Method for Estimating Infant Mortality Rate for Chhattisgarh State in India

Sachin Pandey, Hemlata Thakur, Sakuntala Jitpure, Arun Singh

ABSTRACT

Measurement is a fundamental aspect of research in the area of infant mortality. The National Population Policy, 2000 aims at a reduction of Infant Mortality Rate (IMR) to less than 30 by 2010. The estimates on infant and child mortality at the national level and for major states of India are provided by the sample registration system (SRS) annually. The National Family Health Survey (NFHS) also provides the estimates by mother’s educational level, standard of living of the households as well as the other socio-economic characteristics of the households. Thus, at the state level we have good information on these estimates. Estimates of IMR can be derived directly as well as indirectly. The direct estimates are usually based on the number of infant deaths reported during the last one year per 1000 live births. The civil registration system as well as the SRS adopts this technique for providing the estimates.

Keywords: Child mortality rate, Family health survey, Infant mortality rate, National sample registration, Under five mortality rate.


INTRODUCTION

The infant mortality rate (IMR) (the probability of not surviving by age 1) is one of the sensitive indicators of development. It is one of the key indicators from the program point of view. Infant mortality rate is an important indicator of social development of a nation as well as state. It is widely used for assessing socioeconomic and health situation in developing countries (Chandra Sekhar, Jain and Visara). Measurement is a fundamental aspect of research in the area of infant mortality. If the vital registration is complete, IMR for each year can be calculated in the conventional manner directly from the system’s data. Hill, Trussell, Palloni and Helligram have been used for estimating IMR for Nepal using the census or survey data. The National Population Policy, 2000 aims at a reduction of IMR to less than 30 by 2010. The Millennium Declaration aims to reduce infant mortality by two-thirds from its current level. A reduction in the IMR depends on both exogenous and endogenous factors, such as medical assistance at delivery, nutritional level, and health of mother as well as care during and after delivery. The estimates on infant and child mortality at the national level and for major states of India are provided by the SRS annually. The National Family Health Survey (NFHS) also provides the estimates by mother’s educational level, standard of living of the households as well as the other socioeconomic characteristics of the households. Thus, at the state level, we have good information on these estimates. Estimates of IMR can be derived directly as well as indirectly. The direct estimates are usually based on the number of infant deaths reported during the last one year per 1000 live births. The civil registration system as well as the SRS adopts this technique for providing the estimates. Besides, the following indirect methods are used in providing the estimates of IMR:

- Estimation of infant mortality from information on children ever born and children surviving
- Estimation of IMR based on regression methods
- Estimation of IMR from the birth history of women

The second model is applied to obtain the estimates of IMRs for Chhattisgarh and computing relevant t test between presented IMR data and estimated data.

OBJECTIVE

- To estimate IMR (per 1,000 live births) for three different components, such as total, urban, rural with the help of child mortality rate (under five mortality rate).
- To compare between estimated IMR and presented IMR data with respect to years.

MATERIALS AND METHODS

The proposed methodology of estimation is based on simple regression approach described Kumar, Aryal and
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The methodology of estimation developed here follows the usual path of establishing the relationships between the dependent variable, which in this case is the IMR, and the independent variable, such as CMR. Several empirical studies show a linear relationship between IMR and CMR. Therefore, it is decided to fit a regression model of type:

\[ Y = a + bX + e \]  

where \( Y \) = Estimated IMR (per 1,000 live births), \( X \) = Child (under 5) mortality rate (per 1,000 live births).

The next step is to determine the value of the parameters. For this purpose, the regression model is fitted by the following set of data extracted from the NFHS fact sheets (2011–12), census (2011), and NFHS fact sheet of Chhattisgarh (2015–16).

RESULTS

Table 1 gives the following values of constants needed for estimating the parameters.

Intercept (a) for Total = 61.120; Intercept (a) for Urban = 51.736; Intercept (a) for Rural = 62.338.

Slope (b) for Total = –0.137; Slope (b) for Urban = –0.226; Slope (b) for Rural = –0.109

Using these data (Table 2), simple regression approach gives the following estimated regression model for computing IMR for Chhattisgarh as for Total and according to residences by Statistical Package for the Social Sciences (SPSS) 11.5 version.

The results are given below:

\[ Y \text{(Total)} = 61.12 - 0.137X \]  
\[ Y \text{(Urban)} = 51.736 - 0.226X \]  
\[ Y \text{(Rural)} = 62.338 - 0.109X \]

\( n = 8, R^2 = 49.1\% \), \( n = 8, R^2 = 62.9\% \), \( n = 8, R^2 = 40.8\% \)

<table>
<thead>
<tr>
<th>Years</th>
<th>CMR (Total)</th>
<th>IMR (Total)</th>
<th>CMR (Urban)</th>
<th>IMR (Urban)</th>
<th>CMR (Rural)</th>
<th>IMR (Rural)</th>
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<tr>
<td>2005</td>
<td>20.2</td>
<td>63</td>
<td>13</td>
<td>52</td>
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<td>2006</td>
<td>18.4</td>
<td>61</td>
<td>12.5</td>
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<td>19.5</td>
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<tr>
<td>2007</td>
<td>16.9</td>
<td>59</td>
<td>11.9</td>
<td>49</td>
<td>17.9</td>
<td>61</td>
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<tr>
<td>2008</td>
<td>17.1</td>
<td>57</td>
<td>11.7</td>
<td>48</td>
<td>18.1</td>
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<tr>
<td>2009</td>
<td>15.5</td>
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<td>11.4</td>
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<td>2011–12</td>
<td>66</td>
<td>50</td>
<td>44</td>
<td>37</td>
<td>71</td>
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<td>2015–16</td>
<td>64</td>
<td>54</td>
<td>51</td>
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<tr>
<th>Years</th>
<th>( Y \text{(IMR) Total} )</th>
<th>Est. IMR (Total)</th>
<th>( Y \text{(IMR) Rural} )</th>
<th>Est. IMR (Rural)</th>
<th>( Y \text{(IMR) Urban} )</th>
<th>Est. IMR(U)</th>
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2011 to 2012 both are increased, which is shown in year 2015 to 2016 recently.

Graph 2 shows comparisons between estimated IMR (Rural) and presented IMR (Rural) data. It shows that both lines are gradually decreasing but after year 2009 presented data of IMR are less than estimated IMR data, which is a good sign at that time. But in recent year 2015 to 2016, both lines (Estimated IMR and presented IMR for Rural) are collapsed or touch each other, which is shown in year 2015 to 2016 recently.

Graph 3: Comparison between estimated IMR and presented IMR for urban of Chhattisgarh according to years

Table 3: Representing all statistical analysis which are done by SPSS 21.0 version

Test for model adequacy
Tests for goodness of fit:
1. Based on coefficient of determination R² (%), n = 8
2. Based on analysis of variance and F ratio
3. D-W test for autocorrelation

Results
1. For Total = 49.1%, Urban = 62.9%, Rural = 40.8%
2. t_{Total} (for CMR) = –0.137 (p > 0.05 not significant), t_{Rural} = –1.855 (p > 0.05 not significant), t_{Urban} = –2.913 (p < 0.05 significant)
3. F_{Total} = 4.819 (p > 0.05 not significant), F_{Rural} = 3.442 (p > 0.05 not significant), F_{Urban} = 8.495 (p < 0.05 significant)
4. D*** = 1.621, D** = 0.821, D* = 0.743

*for Total, **for Rural, ***for Urban
Graph 3 shows comparisons between estimated IMR (Urban) and presented IMR (Urban) year-wise data. It shows that both lines are gradually decreasing overall, but in year 2011 to 2012 presented data of IMR showed big graph than estimated IMR data, which was a good sign at that time. But in recent scenario 2015 to 2016, both lines of presented IMR for Urban are growing and try to touch each other.

Graph 4 shows year-wise child mortality rate under 5 years and IMR in three types, such as Total, Urban, and Rural.

CONCLUSION

The advantages of the indirect techniques in mortality estimates cannot be overemphasized in developing states, such as Chhattisgarh. The proposed model is very simple and easy to apply; it does not need census or survey data and model life tables for estimation of IMR; and it gives approximately reliable estimates of Chhattisgarh state. The results indicate that the model is fit in Urban area, which means that we can predict the best estimation of IMR in Urban area with respect to CMR in last 8 years. The model seems to provide comparatively better estimates for more recent periods than for the distant past. However, the model seems to be affected by accuracy of data and age structure of the population under study.

Conclusively, the model may be considered suitable for estimating IMR for Chhattisgarh for few more decades.

REFERENCES