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Inter-District Disparities in Infant Mortality Rates in Rajasthan

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Abstract

Infants represent the foundation of a nation's future, and their survival is a critical measure of societal progress. The infant mortality rate (IMR) is widely recognized as a key indicator of public health and was central to evaluating progress under the United Nations' Millennium Development Goals, particularly Goal 4, which focused on reducing child mortality. IMR not only reflects the effectiveness of healthcare systems but also mirrors broader socio-economic conditions, including access to nutrition, sanitation, education, and maternal care.Although governments have introduced multiple health programs and policy interventions to improve maternal and child health outcomes, the pace of reduction in infant mortality remains uneven and, in many regions, slower than expected. Persistent disparities highlight structural challenges within healthcare delivery and social development. Notably, a significant divide continues to exist between rural and urban areas, where differences in infrastructure, healthcare accessibility, and living conditions contribute to unequal survival outcomes for infants.In addition, gender-based inequalities remain an important concern, as social preferences and disparities in care-seeking behavior can influence infant survival rates. These issues underscore the complex interplay of demographic and environmental determinants in shaping health outcomes.This study aims to examine variations in infant mortality by focusing on two key dimensions: gender and place of residence. By conducting a comparative analysis, the paper seeks to better understand the underlying disparities and contribute to more targeted and effective policy interventions.

Keywords: *Infant Mortality Rate, Millennium Development Goals, Gender, Country*

Introduction

Improving living standards and health conditions of the population is a key objective in Indian planning. India is also committed to international goals that reflect long-term visions. These visions are integrated into all five-year plans and emphasized in policies such as the National Population Policy, National Health Policy, and National Nutrition Policy, among others. To achieve these objectives, it is crucial to improve access to and utilization of various family, health, and nutrition services, with particular focus on the deprived segments of the population. Infant mortality means the death of a newly born infant before reaching their first birthday. It is quantified by the Infant Mortality Rate (IMR), which is calculated by dividing the number of infant deaths (under one year) by the total number of live births in the same year, then multiplying by 1,000.

As Thomas Chandy, CEO of 'Save the Children' India, emphasized in *The Hindu* (February 26, 2014), "If we want to achieve MDG 4 [Millennium

Development Goal on child mortality] by 2015, we must focus on ensuring survival on the first day of birth." In spite of these improvements, Rajasthan is still on course fail to achieve the MDG 4 target, which aimed to reduce under-five mortality and the infant mortality rate (IMR) by two-thirds between 1990 and 2015. This underscores the urgent need for more focused and proactive healthcare policies in the state.

Although Rajasthan has shown improvements in overall health indicators, disparities in infant, maternal, and child mortality rates still persist, especially between rural and urban areas, and across different districts within the state. Some regions in Rajasthan continue to have IMR rates comparable to those in the world's poorest nations.

One of the most significant concerns in Rajasthan is the persistence of regional and social disparities in infant mortality. The gap between rural and urban areas continues to be substantial, largely due to differences in healthcare infrastructure, accessibility, and awareness. Rural areas often face shortages of healthcare facilities, trained medical personnel, and essential services, which negatively affect maternal and child health outcomes. In contrast, urban areas generally have better access to hospitals, skilled birth attendants, and postnatal care, resulting in comparatively lower infant mortality rates.

In addition to rural–urban disparities, variations across districts within Rajasthan further highlight the unequal distribution of healthcare resources and socio-economic development. Some districts, particularly those located in remote or desert regions, report infant mortality rates that are comparable to those found in some of the poorest regions of the world. These disparities are influenced by factors such as poverty, low levels of female literacy, malnutrition, and inadequate sanitation facilities. Social and cultural practices also play a role in shaping health-seeking behavior, which can affect infant survival outcomes.

Recognizing the urgency of addressing infant mortality, the government of India has implemented a series of child health programs over the decades. These initiatives have aimed to reduce preventable deaths and improve the overall health of infants and mothers. One of the earliest efforts was the Expanded Program on Immunization (EPI), launched in 1978, which focused on protecting children against common infectious diseases. This was later strengthened by the Universal Immunization Program (UIP) in 1984, which expanded coverage and targeted six major vaccine-preventable diseases.

In 1985, the Oral Rehydration Therapy (ORT) program was introduced to combat deaths caused by diarrheal diseases, which were a leading cause of infant mortality at the time. The program emphasized the use of oral rehydration solutions to prevent dehydration and improve survival rates among infants. By 1990, both UIP and ORT programs were universalized across all districts, significantly increasing their reach and effectiveness.

Further initiatives included the introduction of the Acute Respiratory Infections (ARI) program in 1990, which addressed respiratory illnesses, another major cause of infant deaths. The Child Survival and Safe Motherhood (CSSM) program, launched in 1992, marked an important step toward integrating maternal and child health services. This program emphasized antenatal care, safe delivery practices, and postnatal care, thereby adopting a more comprehensive approach to reducing both maternal and infant mortality.

Despite these sustained efforts, challenges remain in achieving equitable healthcare outcomes across the state. Structural issues such as inadequate healthcare infrastructure in rural areas, shortage of skilled healthcare providers, and socio-economic inequalities continue to hinder progress. Moreover, awareness regarding maternal and child health practices is still limited in certain communities, further contributing to higher infant mortality rates.

Review of Literature

A study by Gupta et al. (1981) revealed that infant mortality in rural Rajasthan was strongly influenced by socio-economic conditions such as poverty, illiteracy, and inadequate healthcare access. The study found that a large proportion of infant

deaths occurred within the neonatal period, with infections, malnutrition, and respiratory diseases being the leading causes.

A follow-up study conducted after 25 years demonstrated a significant decline in infant mortality rates in Rajasthan, indicating improvements in healthcare services and awareness. However, the rate remained relatively high compared to national averages, suggesting persistent structural issues (Gupta et al., 2005). More recent studies emphasize the role of socio-economic determinants in influencing infant mortality. Factors such as female literacy, income levels, and access to healthcare services have been found to significantly affect infant survival. In particular, female literacy has emerged as a key factor associated with lower infant mortality rates in rural areas.

Research also highlights the importance of healthcare infrastructure and policy interventions. Studies indicate that increased vaccination coverage and institutional healthcare services contribute to reducing infant mortality, although disparities between rural and urban areas remain significant (Parihar, 2021).

In Rajasthan, maternal health conditions are closely linked to infant survival. Poor maternal health, limited access to skilled birth attendants, and inadequate prenatal care contribute to higher infant mortality rates, especially in rural and desert regions of the state.

Additionally, birth-related factors such as low birth weight and premature births have been identified as major contributors to infant deaths. Studies conducted in Rajasthan indicate that infants with low birth weight face a significantly higher risk of mortality, largely due to poor maternal nutrition and inadequate healthcare facilities.

Comparative and regional studies further reveal that Rajasthan continues to experience higher infant and child mortality rates compared to more developed states, primarily due to socio-economic inequalities, limited healthcare access, and regional disparities.

Overall, the existing literature suggests that while Rajasthan has made progress in reducing infant mortality, the decline has been uneven. Persistent rural–urban gaps, gender disparities, and socio-economic inequalities continue to influence infant mortality outcomes. These findings highlight the need for targeted interventions focusing on maternal health, education, and equitable healthcare access.

Research also points to significant regional disparities in IMR within Rajasthan. Some districts such as Jaisalmer, Barmer, and Udaipur report higher IMR, largely due to their geographic isolation, limited healthcare facilities, and lower socio-economic development. On the other hand, districts like Jaipur and Udaipur show comparatively lower IMR figures, benefiting from better infrastructure and government initiatives (Sharma, 2021).

A study by Gupta and Jain (2017) underscores the importance of addressing these regional disparities by focusing on areas with the highest IMR. The authors argue that targeted intervention in districts with poor health outcomes can bridge the gap in IMR between rural and urban areas.

Data

The data used in our study is secondary data obtained from the Civil Registration System (CRS-2023), managed by the Directorate of Economics and Statistics. CRS provides district wise data on vital events i.e. births, deaths infant deaths etc. Here all the figures are derived from the birth and death registration data for the year 2023. Therefore, it is not practical to compare these with the Sample Registration System (SRS) rates.

Table 1: District-wise infant mortality rate of Rajasthan, in CRS-2023

Infant Mortality Rate						
Districts	Gender			Place of residence		
	Male	Female	Total	Rural	Urban	Total
Ajmer	15.77	11.62	13.79	0.35	20.96	13.79

Infant Mortality Rate						
Districts	Gender			Place of residence		
	Male	Female	Total	Rural	Urban	Total
Alwar	2.14	1.92	2.05	0.4	3.11	2.05
Banswara	4.34	2.74	3.57	0.21	13.96	3.57
Baran	1.03	0.56	0.81	0.19	1.54	0.81
Barmer	3.2	2.65	2.95	0.18	11.86	2.95
Bharatpur	4.17	3.81	4	0.24	5.92	4
Bhilwara	5.91	4.91	5.45	0.48	9.82	5.45
Bikaner	13.13	9.05	11.19	0.07	29.87	11.19
Bundi	3.82	5.63	4.69	0.46	7.98	4.69
Chittorgarh	0.3	0.55	0.42	0.44	0.41	0.42
Churu	2.29	1.62	1.98	0.39	3.74	1.98
Dausa	0.29	0.71	0.48	0.38	0.58	0.48
Dholpur	11.26	9.79	10.59	0.28	15.09	10.59
Dungarpur	1.61	0.75	1.2	0.36	2.94	1.2
Ganganagar	2.49	2.74	2.62	0.55	4.22	2.62
Hanumangarh	2.25	2.57	2.43	1.15	3.11	2.43
Jaipur	4.44	13.57	18.76	0.42	24.81	18.76
Jaisalmer	0.14	0.24	0.19	0.1	0.48	0.19
Jalore	0.52	0.65	0.58	0.21	1.39	0.58
Jhalawar	15.22	8.7	13.19	0.24	23.25	13.19
Jhunjhunu	1.34	1.61	1.48	0.53	2.16	1.48
Jodhpur	2.69	1.8	2.27	0.19	5.31	2.27
Karauli	0.42	0.37	0.4	1.2	0.08	0.4
Kota	10.01	7.68	8.9	0.66	10.21	8.9
Nagaur	0.25	0.33	0.3	0.3	0.29	0.3
Pali	5.56	4.92	5.26	0.27	13.2	5.26
Pratapgarh	0.4	0.26	0.34	0.42	0.21	0.34
Rajsamand	0.83	1.13	0.98	0.96	1.01	0.98
Sawai Madhopur	3.87	3.94	3.91	0.24	5.77	3.91
Sikar	1.27	1.6	1.43	0.56	1.94	1.43
Sirohi	2.83	2.7	2.77	0.34	5.72	2.77
Tonk	2.65	2.83	2.74	0.83	4.03	2.74
Udaipur	12.96	10.45	11.77	1.43	38.03	11.77
Rajasthan	0.69	4.79	5.75	0.42	10.83	5.75

From the table it is clear that there is more diversity in IMR of Rajasthan among all the districts. Average male and female infant mortality rates are 0.69 & 4.79 respectively. Average rural and urban infant mortality rates are 0.42 & 10.83 respectively

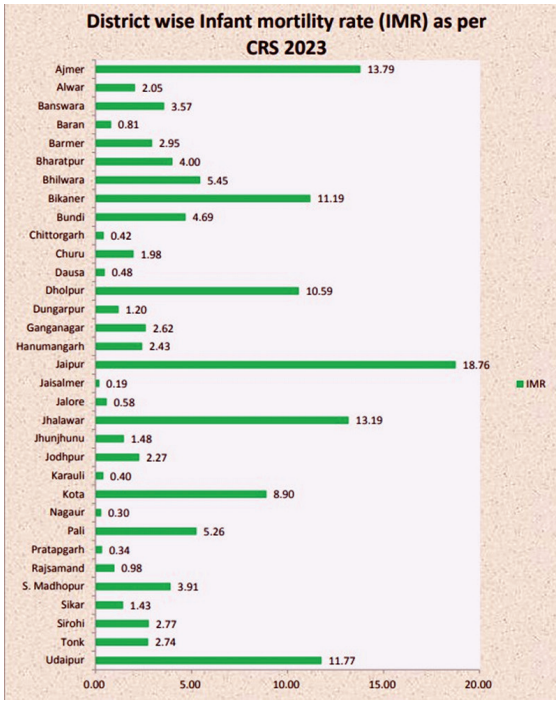

Fig. 1: From the above graph, it is clear that the highest IMR of Jaipur is 18.76 and the lowest is 0.19 in Jaisalmer, whereas the average of Rajasthan is 5.75.

Methodology & Results Discussions

It is clearly apparent from the table that the urban infant mortality rate is higher than the rural infantmortality rate, and this difference in IMR can be seen in the male and female Infant mortality rates.

The null hypothesis is specified as follows:

H_{o1}: There is no significant difference between infant mortality rate in rural and urban areas,i.e.place of residence.

H_{o2}: There is no significant difference between the infant mortality rate in males and female i.e. Gender.

Table 2: Genderwise infant mortality rate of Rajasthan's districts, in CRS-2023

Districts	Male	Female
Ajmer	15.77	11.62
Alwar	2.14	1.92
Banswara	4.34	2.74
Baran	1.03	0.56
Barmer	3.2	2.65
Bharatpur	4.17	3.81
Bhilwara	5.91	4.91
Bikaner	13.13	9.05
Bundi	3.82	5.63
Chittorgarh	0.3	0.55
Churu	2.29	1.62
Dausa	0.29	0.71
Dholpur	11.26	9.79
Dungarpur	1.61	0.75
Ganganagar	2.49	2.74
Hanumangarh	2.25	2.57
Jaipur	4.44	13.57
Jaisalmer	0.14	0.24
Jalore	0.52	0.65
Jhalawar	15.22	8.7
Jhunjhunu	1.34	1.61
Jodhpur	2.69	1.8
Karauli	0.42	0.37
Kota	10.01	7.68
Nagaur	0.25	0.33
Pali	5.56	4.92
Pratapgarh	0.4	0.26
Rajsamand	0.83	1.13
Sawai Madhopur	3.87	3.94
Sikar	1.27	1.6
Sirohi	2.83	2.7
Tonk	2.65	2.83
Udaipur	12.96	10.45

One Way ANOVA:

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Male	33	139.4	4.224242	21.01201
Female	33	124.4	3.769697	13.88403

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.409091	1	3.409091	0.195386	0.659962	3.990924
Within Groups	1116.674	64	17.44802			
Total	1120.083	65				

Here, the P-value is greater than 0.05, so we can conclude not to reject the null hypothesis and there is no significant difference between infant mortality rate in male and female.

Table 3: Region-wise infant mortality rate of Rajasthan's Districts, in CRS-2023

Districts	Rural	Urban
Ajmer	0.35	20.96
Alwar	0.4	3.11
Banswara	0.21	13.96
Baran	0.19	1.54
Barmer	0.18	11.86
Bharatpur	0.24	5.92
Bhilwara	0.48	9.82
Bikaner	0.07	29.87
Bundi	0.46	7.98
Chittorgarh	0.44	0.41
Churu	0.39	3.74
Dausa	0.38	0.58
Dholpur	0.28	15.09
Dungarpur	0.36	2.94
Ganganagar	0.55	4.22
Hanumangarh	1.15	3.11
Jaipur	0.42	24.81
Jaisalmer	0.1	0.48
Jalore	0.21	1.39
Jhalawar	0.24	23.25
Jhunjhunu	0.53	2.16
Jodhpur	0.19	5.31
Karauli	1.2	0.08
Kota	0.66	10.21
Nagaur	0.3	0.29
Pali	0.27	13.2
Pratapgarh	0.42	0.21
Rajsamand	0.96	1.01
Sawai Madhopur	0.24	5.77
Sikar	0.56	1.94
Sirohi	0.34	5.72
Tonk	0.83	4.03
Udaipur	1.43	38.03

One Way ANOVA:

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Rural	33	15.03	0.455455	0.104357
Urban	33	273	8.272727	90.53783

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1008.311	1	1008.311	22.24816	1.34E-05	3.990924
Within Groups	2900.55	64	45.32109			
Total	3908.861	65				

Here P value is much less than 0.05, so we can reject the null hypothesis, and hence there is a significant difference between rural and urban IMR.

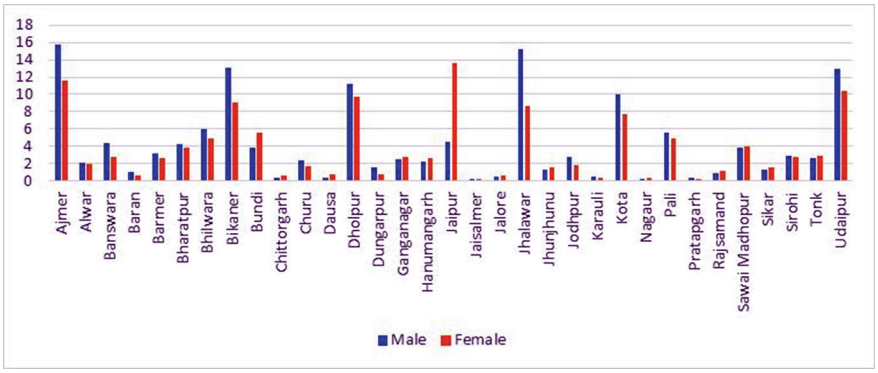

Fig. 2: Gender-wise disparities in IMR among the districts of Rajasthan

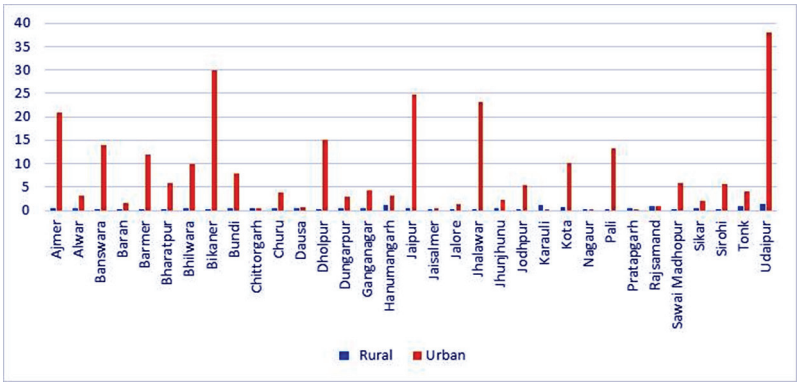

Fig. 3: Region-wise disparities in IMR among the districts of Rajasthan

Conclusion

The statistical analysis reveals mixed outcomes across the variables studied. There is no significant difference in infant mortality rates between males and females, as the p-value exceeds the 0.05 significance level, leading to a failure to reject the null hypothesis.

In contrast, there is a statistically significant difference in infant mortality rates between rural and urban populations, as the p-value is much less than 0.05. This result leads to the rejection of the null hypothesis and indicates that location (rural vs. urban) plays an important role in influencing infant mortality rates.

Overall, the findings suggest that while gender does not significantly affect infant mortality, geographical factors such as rural–urban disparities are a key determinant and should be a focus for policy interventions and healthcare improvements.

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