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An assessment of infant and child mortality by social group and place of residence in districts of Orissa

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ABSTRACT

Objective: To provide an approximation of infant and child mortality rate for all the districts of Orissa using CEB (Children Ever Born) and CS (Children Survival) data of Census of India, 2001. And to find out the correlations of IMR and CMR with selected monitoring indicators.

Methods: Trussell method has been used in estimating infant and child mortality rate. For a better understanding, the districts were classified into three groups on the basis of estimated infant mortality rate *viz.* i) infant mortality rate lower than national average, ii) infant mortality rate between state and national average and iii) infant mortality rate more than state average.

Results: Study reveals that most of the districts of Orissa are experiencing higher IMR and CMR as compared to estimated IMR and CMR of state average. Only one district of Orissa (Mayurbhanj) has IMR and CMR lower than national average in comparison with other districts of Orissa. On the other hand, 17 districts have an infant mortality between the state and national average, 12 districts have an infant mortality higher than the state average. **Conclusion:** The ranking of districts helps to identify the backward and most backward districts in reproductive and child health programmes and to intensify the intervention strategies to reduce the infant and child mortality in the state of Orissa.

1. Introduction

Mortality in infancy and childhood is used as a reliable indicator of health status and well-being of children. It is quite well-known that determinants of infant and child mortality vary between geographical regions, between cultural groups and also between the regions of different economic status. There are good numbers of studies on infant and child mortality all over the world. Women's birth histories were examined to children born during the 10 years period before the survey by major division in Bangladesh, using data from the 1999–2000 Bangladesh

Demographic and Health Survey (BDHS)[1]. The catholic and Lutheran families in 19th century Poznan showed differences resulted from ecological conditions rather than from religious differences[2]. Ecological analysis examined the relationship between infant mortality and economic status by race in metropolitan Ohio, using census data on mother's residence and economic status[3]. Education of both parents, marital status of the mother as well as her occupation, the loss of older children previously and the duration of breastfeeding, are the factors affecting under five mortality in South Africa[4]. In four rural areas of Bangladesh the effect of women's status on infant and child mortality was examined[5]. Another study in Bangladesh indicates that age at marriage, birth order, birth interval, household conditions, source of drinking water and breastfeeding practices have significant effects on infant, child and under-five mortality[6]. A study in South Wales, Australia showed that it is essential to include strategies to predict and prevent prematurity and low birth weight to

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reduce still births and neonatal deaths[7]. In China, neonatal mortality declined dramatically both in urban and rural groups in Gansu province during 2004–2009. Disparities persisted between rural and urban populations[8]. From a study on bio-demographic and health seeking behavior factors influencing neonatal and post-neonatal mortality in Bangladesh, Causes of deaths after neonatal period are found to be deeply rooted in poverty, regional administrative disparity, lack of breastfeeding, unplanned frequency of births, small interval between births and non-utilization of health seeking services[9]. It reveals from Haiti Demographic Profile–2011 that there exists marked difference between male infant mortality (58.16 per 1 000 live births) and female infant mortality (49.83 per 1 000 live births)[10]. Abuqamar *et al.* attempted to determine the relation-ship between socio-economic differences (literacy rate, unemployment, poverty, gross domestic product, early marriage, and consanguineous marriage) and infant mortality in the Arab World during the last two decades[11]. Infant mortality is high in Nepal. In this context mother's literacy and involvement in healthcare decision making appear to be the most powerful predictors for reducing infant mortality [12]. There is a clear need for robust and current measures of fertility and mortality in Afghanistan, especially in view of widespread changes in the country, including large investment in health services development, and the various obstacles to accurate measurement in the country[13].

To quote a few from various studies on infant and child mortality in India it was noticed that there was significant effects of maternal age on mortality of offspring among women of different age, caste and population groups of North Indian Muslim[14]. A study on infant mortality in an urban slum in India emphasized the need to improve antenatal and perinatal care to improve survival in the neonatal period. The strikingly high death rate due to diarrheal illness highlights the requirements for better sanitation and water quality[15].

Orissa is one of the states in eastern India, which is neither industrially nor agriculturally developed. Nearly 87 percent of Orissa's population is living in rural areas and depends mostly on agriculture. In terms of the Human Development Index, the state ranks at 11th position, and in the Human Poverty Index its rank is 31st. The total fertility rate was three children per woman and the infant mortality rate was 88 per 1 000 live births in 2001. According to the 2001 census[16], the total number of districts in Orissa has increased from 13 to 30. Out of the erstwhile 13 districts, the jurisdiction of only three districts viz. Sundergarh, Kendujhar and Mayurbhanj remain in tact while the remaining 10 districts were divided into 27 districts. Orissa has the highest number of tribal (62) and primitive tribal (13) groups in the country. The tribal population in Orissa constitutes a significant proportion of 30 percent of the state's population. In western Orissa, there is heavy concentration of tribal population and in the coastal districts, they constitute a low percentage. In the

KBK (Kalahandi, Balangir and Koraput) districts, noted for their poor economic infrastructure, low spread of medical facilities and widespread poverty, IMR continues to be at a high level. Orissa is classified as a socio-economically and demographically backward state in India. Present study is an attempt to estimate the infant and child mortality rates by caste groups and place of residence in the districts of Orissa, and to understand the linkages of selected reproductive and child health indicators with infant and child mortality in Orissa.

2. Material and methods

The estimates are arrived at by using the data on children ever born (CEB) and children surviving (CS) to the women aged 15–49 years from the Census of India, 2001[16]. Apart from the Census of India, the District Level Household Survey (DLHS–2) data conducted by RCH–III[17] is used to examine the linkage between selected Reproductive and Child Health indicators with infant and child mortality rates.

There are a number of indirect methods to estimate infant and child mortality using CEB and CS data. Brass was the first to develop a procedure for converting proportions of children ever born reported by women in the age groups 15–19, 20–24 *etc.* into estimates of the probability of dying before attaining certain exact childhood ages by assuming fertility and childhood mortality to be constant in the recent past. If fertility has been changing, the ratios of average parities obtained from a cross-sectional survey will not replicate accurately the experience of any cohort of women. Trussel modify and re-estimated by using multiplying factors for the Brass technique[18]. In this paper, the Trussel method is used. MORTPACK (Mortality analysis package) is used to estimate the infant and child mortality data using the United Nations South Asian Pattern of model life table. The estimation of infant and child mortality requires data on the following:

- i. Total women (15–49)
- ii. Children ever born (the average number of children ever born per woman) and
- iii. Children surviving (the average number of children surviving per woman) in the same age group.
- iv. Mean age of childbearing (M) in the population was tabulated by age of mother.

The basic assumptions are:

- (i) The reporting of CEB and CS is accurate, at least by younger women.
- (ii) Mortality and Fertility have remained constant or have declined linearly and slowly.
- (iii) There is no relation between IMR and CMR with the age of women.

The estimating equations are as follows:

$$q_i = K_i * D_i \text{ Where } i=1 \text{ for } 15-19, 2 \text{ for } 20-24, 3 \text{ for } 25-29, \dots$$

Where, D_i = Proportion of children dead = $CEB_i - CS_i / CEB_i$
 And K_i = Multiplier (Constant) = $E_i + A_i * (P_1/P_2) + B_i * (P_2/P_3) + C_i * \ln(P_1/P_2) + D_i * \ln(P_2/P_3)$
 * The reference period is calculated using equation $t_i = a_i + b_i * (P_1/P_2) + c_i * (P_2/P_3)$.
 * Mortality estimates based on the reports of women aged

15–19 are generally disregarded in part for this reason and part because the numbers of children born and dead are usually small.

* An important assumption made in the development of this method is that the risk of dying of child is a function only of the age of the child and not of the other factors such

Table 1

Socio-economic and demographic profile of Orissa and India.

Variables	Orissa		India	
	1991	2001	1991	2001
Total Population	31659736	36706920	84638788	1027015247
Sex Ratio	971	972	927	933
IMR*	124	91	80	66
Life Expectancy at Birth	55.7	58.7	59	62.7
Density	211	236	267	324
Literacy				
Total	49.09	64	52.21	65.38
Male	63.09	76	64.13	75.85
Female	34.68	51	39.29	54.16
Work participation rate				
Total	37.53	38.88	37.67	39.26
Male	53.79	52.75	51.52	51.93
Female	20.74	24.62	22.69	25.68

Source: Census of India, 2001 and 1991 *Sample registration system, 2001.

Table 2

Infant and child mortality in Orissa by caste and place of residence.

		Infant mortality rate			Child mortality rate		
		Total	Male	Female	Total	Male	Female
Total	Total	88	89	86	46	47	44
	Rural	90	92	88	48	50	46
	Urban	70	71	68	31	32	30
Schedule caste	Total	94	96	91	51	54	49
	Rural	96	98	94	53	56	51
	Urban	78	83	74	38	41	34
Schedule tribe	Total	98	101	95	32	59	53
	Rural	99	102	96	57	60	54
	Urban	81	81	80	39	40	40

Estimated from CEB and CS in the age group 15–49; Source: Census of India, 2001.

as mother's age or the child's birth order. It generally appears that children of young mothers experience mortality risks well above average. For this reason, in the estimate of the IMR, $q(1)$ the probability of dying before age one can be derived from reports of women aged 15–19, which frequently suggest heavier child mortality than estimates derived from reports of older women. Therefore, the average of IMR and CMR to the women aged 20–24, 25–29 and 30–34 age groups are used. These estimates are multiplied by 1000. In addition to this, a correlation matrix is constructed to understand the association among selected variables.

Table 1 shows the socio-economic and demographic profile of Orissa and India for 1991 and 2001. The level of infant mortality rate in Orissa continued to be higher than the national average. The life expectancy at birth, the summary indicator of health status, is lower in the state compared to the country at both the periods. Female literacy, a key indicator of development, is also lower in Orissa than the national average. The work participation rate of males and females in the state is of a similar pattern as in the country.

The estimated infant and child mortality rates by caste, sex and place of residence are given in table 2. It is observed that the infant mortality rate in the state is 88 compared to 98 for Schedule tribes and 94 for Schedule castes per 1 000 live

3. Results

births. There is not much difference in the infant mortality rate by sex in the state. However, the differential in infant mortality rate between rural and urban areas is sharp. The estimated infant mortality rate in rural areas is 90 compared to 70 in urban areas. In rural areas, the infant mortality rate among Schedule tribes is 99, for Schedule castes is 96 and 90 for the state. Similarly, in urban areas, the estimated infant mortality rate for Schedule tribes is 81 for Schedule castes 78 and 70 for the state. The pattern is similar in the case of child mortality rate. The child mortality rate for Schedule tribes is 32, for Schedule castes is 51 and 46 in the state per 1 000 live births. The differences are wider by place of residence. In rural areas the child mortality rate of Schedule tribes is 57 and for Schedule castes 53, but in the urban areas it is 39 for Schedule tribes and 38 for Schedule castes per 1 000 live births. There are a number of factors responsible such as education, medical facilities, safe drinking water facilities, immunization *etc.* Majorities of the population of Orissa live in rural areas, but information about infrastructure facilities are not available. Table 3 shows the trends of infant mortality rate in Orissa from 1980 to 2005. 143 in 1980 to 96 in 2000” by 133 during 1980–1985 and 102 during 2000–2005. Infant mortality rate in Orissa declined very slowly from 133 during 1980–1985 and 102 during 2000–2005 per 1 000 live births.

Table 3
Levels and trends of infant mortality in Orissa.

Year	Total	Rural	Urban
1980–1985	133	139	70
1985–1990	125	129	76
1990–1995	115	119	71
1995–2000	98	101	65
2000–2005	102	106	70

Source: Compendium of India’s fertility and mortality, SRS.

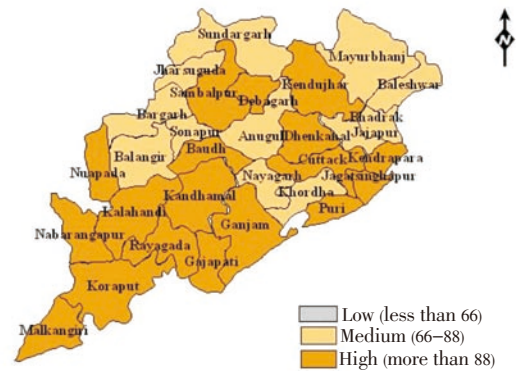


Figure 2. Infant mortality rate in districts of Orissa (rural), 2001.

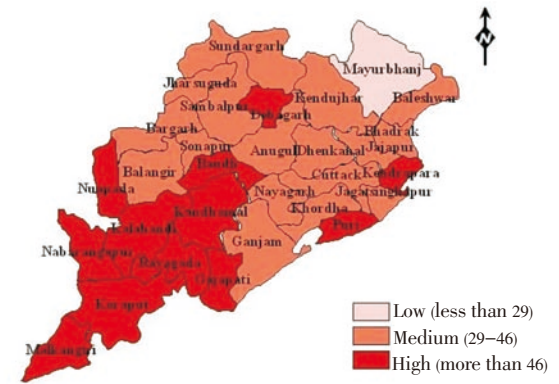


Figure 3. Child mortality rate in districts of Orissa (Total), 2001.

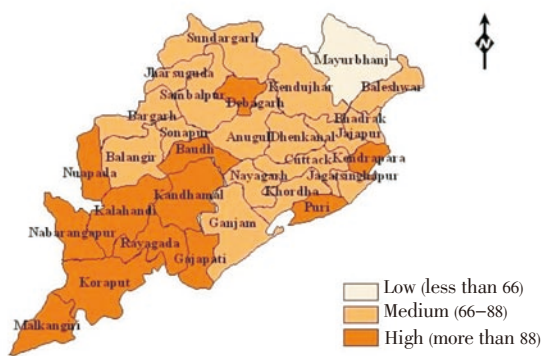


Figure 1. Infant mortality rate in districts of Orissa (Total), 2001

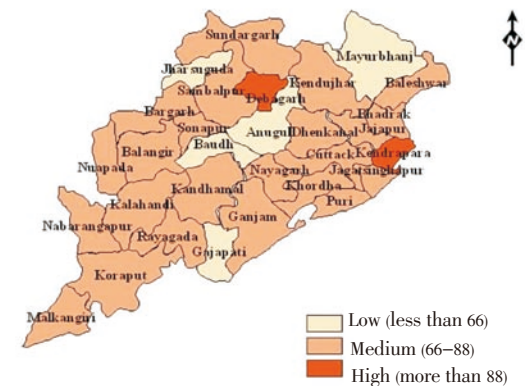


Figure 4. Infant mortality rate in districts of Orissa (urban), 2001.

Table 4 (a) and Figure 1 show the estimates of infant mortality rate in the districts of Orissa. The districts have been arranged in ascending order of the infant mortality rate. It can be observed that the infant mortality rate is highest in the district of Kandhamal (119) followed by Gajapati (107)

Table-4 (a)

Estimated infant mortality rate by caste in districts of Orissa (Total).

Rank	State/district	Total (IMR)			Schedule caste (IMR)			Schedule tribe (IMR)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
01	Mayurbhanj	65	74	63	64	64	64	68	69	66
02	Jharsuguda	68	69	66	76	77	74	72	74	70
03	Bargarh	76	81	71	79	84	75	82	86	78
04	Sonapur	76	79	74	79	79	78	82	92	71
05	Khordha	79	78	79	91	93	89	93	93	93
06	Sundargarh	79	81	77	80	85	75	89	91	87
07	Baleshwar	80	92	80	90	91	89	76	77	75
08	Anugul	82	81	81	91	91	92	104	104	103
09	Balangir	82	87	76	72	87	72	93	101	84
10	Jagatsinghapur	83	85	97	88	89	88	81	82	81
11	Sambalpur	84	89	78	93	100	87	87	90	83
12	Jajapur	85	86	83	93	94	92	92	94	90
13	Ganjam	86	85	87	98	99	97	132	133	131
14	Cuttack	87	100	85	97	99	95	106	112	98
15	Kendujhar	87	90	85	85	89	82	97	99	95
	ORISSA	88	89	86	94	96	91	98	101	95
16	Dhenkanal	88	87	101	98	99	96	111	112	111
17	Nayagarh	88	88	88	105	109	102	121	128	116
18	Bhadrak	88	102	87	96	97	95	85	84	86
19	Kendrapara	90	103	89	100	99	102	96	89	102
20	Puri	91	93	89	103	108	99	100	88	112
21	Nuapada	91	97	86	94	100	87	94	100	87
22	Baudh	95	100	91	98	101	96	132	135	129
23	Debagarh	98	99	105	110	114	105	113	115	112
24	Koraput	101	103	99	103	106	101	109	111	101
25	Nabarangapur	102	108	96	95	98	92	95	98	92
26	Kalahandi	103	110	96	105	114	96	119	126	112
27	Malkangiri	103	105	102	85	86	84	115	86	84
28	Rayagada	106	107	105	110	110	111	112	114	110
29	Gajapati	107	110	104	92	97	86	115	130	122
30	Kandhamal	119	122	115	114	120	107	128	132	124

Estimated from CEB and CS in the age group 15–49; Source: Census of India, 2001.

and Rayagada (106). The infant mortality rate is lowest in the district of Mayurbhanj (65) followed by Jharsuguda (68). There is a small variation in the infant mortality rate by sex. It shows the infant mortality rate of males is marginally higher than that of females in some of the districts. For a better understanding, the districts are classified into three groups on the basis of estimated infant mortality rate.

1. Infant mortality rate lower than national average (less than 66)
2. Infant mortality rate between state and national average (66–88)
3. Infant mortality rate more than state average (more than 88)

It is clear that all the districts of former KBK (Kalahandi, Balangir and Koraput) region fall under the higher range of infant mortality rate except Balangir. This region is also economically most backward. The incidence of poverty in this region is highest in the state. In addition to this, the reproductive health care utilization is lowest in this part of the state. However, only one of the 30 districts is having an

infant mortality lower than the national average. The figure for the national average is obtained from the SRS (Sample Registration Sample) while that of state average is the estimated figure given in table 2. It is found that only in one district (Mayurbhanj) is the infant mortality rate less than the national average. While 17 districts have an infant mortality between the state and national average, 12 districts have an infant mortality higher than the state average.

The differential in level of infant mortality rate by caste is sharp. It is found that the infant mortality rate is 132 per 1000 live births among Schedule tribes in the district of Boudh followed by Kandhamal (128). The infant mortality rate of Schedule castes in the districts of Kandhamal is 114 followed by Rayagada 110. The pattern is similar in many of the districts in the region. This indicates that programme efforts not been adequate to reduce the infant mortality of the Schedule tribe population. In most of the districts, there are narrow differences in infant mortality rate between males and females. But in general, the infant mortality rate of males is higher than that of females. As females

Table 4(b)

Estimated infant mortality rate by caste in districts of Orissa (rural).

Rank	State/district	Total (IMR)			Schedule Caste (IMR)			Schedule Tribe (IMR)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
01	Mayurbhanj	66	75	64	64	64	65	68	70	66
02	Jharsuguda	72	74	70	81	84	78	72	73	70
03	Bargarh	77	82	71	81	84	76	82	86	77
04	Baleshwar	77	79	76	90	91	89	77	79	76
05	Sonapur	77	88	75	78	80	76	84	75	94
06	Balangir	83	89	78	82	90	73	93	101	84
07	Anugul	84	96	82	93	92	93	104	105	103
08	Khordha	84	83	85	95	96	94	101	102	99
09	Jajapur	85	98	83	94	95	93	93	94	91
10	Bhadrak	86	85	86	97	97	97	86	85	86
11	Sundargarh	87	92	83	87	92	83	92	94	89
12	Nayagarh	88	88	88	105	107	102	121	127	116
13	Dhenkanal	89	103	87	98	99	97	111	112	110
14	Sambalpur	89	109	94	102	109	94	88	93	83
15	Jagatsinghapur	89	90	89	89	90	89	79	81	76
16	Ganjam	89	104	87	100	101	100	133	135	132
17	Kendujhar	90	93	83	87	91	83	97	99	96
	ORISSA	90	92	88	96	98	94	99	102	96
18	Cuttack	91	91	91	101	102	99	106	115	98
19	Nuapada	93	98	88	96	101	90	96	101	90
20	Puri	94	96	111	105	110	102	106	95	116
21	Baudh	97	113	94	100	103	97	132	135	130
22	Debagarh	98	99	97	108	113	101	113	115	111
23	Kendrapara	100	98	102	100	98	102	99	98	101
24	Nabarangapur	103	109	98	96	99	93	96	99	93
25	Koraput	104	106	103	107	109	105	107	109	105
26	Kalahandi	105	112	97	107	116	99	104	116	99
27	Malkangiri	105	106	103	85	87	83	115	116	83
28	Rayagada	111	113	109	116	115	117	113	115	117
29	Gajapati	111	131	108	100	105	95	126	130	122
30	Kandhamal	121	142	118	115	120	110	129	133	124

Estimated from CEB and CS in the age group 15–49; Source: Census of India, 2001.

are biologically stronger than males, keeping other factors constant, the female infant mortality rate would be less than that of males.

Table 4 (b) and Figure 2 show the infant mortality rate in rural Orissa. The districts have been arranged in ascending order of the infant mortality rate in rural Orissa. It may be observed that the infant mortality rate is highest in the district of Kandhamal (121) followed by Gajapati (111) and Rayagada (111). The infant mortality rate is lowest in the district of Mayurbhanj (66) followed by Jharsuguda (72). It is found that in none of the 30 districts is the infant mortality less than the national average. In 12 districts, the IMR was between the state and national average and in 18 districts; it was above the state average. It is observed that the estimated rural infant mortality rate is higher than state average in 18 out of 30 districts.

Table 4 (c) and Figure 4 show the infant mortality rate in districts of urban Orissa. The pattern is relatively bettered compared to rural Orissa. It is observed that Kendrapara district ranks highest in total infant mortality rate (105)

followed by Debagarh district (103). In case of schedule tribes the highest infant mortality is observed in the district of Dhenkanal (122) followed by Debagarh (114). In five districts the IMR in urban areas is found to be less than the national average, in 23 districts it is between the state and national average and in two districts it is higher than the state average. This is because facilities such as water supply, medical facilities, primary school, higher secondary school and immunization coverage etc are more easily available in urban than in rural areas. There is no significant sex differential in infant mortality in the urban areas. The infant mortality rate of Baudh, Puri and Nayagarh districts (urban) has not been estimated due to the small size of Schedule tribe population.

The estimated child mortality rate is given for all areas combined, rural and urban areas in Tables 5 and Figure 3, respectively. The child mortality rates have been estimated using NFHS II data. The districts are classified into three groups on the basis of estimated child mortality rate.

(I) Child mortality rate lower than national average (Less

TABLE-4(c)

Estimated infant mortality rate by caste in districts of Orissa (urban).

Rank	State/district	Total (IMR)			Schedule Caste (IMR)			Schedule Tribe (IMR)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
01	Baudh	55	56	54	48	46	51	NA	NA	NA
02	Jharsuguda	60	60	68	67	65	68	73	77	70
03	Gajapati	60	68	58	58	67	49	107	96	102
04	Mayurbhanj	63	63	60	63	63	60	54	56	51
05	Anugul	65	74	64	78	79	76	96	94	98
06	Baleswar	67	65	70	82	83	81	67	65	70
07	Jagatsinghapur	67	69	64	67	69	64	89	88	90
08	Sambalpur	68	75	67	71	75	67	76	70	81
09	Jajapur	68	77	65	77	82	73	77	82	74
10	Sundargarh	68	72	64	68	72	64	69	72	66
11	Rayagada	68	70	67	74	77	71	90	77	71
12	Puri	69	78	67	72	85	59	NA	NA	NA
13	Ganjam	69	78	67	78	81	74	77	89	83
14	Balangir	69	72	66	66	64	67	66	64	67
15	Nuapada	69	84	54	74	89	61	74	89	61
	ORISSA	70	71	68	78	83	74	81	81	80
16	Bargarh	70	80	60	70	80	60	87	70	102
17	Khordha	71	80	69	81	84	78	77	73	80
18	Sonapur	71	81	69	84	75	94	75	80	76
19	Kendujhar	71	81	72	77	80	74	90	92	87
20	Kalahandi	72	76	67	76	85	66	76	85	69
21	Cuttack	74	84	72	81	85	77	92	84	100
22	Dhenkanal	79	90	77	93	98	87	122	106	138
23	Koraput	79	83	74	87	94	79	87	94	79
24	Bhadrak	80	70	90	85	103	65	80	70	90
25	Kandhamal	80	92	78	101	116	84	94	90	96
26	Malkangiri	81	82	79	80	72	88	80	72	88
27	Nabarangapur	81	88	74	91	96	84	91	96	84
28	Nayagarh	83	95	69	116	139	84	NA	NA	NA
29	Debagarh	103	101	105	130	116	137	114	112	116
30	Kendrapara	105	111	96	105	111	96	67	59	113

Estimated from CEB and CS in the age group 15–49; Source: Census of India, 2001.

than 29).

(II) Child mortality rate between state and national average (29–46).

(III) Child mortality rate more than state average (More than 46).

As in the case of infant mortality, it is only in Mayurbhanj district that the child mortality is less than the national average. In 17 districts the child mortality is between the state and national average and in 12 districts it is higher than the state average. It is to be noted that child mortality rate is highest in Kandhamal (77) followed by Gajapati (65). The district with the lowest child mortality rate is Mayurbhanj (27) followed by Jharsuguda (30).

The variation in child mortality rate among caste groups is very clear. Among the schedule tribes the highest child mortality rate is in Baudh (93) followed by Ganjam (92) but in the case of schedule castes the highest child mortality rate is in the district of Kandhamal (71) followed by Rayagada (68). Sex differential among schedule castes and schedule tribes has shown almost a balanced picture between males

and females. There is considerable variation in the child mortality rate between males and females. The pattern is similar in rural and urban child mortality in Orissa. In rural areas child mortality rate is highest in the district of Kandhamal (79) and in urban areas also child mortality is highest in Kandhamal (39). There is marginal difference in child mortality between rural and urban areas of Orissa. It is observed that children in rural areas of Orissa experience two times higher probability of dying before their fifth birthday than do urban children. Child mortality, however, is highest among children born to schedule caste and schedule tribe women. Variation in the child mortality rate among the schedule castes and schedule tribes indicates low education level of women, poverty and low nutritional status of children. Orissa is in a poor state of reproductive and child health where the percentage of population below poverty line is highest at 49 percent and compared to 26 percent at the national level. The state's domestic product per capita is also much lower than the national average.

Distribution of districts according to selected RCH

TABLE-5 (a)

Estimated Child Mortality Rate by caste Districts of Orissa (Total).

Rank	State/District	Total (CMR)			Schedule Caste (CMR)			Schedule Tribe (CMR)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
01	Mayurbhanj	27	14	29	27	27	27	30	31	29
02	Jharsuguda	30	30	29	36	37	35	33	34	31
03	Bargarh	36	40	32	39	43	36	41	45	38
04	Sonapur	36	39	34	38	39	37	41	51	32
05	Khordha	38	38	39	49	50	47	51	50	51
06	Sundargarh	39	40	37	39	43	36	47	49	45
07	Baleshwar	39	21	39	48	49	47	36	37	35
08	Anugul	41	41	40	49	48	49	61	62	60
09	Balangir	41	45	36	33	45	33	51	59	43
10	Jagatsinghapur	41	43	23	47	47	46	40	41	40
11	Sambalpur	43	48	38	52	58	45	45	48	42
12	Jajapur	44	44	43	52	53	50	50	52	48
13	Ganjam	45	44	45	55	56	54	92	94	91
14	Cuttack	45	24	48	54	57	53	63	70	56
	Orissa	46	47	44	51	54	49	32	59	53
15	Kendujhar	46	48	43	44	47	41	55	56	53
16	Dhenkanal	46	46	25	55	57	54	69	69	69
17	Bhadrak	46	25	50	54	54	53	44	43	45
18	Nayagarh	46	46	46	63	66	59	80	87	74
19	Kendrapara	48	26	47	58	56	59	54	48	61
20	Puri	49	51	47	61	66	56	58	46	73
21	Nuapada	49	54	44	51	58	45	51	58	45
22	Baudh	53	57	49	55	59	53	93	97	89
23	Debagarh	55	56	62	67	72	62	71	73	69
24	Koraput	59	61	57	61	64	58	67	69	58
25	Nabarangapur	60	66	54	53	56	50	53	56	50
26	Kalahandi	61	68	53	63	72	54	78	85	70
27	Malkangiri	61	62	60	43	45	43	73	45	43
28	Rayagada	64	65	62	68	68	69	70	72	68
29	Gajapati	65	68	62	49	54	45	73	90	81
30	Kandhamal	77	81	73	71	78	66	88	93	83

Estimated from CEB and CS in the age group 15–49. Source: Census of India, 2001.

Table-5 (b)

Estimated child mortality rate by caste in districts of Orissa (rural).

Rank	State/district	Total (CMR)			Schedule caste (CMR)			Schedule tribe (CMR)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
01	Mayurbhanj	28	15	30	27	27	27	30	31	29
02	Jharsuguda	34	35	32	41	43	39	33	34	32
03	Baleshwar	37	38	35	48	49	47	37	38	35
04	Bargarh	37	41	33	40	44	37	41	45	37
05	Sonapur	37	20	40	38	39	36	43	35	53
06	Balangir	42	47	37	40	48	33	51	59	43
07	Anugul	43	23	46	50	50	51	62	63	61
08	Khordha	43	42	44	53	54	52	58	59	57
09	Jajapur	44	24	47	52	53	51	50	52	49
10	Bhadrak	44	45	45	54	54	54	44	45	45
11	Sundargarh	46	51	42	46	51	42	50	52	48
12	Nayagarh	46	46	46	62	65	60	80	86	75
13	Dhenkanal	47	26	50	55	57	54	69	69	68
14	Jagatsinghapur	47	48	47	47	48	47	38	40	36
15	Ganjam	47	26	51	58	59	57	95	96	93
16	Sambalpur	48	68	52	60	68	52	46	51	42
17	Kendujhar	48	50	42	45	49	42	55	57	53
	ORISSA	48	50	46	53	56	51	57	60	54

PHLT	-0.502**	0.607**	0.859**	1								
PSDWT	-0.008	-0.158	-0.107	-0.279	1							
PSTP	0.818**	-0.785**	-0.070	-0.331	-0.070	1						
PSCP	-0.415*	0.343	-0.201	-0.132	0.300	-0.632**	1					
PCIMM	-0.385*	0.515**	0.405*	0.416*	0.029	-0.482**	0.283	1				
PLSLI	0.751**	-0.816**	-0.459*	-0.723**	0.208	0.724**	-0.152	-0.594**	1			
PRANC	-0.018	0.138	0.230	0.145	-0.087	-0.078	-0.120	0.478**	-0.359	1		
IMR	0.449*	-0.563**	-0.414*	-0.369*	0.004	0.387*	-0.048	-0.305	0.357	-0.038	1	
CMR	0.484**	-0.591**	-0.405*	-0.376*	-0.010	0.430*	-0.071	-0.313	0.383*	-0.052	0.998**	1

* Correlation is significant at the 0.05 levels; ** Correlation is significant at the 0.01 levels.

Description of variables:

- IMR– Probabilities of newborn child dying before age one (0q1)
- CMR– Probabilities of dying between first and fifth birthday ((1q4)
- PWF– Percentage of work participation female
- PLF– Percentage of literacy female
- PUF– Percentage of urban female
- PCIMM– Percentage of children received full immunization
- PLSLI– Percentage of households with low standard of living
- PRANC– Percentage of women received full ANC
- PHLT– Percentage of having latrine total
- PSDWT– Percentage of safe drinking water
- PSTP– Percentage of schedule tribe population
- PSCT– Percentage of schedule caste population

Appendix of different variables

District	PWF	PLF	PUF	PHLT	PSDWT	PSTP	PSCP	PCIMM	PLSLI	PRANC	IMR	CMR
Bargarh	31.1	50.0	7.1	9	82	19.4	19.4	71.6	70.5	9.4	76	36
Jharsuguda	22.4	59.2	34.9	21	58	31.3	17.1	71.1	58.7	17.0	68	30
Sambalpur	35.6	54.8	24.3	19	63	34.5	17.0	65.7	64.6	22.8	84	43
Debagarh	38.6	47.6	6.0	8	57	33.6	15.4	46.5	70.5	17.5	98	55
Sundargarh	28.9	54.3	29.2	24	65	50.2	8.6	59.0	62.5	14.5	79	39
Kendujhar	28.0	46.7	12.3	10	55	44.5	11.6	34.0	77.1	13.7	87	46
Mayurbhanj	39.9	38.3	4.9	9	44	56.6	7.7	39.6	73.8	17.8	65	27
Baleshwar	11.4	59.6	9.5	15	87	11.3	18.8	69.2	52.4	16.4	80	39
Bhadrak	7.9	63.6	10.4	11	89	1.9	21.5	51.7	63.0	12.0	88	46
Kendrapara	9.9	67.3	5.3	9	73	0.5	20.5	55.5	60.2	15.5	90	48
Jagatsinghapur	11.4	69.9	9.8	13	79	0.8	21.1	46.6	54.7	19.6	83	41
Cuttack	13.6	66.2	23.5	26	56	3.6	19.1	82.8	44.5	33.0	87	45
Jajapur	6.7	61.5	4.0	15	44	7.8	23.0	35.1	61.2	3.7	85	44
Dhenkanal	15.0	58.6	7.1	12	31	12.8	18.5	62.1	58.6	24.1	88	46
Anugul	26.5	56.0	11.7	18	44	11.7	17.2	50.8	56.3	14.2	82	41
Nayagarh	10.9	58.1	3.5	16	51	5.9	14.0	62.0	57.8	10.7	88	46
Khordha	8.6	71.1	38.6	38	52	5.2	13.5	63.4	48.7	13.4	79	38
Puri	7.5	67.8	11.8	18	78	0.3	18.2	69.5	48.1	19.1	91	49
Ganjam	31.1	47.7	13.1	19	59	2.9	18.6	51.5	56.7	11.2	86	45
Gajapati	49.8	28.9	6.7	10	45	50.8	7.5	46.3	65.9	19.6	107	65
Kandhamal	42.2	36.2	4.6	10	34	52.0	16.9	58.3	71.2	12.8	119	77
Baudh	35.5	39.8	3.5	5	65	12.5	21.9	66.8	67.3	20.0	95	53
Sonapur	32.9	47.3	6.3	7	76	9.8	23.6	58.4	71.3	13.8	76	36
Balangir	28.4	39.3	9.3	9	74	20.6	16.9	63.4	70.0	21.4	82	41
Nuapada	36.9	26.0	5.0	6	84	34.7	13.6	41.8	75.7	16.3	91	49
Kalahandi	35.8	29.6	6.1	8	81	28.6	17.7	50.1	72.9	15.1	103	61
Rayagada	41.3	24.3	9.8	10	79	55.8	13.9	45.0	71.1	19.7	106	64
Nabarangapur	42.3	21.0	4.3	7	79	55.0	14.1	46.2	73.9	14.3	102	60
Koraput	40.5	24.8	12.2	13	67	49.6	13.0	31.4	71.7	13.0	101	59
Malkangiri	44.1	21.3	5.9	7	82	57.4	21.4	39.7	91.5	7.5	103	61

indicators:

In order to understand the association of reproductive and child health with level of infant mortality rate and child mortality rate in districts of Orissa, a correlation matrix is constructed. The variables considered under reproductive and child health are, (i) Percentage of children received full immunization (PCIMM), ii) Percentage of women received full ANC (PRANC) and iii) Percentage of households with a low standard of living (PLSLI). The socio-economic indicators considered from the Census of India are female work participation rate (PWF), percentage of female literacy (PLF), percentage of urban population (PUF), percentage of having latrine (PHLT), percentage having safe drinking water (PSDWT), percentage of schedule tribe (PSTP) and percentage of schedule caste population (PSCP).

Table 6 presents the zero order correlation Matrix of the selected indicators in all 30 districts. It can be noted that infant mortality rate and child mortality rates are positively related with work participation rate (0.449 and 0.484). Similarly, the correlation coefficients of infant and child mortality with female literacy are found to be -0.563 and -0.591 respectively and statistically significant. This indicates that literacy is negatively associated with infant and child mortality. Higher literacy levels would improve child survival. Similarly, the correlation coefficients of infant and child mortality with percentage of urban are found to be -0.414 and -0.405 respectively. From the table it is clear that child immunization is negatively associated with infant and child mortality. The low standard of living also influences infant and child mortality and statistically significant. Similarly, antenatal services are negatively associated with infant and child mortality.

4. Discussion

In Orissa, there is considerable regional diversity in the distribution of population groups, availability and quality of health services including maternal health services. The schedule tribe population of the state's population and is largely concentrated in the former KBK (Kalahandi, Balangir and Koraput) region. This region is not only economically and socially underdeveloped, but also has lower coverage of health services. As resource available for health services are limited, it would be useful to provide the estimates of infant child mortality by caste groups in the districts of Orissa according to place of residence. Therefore, this study is a modest attempt to estimate the infant mortality and child mortality in the districts of Orissa by caste and place of residence.

The study reveals that the level of infant and child mortality is quite high in the district of Kandhamal followed by Gajapati and low in the district of Mayurbhanj. Seventeen districts have infant mortality higher than the national average and 12 districts have values higher than the state average. Infant and child mortality is high in those districts where schedule tribe population is high. For child mortality, only Mayurbhanj has levels lower than the national average, while for other districts similar pattern as for infant mortality can be observed. Among the scheduled castes and tribes also, a similar pattern is observed. Hence, it is clear that a majority of the districts in the state have high levels of infant and child mortality, equally prevalent among the different social groups. In most of the districts, levels of infant and child mortality are higher than the national average, which is definitely a cause of concern. Moreover, the differential is clear among SCs and STs. The reproductive health indicators also indicate very low coverage in districts of Orissa and these regions are not only economically and socially underdeveloped, but also have lower coverage of health services. There is significant variation in infant and child mortality rate among the districts of Orissa. The ranking of districts help us to identify the backward and most backward districts in reproductive and child health programme and to intensify the intervention strategies to reduce the infant and child mortality.

Orissa is classified as an Empowered Action Group (EAG) state, and remains at the centre of policy efforts to ensure better maternal and child health outcomes. The findings of this paper suggest that at the district level risks of mortality continue to remain high among infants and children, which raises doubt about the efficacy of the child health programmes in these districts. The state needs to make concentrated efforts to improve the social and economic conditions of the schedule tribes by increasing level of literacy and improving technology to reach of the various services especially for the women and children. In fine, it may be concluded that the most backward districts should be given special attention to improve child survival and maternal health in the state. Also, it is necessary to undertake carefully targeted sector specific interventions.

Conflict of interest statement

We declare that we have no conflict of interest.

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