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ABSTRACT

Background Increasing the coverage of key maternal, newborn and child health interventions is essential, if India has to attain Millennium Development Goals 4 and 5. This study assesses the coverage gap in maternal and child health services across states in India during 1992–2006 emphasizing the rural–urban disparities. Additionally, association between the coverage gap and under-5 mortality rate across states are illustrated.

Methods The three waves of National Family Health Survey (NFHS) conducted during 1992–1993 (NFHS-1), 1998–1999 (NFHS-2) and 2005–2006 (NFHS-3) were used to construct a composite index of coverage gap in four areas of health-care interventions: family planning, maternal and newborn care, immunization and treatment of sick children.

Results The central, eastern and northeastern regions of India reported a higher coverage gap in maternal and child health care services during 1992–2006, while the rural–urban difference in the coverage gap has increased in Gujarat, Haryana, Rajasthan and Kerala over the period. The analysis also shows a significant positive relationship between the coverage gap index and under-five mortality rate across states.

Conclusion Region or area-specific focus in order to increase the coverage of maternal and child health care services in India should be the priority of the policy-makers and programme executors.

Keywords coverage gap, India, maternal and child health care, NFHS, public health

Introduction

Maternal and child health remain an intimidating challenge to the health-care system worldwide. Followed by the Safe Motherhood Initiatives in 1987 and the International Conference on Population and Development in 1994, a global consensus on the concerns of maternal and child health was reemphasized in 2000 as the Millennium Development Goals (MDGs). The MDG 4 and 5 aim for a 75% reduction (from the level of 1990) in child and maternal mortality by 2015.¹ India is one of the signatories of the MDG. If India wishes to achieve the MDG 4 and 5 targets, the coverage of key maternal, newborn and child health (MNCH) care interventions needs to be increased. ‘Coverage’ is defined as the percentage of people receiving a specific intervention out of those who need it.² It is an important output of health services and is regarded as an essential part of any strategy to monitor progress in programme implementation.³ The indicators representing health service coverage reflect the extent to which people in need actually receive important health interventions. The coverage gap indicator was found positively correlated with the under-five mortality rate (USMR) by empirically examining the data of 54 Countdown countries.⁴

The Countdown 2008 equity analysis group⁵ confirmed that most of the Countdown countries including India have made a gradual progress in reducing the coverage gap for key interventions since 1990. This study was based on a country-level analysis and thus masked the considerable

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of NFHS are comparable, and previous studies have assessed the trends and patterns using the three NFHS rounds. The details of the sampling weights as well as extensive information on survey design, data collection and management procedures are described in the NFHS reports of the respective rounds. The state-wise estimates on USMR for overall, rural and urban areas were collected directly from the respective NFHS reports.

### Measure and procedure

The coverage gap in maternal and child health-care services is measured using a composite indicator, known as a coverage gap index. A detailed description of the variables selected for constructing the CGI along with their definitions is presented in Table 1. The CGI comprises a set of four intervention areas, which were presented along the continuum of care, a major theme of the 2008 Countdown: family planning, maternal and newborn care, immunization and treatment of sick children. In each intervention area, one to three indicators are selected. The formula to calculate the CGI is

\[
\text{CGI} = \frac{(\text{ORT} + \text{ARI})/2 + \text{FP} + (\text{SBA} + \text{ANC})/2 + (\text{MSL} + 2\times\text{DPT}3 + \text{BCG})/4}{4}
\]

where ORT denotes oral rehydration therapy; ARI, acute respiratory infection; FP, family planning; SBA, skilled birth attendance; ANC, at least three antenatal care visits; MSL, measles vaccination; and DPT3, three doses of diphtheria, pertussis and tetanus vaccine. The Cronbach’s α reliability test was performed for all the three survey data sets to ascertain the internal consistency of the items (the four intervention areas) in relation to the underlying constructs. The result is presented as a measure of the gap between the maximum and actual coverage for various reasons. First, monitoring progress towards reduction of the coverage gap becomes a more meaningful comparison once the coverage of interventions is over 50%; secondly, a gap measure allows for the introduction of new interventions in a more meaningful way than coverage allows; thirdly, theoretically, the goal might not be 100% coverage for some interventions and a gap measure allows defining lower goals as a target and fourthly, it clearly distinguishes the aggregate index from ordinary intervention coverage measures. The census of India definition of urban or rural is used to classify a household as urban or not in the NFHS. Selected indicators were estimated for rural and urban areas separately for each state (including the overall estimates) from the respective surveys using appropriate weights and accounting for survey

### Methods

#### Data set

This study used the data from three rounds of National Family Health Survey (NFHS), conducted during 1992–93 (NFHS-1), 1998–99 (NFHS-2) and 2005–06 (NFHS-3). The NFHS is characterized as a nationally representative, large-scale and repeated cross-sectional survey. This is the Indian version of the Demographic and Health Surveys conducted in the other Countdown countries. These surveys used a multistage cluster sampling design to collect data on fertility, mortality, family planning and important aspects of nutrition, health and health care. The information on coverage of selected maternal and child health indicators were collected from women aged 15–49 years administering standard questionnaire. By nature of the sampling design, the estimates obtained from the three rounds of NFHS are comparable, and previous studies have assessed the trends and patterns using the three NFHS rounds. The details of the sampling weights as well as extensive information on survey design, data collection and management procedures are described in the NFHS reports of the respective rounds. The state-wise estimates on USMR for overall, rural and urban areas were collected directly from the respective NFHS reports.
design using ‘SVY’ command available in Stata. The rural–urban comparison of CGI is shown using ratio and the absolute difference. Although, both the indicators ‘ratio’ and ‘absolute difference’ refer the rural–urban disparity in a distinct manner, the latter has advantage in reflecting even a minor variation. The association between the CGI and the U5MR were assessed using linear regression (OLS) method applied on pooled state level estimates from three survey periods. The data were analysed using Stata 10. Maps were prepared using ArcGIS 9.3 software package to illustrate the changes in the CGI during 1992–2006 across states in India.

Results

Coverage gap by intervention area

Table 2 shows the mean coverage gap by place of residence for the summary measure and each of the four intervention areas with respective indicators for 29 states, based on the most recent NFHS data (2005–06). The mean overall coverage gap was 53%, ranging from around 56% for the rural and ~45% for the urban areas. The mean size of the gap was the largest for the family planning interventions (followed by treatment of sick children, and maternal and newborn care), and was the smallest for immunization. The large gap for the oral rehydration therapy (65.5%) and delivery care indicator (skilled birth attendance) was striking (44.3%). The largest rural–urban difference in the coverage gap was also observed for delivery care (30.1%), followed by that for the antenatal care indicator (22.8%), while the overall difference for maternal and newborn care indicator was 26.5%.

Coverage gap and U5MR

The statistical relationships between CGI and U5MR across states in India during 1992–2006 are established in Fig. 1 showing a linear regression fit for overall, rural and urban areas separately. The extent of predictability (as confirmed by R square value) of the CGI for U5MR in rural areas was almost 70%, followed by urban areas (58%) and the total (45%). The higher predictability for rural areas manifests the urgency of mitigating the coverage gap in the vital maternal and child health services in rural areas if U5MR to be curbed. The figure also illustrates the relative position of states in terms of U5MR and CGI score across the survey periods for urban (Fig. 1A), rural (Fig. 1B) and overall (Fig. 1C) areas separately. In all the three graphs, a clear manifestation of major states in eastern, central and north-eastern regions of the country such as Bihar, Orissa, Uttar Pradesh, Madhya Pradesh, Rajasthan and Assam placed at

| Table 1 Definition of indicators by intervention area used for the CGI |
|----------------|----------------------------------|
| Indicators for CGI | Definition |
| Indicators for family planning | Need for family planning satisfied Percentage of currently married women who say that they do not want any more children or that they want to wait 2 or more years before having another child, and are using contraception |
| Indicators for maternal and newborn care | Skilled birth attendance Percentage of livebirths in 3 years before the survey attended by skilled health personnel (doctor, nurse, midwife or auxiliary midwife) |
| | Antenatal care Percentage of women attended at least thrice during pregnancy by skilled health personnel for reasons related to the pregnancy in 3 years before the survey |
| Indicators for immunization | Measles vaccination Percentage of children aged 12–23 months who are immunized against measles |
| | Diphtheria, pertussis and tetanus vaccination Percentage of children aged 12–23 months who received three doses of diphtheria, pertussis and tetanus vaccine |
| | BCG vaccination Percentage of children aged 12–23 months currently vaccinated against BCG |
| Indicators for treatment of sick children | Oral rehydration therapy Percentage of children under-five with diarrhoea in the past 2 weeks who received oral rehydration therapy (packets of oral rehydration salts, recommended home solution, or increased fluids) and continued feeding |
| | Treatment of acute respiratory infection Percentage of children aged 0–59 months with suspected pneumonia (cough and dyspnoea) who sought care from a health provider |
the right top corner of the graph indicates higher U5MR and a higher coverage gap. The number attached with the state abbreviations refer to the survey period (i.e. 1 for 1992–93; 2 for 1998–99 and 3 for 2005–06), which also suggest very slow movement in the position of these states over a period of around one and half decades. However, a considerable change was pointed out in the position of the three states, i.e. Bihar, Uttar Pradesh and Madhya Pradesh during 2005–06, especially in rural areas, due to their bifurcation in the year 2000.

**Region/state-wise coverage gap and rural–urban differentials**

Table 3 presents the estimates of CGI with rural–urban differences across states and broad regions of India during 1992–2006. The figures show a negligible reduction in the coverage gap in India with a rate of <0.5 percentage points per year during the period. These reductions were even less than the national average in the northern, central and western regions of the country. However, the absolute coverage gap was estimated higher in the northeastern (66.4%), central (66%) and eastern (60.6%) regions during 2005–06 compared with the national CGI (57.3%). The striking rural–urban differences in CGI during 2005–06 were recorded in states of Rajasthan (19.8), Haryana (16), Gujarat (14.6) and Bihar (13.5); while among regions, the northeast reported the highest rural–urban difference. The largest reduction in the rural–urban difference in CGI over the period was recorded in the southern region (40%), and the least in the northern region (3%). Tamil Nadu reduced the rural–urban difference in CGI by 85% from 1992–93 to 2005–06, closely followed by Himachal Pradesh (79%), Andhra Pradesh (59%), Punjab (56%) and Jammu and Kashmir (45%). The western region showed an increase of around 33% in the rural–urban difference during 1992–2006, with Gujarat recording an increase of >40%. However, Haryana tops the list with 49% increase in the rural–urban difference in the coverage gap. Rajasthan and Kerala with 31% and 8% increase in the rural–urban difference in the CGI over the period, respectively, were other states in this group.

Figures 2–4 demonstrate a clear picture of regional progress in reducing the overall coverage gap across states during 1992–2006 for overall, rural and urban areas respectively. The maps clearly manifest the dominance of Bihar, Uttar Pradesh, Rajasthan, Madhya Pradesh and some of the states in the northeast with a higher coverage gap in maternal and child health-care services.

**Discussion**

**Main findings of this study**

The study establishes a strong relationship between CGI and U5MR (especially in rural areas) in India. The large overall coverage gap was found for the oral rehydration therapy and delivery care indicator, while the higher rural–urban difference was recorded for delivery and antenatal care. The reduction in CGI has been negligible during
What is already known about this topic

Coverage of health service interventions, as an important outcome and essential part of any strategy to monitor progress in health programme implementation, is well recognized in the literature. Previous works have shown the competence of a composite index for coverage of health services that summarizes the coverage across a range of interventions. Lozano et al. developed a composite measure of health system coverage to compare the health-system performance between states in Mexico. This measure was based on 14 interventions for child and adult health for which state-level estimates of coverage were available. This method allowed the inclusion of curative as well as preventive interventions. Later, the measure of coverage in health interventions was replicated by Countdown to 2015 Analysis Group to track country and global progress towards achievement of MDGs 4 (reduce child mortality) and 5 (improve maternal health) at a regular interval. India is also among the countries being tracked by the Countdown to 2015 Analysis Group. The Countdown study shows that the overall coverage gap in health service interventions in India was remarkably persistent over time, with only a gradual change of 1% per year during 1990–2006.

**Fig. 1** An association between U5MR and coverage gap (%) for (A) urban (B) rural and (C) overall area across states in India, 1992–93 to 2005–06. Note: Abbreviations shown for the states are as follows: Andhra Pradesh (AP); Arunachal Pradesh (AR); Assam (AS); Bihar (BR); Chhattisgarh (CG); Delhi (DL); Goa (GO); Gujarat (GJ); Haryana (HR); Himachal Pradesh (HP); Jammu and Kashmir (JK); Jharkhand (JH); Karnataka (KL); Kerala (KB); Madhya Pradesh (MP); Maharastra (MH); Manipur (MN); Meghalaya (MG); Mizoram (MZ); Nagaland (NL); Orissa (OR); Punjab (PB); Rajasthan (RJ); Sikkim (SK); Tamil Nadu (TN); Tripura (TR); Uttar Pradesh (UP); Uttarakhand (UK); and West Bengal (WB). Numbers attached to the state abbreviations represent the survey periods: 1992–93 (1), 1998–99 (2) and 2005–06 (3). The estimates for new states, i.e. CG, JH and UK, are shown only for the survey period 2005–06.
Table 3 The coverage gap (%) by period\(^a\) and yearly change with summary measures of the rural–urban difference across regions and states in India

<table>
<thead>
<tr>
<th>Region/state</th>
<th>Overall coverage gap</th>
<th>Rural–urban ratio (rural/urban)</th>
<th>Rural–urban difference (rural–urban)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>64.6</td>
<td>60.8</td>
<td>57.3</td>
</tr>
<tr>
<td>North</td>
<td>63.2</td>
<td>60.9</td>
<td>56.4</td>
</tr>
<tr>
<td>Jammu and Kashmir</td>
<td>53.5</td>
<td>49.9</td>
<td>42.9</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>54.4</td>
<td>45.5</td>
<td>44.1</td>
</tr>
<tr>
<td>Punjab</td>
<td>51.4</td>
<td>45.2</td>
<td>45.2</td>
</tr>
<tr>
<td>Haryana</td>
<td>59.5</td>
<td>55.9</td>
<td>50.6</td>
</tr>
<tr>
<td>Delhi</td>
<td>48.3</td>
<td>45.8</td>
<td>46.0</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>76.4</td>
<td>73.2</td>
<td>65.6</td>
</tr>
<tr>
<td>Central</td>
<td>73.2</td>
<td>72.6</td>
<td>66.0</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>69.0</td>
<td>70.0</td>
<td>60.7</td>
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<tr>
<td>Uttar Pradesh</td>
<td>74.9</td>
<td>74.1</td>
<td>68.4</td>
</tr>
<tr>
<td>East</td>
<td>71.2</td>
<td>68.4</td>
<td>60.6</td>
</tr>
<tr>
<td>Bihar</td>
<td>78.3</td>
<td>79.1</td>
<td>68.7</td>
</tr>
<tr>
<td>Orissa</td>
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<td>60.9</td>
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<tr>
<td>West Bengal</td>
<td>58.1</td>
<td>55.2</td>
<td>48.0</td>
</tr>
<tr>
<td>West</td>
<td>53.6</td>
<td>49.0</td>
<td>46.9</td>
</tr>
<tr>
<td>Goa</td>
<td>39.0</td>
<td>33.2</td>
<td>35.5</td>
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<tr>
<td>Gujarat</td>
<td>58.6</td>
<td>55.3</td>
<td>51.6</td>
</tr>
<tr>
<td>Maharashtra</td>
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<td>46.3</td>
<td>43.8</td>
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<tr>
<td>South</td>
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<td>44.4</td>
<td>42.0</td>
</tr>
<tr>
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<td>45.9</td>
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<td>Karnataka</td>
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<td>35.6</td>
</tr>
<tr>
<td>Tamil Nadu</td>
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<td>39.1</td>
<td>36.2</td>
</tr>
<tr>
<td>Northeast</td>
<td>74.9</td>
<td>72.2</td>
<td>66.4</td>
</tr>
</tbody>
</table>

\(^a\)Data for the three mentioned periods are collected from NFHS-1(1992–93), NFHS-2 (1998–99) and NFHS-3 (2005–06).

\(^b\)The percentage point change per year was calculated as the difference between the first and the last data points and divided by the number of years (15) between the two surveys.

Fig. 2 The overall coverage gap (%) across states in India during (A) 1992–93, (B) 1998–99 and (C) 2005–06.
The economic inequity in the health service coverage in India closely follows some of the African countries. Apart these composite approaches, studies in India have perpetually been manifesting the concern of inequities in utilization of maternal and child health-care services. The evidence shows that the poor, a majority of those who are socially marginalized, get the least access to preventive and curative health services. Women belonging to the scheduled castes and scheduled tribes have much poorer access to health care compared with men and women belonging to the other castes and classes. In addition, the health-care services are suboptimal in rural areas, where majority of people in India reside. India has one of the most fragmented and commercialized health-care systems in the world, where world-class care is greatly outweighed by unregulated poor-quality health services. Since public spending on health has remained low, private out-of-pocket expenditures on health are among the highest in the world. The average national health indicators, though showing improvements in recent decades, mask vast regional and social disparities.

What this study adds
This study assesses the collective coverage gap in health-care interventions aimed to family planning, maternal and newborn care, immunization and treatment of sick children across states and for rural and urban areas separately in India during 1992–2006. It presents a clear picture of progress made by different states or regions in minimizing the gap in order to achieve the universal coverage of maternal and child health-care services during the last one and half decades. The study also manifests how well the coverage gap indicator predicts the U5MR over the period, and reemphasizes the need to excel the maternal and child health-care services, especially in central, eastern and northeastern part of India, in order to follow the MDG 4 and 5 targets.
Policy implications
Acknowledging the failure of National Population Policy (NPP), 2000 and National Health Policy (NHP), 2002 aimed to improve maternal and child health, the Government of India launched an ambitious National Rural Health Mission (NRHM) in 2005 and National Urban Health Mission (NUHM) in 2008. The aim of the NRHM and NUHM are to provide effective health care to rural population and to address the concerns of the urban poor by providing equitable access to health facilities, respectively. The majority of states with high coverage gap from eastern, central, northern and northeastern regions (where the rural–urban gap in CGI is also estimated high) highlighted in this study are designated as ‘High Focus Group States’ under NRHM in order to intensify the programme initiatives in these states. However, the recent Concurrent Evaluation of NRHM conducted in 2009 have registered poor performance in several key indicators in these states. This study illustrates an enormous regional gap in MNCH indicators that needs to be minimized in order to follow the MDG 4 and 5 targets. The ‘High Level Expert Group Report on Universal Health Coverage for India’ instituted by the Planning Commission, Government of India has suggested the ‘National Health Package’ for essential health at the level of primary, secondary, as well as tertiary care for all citizens of India by 2022, which is quite encouraging. Hence, it is imperative to expect a comprehensive ‘package’ which will follow the line of ‘Continuum of Maternal, Newborn and Child health Care’ to avert maternal and child deaths in India.

Limitations of this study
The three states of the Indian Union namely Bihar, Madhya Pradesh and Uttar Pradesh were bifurcated in 2000 resulting into the creation of three new states, i.e. Jharkhand, Chhattisgarh and Uttarakhand, respectively. However, the study does not provide the estimates for these three newly created states for the period 2005–06 in order to maintain the consistency with earlier survey periods. The coverage gap estimates adjusting for socioeconomic group of population and their determinants were not in the scope of this study, and thus, remained unexplained.

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