

## **The Impact of Female Literacy on Infant Mortality Rate in Indian States.**

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### **Abstract**

**Female literacy empowers, and is an emancipator. The benefits of education in women are many and varied; one prime benefit is healthier children. There is an inverse relationship between female literacy and infant mortality. We have attempted to understand in this study the nature of this inverse relationship. Data on the infant mortality rate (IMR) and the female literacy on 28 Indian states were collected from the past 4 censuses. The change in both, the female literacy rate and the IMR between consecutive censuses was determined and then the change in IMR for a percentage rise in female literacy was calculated. The decline in IMR was not constant and the benefits of an accelerated decline in IMR accrued when the female literacy in the states approached 50% and a subsequent similar rapid decline was seen again at a 65%-70% female literacy rate. States which have progressed more on the female literacy front reduce infant mortality at a faster pace and this should motivate and encourage lesser literate states to enhance and reinforce their efforts to boost female literacy.**

**Keywords:** Infant Mortality Rate; Female literacy; Indian Census.

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### **Introduction**

There is a wide gender disparity in India's literacy rate [1], while male literacy rate is 82.14%; female literacy rate is 65.46%. There is also a significant regional variation; female literacy rate in Kerala is 91.9%, while in Rajasthan it is 52.6%. Empowering women through education pays dividends by not only providing opportunities and choice to women but also uplifting the health status of the whole family and community [2-5]. States and countries which have a higher percentage of literate women perform better on developmental and social indices, literate females enjoy greater autonomy and are more involved in decision making. Women's education has often been cited as one of the most valuable tools to reduce poverty [6]. Women who are educated tend to marry later and have smaller families [7]. Academic accomplishment results in greater participation in local councils and democratic institutions, educated women are more likely to assume leadership positions. They are more aware of their rights and more likely to claim those rights [8]. Fe-

male literacy is also said to have a positive influence on the health of their progeny.

Infant Mortality Rate (IMR) is defined as the number of infant deaths per 1000 live births [9]. It has already been established by several studies that there is an inverse relationship between female literacy and infant mortality rate [10-13]. This study on three decades of Indian Census data is undertaken to (i) determine if this inverse relationship between female literacy and infant mortality is consistent and uniform (ii) to quantify the benefits of female literacy by determining the fall in infant mortality for every percentage rise in female literacy.

### **Material and Methods**

Data on female literacy in individual states were collected from the census reports of the 1981, 1991 [14], 2001 and 2011 [1] census. Data from two states - Assam and Jammu & Kashmir, were not included in the study because the census could not be conducted in Assam in 1981 and

Jammu and Kashmir in 1991. Three smaller new states, Jharkhand, Chhattisgarh and Uttarakhand were carved out from the larger states of Bihar, Madhya Pradesh and Uttar Pradesh respectively, in November 2000. But these three larger states were too populous to ignore, therefore the data on these states are included, however there may be a margin of error in the results for these states. Data on 28 states and union territories were compiled; similar statistics for India was also included.

Data on Infant Mortality rate (IMR) for 1981, 1991, 2001 and 2011 were collected [15,16,17]. The change in female literacy rate and Infant mortality rate figures between two successive censuses were calculated, and with the change in IMR as the numerator, and the change in female literacy rate as the denominator the change in IMR

for every percentage rise in female literacy rate was determined.

## Results

Data on female literacy rate from the four censuses between 1981-2011, is featured in Table 1, the change in the female literacy between two consecutive censuses is also provided in the same table. Female Literacy rate in India has more than doubled between 1981 (29.85%) and 2011 (65.4%). Rajasthan along with Arunachal Pradesh had the least percentage of female literates in 1981 (14%). In 2011 Rajasthan, is still placed last in terms of female literates (52.6%). Kerala was the best performer in the 1981 census (75.6%) and also had the maximum percentage of female literates in the 2011 census (91.9%). Sikkim showed the maximum gain (49%) in the percentage of female literates from 1981 to 2011.

*Table 1. Female Literacy Rate.*

States	Female Literacy Rate (%)				Change in (%)		
	1981 a	1991 b	2001 c	2011 d	81-91 (b-a)	91-01 (c-b)	01-11 (d-c)
Andhra Pradesh	24.1	32.7	50.4	59.7	08.6	17.7	09.3
Arunachal Pradesh	14.0	29.7	43.5	59.5	15.7	13.8	16.0
Bihar	16.5	22.9	33.1	53.3	06.4	10.2	20.2
Delhi	62.6	67.0	74.7	80.9	04.4	07.7	06.2
Goa	55.1	67.1	75.4	81.8	12.0	08.3	06.4
Gujarat	38.4	48.6	57.8	70.7	10.2	09.2	12.9
Haryana	26.9	40.5	55.7	66.7	13.6	15.2	11.0
Himachal Pradesh	37.7	52.1	67.4	76.0	14.4	15.3	08.6
Karnataka	33.1	44.3	56.9	68.1	11.2	12.6	11.2
Kerala	75.6	86.2	87.7	91.9	10.6	01.5	04.2
Madhya Pradesh	19.0	28.8	50.3	60.0	09.8	21.5	09.7
Maharashtra	41.0	52.3	67.0	75.4	11.3	14.7	08.4
Manipur	34.6	47.6	60.1	73.1	12.9	12.5	13.0
Meghalaya	37.2	44.8	59.6	73.7	07.6	14.8	14.1
Mizoram	68.6	78.6	86.7	89.0	10.0	08.1	02.3
Nagaland	40.4	54.7	61.5	76.6	14.3	06.8	15.1
Orissa	25.1	34.7	50.5	64.3	09.6	15.8	13.8
Punjab	39.7	50.4	63.4	71.3	10.7	13.0	07.9
Rajasthan	14.0	20.4	43.9	52.6	06.4	23.5	08.7
Sikkim	27.4	46.7	60.4	76.4	19.3	13.7	16.0
Tamil Nadu	40.4	51.3	64.4	73.8	10.9	13.1	09.4
Tripura	38.0	49.6	64.9	83.1	11.6	15.3	18.2
Uttar Pradesh	17.2	25.3	42.2	59.2	08.1	16.9	17.0
West Bengal	36.0	46.5	59.6	71.1	10.5	13.0	11.5
Andaman & Nicobar	53.2	65.5	75.2	81.8	12.3	09.7	06.6
Chandigarh	69.3	72.3	76.5	81.3	3.0	04.2	04.8
Lakshadweep	55.3	72.9	80.5	88.2	17.6	07.6	07.7
Puducherry	53.0	65.6	73.9	81.2	12.6	08.3	07.3
<b>India</b>	<b>65.4</b>	<b>29.85</b>	<b>39.29</b>	<b>53.0</b>	<b>9.44</b>	<b>13.71</b>	<b>12.4</b>

Table 2. Infant mortality Rate

States	Infant Mortality Rate (IMR)				Change in IMR		
	1981	1991	2001	2011	81-91	91-01	01-11
	a	b	c	d	(b-a)	(c-b)	(d-c)
Andhra Pradesh	55	49	43	43	06	06	00
Arunachal Pradesh	91	83	61	32	08	22	29
Bihar	75	70	57	44	05	13	13
Delhi	54	49	40	28	05	09	12
Goa	51	34	28	11	17	06	17
Gujarat	78	69	59	41	09	10	18
Haryana	52	55	40	44	-03	15	-04
Himachal Pradesh	82	75	45	38	07	30	07
Karnataka	74	60	54	35	14	06	19
Kerala	42	37	18	12	05	19	06
Madhya Pradesh	133	107	94	59	26	13	35
Maharashtra	74	58	49	25	16	09	24
Manipur	28	36	31	11	-08	05	20
Meghalaya	80	76	58	52	04	18	06
Mizoram	53	58	41	34	-05	17	07
Nagaland	51	55	39	21	04	16	18
Orissa	125	108	90	57	17	18	33
Punjab	74	54	43	30	20	11	13
Rajasthan	87	81	79	52	06	02	27
Sikkim	60	57	43	26	03	14	17
Tamil Nadu	54	53	44	22	01	09	22
Tripura	82	78	64	29	04	14	35
Uttar Pradesh	99	89	84	57	10	05	27
West Bengal	62	67	59	32	-05	08	27
Andaman & Nicobar	69	49	41	23	20	08	18
Chandigarh	48	46	44	20	02	02	24
Lakshadweep	91	80	60	24	11	20	36
Puducherry	34	47	28	19	13	19	09
<b>India</b>	<b>77</b>	<b>74</b>	<b>54</b>	<b>44</b>	<b>03</b>	<b>20</b>	<b>10</b>

Table 2 provides the Infant Mortality Rate (IMR) from the four censuses between 1981 and 2011 and the change in IMR between consecutive censuses. The IMR in India has fallen from 77 in 1981 to 44 in 2011. In the 1981 census Manipur had the least IMR (28). Goa and Manipur again, had the least IMR (11) in the 2011 census. Madhya Pradesh showed the maximum fall (74) in IMR in the same period. However Madhya Pradesh also had the highest IMR (133) and (59) in the 1981 and 2011 census. There was no change Andhra Pradesh's IMR from 2001 to 2011, and Haryana's IMR actually increased from 2001 to 2011. Fortunately these two states were the only states, not showing a decline in their IMR.

Table 3 shows the change in IMR for a percent rise in the Female Literacy Rate in the States between consecutive censuses. From Analyzing the data on all 3 tables certain factors become starkly self-evident, the greatest fall in IMR does not accompany the decade with the highest rise in female literacy rate but rather, the greatest fall in IMR occurs when the Female literacy rate approaches a threshold range of 50-55%. Consider the example of India's least literate state, Rajasthan, between 1981 and 1991 the Female literacy increased from 14% to 20.4% and the fall in IMR was 6, From 1991-2001 the literacy figures growth was from 20.4% to 43.9%, a gain of 23.6%, but the fall in IMR was a measly 2. In 2011 female literacy was 52.6% a gain of less than 10% but the fall in IMR was a spectacular 27. This data is replicated for almost every state. Arunachal Pradesh's female literacy growth for the same periods was 14%, 29.7%, 43.5%, and 59.5% and the fall in IMR in the 3 decades- 8, 22 and 29. When the same data is studied for the country as a whole, we obtain similar conclusions. India's female literacy rate in the four censuses between 1981 and 2011 were 29.85%, 39.29%, 53% and 65.4% and the fall in the IMR in the same preceding 3 decades were 3, 20 and 10. This reveals that the most rapid decrease in IMR usually accompanied the decade in which the female literacy rate figured in the 50% range. This relationship is illustrated in Figs. 1, 2.

**Table 3.** Change in Infant Mortality Rate for every 1% rise in Female Literacy

States	1981-1991	1991-2001	2001-2011
Andhra Pradesh	0.70	0.33	0.00
Arunachal Pradesh	0.51	1.60	1.81
Bihar	0.78	1.27	0.64
Delhi	1.14	1.16	1.93
Goa	1.42	0.72	2.66
Gujarat	0.88	1.09	1.39
Haryana	-0.22	0.98	-0.36
Himachal Pradesh	0.49	1.96	0.81
Karnataka	1.25	0.48	1.70
Kerala	0.47	12.60	1.43
Madhya Pradesh	2.65	0.60	3.61
Maharashtra	1.41	0.61	2.86
Manipur	0.62	0.40	1.54
Meghalaya	0.52	1.22	0.42
Mizoram	-0.50	2.10	3.04
Nagaland	0.28	2.35	1.20
Orissa	1.78	1.14	2.40
Punjab	1.92	0.85	1.64
Rajasthan	0.94	0.08	3.10
Sikkim	0.15	1.02	1.06
Tamil Nadu	0.09	0.68	2.34
Tripura	0.34	0.91	1.92
Uttar Pradesh	1.23	0.29	1.59
West Bengal	-0.48	0.61	2.48
Andaman & Nicobar	1.62	0.82	2.73
Chandigarh	0.66	0.48	5.00
Lakshadweep	0.62	2.63	4.67
Puducherry	-1.03	2.29	1.23
<b>India</b>	<b>0.31</b>	<b>1.46</b>	<b>0.81</b>

Beyond a 55% female literacy rate, the IMR continues to fall uniformly until it reaches another threshold of 65-75% and then the IMR reduces rapidly again, this can be seen in the reduction in IMR patterns of Goa, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Sikkim, Tamil Nadu, Tripura, West Bengal, Chandigarh and Lakshadweep and Puducherry, as demonstrated in Table III. This data indicates that IMR has an inverse relationship with Female Literacy rate, but what this study further reveals is that the best and rapid benefits of a fall in IMR occur beyond a threshold female literacy level of around 50% and beyond.

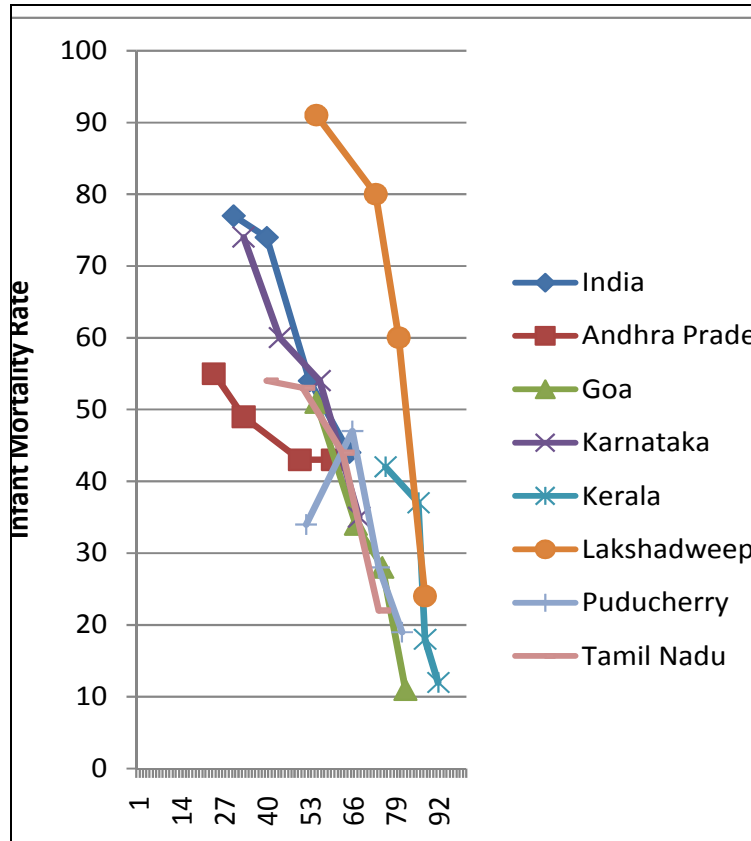
The fall in IMR again gains momentum when the number of female literates in a state reaches 65%. This leads us to believe that the tangible benefits of a rapid fall in IMR occur only when the number of female literates in a state reaches a certain critical mass.

In our study we observed that there are two crucial inflection points on the female literacy front, and those points are at the 50-55% and 65-70% range and it at these points that a demographic dividend, of a rapid fall in IMR, is manifest.

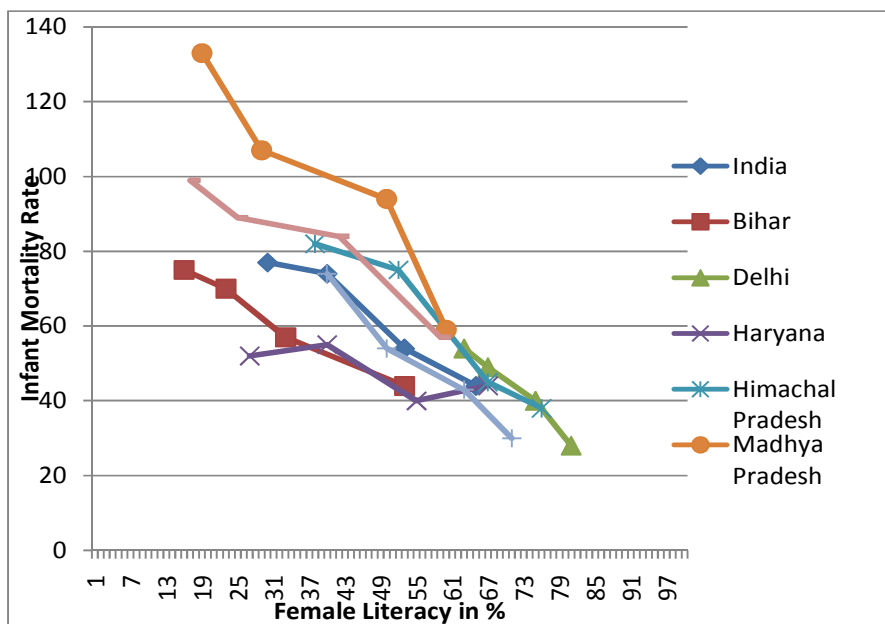
*The Impact of Female Literacy on IMR*

Figure 1 and 2 illustrate the significant variation in female literacy and infant mortality between the Southern and Northern states, Figure 1 shows the inverse relationship between IMR and Female literacy in South Indian states,

Similarly Figure 2 shows the same relationship in North Indian states. The rapid decline in IMR when the female literacy rates cross a threshold level of 50% can also be appreciated.



**Figure 1:** Female Literacy Rate vs Infant Mortality Rate –South Indian States



**Figure 2.** Female Literacy vs Infant Mortality Rate- North Indian states

## Discussion

The founder of Salt Lake City and the first governor of Utah, Brigham Young, famously said 'You educate a man; you educate a man. You educate a woman; you educate a generation'. The importance of the role of female literacy on various health parameters, particularly infant

mortality rate has been corroborated by many earlier studies. But, what this study adds to the discourse on female literacy and its influence on infant mortality is that when the percentage of female literates is low and particularly well below 50%, the benefits of a rapid decline in infant mortality is not tangible, and the rate of decline in IMR generally gains momentum until a female literacy level of 50% and thereon the drop in IMR occurs at a much swifter pace. Another swift reduction in IMR accompanies the progress of female literacy beyond the 65-70% range. The change in mortality rate for every percentage rise in female literacy, were maximum at these two phases or inflection points. This indicates that while the quest to improve female literacy and consequently empower women is a crucial and momentous battle, the benefits of this battle may not be immediately apparent and the real fruits of the struggle are evident only much later.

Female literacy by itself cannot be the sole determinant impacting infant mortality, female literacy by its empowering role acts as an additive and conjunctive ingredient to various other factors. Various other studies have demonstrated the role of other determinants in influencing infant mortality. These include factors such as gender equality and income distribution [18-22].

In a study conducted in Bangladesh the most significant predictors of infant mortality were immunization, breast feeding, mothers age at birth and birth interval [23]. The major determinants of infant mortality rate in a Kenyan study were breast feeding, ethnicity, sex of the child, birth spacing and birth order [24]. But it can be argued that female literacy has a bearing on all these determinants. Some studies have indicated esoteric determinants such as caste [25] and factors such as mother's age, consanguineous marriage and mother's body mass index [26]. An economist in Bristol studied data from 46 underdeveloped countries and the differences in infant mortality rate were explained adopting a logarithmic model and using illiteracy, physicians and nurses per head of population as variables [27]. Only one study had concluded that female literacy had not been successful in reducing infant mortality [28]. The literacy status of the father was far less important when compared to the mother's literacy rate in influencing infant and child mortality [29]. Female literacy is one of the co-determinants in impacting the infant mortality rate, but it has probably the most impact because of its capacity to influence other determinants. Research con-

ducted in the Brazilian state of Ceara, concluded that investments in female education would have substantial positive effects on reducing IMR [30]. While it is difficult to assess the impact of female literacy alone on the decline in IMR, from the empirical evidence it is possible to conclude that literacy in general and female literacy in particular has a major positive impact on the decrease in IMR. In our study there were 4 states that showed a rise in the IMR in the 1991 census, however in the last census, only one state showed a marginal rise in IMR. The percentage of birth deliveries conducted by health personnel or trained birth attendants was the most important determinant of infant mortality, and literate women were more likely to seek the aid of such personnel [8]. There is significant variation in the literacy and infant mortality status of Southern and Northern Indian states. This can be explained by the fact that women in the southern states enjoy more autonomy and are more likely to be active in the labor force and are more likely, to adopt innovative action in fertility control and utilize health services [6].

In developed countries with high levels of literacy like the U.S., the Infant mortality rate has not declined significantly in the past decade and has plateaued and this has been attributed to a rise in pre-term births. From 2000 to 2005 the percentage of pre-term births in the U.S. had risen from 11.6% to 12.7% of all births. In 2005, 68.6% of all infant deaths occurred in preterm infants [9]. Urban India has much better health and infant mortality statistics, illiteracy of females had a more detrimental impact on rural than on urban areas [31]. Literacy helps in shaping choices and decisions; impaired literacy limits the access to health information [32]. But many observers have argued that academic skills are different from health related skills and have made a distinction between general literacy and health literacy [33]. So, what is health literacy? how do we assess health literacy. Some Researchers have attempted to define it. Health literacy is defined as the capacity to acquire, understand and use information in ways which promote and maintain good health, Tools to measure health literacy such as the Health Activity Literacy Scale (HALS) have been developed, HALS tests competencies in five domains-health protection, health promotion, disease prevention, systems navigation and health care and maintenance [34]. Therefore disseminating only bookish knowledge and increasing the literacy rate while neglecting practical aspects of health and nutrition may be a faulty strategy and due emphasis on utilitarian modes of creating health awareness may be advantageous in the long run.

## Conclusions

Female literacy has a definite bearing on infant mortality, Improvement in literacy status of women results in a downward trend in infant mortality rate, the trend how-

ever is not uniform and the benefits of a rapid drop in infant mortality rate, peak when the total number of female literates in any geographically determined area approaches threshold levels of 50% and 65%.

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