health excellence in India, characterised by significantly high life expectancy, drastically low rates of infant and maternal morbidity and mortality, almost total access to maternal care services such as institutional births and competent care, a set of highly diverse primary healthcare services, and an exceptionally dense healthcare environment, and a significantly strong workforce density, including good doctor patient and nurse population ratios, notwithstanding relatively small susceptibilities of acute wasting and unmet contraceptive needs. Rajasthan on the other hand records admirable progresses marked by a higher share of its gross state domestic productivity on health activities, faster historical gains on maternal mortality and higher prevalence of contraceptive use by married women, but suffers severe gaps of chronic stunting, high poverty rates of maternal anaemia and equity of access to frontline services, which all point to urgent areas in which to intensify intervention. In its essentials, the preeminence of Kerala comes not only through the fiscal inputs but also

through the synergistic interactions between high literacy rates, shrewd governance structures, and highly embedded social determinants that increase resource efficacy and preventive orientations, and establish in its practical archetype of resource efficacy and preventive orientations that Rajasthan and indeed the Indian context at large can learn in its pursuit of Sustainable Development Goal 3, through resourceful focuses on workforce retention, rural fortification of infrastructures, nutritional fortification initiatives

7. Study implication

The study has far reached implications in both policy, research and practise fields of the federal health environment of India. In Rajasthan and other states with the same high burden, policymakers can focus on decentralisation of primary health centres, empowering rural workers with performance-based incentive to community health workers much like in Kerala under ASHA, and vigorously scaling maternal-child interventions to recreate rapid infant and maternal mortality roles, and use federal transfers to institute proven protocols such as newborn screening and optimised Integrated Child Development Services. The evidence suggests throughout the country that Kerala models of high-coverage models of delivery, enhanced by transport subsidies and free diagnosis, be spread as scaled-up models, as well as were special investments in the level of female literacy so that the multiplicative effect of any benefits on nutrition, fertility, and survival became evident. In the case of research, the analysis justifies National Family Health Surveys and Sample Registration System findings as the basis of robust state benchmarking, and highlights the necessity of equity-adjusted research that breaks down the nation into disaggregates of caste, income and geography, to conceal the intra-state disparities, and provides an example of the power of comparative case studies in federal settings to inform causal inference, which in turn opens the way to standardised mixed-methods constructions. In practise, Rajasthan health managers benefit by improving Janani Shishu Suraksha Karyakram to enable universal births in institutions and deal with anaemia through localised fortification, and Kerala should fortify its family planning advice to meet the unmet contraception needs as it goes through an epidemiological transition, which would drive both states on the goals of sustainable development goal 3 achievement.

8. Future scope of the study

Further studies that may be conducted based on this comparative analysis between Kerala and Rajasthan, on the basis of their respective health systems, have a significant potential on different levels. To assess the extent to which increased budgetary commitments in Rajasthan would be compared to those in Kerala regarding the management of non-communicable diseases using updated data on national surveys like the Sample Registration System and National Family Health Surveys, longitudinal studies may track changing health outcomes post-2025. Causal studies could take a mixed methodology approach such as economic models to determine the relationship between high literacy levels and health outcomes, as well as qualitative case studies of primary health facilities to identify workforce retention strategies and governance approaches that can be generalised. Scalable alternatives, including the piloting of Kerala community health worker incentives or all-telemedicine models, could be evaluated

in terms of intervention-based intervention through randomized controlled study or a quasi-experimental study to reveal an improvement in maternal care coverage and child nutrition indicators. Critical expansion would reach equity dimensions by disaggregating indicators at the district level on the basis of caste, income, and gender and factor in the climate resilience factors that are specific to the arid ecology of Rajasthan as opposed to the coastal environment of Kerala. Lastly, combining new priorities, such as mental health prevalence, adoption of digital health infrastructure, and post-pandemic surges in chronic conditions, would put a more comprehensive prism over harmonising state-level strategies with Sustainable Development Goal 3, and eventually formulate policy transfer mechanisms nationwide.

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