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Method for Estimating Infant Mortality Rate for Chhattisgarh State in India

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Abstract

Measurement is a fundamental aspect of research in the area of infant mortality. The National Population Policy, 2000 aims at a reduction of 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 SRS annually. The 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: NFHS-National Family Health Survey; SRS-Sample Registration; IMR-Infant Mortality Rate; U5MR-Under Five Mortality Rate; CMR-Child Mortality Rate.

Introduction

The Infant Mortality Rate (the probability of not surviving by age one) is one of the sensitive indicators of development. It is one of the key indicators from the programme point of view. Infant mortality rate (IMR) is an important indicator of social development of a nation as well as state [1]. It is widely used for assessing socio-economic and health situation in developing countries (Chandra Sekhar [2] 1972:77, Jain and Visara [4] 1988). Measurement is a fundamentalaspect of research in the area of infant mortality. It the vital registration is Complete, IMR for each year can be calculated in the conventional manner directly from the system's data (Hill [3] 1991:369). Trussell [7] (1975), Palloni and Helligram [6](1986) 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 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.

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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. 1) Estimation of Infant Mortality from information on Children Ever Born and Children surviving 2) Estimation of IMR based on Regression Methods 3) 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

1) To estimate IMR (per 1000 live births) for three different component as Total, Urban, Rural with the help of Child Mortality Rate(Under five Mortality Rate).

2) To comparison between Estimated IMR and Presented IMR data with respect to years.

Material and Methods

The proposed methodology of estimation is based on simple regression approach described (Kumar [5] 1981; Aryal and Gautam [1] 2001). 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 as CMR. Several empirical studies show a linear relationship between IMR and CMR. Therefore, it was decided to fit a regression model of type:

$$Y= a+ bX +e \quad (1)$$

Where Y=IMR (per 1000 live births); X=CMR (per 1000 population); e is a random error term; and a & b are parameters to be estimated.

The next step is to determine the value of the parameters. For this purpose ,the regression model is fitted in by the following set of data extracted from NFHS fact sheets (2011-12), Census (2011) & NFHS fact Sheet of Chhattisgarh (2015-16).

Results

The 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 Total= -0.226 Slope (b) for Rural= -0.109

Using these data, simple regression approach gives the following estimated regression model for computing IMR for Chhattisgarh as for Total and according to residences by SPSS 21.0 Version.

The results are given below:

$$Y(\text{total}) =61.12-.137X \quad (1)$$

$$Y(\text{Urban})=51.736-.226X \quad (2)$$

$$Y(\text{Rural})=62.338-.109X \quad (3)$$

n=8, R^2=49.1%, n=8, R^2=62.9%, n=8, R^2=40.8%

Where Y=Estimated IMR (per 1000 live births)

X=Child (under Five) Mortality Rate (per 1000 live births)

Where n is denoted no of year wise presented data of IMR& Child Mortality Rate (CMR). The coefficient of determination (R^2) is computed for goodness of fit. The value of coefficient of determination for Urban=62.9% is very high which indicates goodness of fit as 63% approx. of the variation in IMR amongst the periods appears to explained by the variation in the CMR. Similarly, the smaller value of computed Standard Error (SE) (Y) for Urban =0.78 indicates the higher reliable of the model. The goodness of fit of a regression model is mostly affected by the estimates values of the parameters. Similarly, the estimated parameters may be considered significant as they satisfied the t test. For the Urban IMR prediction, the parameter b to be considered significant as the t test =2.93 which has p<.05. Statistically significant. This is also true for the constant parameter in all three different situation as total, Urban and Rural prediction of IMR. The calculated F ratio is statistically significant only in prediction of Urban area of Chhattisgarh. Finally we can say the regression model for IMR

Table 1(a): Estimates of CDR and IMR for Chhattisgarh used for fitting the equation (1)

Years	CMR (Total)	IMR (Total)	CMR (Urban)	IMR (Urban)	CMR (Rural)	IMR (Rural)
2005	20.2	63	13	52	21.1	65
2006	18.4	61	12.5	50	19.5	62
2007	16.9	59	11.9	49	17.9	61
2008	17.1	57	11.7	48	18.1	59
2009	15.5	54	11.4	47	16.2	55
2011-12	66	50	44	37	71	53
2015-16	64	54	51	44	68	56

Table1(b): Representing current & Estimated IM R(Infant Mortality Rate) for Total, Urban and Rural for Chhattisgarh

Years	Y(IMR)Total	Est.IMR(total)	Y(IMR)Rural	Est.IMR(Rural)	Y(IMR)Urban	Est.IMR(U)
2005	63	52	65	60	52	58
2006	61	52	62	60	50	59
2007	59	52	61	60	49	59
2008	57	52	59	60	48	59
2009	54	52	55	61	47	59
2011-12	50	52	53	55	37	52
2015-16	54	52	56	55	44	52

is best model for prediction of IMR in Urban area.

The presence of autocorrelation is a serious problem and therefore, D-W test is computed for detection of autocorrelation. The results of D-W test clearly show absence of autocorrelation in the residuals because the first order autocorrelation coefficient is very small. and the condition: $d_u<d<4-d_u$ is well satisfied for Urban area.

This Figure 1 shows comparisons between Estimated IMR (Total) and Presented IMR (total) data with year wise. It shows that current Infant Mortality Rates line is gradually decreasing but after year 2011-12 it has arised. which is shown in year 2015-16 recently.

This Figure 2 shows comparisons between Estimated IMR (Rural) and Presented IMR (Rural) data with year wise. It shows that presented IMR line is gradually decreasing but after year 2009 it is raised. But in recent scene 2015-16 both line (estimated IMR and Presented IMR for Rural are collapsed or touch to each other.) which is shown in year 2015-16 recently.

This Figure 3 shows comparisons between

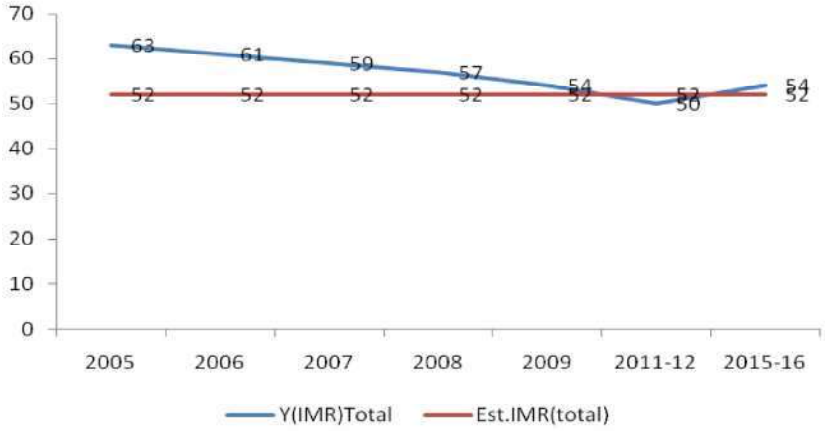

Fig. 1: Comparison of Presented IMR (Total) and Estimated IMR (Total) according to Years

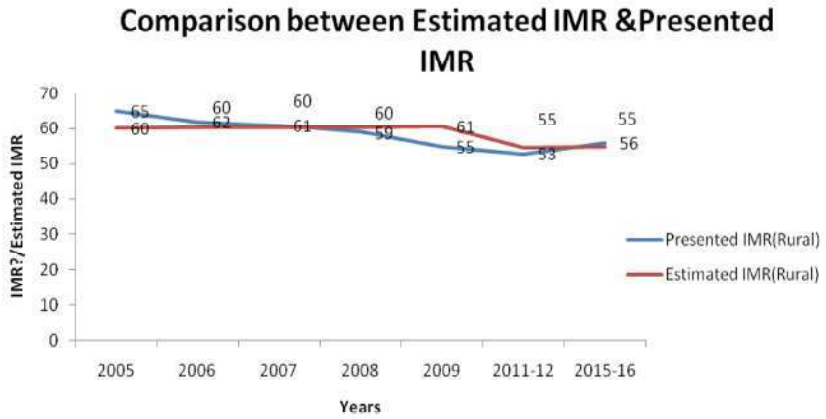

Fig. 2: Comparison between Estimated IMR and Presented IMR for Rural of Chhattisgarh according to Years

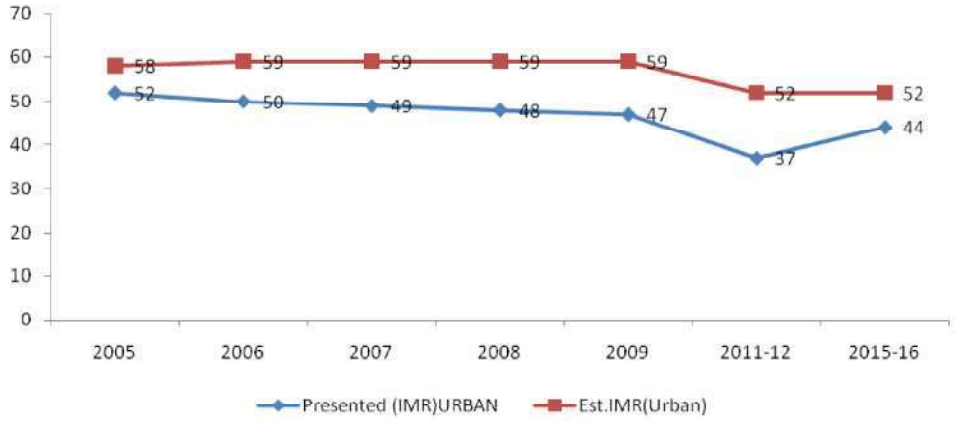

Fig. 3: Comparison between Estimated IMR and Presented IMR for Urban of Chhattisgarh according to Years

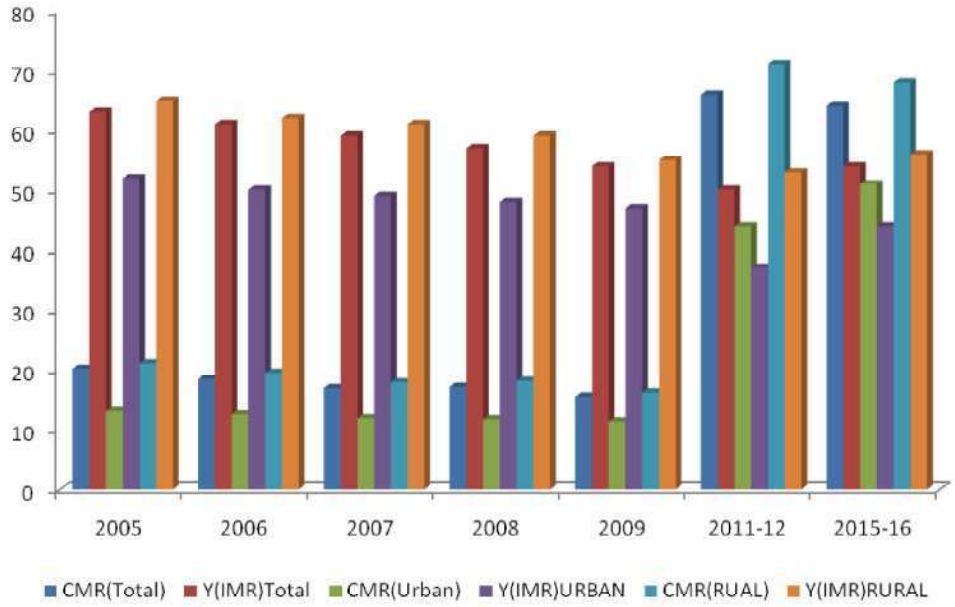

Fig. 4: Representing Bar Chart Child Mortality Rate and Infant Mortality Rate for Total, Urban and Rural of Chhattisgarh according to Years

Table 3: Representing all statistical Analysis which are done by SPSS 21.0 Version

Test for Model Adequacy	Results
1.Tests for Goodness of Fit: 1.Based on Coefficient of determination R^2(%), n=8	For Total=49.1%,Urban=62.9%,Rural=40.8%
2.Test of Significance 1.Based on t test 2.Based on ANOVA and F ratio 3.P value 4.D-W test for Autocorrelation D statistic *for Total,**for Rural,***for Urban	t_{total}(for CMR)=-.137 (p>.05 not significant), t_{rural}=-1.855 (p>.05 not significant), t_{urban}=-2.913 (p<.05 significant) F_{total}=4.819 (p>.05 not significant), F_{rural}=3.442 (p>.05 not significant), F_{urban}=8.495 (p<.05 significant) D***=1.621,D**=.821.D*=.743

Estimated IMR (Urban) and Presented IMR (Urban) data with year wise. It shows that both line is gradually decreasing over all but in year 2011-12 presented Data of IMR is big gaps than Estimated IMR Data which was good sign at that time. But in recent scenario 2015-16 line of Presented IMR for Urban are growing and try to touch to each other).

This figure 4 shows Child Mortality rate under 5 years and Infant Mortality Rate according to year wise in three type as total, Urban and Rural.

Discussion

A checking for model that fails in diagnostic checking for model adequacy will always remain suspect and little faith can be put in the results (Kerlinger 1988 [8]). Therefore it is essential that that the model is fitted for estimation purposes should satisfy the important tests of model adequacy. In this study, the diagnostic checking for model adequacy is done in Nepal contexts, comparing the estimated of IMR for Nepal with other estimates available for the country from different sources (Singh 1979 [9]; CBS 1987a, 1995 [10,11]; UNICEF 2001 [12]); and by computing relevant tests for model adequacy describes elsewhere. it is attempted to review a few of the methods used in the estimation of IMR and provide the estimates of IMR using the Reproductive and Child Health Survey data (RCH, Round II)

Conclusions

The advantages of the indirect techniques in mortality estimates cannot be overemphasized in developing state Like Chhattisgarh. The proposed model is very simple and easy to apply; does not need census or survey data and model life tables for estimation of IMR; and gives approximately reliable estimates of Chhattisgarh state. The results is indicates that the model is fit in Urban area it means that we can predict or best estimation of IMR in urban area with respect to CMR in last 08 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.

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