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Spatial and Temporal Variations in Child Mortality in Uttar Pradesh, India

Aalok Ranjan Chaurasia
Binod Kumar Singh

Abstract

This paper analyses spatial and temporal variations in child mortality in Uttar Pradesh, the most populous state of India based on data available from 2001 and 2011 population census. Both infant and under-five mortality has decreased in the state during 2001-2011 and the decrease in child mortality has been more rapid in rural than in urban areas of the state. GIS based thematic mapping has identified two clusters of high child mortality in central and eastern parts of the state. The analysis suggests that reduction in child mortality inequality within the state through a district-based approach can contribute substantially to reducing child mortality in the state. The high-risk population subgroups identified in the analysis and differential risk profile of these subgroups, can assist public health professionals to identify child mortality hotspots to guide policy interventions in resource-limited settings. A state specific child survival policy may be a beginning in this direction.

Introduction

Uttar Pradesh is the most populous state of India and accounts for more than 16.5 per cent population of the country according to the 2011 population census. This implies that mortality scenario of the state has a strong influence on the mortality scenario of the country. According to India's official Sample Registration System, the under-five mortality rate ($_5q_0$) in the state was 47 under-five deaths per 1000 live births in 2018 which is substantially higher than the national average of 36 under-five deaths per 1000 live births (Government of India, 2020). On the other hand, the National Family Health Survey 2015-16 estimates that $_5q_0$ in the state was 78 under-five deaths per 1000 live births compared to the national average of 50 (Government of India, 2017a). It is obviously that an accelerated reduction in $_5q_0$ in the state will contribute significantly towards hastening the pace of the decrease in child mortality in the country. The United Nations 2030 Agenda for Sustainable Development calls for every country to reduce the under-five mortality rate to at least as low as 25 under-five deaths for every 1000 live births by the year 2030 and reduce inequalities in child mortality within the country as part of the Sustainable Development Goal 3: Ensure Healthy Lives and Promote Well-being for All at all Ages (United Nations, 2015). Similarly, India's National Health Policy

2017 aims at reducing under-five mortality rate to 23 under-five deaths for every 1000 live births by 2025; reducing infant mortality rate to 28 infant deaths for every 1000 live births by the year 2019; and reducing neonatal mortality rate to 16 neonatal deaths for every 1000 live births by 2025 in the country (Government of India, 2017b).

A major challenge to improving child survival in India is very pervasive within country inequality in child mortality which has persisted over time. Although child mortality in the country is decreasing, yet, within country inequalities in child mortality continue to persist (Behl, 2013). A reduction in within country inequality in child mortality can contribute significantly towards achieving the targets laid down in the National Health Policy 2017 and the targets set under the United Nations 2030 Sustainable Development Agenda. Evidence available from the Annual Health Survey 2012-13 indicates substantial variation in ${}_5q_0$ across districts of Uttar Pradesh ranging from 50 under-five death per 1000 population in district Kanpur Nagar to more than 130 under-five deaths per 1000 live births in district Shrawasti (Government of India, 2013a). It is also logical to assume that with every district, ${}_5q_0$ varies across different mutually exclusive population subgroups. However, the current understanding of within district inequality in ${}_5q_0$ in the state is very poor. It is obvious that a holistic understanding of inequality in the risk of death in the first five years of life can serve as the basis to suggest strategies to reduce the inequality and hence accelerate the pace of decrease in child mortality in the state.

An analysis of child mortality inequality in Uttar Pradesh is important because prevailing levels of child mortality in the state are at concordance with its income levels and economic development. Uttar Pradesh is one of the low-income states of India. The net state domestic product per capita at 2011-12 prices in Uttar Pradesh is estimated to be almost Rs 40 thousand in the year 2014-15 which is the second lowest among the major states of the country, states with a population of at least 200 million at the 2011 population census. Among the major states of the country, Uttar Pradesh is the 6th least urbanised state with less than 22.5 percent of the state population living in the urban areas as defined at the time of the 2011 population census. However, the distribution inequality in the state appears to be quite substantial as more than 29.4 per cent of the state population was living below the poverty line in 2011-12. This proportion was 30.4 per cent in the rural areas (Government of India, 2014).

The objective of this paper is to analyse spatial and temporal variations in the risk of death during the first five years of life across districts of the state and across mutually exclusive population subgroups within districts. GIS-based thematic mapping has been used to identify clusters of high risk of death during the first five years of life within the state and across different population subgroups. There are studies that have highlighted inter-district inequality in under-five mortality in Uttar Pradesh (India State-Level Disease Burden Initiative Child Mortality Collaborators, 2020; Bora and Saikia, 2018; Kumar et al, 2012; Liu et al, 2019). However, to the best of our knowledge, there is no study that has analysed within district inequality in child mortality across different

mutually exclusive population sub-groups and how this inequality contributes to the child mortality in the district.

The paper is organised as follows. The next section of the paper describes the analytical strategy adopted for the analysis while section three describes the data source. Inter-district variation in ${}_5q_0$ is discussed in section four of the paper while section five discusses variation in ${}_5q_0$ across mutually exclusive population subgroups within each district of the state. The last section of the paper summarises main findings of the analysis and discusses their policy and programme implications in the context of an accelerated reduction in child mortality in the state.

Analytical Framework

The analytical strategy adopted in the present analysis comprises of two parts. The first part is devoted to the estimation of child mortality for different mutually exclusive subgroups of the population at state and district levels based on summary birth history data available from 2001 and 2011 population census. We have used the indirect method of child mortality estimation pioneered by Brass and Coale (1968). This method is based on reports from mothers about the survivorship of their ever-born children. The Brass and Coale method revolutionised estimation of child mortality in populations where direct estimation of child mortality is not possible because of the lack of necessary data. Although this approach of child mortality estimation has some limitations (Preston et al, 2003), yet, it has been found to be fairly reliable for estimating the risk of death during early childhood and the trend over a period of around 10 years (Hill, 1991). The rationale of the method and detailed step-by-step procedure of estimation are described in detail elsewhere (United Nations, 1983; Preston et al, 2003; Moultrie et al, 2013). Actual calculations have been carried out using the worksheet developed by Moultrie et al (2013). The method requires selection of a family of model life tables. We have selected the South-Asian family of the United Nations Model Life Table System (United Nations, 1982) for the purpose.

The second part of the analysis is devoted to the thematic mapping of inter-district variation in under-five mortality rate and estimation of within district, across mutually exclusive population subgroups, inequality in the under-five mortality rate (${}_5q_0$) for each district of the state. The thematic mapping was done using the ArcGIS 10.0 software package for Windows. The base map for thematic mapping was prepared by digitizing, editing, and processing the administrative map of Uttar Pradesh as published in the Administrative Atlas of India at the time of 2011 population census (Government of India, 2011). On the other hand, within district inequality in ${}_5q_0$ across mutually exclusive population subgroups was measured in terms of differential or the ratio of the maximum to minimum ${}_5q_0$ within the district and the unweighted coefficient of variation across different mutually exclusive population sub-groups in each district. We have not calculated the weighted coefficient of variation which also takes into the account the proportionate distribution of live births across different mutually exclusive population subgroup within the district.

Data Source

The data for the present analysis come from the 2001 and 2011 population censuses. In the population census, two questions were asked, one related to children ever born alive and the other related to children surviving from all ever-married women. The total number of children ever born alive to the woman included both living and dead daughters and sons. The number of daughters and sons ever born alive to the woman includes children born to her out of her earlier marriage(s) also. However, children that the husband of the woman that he had from his earlier marriage(s) were not included. Similarly, adopted daughter(s) or son(s) were also not counted for the purpose of this question. On the other hand, number of children surviving at the time of enumeration includes number of daughters and sons not staying with the household at the time of enumeration. The daughters and sons surviving at the time of enumeration included all daughters and sons surviving from the time she first got married, if married more than once, but exclude adopted children and the children her husband had from his earlier marriage(s) (Government of India, 2011). The data are available by the age of the ever-married women for total population of the district and separately for Scheduled Castes and Scheduled Tribes. For each social class, data are available separately for rural and urban areas and, within rural or urban areas, separately for male and female children. This means that the population of the or the state can be divided into the following 12 mutually exclusive population subgroups:

1. Rural Scheduled Castes male
2. Rural Scheduled Castes female
3. Rural Scheduled Tribes male
4. Rural Scheduled Tribes female
5. Rural Other Castes male
6. Rural Other Castes female
7. Urban Scheduled Castes male
8. Urban Scheduled Castes female
9. Urban Scheduled Tribes male
10. Urban Scheduled Tribes female
11. Urban Other Castes male
12. Urban Other Castes female

The Scheduled Tribes, however, constitute only 0.57 per cent of the state population. There are only 3 districts where Scheduled Tribes population was more than 100 thousand at the 2011 population census. As such, we have estimated ${}_5q_0$ for the 12 mutually exclusive population subgroups for these three districts only. In these 3 districts, within district inequality in ${}_5q_0$ is measured by taking into consideration 12 mutually exclusive population subgroups. In the remaining districts, ${}_5q_0$ has been estimated for 8 mutually exclusive population subgroups only and within district inequality in ${}_5q_0$ is measured in terms of variation in 8 mutually exclusive population subgroups only. The ever-married women with missing data on the number of children ever born alive or the number of children surviving, or both have been excluded from the estimation of ${}_5q_0$ as recommended by Hill (2013).

Child Mortality in Uttar Pradesh

Estimates of ${}_5q_0$ in the state and in its constituent districts, derived from the data on children ever born and children surviving available through 2001 and 2011 census data, are presented in table 1 for the total population and separately for rural and urban areas. For the state, ${}_5q_0$ is estimated to be 0.101 around the year 2005, according to the 2011 population census. According to the abridged life tables prepared by the Registrar General and Census Commissioner of India based on the age-specific deaths rates available through the official Sample Registration System, ${}_5q_0$ in the state is estimated to be around 0.108 for the period 2003-07 (Government of India, 2012). This shows that ${}_5q_0$ estimated from the data on children ever born and children surviving available through the 2011 population census is a very close approximation of the estimate based on the official Sample Registration System. This proximity justifies using the data on children ever born and children surviving collected from population census to estimate child mortality. Table 1 indicates that ${}_5q_0$ varies widely across districts of the state ranging from 0.075 in district Deoria to 0.127 in Kaushambi and Sitapur districts. Table 1 also suggests that ${}_5q_0$ in the state decreased by around 18 per cent between 1995 and 2005 but the decrease in the urban areas has been slower than that in the rural areas. There is also consideration variation in the decrease in ${}_5q_0$ across districts. There are three districts – Ghaziabad, Kushinagar, and Mau – where ${}_5q_0$ appears to have increased whereas it decreased by at least 30 per cent in 7 districts.

The decrease in ${}_5q_0$ in the rural areas has been different from that in the urban areas in the state and in its constituent districts of the state. In the state, ${}_5q_0$ in the rural areas decreased from 0.130 based on 2001 population census to 0.106 based on 2011 population census. The ${}_5q_0$ in the rural areas also decreased in all but two districts of the state. The two districts where ${}_5q_0$ in the rural areas increased according to the data available from 2001 and 2011 population census are Ghaziabad and Mau. The pace of decrease in ${}_5q_0$ in the rural areas, however, varied across districts. There are only 9 districts in the state where ${}_5q_0$ in the rural areas decreased by at least 30 per cent whereas in 32 districts, the decrease in rural ${}_5q_0$ ranged between 20-30 per cent. This leaves 14 districts where rural ${}_5q_0$ decreased by less than 10 per cent.

By contrast, the decrease in urban ${}_5q_0$ has been slow. In the state, as a whole, the ${}_5q_0$ in the urban areas decreased from 0.088 according to the 2001 population census to only 0.080 according to the 2011 population census. There are 17 districts in the state where ${}_5q_0$ in the urban areas has increased over time compared to only 2 districts in the rural areas. In more than half of the districts of the state the decrease in ${}_5q_0$ in the urban areas ranged between 10-20 per cent as revealed through 2001 and 2011 population censuses. There are only 20 or less than one third districts in the state where ${}_5q_0$ in the urban areas decreased by at least 20 per cent. The increase in ${}_5q_0$ in the urban areas of many districts of the state appears to be largely responsible for very slow decrease in ${}_5q_0$ in the urban areas of the state as compared to its rural areas. The slow decrease in ${}_5q_0$ in the urban areas of the state has implications for the pace of the decrease in ${}_5q_0$ in the state.

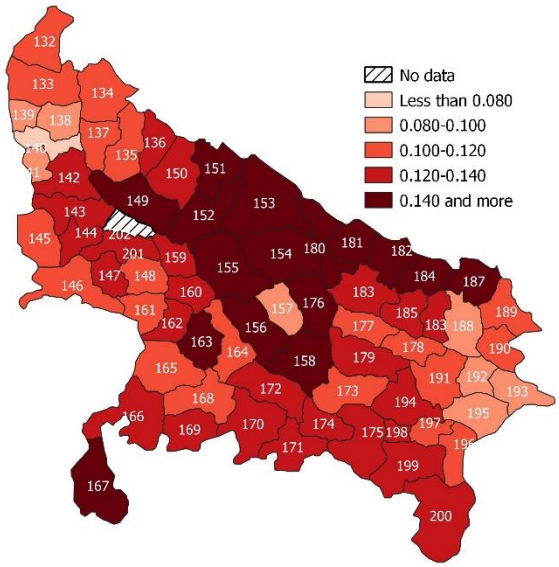

Figure 4: Under-five mortality rate in districts of Uttar Pradesh, total population, 2001
Remarks: Labels are district codes (Table 1)
Source: Authors

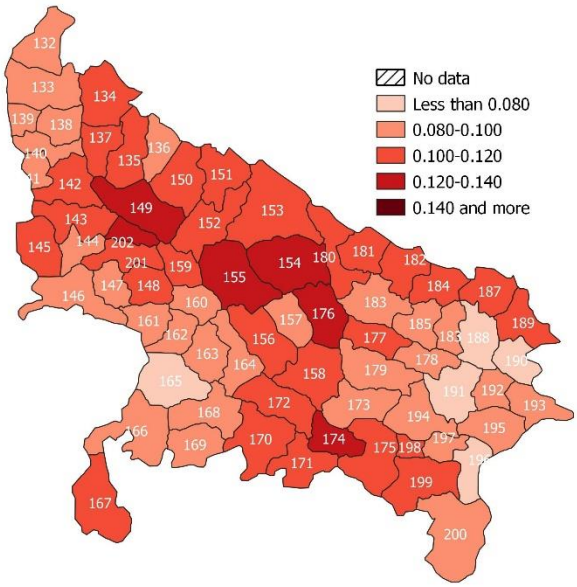

Figure 5: Under-five mortality rate in districts of Uttar Pradesh, total population, 2011
Remarks: Labels are district codes (Table 1)
Source: Authors

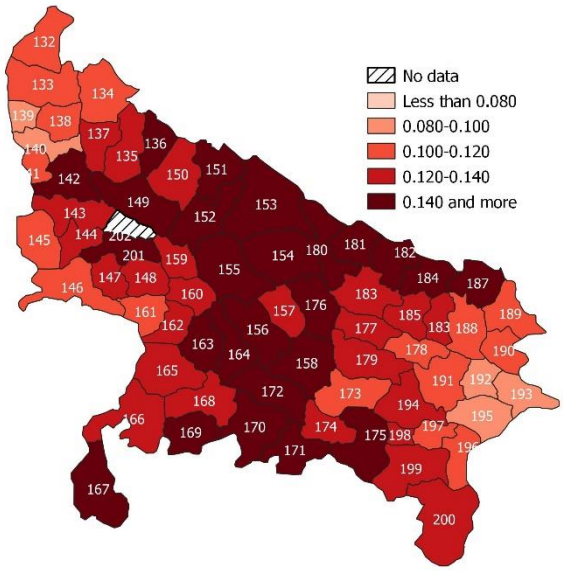

Figure 6: Under-five mortality rate in districts of Uttar Pradesh, Rural population, 2011
Remarks: Labels are district codes (Table 1)
Source: Authors

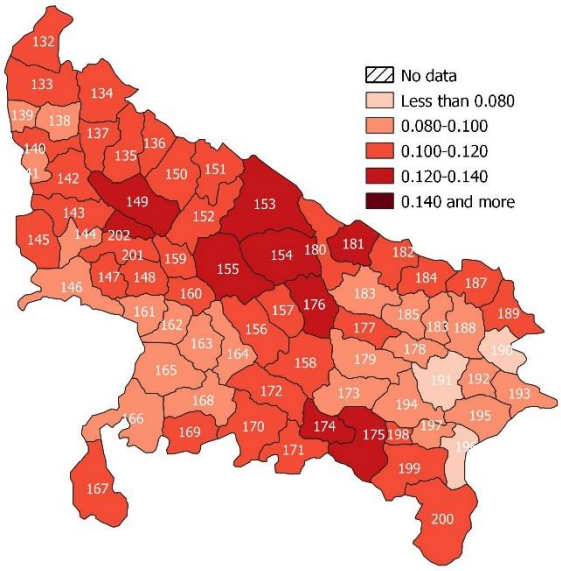

Figure 7: Under-five mortality rate in districts of Uttar Pradesh, rural population 2011
Remarks: Labels are district codes (Table 1)
Source: Authors

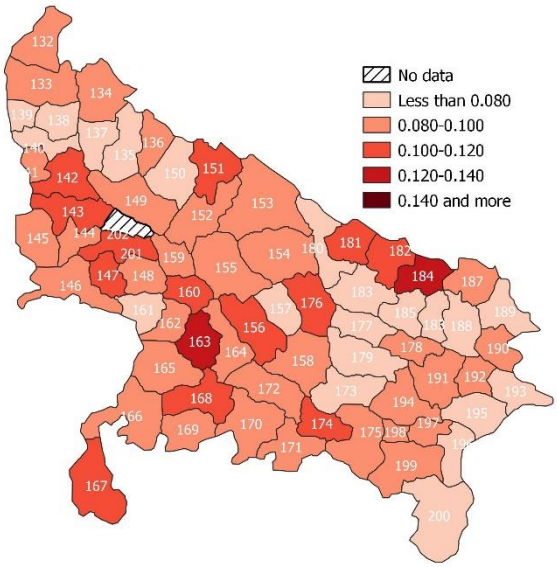

Figure 8: Under-five mortality rate in districts of Uttar Pradesh, urban population, 2001
Remarks: Labels are district codes (Table 1)
Source: Authors

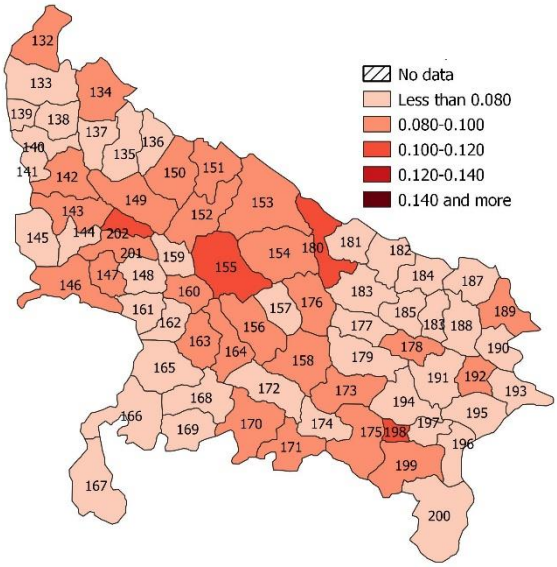

Figure 9: Under-five mortality rate in districts of Uttar Pradesh, urban population, 2011
Remarks: Labels are district codes (Table 1)
Source: Authors

Table 1: Probability of death during the first five years of life, ${}_5q_0$, in Uttar Pradesh based on 2001 and 2011 population census

Code	State/District	2001 population census			2011 population census		
		Total	Rural	Urban	Total	Rural	Urban
0	Uttar Pradesh	0.123	0.131	0.088	0.101	0.106	0.080
132	Saharanpur	0.108	0.114	0.087	0.099	0.105	0.084
133	Muzaffarnagar	0.106	0.110	0.094	0.096	0.105	0.074
134	Bijnor	0.109	0.114	0.090	0.104	0.110	0.082
135	Moradabad	0.112	0.128	0.067	0.109	0.120	0.080
136	Rampur	0.133	0.142	0.098	0.098	0.105	0.072
137	Jyotiba Phule Nagar	0.112	0.121	0.078	0.103	0.111	0.075
138	Meerut	0.092	0.110	0.070	0.085	0.100	0.069
139	Baghpat	0.087	0.092	0.069	0.084	0.088	0.068
140	Ghaziabad	0.079	0.099	0.062	0.089	0.110	0.079
141	Gautam Budaha Nagar	0.096	0.102	0.084	0.083	0.096	0.074
142	Bulandshahr	0.136	0.141	0.120	0.104	0.111	0.083
143	Aligarh	0.133	0.137	0.120	0.104	0.109	0.092
144	Hathras	0.127	0.134	0.097	0.088	0.091	0.075
145	Mathura	0.109	0.117	0.085	0.106	0.115	0.080
146	Agra	0.113	0.120	0.100	0.089	0.095	0.081
147	Firozabad	0.128	0.135	0.109	0.098	0.104	0.084
148	Mainpuri	0.120	0.126	0.085	0.109	0.114	0.075
149	Budaun	0.147	0.157	0.094	0.125	0.130	0.096
150	Bareilly	0.123	0.139	0.080	0.112	0.118	0.096
151	Pilibhit	0.141	0.147	0.109	0.109	0.114	0.084
152	Shahjahanpur	0.141	0.152	0.092	0.113	0.118	0.083
153	Kheri	0.143	0.149	0.086	0.118	0.121	0.089
154	Sitapur	0.147	0.155	0.084	0.127	0.130	0.092
155	Hardoi	0.157	0.164	0.096	0.125	0.128	0.101
156	Unnao	0.141	0.147	0.102	0.108	0.111	0.093
157	Lucknow	0.098	0.132	0.072	0.080	0.102	0.065
158	Rae Bareli	0.142	0.147	0.089	0.108	0.110	0.081
159	Farrukhabad	0.122	0.129	0.093	0.101	0.106	0.079
160	Kannauj	0.125	0.129	0.102	0.099	0.101	0.091
161	Etawah	0.104	0.112	0.076	0.086	0.092	0.062
162	Auraiya	0.122	0.127	0.083	0.090	0.093	0.073
163	Kanpur Dehat	0.149	0.150	0.128	0.096	0.097	0.085
164	Kanpur Nagar	0.112	0.142	0.094	0.084	0.086	0.083
165	Jalaun	0.116	0.124	0.086	0.076	0.081	0.057
166	Jhansi	0.121	0.138	0.090	0.084	0.090	0.074
167	Lalitpur	0.156	0.164	0.102	0.113	0.118	0.076
168	Hamirpur	0.120	0.124	0.103	0.091	0.096	0.071
169	Mahoba	0.133	0.143	0.096	0.096	0.101	0.075
170	Banda	0.138	0.144	0.096	0.102	0.104	0.086

Code	State/District	2001 population census			2011 population census		
		Total	Rural	Urban	Total	Rural	Urban
171	Chitrakoot	0.140	0.144	0.093	0.102	0.104	0.083
172	Fatehpur	0.137	0.142	0.087	0.108	0.112	0.070
173	Pratapgarh	0.117	0.119	0.079	0.095	0.095	0.096
174	Kaushambi	0.135	0.137	0.112	0.127	0.130	0.077
175	Allahabad	0.136	0.143	0.098	0.118	0.125	0.087
176	Barabanki	0.141	0.143	0.113	0.123	0.126	0.090
177	Faizabad	0.115	0.122	0.062	0.101	0.105	0.071
178	Ambedkar Nagar	0.117	0.119	0.092	0.094	0.095	0.093
179	Sultanpur	0.130	0.133	0.077	0.092	0.093	0.064
180	Bahraich	0.144	0.150	0.078	0.115	0.116	0.109
181	Shrawasti	0.151	0.152	0.119	0.119	0.121	0.056
182	Balrampur	0.157	0.160	0.105	0.110	0.112	0.080
183	Gonda	0.123	0.127	0.063	0.095	0.097	0.054
184	Siddharthnagar	0.147	0.147	0.124	0.106	0.108	0.072
185	Basti	0.127	0.130	0.072	0.092	0.094	0.052
186	Sant Kabir Nagar	0.134	0.137	0.100	0.088	0.089	0.070
187	Mahrajganj	0.145	0.147	0.098	0.109	0.111	0.066
188	Gorakhpur	0.095	0.101	0.066	0.079	0.081	0.069
189	Kushinagar	0.107	0.109	0.076	0.108	0.108	0.094
190	Deoria	0.108	0.109	0.096	0.075	0.077	0.062
191	Azamgarh	0.109	0.110	0.088	0.076	0.076	0.079
192	Mau	0.089	0.090	0.086	0.093	0.092	0.097
193	Ballia	0.085	0.086	0.076	0.081	0.081	0.075
194	Jaunpur	0.127	0.129	0.096	0.095	0.096	0.078
195	Ghazipur	0.097	0.098	0.080	0.097	0.098	0.076
196	Chandauli	0.104	0.107	0.078	0.077	0.078	0.070
197	Varanasi	0.107	0.118	0.088	0.091	0.098	0.079
198	Sant Ravidas Nagar	0.134	0.139	0.094	0.114	0.115	0.103
199	Mirzapur	0.128	0.134	0.083	0.112	0.115	0.087
200	Sonbhadra	0.127	0.140	0.063	0.098	0.103	0.066
201	Etah	0.140	0.145	0.112	0.107	0.111	0.085
202	Kanshiram Nagar	na	na	na	0.121	0.124	0.105

Source: Authors' calculations based on the data available through 2001 and 2011 population census.
Remarks: District Kanshiram Nagar was not in existence at the 2001 population census

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Table 2: ${}_5q_0$ in different mutually exclusive population subgroups and inter-district and within district inequality, 2011

State/district	Rural						Urban						D	CV
	Scheduled Castes		Scheduled Tribes		Other Castes		Scheduled Castes		Scheduled Tribes		Other Castes			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Uttar Pradesh	0.111	0.124	0.111	0.114	0.097	0.108	0.083	0.092	0.065	0.072	0.075	0.083	1.888	0.192
Saharanpur	0.097	0.122	*	*	0.092	0.115	0.075	0.088	*	*	0.075	0.095	1.630	0.167
Muzaffarnagar	0.103	0.120	*	*	0.096	0.112	0.080	0.086	*	*	0.068	0.080	1.777	0.180
Bijnor	0.110	0.121	*	*	0.105	0.111	0.082	0.085	*	*	0.080	0.084	1.506	0.154
Moradabad	0.117	0.136	*	*	0.114	0.124	0.072	0.086	*	*	0.078	0.082	1.881	0.223
Rampur	0.110	0.118	*	*	0.098	0.109	0.068	0.090	*	*	0.072	0.072	1.737	0.200
Jyotiba Phule Nagar	0.111	0.128	*	*	0.105	0.114	0.082	0.084	*	*	0.073	0.074	1.747	0.201
Meerut	0.107	0.122	*	*	0.089	0.104	0.072	0.081	*	*	0.064	0.072	1.903	0.213
Baghpat	0.100	0.095	*	*	0.081	0.093	0.094	0.106	*	*	0.063	0.069	1.680	0.163
Ghaziabad	0.122	0.134	*	*	0.097	0.115	0.083	0.095	*	*	0.073	0.082	1.841	0.202
Gautam Buddha Nagar	0.096	0.118	*	*	0.084	0.105	0.081	0.089	*	*	0.070	0.075	1.685	0.167
Bulandshahr	0.115	0.133	*	*	0.100	0.114	0.088	0.101	*	*	0.078	0.084	1.708	0.169
Aligarh	0.107	0.131	*	*	0.097	0.116	0.093	0.095	*	*	0.088	0.096	1.484	0.130
Mahamaya Nagar	0.089	0.111	*	*	0.079	0.098	0.087	0.099	*	*	0.067	0.075	1.649	0.152
Mathura	0.120	0.142	*	*	0.101	0.121	0.091	0.098	*	*	0.077	0.079	1.846	0.203
Agra	0.091	0.124	*	*	0.080	0.103	0.079	0.093	*	*	0.071	0.088	1.732	0.168
Firozabad	0.105	0.121	*	*	0.089	0.116	0.088	0.096	*	*	0.077	0.088	1.557	0.144
Mainpuri	0.115	0.129	*	*	0.098	0.128	0.068	0.099	*	*	0.067	0.082	1.933	0.236
Budaun	0.123	0.145	*	*	0.120	0.140	0.096	0.115	*	*	0.092	0.098	1.578	0.160
Bareilly	0.118	0.138	*	*	0.108	0.126	0.098	0.108	*	*	0.092	0.099	1.501	0.131
Pilibhit	0.115	0.148	*	*	0.100	0.119	0.075	0.109	*	*	0.070	0.097	2.119	0.224
Shahjahanpur	0.119	0.130	*	*	0.108	0.127	0.076	0.084	*	*	0.081	0.086	1.705	0.204
Kheri	0.125	0.137	*	*	0.108	0.127	0.065	0.112	*	*	0.082	0.098	2.121	0.214

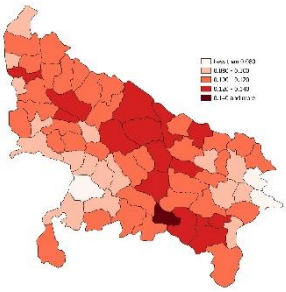
State/district	Rural						Urban						D	CV
	Scheduled Castes		Scheduled Tribes		Other Castes		Scheduled Castes		Scheduled Tribes		Other Castes			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Sitapur	0.127	0.148	*	*	0.117	0.137	0.092	0.102	*	*	0.089	0.095	1.661	0.183
Hardoi	0.124	0.141	*	*	0.116	0.135	0.100	0.113	*	*	0.091	0.111	1.559	0.136
Unnao	0.112	0.118	*	*	0.108	0.111	0.104	0.099	*	*	0.090	0.092	1.301	0.088
Lucknow	0.111	0.112	*	*	0.095	0.096	0.076	0.073	*	*	0.062	0.065	1.793	0.214
Rae Bareli	0.122	0.120	*	*	0.106	0.101	0.115	0.115	*	*	0.077	0.070	1.746	0.179
Farrukhabad	0.100	0.117	*	*	0.095	0.118	0.069	0.089	*	*	0.074	0.085	1.701	0.180
Kannauj	0.104	0.122	*	*	0.092	0.104	0.096	0.118	*	*	0.080	0.099	1.518	0.124
Etawah	0.093	0.115	*	*	0.082	0.093	0.059	0.070	*	*	0.055	0.068	2.106	0.239
Auraiya	0.094	0.103	*	*	0.089	0.093	0.075	0.080	*	*	0.066	0.079	1.557	0.131
Kanpur Dehat	0.099	0.110	*	*	0.089	0.100	0.080	0.118	*	*	0.082	0.081	1.474	0.140
Kanpur Nagar	0.095	0.104	*	*	0.079	0.082	0.091	0.102	*	*	0.076	0.086	1.374	0.109
Jalaun	0.078	0.094	*	*	0.074	0.085	0.061	0.065	*	*	0.053	0.058	1.784	0.188
Jhansi	0.092	0.103	*	*	0.086	0.086	0.080	0.076	*	*	0.072	0.075	1.446	0.117
Lalitpur	0.117	0.140	*	*	0.104	0.115	0.109	0.079	*	*	0.072	0.072	1.951	0.227
Hamirpur	0.088	0.118	*	*	0.088	0.100	0.081	0.105	*	*	0.058	0.071	2.015	0.200
Mahoba	0.102	0.116	*	*	0.092	0.103	0.065	0.062	*	*	0.072	0.083	1.883	0.213
Banda	0.109	0.135	*	*	0.091	0.107	0.076	0.107	*	*	0.078	0.093	1.768	0.180
Chitrakoot	0.114	0.139	*	*	0.086	0.103	0.096	0.101	*	*	0.069	0.087	2.025	0.197
Fatehpur	0.117	0.129	*	*	0.104	0.112	0.088	0.092	*	*	0.062	0.071	2.071	0.222
Pratapgarh	0.106	0.112	*	*	0.088	0.094	0.086	0.087	*	*	0.095	0.100	1.308	0.093
Kaushambi	0.145	0.149	*	*	0.119	0.120	0.094	0.092	*	*	0.068	0.078	2.206	0.260
Allahabad	0.139	0.155	*	*	0.109	0.124	0.092	0.108	*	*	0.081	0.089	1.926	0.216

State/district	Rural						Urban						D	CV
	Scheduled Castes		Scheduled Tribes		Other Castes		Scheduled Castes		Scheduled Tribes		Other Castes			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Barabanki	0.134	0.135	*	*	0.122	0.123	0.111	0.107	*	*	0.093	0.083	1.634	0.154
Faizabad	0.121	0.122	*	*	0.097	0.100	0.089	0.075	*	*	0.071	0.067	1.810	0.214
Ambedkar Nagar	0.102	0.107	*	*	0.091	0.091	0.109	0.100	*	*	0.093	0.090	1.208	0.073
Sultanpur	0.109	0.114	*	*	0.086	0.089	0.083	0.075	*	*	0.061	0.064	1.864	0.208
Bahraich	0.126	0.141	*	*	0.106	0.120	0.134	0.090	*	*	0.117	0.099	1.567	0.139
Shrawasti	0.117	0.149	*	*	0.102	0.136	0.019	0.036	*	*	0.053	0.061	7.973	0.539
Balrampur	0.121	0.138	*	*	0.101	0.117	0.086	0.114	*	*	0.067	0.092	2.066	0.203
Gonda	0.107	0.122	*	*	0.087	0.102	0.076	0.081	*	*	0.050	0.054	2.451	0.279
Siddharthnagar	0.119	0.130	*	*	0.102	0.107	0.069	0.090	*	*	0.071	0.070	1.891	0.234
Basti	0.099	0.109	*	*	0.087	0.094	0.060	0.062	*	*	0.051	0.049	2.232	0.288
Sant Kabir Nagar	0.089	0.092	*	*	0.086	0.092	0.069	0.109	*	*	0.061	0.072	1.784	0.172
Mahrajganj	0.117	0.118	*	*	0.109	0.111	0.102	0.072	*	*	0.064	0.062	1.906	0.240
Gorakhpur	0.085	0.091	*	*	0.078	0.081	0.071	0.071	*	*	0.063	0.074	1.461	0.109
Kushinagar	0.115	0.117	*	*	0.109	0.104	0.085	0.055	*	*	0.095	0.096	2.131	0.194
Deoria	0.080	0.087	0.087	0.076	0.074	0.076	0.068	0.063	0.071	0.071	0.057	0.067	1.525	0.117
Azamgarh	0.088	0.088	*	*	0.071	0.073	0.085	0.079	*	*	0.079	0.077	1.251	0.078
Mau	0.092	0.097	*	*	0.090	0.092	0.085	0.092	*	*	0.100	0.095	1.183	0.047
Ballia	0.076	0.084	0.087	0.085	0.079	0.084	0.078	0.094	0.062	0.088	0.071	0.076	1.523	0.102
Jaunpur	0.109	0.117	*	*	0.088	0.093	0.094	0.105	*	*	0.077	0.074	1.587	0.151
Ghazipur	0.104	0.107	*	*	0.094	0.098	0.066	0.077	*	*	0.070	0.085	1.616	0.166
Chandauli	0.088	0.095	*	*	0.069	0.076	0.065	0.084	*	*	0.066	0.073	1.458	0.134
Varanasi	0.125	0.138	*	*	0.086	0.094	0.089	0.091	*	*	0.077	0.078	1.788	0.211
Sant Ravidas Nagar	0.136	0.161	*	*	0.098	0.111	0.114	0.150	*	*	0.093	0.101	1.722	0.196

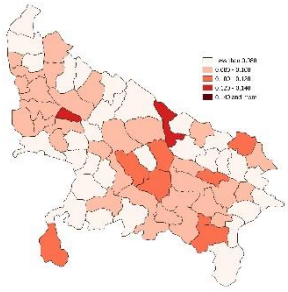
State/district	Rural						Urban						D	CV
	Scheduled Castes		Scheduled Tribes		Other Castes		Scheduled Castes		Scheduled Tribes		Other Castes			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Mirzapur	0.137	0.149	*	*	0.096	0.111	0.108	0.124	*	*	0.077	0.087	1.927	0.206
Sonbhadra	0.112	0.122	0.117	0.121	0.083	0.094	0.072	0.076	0.109	0.097	0.058	0.069	2.097	0.226
Etah	0.107	0.143	*	*	0.093	0.124	0.087	0.096	*	*	0.072	0.097	1.994	0.205
Kanshiram Nagar	0.133	0.143	*	*	0.115	0.127	0.133	0.119	*	*	0.102	0.103	1.402	0.114
Differential	1.905	1.902	*	*	1.765	1.919	7.139	4.205	*	*	2.337	2.277		
Coefficient of Variation	0.138	0.145	*	*	0.129	0.147	0.208	0.198	*	*	0.176	0.158		

Source: Authors' calculations

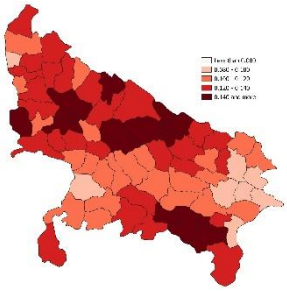
Remarks: * estimates of 5q0 are not calculated because of very small Scheduled Tribes population in these districts.



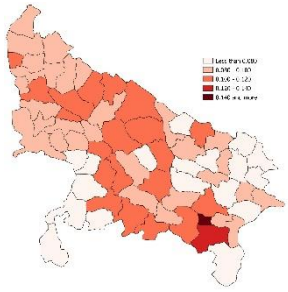
Rural Scheduled Castes male



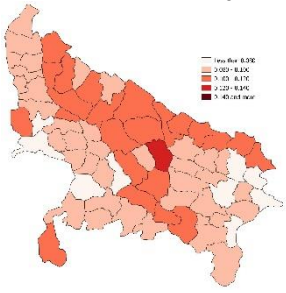
Urban Scheduled Castes male



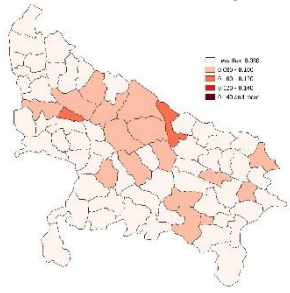
Rural Scheduled Castes female



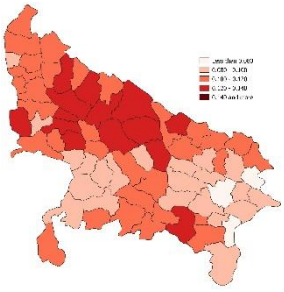
Urban Scheduled Castes female



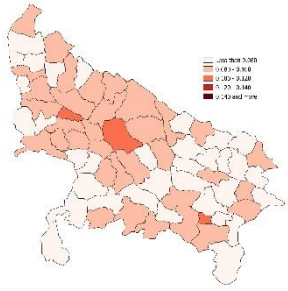
Rural Other Castes male



Urban Other Castes male



Rural Other Castes, female



Urban Other Castes female

Figure 7: Under-five mortality rate in districts of Uttar Pradesh for different mutually exclusive population groups, 2011

Table 2 presents estimates of ${}_5q_0$ for 12 mutually exclusive population subgroups in the state and in districts as they existed at the 2011 population census. At the state, level, ${}_5q_0$ is estimated to be the highest in female Scheduled Tribes children living in the rural areas (0.124) but the lowest in male Scheduled Tribes children living in the urban areas (0.065). It may also be seen from the table that ${}_5q_0$ in female Scheduled Castes children living in rural areas is the highest in 62 districts of the state. There is no district where ${}_5q_0$ in male Other Castes children in the rural areas is the highest among mutually exclusive population subgroups. Similarly, there is no district where ${}_5q_0$ in female Other Castes children in urban areas is the highest. Among the 3 districts where Scheduled Tribes population is at least 100 thousand, ${}_5q_0$ is the highest in male Scheduled Tribes children in rural areas in district Deoria and in female Scheduled Tribes children in rural areas in district Ballia. In other population subgroups, ${}_5q_0$ is the highest in only a few districts. Taking variation across districts and across population subgroups within district, ${}_5q_0$ is estimated to be the highest in Scheduled Castes female children in the rural areas of district Sant Ravidas Nagar (0.161) but the lowest in the Scheduled Castes male children in the urban areas of district Shrawasti (0.019).

The residence and gender effects of ${}_5q_0$ are very strong in the state. Rural ${}_5q_0$ is higher than urban ${}_5q_0$ in the state and in all districts but rural-urban gap has decreased in the state and in most of the districts. There are 12 districts where rural-urban gap has widened. Similarly, ${}_5q_0$ is higher in female compared to male children in all social classes in both rural and urban areas. In the urban areas, female ${}_5q_0$ is substantially higher than male ${}_5q_0$ in Other Castes. In case of male Scheduled Castes children, ${}_5q_0$ is higher in urban than in rural areas in 3 districts, whereas in case of female Scheduled Castes children, ${}_5q_0$ is higher in urban than in rural areas in 4 districts. In Other Castes, male ${}_5q_0$ is higher in urban than in rural areas in 5 districts.

Child Mortality Inequality

Figure 1 shows district wise distribution of ${}_5q_0$ for the combined population for 2001 and 2011 census which depicts inter-district variation in the child mortality in the state. of Uttar Pradesh. The figure reveals that inter-district disparity in ${}_5q_0$ in the state has decreased over time. The data available from 2011 population census suggest that ${}_5q_0$ was higher than the state average in 35 of the 71 districts that existed at the 2011 population census whereas data available from 2001 population census suggest that ${}_5q_0$ was higher than the state average in 36 of the 70 districts which existed at the 2001 population census. According to the 2001 population census, ${}_5q_0$ was very high (>0.130) in 29 of the 70 districts. However, there was no district according to the 2011 population census where ${}_5q_0$ was very high. On the other hand, according to the 2001 population census, ${}_5q_0$ was very low (≤ 0.085) in only 2 districts of the state whereas according to the 2011 population census, ${}_5q_0$ was very low in 12 districts of the state. The differential or the ratio of the highest

to the lowest ${}_5q_0$ across districts decreased from 1.99 based on 2001 population census to 1.69 based on 2011 population census whereas the inter-district coefficient of variation decreased from 0.152 to 0.134 reflecting the decrease in inter-district inequality and the convergence in ${}_5q_0$ across the districts of the state over time.

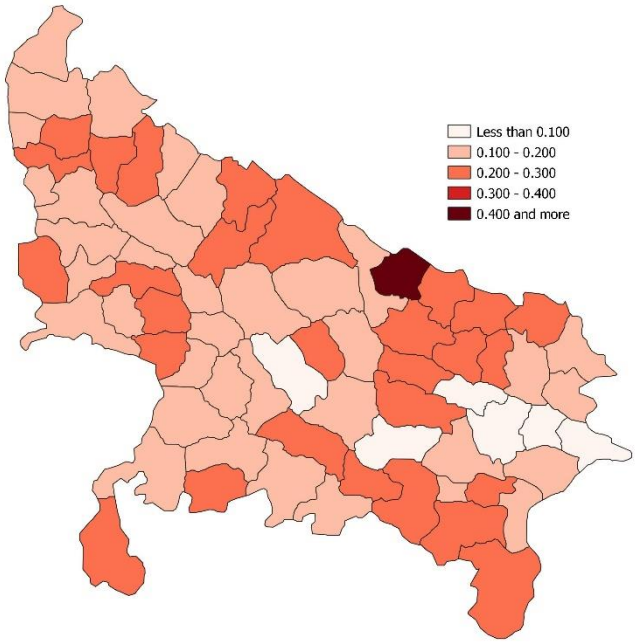


Figure 8: Within-district inequality in under-five mortality rate in Utter Pradesh, total population, 2011

The inter-district inequality in ${}_5q_0$ has been found to be relatively higher in the urban as compared to the rural areas of the state according to the 2011 population census. More importantly, inter-district inequality in the rural areas appears to have decreased over time as the inter-district differential (ratio of highest to lowest under-five mortality rate) decreased from 1.907 to 1.693 and inter-district coefficient of variation decreased from 0.140 to 0.134 according to 2001 and 2011 population census. In the urban areas, however, the inter-district differential in ${}_5q_0$ increased from 2.065 to 2.096 but the inter-district coefficient of variation decreased from 0.170 to 0.151. It appears that there has been only a marginal decrease in the inter-district inequality in ${}_5q_0$ in the urban areas of the state.

The inter-district inequality in ${}_5q_0$ has been found to be different in different mutually exclusive population sub-groups. Both inter-district differential and inter-district coefficient of variation in ${}_5q_0$ are found to be the lowest in Other Castes male children in the rural areas but the highest in Scheduled Castes male children in the

urban areas. Inter-district inequality in Scheduled Castes female children in the urban areas has also been found to be very high. In the urban areas, inter-district inequality in ${}_5q_0$ is found to be substantially lower in Other Castes children compared to Scheduled Castes children. In the rural areas, however, inter-district inequality in Other Castes female children is higher than that in Scheduled Castes female children but inter-district inequality in ${}_5q_0$ in Other Castes male children is found to be lower than that in Scheduled Castes male children.

Finally, within district inequality in ${}_5q_0$ across mutually exclusive population subgroups varies widely across the districts of the state (Figure 8). This inequality is found to be the highest in district Shrawasti but the lowest in district Mau of the state. In district Shrawasti, ${}_5q_0$ in Scheduled Castes female children living in the rural areas is found to be almost 8 times the ${}_5q_0$ in Scheduled Castes male children living in the urban areas of the district. By contrast, in district Mau, ${}_5q_0$ is the in the Other Castes male children living in the urban areas which is the highest in the district is less than 20 per cent higher than the ${}_5q_0$ in the Other Castes male children living in the rural areas which is the lowest in the district.

Conclusions

The present analysis shows that the inequality in child mortality within Uttar Pradesh are quite pervasive and addressing these differentials is necessary to increase the survival chances of young children in the state. The analysis also emphasises that the current, heavily centralised, approach to promoting child survival in the state should be replaced by a decentralised institutional set-up which can effectively address the local context of child mortality, and which may provide better opportunities for people's participation in child efforts directed towards preventing unwanted, premature, child deaths. Such a shift in the approach towards child survival, however, requires significant improvement in the administrative capacity and organisational efficiency of the public health care delivery system along with the reduction in the residence and social class inequalities in the quality of life. There is a need of a long-term vision, strong political commitment for child survival in the state which remains to be unacceptably low.

The analysis also reveals substantial within-district inequality in child mortality. This inequality reflects both inequality in living standards and disproportionate use of health care services such as immunisation against vaccine preventable diseases and use of oral rehydration salt to prevent deaths due to dehydration during diarrhoea across different mutually exclusive population groups within the same district. It appears that the reach of child survival efforts in the state is not the same in different population groups which again reflects that there is scope for improvement in the needs effectiveness and capacity efficiency of child survival efforts in the state. At present, very little is known about the needs effectiveness and capacity efficiency of child survival efforts in the state, especially at the local level. A data

revolution is needed to generate the data necessary for analysing both endogenous and exogenous factors of child mortality at the local level.

Probably, and so obviously, Uttar Pradesh needs a policy on children to address the child mortality inequality that appears to be so pervasive and persistent in the state. A state policy on children is also necessary to address regional, social class, residence, and gender inequality in child mortality. The state endorses the National Policy on Children (Government of India, 2013) which is, however, silent about the need of addressing the regional, social class, residence, and gender inequalities in child mortality. Uttar Pradesh can accelerate the pace of reduction in child mortality just by reducing inter-district, social class, residence, and gender inequalities in child mortality by suitably reorienting its child survival efforts. A state-specific policy on children may be the beginning in this direction.

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