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## Socio-demographic determinants of infant mortality among the Gond tribe in Satna district, Madhya Pradesh, India

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### Abstract

Infant mortality is a key indicator of maternal and infant health and reflects the socio-economic and healthcare conditions of a community. Despite considerable progress in reducing infant mortality in India, tribal populations continue to experience disproportionately high infant deaths due to poverty, low educational attainment, inadequate healthcare services, poor sanitation, malnutrition, and limited access to maternal and infant healthcare. The present study aimed to examine the socio-demographic determinants of infant mortality among the Gond tribe in Satna District, Madhya Pradesh, India.

A community-based cross-sectional study was conducted among 421 Gond households selected through a sampling technique. Data on live births were collected using a structured household interview schedule. The study assessed the influence of maternal and paternal education, household economic status, family size, occupation, maternal age at first birth, fertility behaviour, and women's participation in household decision-making on infant mortality. Descriptive statistics, percentage analysis, Pearson's correlation coefficient, and Student's *t*-test were used for data analysis.

A total of 26 infant deaths were recorded among 821 live births. Infant mortality was higher among households with low parental education, poor socio-economic status, larger family size, early maternal age at first childbirth, and higher fertility. Mothers with greater participation in household decision-making experienced lower infant mortality than those with limited autonomy. A significant positive association was observed between the number of pregnancies and infant mortality.

The findings indicate that socio-demographic factors play a significant role in determining infant survival among the Gond tribe. Strengthening maternal and child healthcare services, improving female education, promoting family planning, delaying the age at first childbirth, and enhancing women's decision-making autonomy are essential for reducing infant mortality and improving infant survival in tribal communities.

**Keywords:** Infant mortality, Gond tribe, Satna district, tribal health, maternal education, women's empowerment, infant survival, socio-economic determinants.

### Introduction

Infant mortality is one of the most important indicators of maternal and child health and reflects the socio-economic and healthcare status of a population (World Health Organization [WHO], 2005; Gubhaju, Streatfield, & Majumder, 1992) <sup>[4]</sup>. In India, although substantial progress has been achieved in reducing infant mortality through various maternal and child health programmes, infant deaths continue to remain a major public health concern, particularly among socially and economically disadvantaged populations (International Institute for Population Sciences [IIPS] & ICF, 2021) <sup>[5]</sup>. Programmes such as the National Health Mission (NHM), Janani Suraksha Yojana (JSY), Janani Shishu Suraksha Karyakram (JSSK), Integrated Management of Neonatal and Childhood Illness (IMNCI), and the Universal Immunization Programme (UIP) have contributed significantly to improving infant survival (Ministry of Health and Family Welfare [MoHFW], 2022) <sup>[7]</sup>. However, disparities in infant mortality persist across regions and socio-economic groups due to poverty, inadequate healthcare facilities, malnutrition, poor sanitation, low educational attainment, and limited utilization of maternal and child healthcare services (IIPS & ICF, 2021) <sup>[5]</sup>.

Infant mortality is influenced by a complex interaction of biological, demographic, social, and economic factors. Maternal and paternal education, household economic status, maternal age at first childbirth, fertility behaviour, birth spacing, nutritional status, access to healthcare, and women's participation in household decision-making have been identified as important determinants of infant survival (Sandhya, 1991; Talwar, 1988; Kirchengast & Hartmann, 2003) [12, 14, 6]. Improvements in these factors not only enhance infant survival but also contribute to fertility decline and overall socio-economic development (Gubhaju *et al.*, 1992) [4].

Madhya Pradesh has one of the largest Scheduled Tribe populations in India and continues to experience relatively poor maternal and child health indicators. According to the Census of India (2011) [9], Scheduled Tribes constitute approximately 21% of the state's population (Office of the Registrar General & Census Commissioner, India, 2011) [9]. Tribal communities often reside in geographically isolated areas where access to quality healthcare, education, sanitation, and nutrition remains inadequate. Consequently, tribal populations continue to experience a higher burden of infant mortality than the general population (IIPS & ICF, 2021) [5].

The Gond tribe is the largest Scheduled Tribe in Madhya Pradesh and is predominantly engaged in agriculture, agricultural labour, forest-based occupations, and daily wage employment (Adak *et al.*, 2003) [1]. Many Gond households are characterized by low literacy, poor housing conditions, limited income, inadequate sanitation, and restricted access to

institutional healthcare. These socio-economic disadvantages adversely affect maternal health, pregnancy outcomes, and infant survival (Adak *et al.*, 2004; Bishwas & Kapoor, 2003) [2]. Although several studies have examined infant mortality among tribal populations in India, district-level evidence focusing specifically on the Gond tribe of Satna District remains limited (Singh, 2009) [13].

Therefore, the present study aims to examine the socio-demographic determinants of infant mortality among the Gond tribe in Satna District, Madhya Pradesh. The study specifically investigates the influence of parental education, household economic status, family size, maternal age at first birth, fertility behaviour, occupation, and women's participation in household decision-making on infant survival. The findings are expected to provide evidence for policymakers and public health professionals in designing targeted interventions for improving maternal and child health among tribal communities.

## Materials and Methods

### Study area

The present study was conducted in Satna district, located in the north-eastern part of Madhya Pradesh, India. As shown in the location map, the study area includes three development blocks: Chitrakoot (Majhgawan), Nagod and Unchahara. The map depicts the location of Satna district within Madhya Pradesh and the spatial distribution of the selected blocks. These blocks represent the geographical area from which the study data were collected.

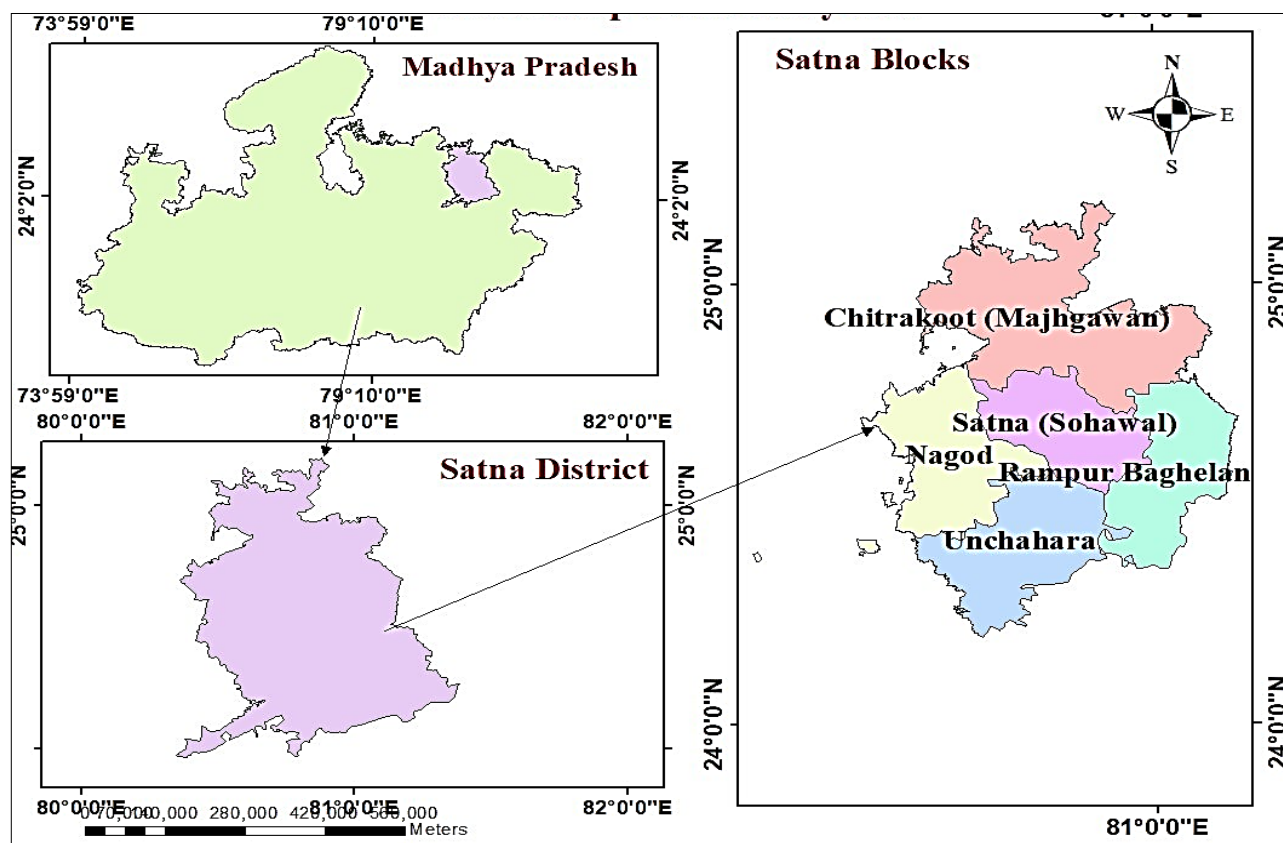


Fig 1: Location map of the study area

### Research design

The study adopted a descriptive and analytical research design to examine the socio-economic and demographic determinants of infant mortality among the Gond tribe of Satna district.

### Sources of data

The study is based on both primary and secondary data.

**Primary data:** Primary information was collected through a structured household interview schedule administered to eligible Gond women.

**Secondary data:** Secondary information was obtained from the Census of India (2011) <sup>[9]</sup>, National Family Health Survey (NFHS-5), Sample Registration System (SRS), Ministry of Health and Family Welfare, Government of Madhya Pradesh, District Statistical Handbook, and published research articles related to infant mortality and tribal health.

### Sampling design

A multistage sampling technique was adopted for selecting the respondents. In the first stage, tribal-dominated development blocks of Satna district were identified. In the second stage, selected villages having a sizeable Gond population were chosen. Finally, Gond households having ever-married women with at least one live birth were selected through systematic random sampling.

For the purpose of analysis, a total of 421 Gond families were considered as the study sample. Information regarding births, infant deaths, maternal characteristics, educational status, occupation, and household socio-economic conditions was collected from the respondents.

### Variables included in the study

The dependent variable was:

- Infant Mortality

### The independent variables included:

- Mother's education
- Father's education

- Family size
- Household economic status
- Father's occupation
- Mother's age at first birth
- Number of pregnancies
- Women's participation in household decision-making

### Statistical techniques

The collected data were classified, coded, and analysed using appropriate statistical techniques. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Inferential statistical techniques including the Student's t-test, Pearson's correlation coefficient, and percentage analysis were employed to examine the relationship between infant mortality and selected socio-economic variables. The statistical analysis was carried out using standard statistical software, and significance was tested at the 5 percent level ( $p < 0.05$ ) wherever applicable. Data were coded and analysed using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA).

### Ethical considerations

The study was conducted under an MPCST-funded research project after obtaining the necessary institutional approval. Written informed consent was obtained from all participants, and confidentiality and anonymity were maintained throughout the study.



**Fig 1:** Household Interview with Gond Tribal Respondents during Field Survey.



**Fig 2:** Geographical Location of the Selected Study Area in Satna District, Madhya Pradesh.



**Fig 3:** Collection of Primary Data from Gond Households in Satna District.



**Fig 4:** Field Survey Conducted among Gond Tribal Families in the Study Area.

## Results and Discussion

The present study examines the socio-economic and demographic determinants of infant mortality among the Gond tribe of Satna district, Madhya Pradesh. The analysis is based on selected household and maternal characteristics that are known to influence infant survival. Variables such as parental education, family size, household economic status, father's occupation, maternal age at first birth, fertility behaviour, and women's participation in family decision-making were analysed to understand their association with infant mortality. The findings indicate that infant mortality is not uniformly distributed across all households. Considerable variations were observed according to educational attainment, economic condition, fertility pattern, and women's empowerment. Households with illiterate parents, low income, larger fertility, and poor access to health services experienced relatively higher infant mortality than households with better educational and socio-economic conditions. Education emerged as one of the strongest determinants of infant survival. Mothers with primary or higher education showed a lower proportion of infant deaths compared to illiterate mothers. Similarly, households where fathers had attained secondary or higher education also reported comparatively fewer infant deaths. These findings suggest that education improves awareness regarding antenatal care, institutional delivery, immunization, breastfeeding practices,

and child nutrition. Economic status also showed a significant association with infant mortality. Families belonging to lower-income groups experienced a greater proportion of infant deaths than economically better-off households. Poor housing conditions, inadequate nutrition, lack of sanitation, and limited access to quality healthcare contribute substantially to this difference.

The analysis further indicates that early age at first childbirth and higher fertility are associated with increased infant mortality. Mothers who gave birth at a younger age experienced comparatively higher infant losses than mothers whose first childbirth occurred after the age of 20 years. Likewise, women with a larger number of pregnancies showed a higher proportion of infant deaths, indicating the importance of birth spacing and family planning.

Women's participation in household decision-making also demonstrated a positive relationship with infant survival. Families in which women actively participated in decisions regarding healthcare, nutrition, expenditure, and child care reported lower infant mortality compared to families where women had limited autonomy. This finding highlights the importance of women's empowerment in improving maternal and child health outcomes.

The detailed statistical analysis supporting these findings is presented in Table No. 1 to 5, which describe the relationship between family characteristics, fertility behaviour, women's

autonomy, and infant mortality among the Gond tribe of Satna district.

### Population of Madhya Pradesh

The population of Madhya Pradesh is 72,597,565 million (2011 census), an increase of 20.3% and the population density is 236 people per square kilometer. More than 75% of state population resides in villages whose main occupation is agriculture, while the rest of the population lies in towns. Number of females per thousand male (sex ratio) in the state is 931 where as the literacy rate is 70.6%. The majority population is Hindu while Muslims making up the largest minority community. The tribes of Madhya Pradesh

population constitute over 20% of the state population and are mainly concentrated in southern part of the state. The lifestyle, culture and customs of this community mostly resemble the Hindu religion though they still strongly believe in orthodox traditions.

Gond is the best known tribe and forms the second largest group in Madhya Pradesh. They mainly in habit areas on both sides of the Narmada in the Mandla, Chhindwara, Betul and Seoni regions and the hilly terrains of the Vindhya and the Satpura region. Agaria, Pradan, Ojhan, Solahas are the descendent tribal groups originating from Gonds, with two sub castes- Rajgond and Datoliya.

**Table 1:** Population characteristics of Gond tribes of M.P.

| Characteristics                | Gond tribes | M.P.(Rural) |
|--------------------------------|-------------|-------------|
| <b>Literacy rate (%)</b>       |             |             |
| Total                          | 50.6        | 50.4        |
| Male                           | 59.6        | 58.4        |
| Female                         | 41.5        | 40.1        |
| <b>Age (%)</b>                 |             |             |
| 0-14                           | 40.0        | 38.4        |
| 15-59                          | 53.8        | 55.5        |
| 60+                            | 6.2         | 6.1         |
| Young age Dependency Ratio (%) | 75.5        | 73.0        |
| Old age Dependency Ratio (%)   | 11.5        | 10.8        |
| Total age Dependency Ratio (%) | 86.0        | 83.9        |
| Index of Ageing (%)            | 15.5        | 15.9        |
| Sex Ratio                      | 1068        | 989         |

**Source:** Office of the Registrar General, India

Table 1 shows the population characteristics of Gond tribes. This table indicates that literacy rate is 59.6% of male whereas female rate is low i.e., 41.5%. Literacy rate of M.P. (rural) is 58.4% and 40.1% of male and female which is higher than Gond tribes. It is further observed that 53.8% population are in 15-59 age group and 40% population are of

0-14 age group of tribes which is similar to M.P. (rural). The trends of young, old and total age dependency ratio of gond tribes are 75.5%, 11.5% and 86% respectively which are closely to M.P. (rural) and sex ratio is 1068 where as for M.P. (rural) is 989 only.

**Table 2:** Various measures of mortality among Gond tribes.

| S. No. | Mortality measures                                         | Satna District |
|--------|------------------------------------------------------------|----------------|
| 1.     | Crude death rate                                           | 14.27          |
| 2.     | Max. age specific death rate >4 & 55 < age group           | 109.66         |
| 3.     | Min. age specific death rate in 10-34 age groups.          | 7.59           |
| 4.     | No. age specific mortality rate in 25-29 & 45-49 age group | 0.00           |
| 5.     | Still birth rate                                           | 16.80          |
| 6.     | Perinatal mortality rate                                   | 25.21          |
| 7.     | Neo -natals mortality rate                                 | 50.42          |
| 8.     | Post-natal mortality rate                                  | 16.80          |
| 9.     | Infant mortality rate                                      | 75.63          |
| 10.    | Under five mortality rate                                  | 35.48          |
| 11.    | child mortality rate                                       | 16.12          |

Figure of table No. 2 shows that crude death rate and still birth rate are found 14.27 and 16.80 respectively. Neo-natal, infant mortality and under five mortality rate of Gond tribes are 50.42, 75.63 and 35.48 respectively where as in M.P., figures are 35,43 and 49 respectively (NFHS-5). These rates implies that, despite decline in mortality, 1 in 14 children still

die within the first year of life, and 1 in 12 die before reaching age five. The IMR is 13 percent higher in rural areas than in urban areas of M.P. (NFHS-5). Perinatal, Post-natal and child mortality rate are 25.21, 16.80 and 16.12 for gond tribes of Satna which shows higher rate than M.P. which is a major problem in development of Madhya Pradesh.

**Table 3:** Distribution of Infant Deaths by Household and Maternal Characteristics.

| S. No.                              | Family Characteristics    | Households | Live Births | Infant Deaths | % Infant Deaths |
|-------------------------------------|---------------------------|------------|-------------|---------------|-----------------|
| <b>Mother's Education</b>           |                           |            |             |               |                 |
| 1                                   | Illiterate                | 80         | 150         | 10            | 6.67            |
| 2                                   | Primary                   | 182        | 355         | 10            | 2.82            |
| 3                                   | Middle & Above            | 159        | 316         | 6             | 1.90            |
| <b>Father's Education</b>           |                           |            |             |               |                 |
| 1                                   | Illiterate                | 80         | 148         | 10            | 6.76            |
| 2                                   | Primary                   | 182        | 354         | 9             | 2.54            |
| 3                                   | Middle                    | 76         | 154         | 5             | 3.25            |
| 4                                   | High School & Above       | 83         | 165         | 2             | 1.21            |
| <b>Family Size</b>                  |                           |            |             |               |                 |
| 1                                   | Small (Up to 3 Members)   | 152        | 240         | 5             | 2.08            |
| 2                                   | Medium (4–5 Members)      | 166        | 340         | 8             | 2.35            |
| 3                                   | Large (6 & Above Members) | 103        | 241         | 13            | 5.39            |
| <b>Occupation of Household</b>      |                           |            |             |               |                 |
| 1                                   | Labour                    | 181        | 352         | 11            | 3.13            |
| 2                                   | Cultivator                | 22         | 45          | 1             | 2.22            |
| 3                                   | Agricultural Labour       | 48         | 102         | 6             | 5.88            |
| 4                                   | Govt./Private Service     | 10         | 22          | 0             | 0.00            |
| 5                                   | Housewife                 | 160        | 300         | 8             | 2.67            |
| <b>Housing Type</b>                 |                           |            |             |               |                 |
| 1                                   | Kachcha House             | 228        | 430         | 15            | 3.49            |
| 2                                   | Mixed House               | 149        | 286         | 8             | 2.80            |
| 3                                   | Pakka House               | 44         | 105         | 3             | 2.86            |
| <b>Age of Mother at first birth</b> |                           |            |             |               |                 |
| 1                                   | 15–19 Years               | 2          | 5           | 0             | 0.00            |
| 2                                   | 19–22 Years               | 218        | 425         | 15            | 3.52            |
| 3                                   | 23–25 Years               | 171        | 305         | 9             | 2.95            |
| 4                                   | 26 years and above        | 30         | 86          | 2             | 2.32            |

Table No. 3 shows that Mother's education showed a significant relationship with infant survival. The proportion of infant deaths was highest among illiterate mothers and declined progressively with increasing educational attainment. Educated mothers are generally more aware of antenatal care, immunization, nutrition, hygiene, and timely utilization of health services, which contribute to improved infant survival. A similar pattern was observed with father's education. Households where fathers had higher educational qualifications experienced lower infant mortality than those with illiterate fathers. Education enhances awareness regarding disease prevention, health-seeking behaviour, sanitation, and financial planning, thereby improving the health status of children.

Family size also appeared to influence infant mortality. Larger families showed relatively higher infant mortality compared with smaller families. This may be attributed to limited household resources, inadequate parental attention, nutritional constraints, and reduced access to healthcare for each child in larger households.

Occupation of the household head demonstrated noticeable variation in infant mortality. Agricultural labourers and daily wage labourers experienced comparatively higher infant mortality than families engaged in government or private service. The unstable income and poor socio-economic conditions associated with manual labour may restrict access to quality healthcare, balanced nutrition, and proper living conditions.

Housing conditions were another important determinant. Families living in kachcha houses exhibited a higher proportion of infant deaths than those living in mixed or pakka houses. Poor housing is often associated with inadequate sanitation, unsafe drinking water, overcrowding, and increased exposure to infectious diseases, all of which increase the risk of infant mortality.

Maternal age also showed variation in infant mortality. Although infant deaths were reported across different maternal age groups, relatively higher mortality was observed among younger mothers. Young maternal age is often associated with biological immaturity, poor nutritional status, limited reproductive health knowledge, and inadequate maternal care, which may adversely affect infant survival.

Overall, the findings suggest that education, occupation, housing conditions, family size, and maternal characteristics play an important role in determining infant survival. Improving female education, promoting maternal and child healthcare services, strengthening immunization coverage, improving housing and sanitation, and enhancing the socio-economic status of households may substantially reduce infant mortality in the study population.

**Table 4:** Mean Number of Pregnancies According to Number of Infant deaths.

| Families with Different Number of Infant deaths | No. of Families (n=46) | Total Live Birth | Mean Number of Pregnancies per Mother (Mean $\pm$ SD) |
|-------------------------------------------------|------------------------|------------------|-------------------------------------------------------|
| 0–1                                             | 36                     | 142              | 3.94 $\pm$ 0.86                                       |
| 2–3                                             | 10                     | 58               | 5.82 $\pm$ 0.98                                       |

\*The analysis was restricted to families reporting at least one infant death (n = 46).

Independent Sample t-test

- 0–1 vs 2–3 = 2.41\* (d.f. = 44)

Significant at the 5% level of probability ( $p < 0.05$ ).

Correlation coefficient ( $r$ ) = +0.436

Table No. 4 demonstrates the relationship between the mean number of pregnancies and infant mortality among the Gond households included in the study. A total of 46 families were considered for this analysis, of which 36 families experienced 0–1 infant death, while 10 families reported 2–3 infant deaths.

The mean number of pregnancies increased from  $3.94 \pm 0.86$  among families with 0–1 infant death to  $5.82 \pm 0.98$  among families experiencing 2–3 infant deaths. The difference in the mean number of pregnancies between the two groups was found to be statistically significant ( $t = 2.41$ ,  $p < 0.05$ ), indicating that mothers who experienced a higher number of infant deaths also had a significantly higher number of pregnancies.

The positive correlation coefficient ( $r = +0.436$ ) suggests a moderate positive association between fertility and infant mortality. This finding indicates that families experiencing repeated infant deaths tend to have more pregnancies, possibly as a replacement response to compensate for the loss of children. Such reproductive behaviour has also been reported in several demographic studies, particularly among socio-economically disadvantaged and tribal populations where infant survival remains uncertain.

The findings further suggest that reducing infant mortality through improved maternal education, better antenatal and postnatal care, complete immunization, adequate nutrition, and improved access to healthcare services may contribute to a gradual decline in fertility levels. Therefore, strengthening maternal and infant health programmes in tribal communities is essential for improving infant survival and achieving sustainable population stabilization.

Status of women and infant mortality. In order to analyze the impact of the participation of the woman in the family decision making process on infant mortality (Table No. 5), we used a seven point scale to measure the participation in family decision making. The methodology suggested by Guru (1997) was followed for the purpose. The women surveyed were asked about their participating in deciding:

1. The desired number of children the family should have.
2. The care during pregnancy and at the time of delivery.
3. Child rearing and child feeding.
4. The treatment of the sick child.
5. The expenditure in the family.
6. The choice about family food.
7. Working outside the house.

For each variable the degree of participation was categorized as low, moderate and high on the basis of the response given by the women, the low category was given a score of 1; moderate, a score of 2 and high, a score of 3. For each woman, scores of all the seven variables were combined. On the basis of this combined score, woman's participation index was calculated as follows:

- Low participation (Score 7-11)
- Moderate participation (Score 12-16)
- High participation (Score 17-21)

**Table 5:** Mother's Degree of Participation in Family Decision-making and Proportion of Infant Deaths

| Level of Autonomy      | Total Live Births | Infant Deaths | Percentage (%) |
|------------------------|-------------------|---------------|----------------|
| Low Participation      | 225               | 19            | 8.44           |
| Moderate Participation | 105               | 5             | 4.76           |
| High Participation     | 45                | 2             | 4.44           |
| Total                  | 375               | 26            | 6.93           |

Table No. 5 presents the relationship between mothers' participation in 150 families decision-making and infant mortality among the Gond households included in the study. The findings indicate that the proportion of infant deaths decreased with increasing levels of women's autonomy within

the household. Among mothers with low participation in family decision-making, 19 infant deaths were reported out of 225 live births, resulting in the highest infant mortality rate (8.44%). In contrast, mothers with moderate participation experienced 5 infant deaths among 105 live births, corresponding to a infant mortality rate of 4.76%. The lowest infant mortality rate (4.44%) was observed among mothers with high participation, where only 2 infant deaths occurred out of 45 live births.

The results suggest that women who actively participate in household decision-making are more likely to utilize maternal and infant healthcare services, ensure complete immunization, maintain appropriate nutritional practices, and seek timely medical care for their infant. Greater decision-making autonomy also reflects improved awareness, confidence, and access to health-related information, which positively influence infant survival.

The gradual decline in infant mortality from the low participation group to the high participation group indicates a negative association between maternal autonomy and infant mortality. These findings support the view that women's empowerment is an important determinant of infant health and survival. Similar observations have been reported in demographic and public health studies, where increased female participation in household decisions has been associated with better maternal and infant health outcomes.

Overall, the findings suggest that strengthening women's education, improving their socio-economic status, and encouraging their active participation in family decision-making may substantially reduce infant mortality among the Gond tribe of Satna district. Programmes promoting women's empowerment, along with improved maternal and infant healthcare services, can play a crucial role in enhancing infant survival in tribal communities.

## Conclusion

The present study demonstrates that infant mortality among the Gond tribe in Satna district is strongly influenced by socio-demographic factors. Lower parental education, poor socio-economic status, larger family size, agricultural and daily wage occupations, early maternal age at first childbirth, and higher fertility were associated with increased infant mortality. In contrast, greater participation of women in household decision-making was linked with better infant survival. A significant positive relationship between the number of pregnancies and infant mortality further highlights the importance of family planning and birth spacing. The findings suggest that improving female education, strengthening maternal and infant healthcare services, promoting institutional deliveries and immunization, enhancing women's empowerment, and improving the socio-economic conditions of tribal households are essential for reducing infant mortality. The study provides valuable evidence for policymakers and public health planners to design targeted interventions aimed at improving infant survival among vulnerable tribal population ns in Madhya Pradesh.

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