Infant mortality in India: Trends, Determinants and NHP target achievement at district level

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Abstract

Infant mortality is an excellent indicator of socio-economic development. Along with maternal and child mortality, infant mortality has been one of the prime focus for international organizations and national governments. Government has long ago realized that reduction in infant and child mortality rates is an urgent necessary precursor for achieving rapid reduction in fertility.
Due to the diverse population and climatic conditions of India, each state has its own pace of decline. It's necessary to know the determinants according to the regions and study the variation within a state. These information are very necessary to assist in decentralization of policies and proper optimization of funds. Thus, objective of this study is to:-
1) To examine the present district level distribution and chronological trend of infant mortality rate in India since 1972.
2) To examine the infant deaths across different households, maternal and infant's characteristics, and to find out the determinants of infant deaths in India.

Introduction

Infant mortality is one of the most important indicators of socio-economic development of a region. Economically backward states of India are found to have higher IMR than economically advanced states. India is home to 17.99 percent of the global population. Being the second most populous country in the world it faces many hurdles in providing extensive, updated and affordable healthcare facilities to its citizens. A report by United Nations Inter-agency Group for Child Mortality Estimation (UNIGME) in 2017 stated "Infant deaths were reported the highest in the world in India". India recorded 605,000 neonatal deaths in 2017, and the number of deaths among children aged 5-14 was recorded at 152,000". It mentioned lack of access to water, sanitation, proper nutrition and basic health services as some of the most direct causes.

A report published in 2019 on level and trends in child mortality by the UN inter- agency group for child mortality estimation provides us a brief glimpse of the world scenario. It states that the age distribution of the mortality of children and young adolescents shows that the highest risk of death during the neonatal period (the first 28 days of life). In 2018, the neonatal mortality rate was estimated at 18 deaths per 1000 live births globally. The probability of dying after the first month and before reaching age 1 was at 11 per 1000. The neonatal mortality rate fell to 18 (17, 19) deaths per 1,000 live births in 2018 from 37 (36, 38) in 1990 and 31 (30, 31) in 2000 – a 52 (47, 53) per cent and 42 (37, 45) per cent decline, respectively. There's an urgent need to accelerate the prevention of infant mortality. The uneven rates also necessitates immediate concentrative effort in lagging regions.

Endogenous and exogenous causes of infant mortality in different countries have been highlighted by J Bourgeois- Pichat in 1964. Endogenous causes like age of mother, premature birth, weight at birth, multiple births, birth order are more severe (mainly congenital malformations) and are more difficult to prevent or correct. In regions with low infant mortality rate, a higher proportion of infant deaths occur during the neonatal stage, because as the region is developed, it has been successful in almost eliminating the environmental factors responsible for such deaths. Whereas in countries where infant mortality rates are high, most infant deaths occurs after the neonatal stage and is due mainly to environmental factors.

Even under the best conditions, there are considerable variations at the individual level in the probability of an infant's survival. The reasons for these variations are not known. Within a community, they could reflect differences between households, most probably due to the genetic differences. The individual factors alone cannot explain all the differences in individuals' chances of survival; their relative contributions would depend upon the level of infant mortality in a population; and would vary in different populations. Moreover, no model is perfect, considerable wasteful expenditures are inherent in any public policy measure implemented for the reduction of infant mortality in an area

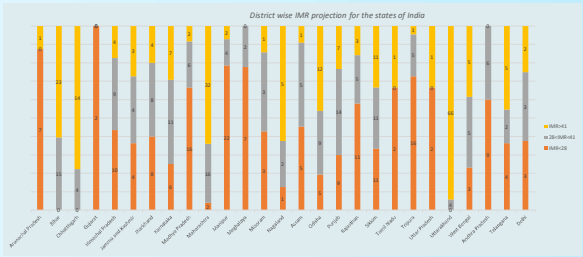
Data and Methods:

This study is based on the data collected by National Family Health Survey and Sample Registration System. The NFHS provides state- and national-level information on fertility (usually three years prior to the survey), family planning, infant and child morbidity and mortality (usually five years prior to the survey), maternal and reproductive health, nutritional status of women and children, and the quality of the health services. SRS is a dual record system of birth and death registration. The scheme of sample registration of births and deaths in India popularly known as Sample Registration System (SRS) was initiated by the Office of Registrar General in 1964-65 on a pilot basis and on full scale from 1969-70.

District level estimations of IMR is done using the Stata package "syncmrates" . Inferences regarding IMR are strictly based on the districts for which estimated mortality rates are statistically significant at 5% level of significance. To present a state-wise comparative analysis of district status with reference to the National Health Policy target on preventable deaths among infants, all districts are categorized as follows: (a). District which had already achieved the target 28 or fewer deaths per 1000 live births (b). Districts which have IMR between 28 and 41 (c). Districts which are lagging behind and have IMR above 41. To Include a district in category (b), first the state-specific yearly percentage reduction IMR between NFHS-3 and NFHS-4 is computed. Then the yearly state-specific reduction in the corresponding district's mortality rate for a 3-year period is applied. A district is assigned as being "on track" if, after experiencing state-specific reduction rate in 10 years, its expected mortality rate is less than 28 in 2019. We have assumed that reduction in mortality rate in a district during 2010–2019 is be similar to the reduction experienced by the corresponding state between the NFHS-3 and the NFHS4. A district is assigned as being lagging (c) if it does not meet the criteria in either (a) or (b) discussed above. NFHS 3 didn't collect data for union territories and thus are excluded from the study. Moreover, Telangana was carved out of Andhra Pradesh to form a new state. In order to compare NFHS 4 IMR with IMR of Andhra Pradesh from NFHS 3, IMR is calculated by combining the sample for both these states from NFHS 4. Estimation for Kerala has been omitted as sample size isn't enough.

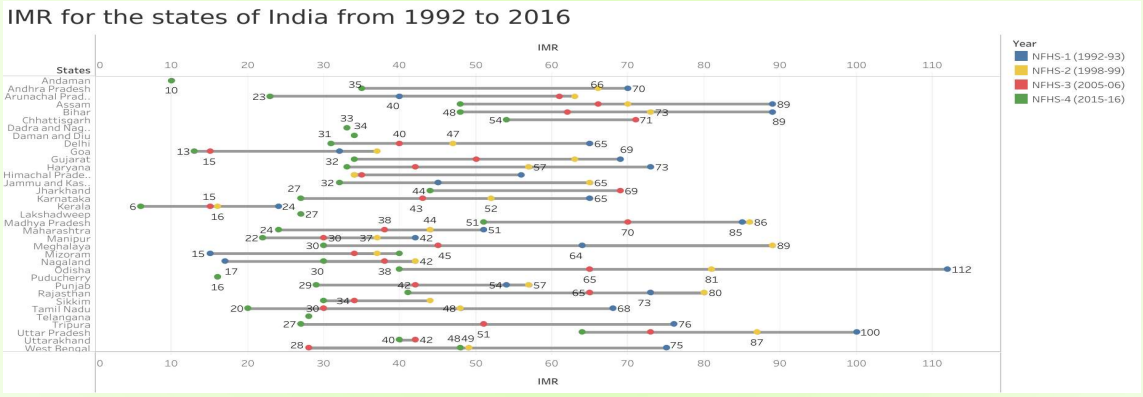
The dependent variable for the present study is considered as infant death, which is coded as 1 'if the death occurred less than 1year' and 0 'otherwise'. Births which took place preceding 5years from the date of survey have been considered for the analysis. The following independent variables have been taken: sex of the child (male, female), size of the child at birth(larger than average, average, smaller than average), place of delivery(non institutional birth, private health institution, public health institution), mother's age at child's birth divided into four categories (15–19, 20-29, 30–39, 40–49), mothers' education (illiterate, primary, secondary, higher), caste of women (scheduled caste [SC], scheduled tribe [ST], other than SC and ST), religion of women (Hindu, Muslim, Christian, Others), birth interval (less than or equal to 24 months, more than 24 months) and birth order (first, second, third, fourth or more), region of residence (rural, urban), wealth index (poorest, poorer, middle, richer, richest), source of drinking water(improved water source, non improved water source), children ever born and household head. Piped water int dwelling/yard/plot, public tap/standpipe, tube well or borehole, protected dug well, protected spring, rainwater, RO plant are considered as improved water sources. The first category of each covariate is considered as a reference category. Mother's autonomy is measured using her ownership of land or house. Further mother's freedom of movement i.e who decides on visits to family or relatives, whether she has a say on large household purchases and her health care is used as proxy indicators to measure her status within the household. The independent variables are chosen using log rank tests.

For study purposes India is divided into six divisions: North(Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Uttarakhand), South (Andaman and Nicobar Islands, Andhra Pradesh, Kerala, Lakshadweep, Puducherry, Tamil Nadu and Telangana), East (Bihar, Jharkhand, Odisha, West Bengal),West (Dadra and Nagar Haveli, Daman & Diu, Goa and Maharashtra), Northeast (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) and Central (Chhattisgarh, Madhya Pradesh, Uttar Pradesh). For each division, the determinants are analyzed using cox proportional hazard model.



District wise IMR projected for 2019

National Health Policy 2017 had a goal of achieving reduction of IMR to 28 by 2019.
Here using NFHS 3 and NFHS 4 data district wise IMR has been projected for the states. This provides us a glimpse of intra state variation of IMR
Among the northern states and UTs (Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab,Rajasthan,Uttarakhand) Rajasthan has the highest and Punjab has the lowest IMR. Central states Chhattisgarh, Madhya Pradesh, Uttar Pradesh. More than half of the districts in these states haven't achieved the target by 2019. In Uttar Pradesh, Chhattisgarh and Maharashtra; 66 out of 71, 14 out of 18 and 32 out of 50 districts have IMR above 41 (2019 projection).
Among Eastern states i.e. Bihar, Jharkhand, Odisha, West Bengal. Bihar unfortunately has a very grim scenario with not even one district having IMR below 28. The district with the highest IMR in Bihar is Purnia with IMR equals 73.62. Intrastate difference is visible in Orissa, it has districts with IMR ranging from 11.8 to 87.3. Similarly, an uneven distribution of IMR can be seen clearly for Jharkhand. It has 6 districts below 28, 11 between 28 to 41 and 7 above 41. Certainly, a common blanket approach will fail to work for Jharkhand or Orissa. Northeastern states include Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Seven sisters though have the same climate, but the health scenario is very different. Despite having road connectivity issues, ethnic unrest, insurgency, illegal immigration, apart from Assam and Mizoram all the remaining states have shown impressive decline in IMR. Interestingly Mizoram has shown an increase in IMR from NFHS-3 to NFHS-4. Western states Dadra and Nagar Haveli, Daman & Diu, Goa and Maharashtra are comparatively better and on track. All of them have IMR below the national average. Goa had already achieved IMR below the National Health Policy target. Southern states and UTs comprises Andaman and Nicobar Islands, Andhra Pradesh, Kerala, Lakshadweep, Puducherry, Tamil Nadu and Telangana. Almost all the districts of Kerala have achieved single digit IMR. Among these southern states Andhra Pradesh is lagging behind followed by Telangana and Lakshadweep.



Findings:

In all the six regions it has been found that IMR is inversely proportional to education of women. Education enables mothers to make informed decisions regarding health care of the newborn as well as herself. Educated mothers will have more opportunity to be economically independent and have autonomy in the household. From the data of the central region, it has been found that babies born to mothers who own a property alone have more chances of survival.
Babies born to mothers in age group 20-29 have the highest chance of survival. The lowest is for the babies born to mothers below 19 years of age. The higher mortality rate among infants born to underage mothers in our study corresponds with earlier studies. Usually, adolescent mothers face financial and social problems that lead to less provision of childcare. Also, physiological immaturity such as a small uterus or narrow bony pelvis and lack of social experience in caring for a newborn can be instrumental. Higher hazard of infant deaths observed in teenage pregnancies can also be attributed to socio-demographic factors.
Hazard of Infant death decreases with increase in economic status of the household. Wealth index also determines the availability of proper sanitation, lean fuel and improved source of drinking water. Babies of households which are deprived of clean drinking water have more chances of dying.
Babies of birth order 3 or higher have better chances of survival. Multiple births are strongly negatively associated with infant survival in India independent of other risk factors. Moreover, babies born after 2 years of the previous birth interval are at lesser risk. The association between birth order and increased infant death might be an artefact of overrepresentation of mothers with poor outcomes in their previous birth as reported by previous authors [1]. Previous studies also have shown that women who experience pregnancy loss or poor pregnancy outcome tend to go for the next pregnancy after a short time to replace the previous pregnancy loss in order to achieve the desired family size, i.e., selective fertility or reproductive compensation. This is an important challenge in reproductive epidemiology, as women who experienced poor outcomes are more likely to continue for the next pregnancy compared with those who had favorable birth outcomes. This results in overrepresentation of high-risk groups (women) in the subsequent pregnancies. Therefore, outcome of previous pregnancy is an important determinant for neonatal survival in the subsequent pregnancy including through shortening of the birth interval, it also influences the length of interval between pregnancies. The increased neonatal mortality among infants in the second birth order and among women with short birth intervals could be explained by the effect of selective fertility. [2-4]
In the central region it was found that women from female-headed households were less likely to experience the death of a child than those from male-headed households. This could be since women could talk more easily with the female head of the household about their reproductive health problem as well as children's illnesses. The other reason could be that female household heads could better understand female health problems, so they encouraged women to visit health facilities to treat a sick child when necessary. Another possible explanation for these could be that women who have autonomy in decision making are more likely to use contraceptives, which might decrease the risks associated with reproductive behavior, prolong birth intervals, lessen their fertility, and ultimately minimize child mortality [5]. Previous research has confirmed that a woman's control over household resources (ability to keep money aside) has a significant positive effect on both the demand for prenatal care and the probability of hospital delivery [6].

From this study we can conclude that to bring overall IMR to a more respectable position, it's very necessary for the policy makers to target the underperforming large states and especially those districts where the rates tend to be severe. This is due to uneven distribution of IMR within a state or population groups. The focus for policy makers should be to think beyond the traditional religious or caste-based differentials and to form decentralized programs targeting districts which are lagging. A generalized method to reduce the IMR won't work. Since each area has its own socioeconomic differentials, policy makers must be flexible and target the problematic issues accordingly.

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