



Inequalities in institutional delivery uptake and maternal mortality reduction in the context of cash incentive program, *Janani Suraksha Yojana*: Results from nine states in India



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ABSTRACT

Proportion of women giving birth in health institutions has increased sharply in India since the introduction of cash incentive program, *Janani Suraksha Yojana* (JSY) in 2005. JSY was intended to benefit disadvantaged population who had poor access to institutional care for childbirth and who bore the brunt of maternal deaths. Increase in institutional deliveries following the implementation of JSY needs to be analysed from an equity perspective. We analysed data from nine Indian states to examine the change in socioeconomic inequality in institutional deliveries five years after the implementation of JSY using the concentration curve and concentration index (CI). The CI was then decomposed in order to understand pathways through which observed inequalities occurred. Disparities in access to emergency obstetric care (EmOC) and in maternal mortality reduction among different socioeconomic groups were also assessed. Slope and relative index of inequality were used to estimate absolute and relative inequalities in maternal mortality ratio (MMR).

Results shows that although inequality in access to institutional delivery care persists, it has reduced since the introduction of JSY. Nearly 70% of the present inequality was explained by differences in male literacy, EmOC availability in public facilities and poverty. EmOC in public facilities was grossly unavailable. Compared to richest division in nine states, poorest division has 135 more maternal deaths per 100,000 live births in 2010. While MMR has decreased in all areas since JSY, it has declined four times faster in richest areas compared to the poorest, resulting in increased inequalities.

These findings suggest that in order for the cash incentive to succeed in reducing the inequalities in maternal health outcomes, it needs to be supported by the provision of quality health care services including EmOC. Improved targeting of disadvantaged populations for the cash incentive program could be considered.

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1. Introduction

Universal access to skilled birth attendance (SBA) and emergency obstetric care (EmOC) are crucial to reduce maternal mortality (World Health Organization, 2004; Graham et al., 2000). However an equity analysis of interventions in the countdown to 2015 from 54 countries revealed that SBA coverage was the least equitable of twelve key maternal and child health interventions; SBA coverage between the wealthiest and poorest population

quintiles differed by 52% (Barros et al., 2012). India has a similar inequality in access to SBA; in 2005 only 13% of pregnant women in the poorest population quintile delivered in health facilities, as compared with 84% in the richest population quintile (International Institute for Population Sciences, 2007). This disparity in access to lifesaving SBA is reflected in maternal mortality; globally, maternal deaths continue to be concentrated among poor women (World Health Organisation, 2012). Over the last decade (2003–2013) India has experienced a steady decline in its maternal mortality ratio (MMR) from 301 (Registrar General of India (2006)) to 178 (Registrar General of India (2013)) maternal deaths per 100,000 live births, though rates vary widely between different areas. To address the issue of high levels of home deliveries and maternal deaths, specifically among poor populations, the Government of India in

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2005 launched a nationwide *Janani Suraksha Yojana (JSY)* (Ministry of Health and Family Welfare (2006)); a cash incentive program that provides a cash incentive for pregnant women to give birth in public or accredited private health facility. In states with low levels of institutional delivery (“low performing states”), the incentive is \$31 for women in rural locations and \$22 for women in urban areas. The JSY by its very nature, is a program that is intended to reduce inequality in access to institutional care for childbirth (and by assumption SBA), by reducing financial barriers for poor women to deliver in a facility. Thus, it is intended to benefit those who experience these barriers most acutely. Eight years into its implementation, a number of studies (Randive et al., 2013) and periodic sub national surveys (Registrar General and Census Commissioner, 2011a) have documented steep rises in institutional delivery proportions since the JSY began. However there is no clear evidence of the extent to which the JSY has succeeded in raising institutional deliveries across different socioeconomic population sub groups. A previous study reported that women from the poorest households and those least educated did not always have the highest chance of receiving the JSY cash incentive (Lim et al., 2010). A study in five low performing states in India found no marked differential between the rates of institutional delivery among poor and nonpoor populations, although there were variations across states (United Nations Population Fund–India, 2009). A hospital based study conducted in Central India reported a small increase in the proportion of hospital deliveries by the lower socioeconomic population in the total deliveries at the hospital since JSY implementation, however results were not based on population level data (Gupta et al., 2012). The available literature is thus limited to simple comparisons of the proportion of JSY beneficiaries in different socioeconomic groups. Hence analysis using advanced inequality measures is necessary to assess the usefulness of the cash incentive program in promoting equitable access to institutional care for childbirth. Also it is important to examine the inequalities in access to EmOC in the context of JSY given key the role of EmOC in reducing maternal mortality.

Given that maternal mortality is concentrated in poor populations (Ronsmans and Graham, 2006), an initiative that is intended to provide this sub group with increased access to SBA and EmOC could be expected to reduce maternal deaths in this group. However, studies tracking the reduction in MMR in different socio-economic sub-groups during the JSY are lacking. An analysis of the distribution of maternal mortality in socioeconomic sub groups of the population will allow the quantification of the inequalities present in maternal mortality and importantly, will indicate if MMR declines among poor population sub groups are larger as higher institutional deliveries were expected in these groups as a result of JSY.

This paper aims to study the change in inequality in access to institutional care for childbirth after the introduction of cash incentive program and understand the pathways through which any inequality in such access might occur. It also assessed disparities in access to EmOC and in maternal mortality decline by socioeconomic groups since JSY began. These analyses will provide empirical evidence to policy makers currently implementing or planning to implement cash incentive programs to promote equity in access to institutional care for childbirth.

2. Method

2.1. Study area

This study is focused on nine low performing states i.e. Rajasthan, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Orissa and Assam, which together account for

about half of India's population and 12% of global maternal deaths (62% of India's total maternal deaths and 70% of her infant deaths) (Registrar General and Census Commissioner, 2011b). Maternal and child health care in these states is predominantly provided through the government health care system which is formally free of charge. These states are subdivided into 284 administrative units called districts, each with a population of approximately 1.5 million. Three to five geographically contiguous districts form a division which is the intermediate administrative unit of the health system between the state and the district.

2.2. Study design and data

This ecological study is an analysis of inequality using secondary data from large population-based cross-sectional demographic health surveys conducted by the Government of India. These included data from *District Level Household Survey (DLHS)-3(2007–08)* (International Institute for Population Sciences, 2010); *Annual Health Survey (AHS) I and II (2010–11 and 2012)* (Ontario Agency for Health Protection and Promotion (Public Health Ontario), 2013; Registrar General and Census Commissioner, 2012) and *Census of India (2011)* (Registrar General and I, 2011). Details on variables used in the analysis are given in Annex-I. Data was analysed at the district level for institutional delivery and the division level for MMR.

3. Analysis

3.1. Ranking of districts and divisions

We used area-based socioeconomic measures (ABSM) for analysis of inequalities. ABSM which characterize the socioeconomic profile of a geographic area rather than of individuals, can account for both-contextual factors (eg. social influences, access to health facilities) and individual level variability (eg. education) (Ontario Agency for Health Protection and Promotion (Public Health Ontario), 2013; Denny and Davidson, 2012). Areas (i.e. districts and divisions) were ranked according to their socioeconomic status (SES) using district level household assets data from the census. Proportion of households in each district that own household assets (television, car, bicycle etc.), have access to amenities (toilet, tap water, electricity etc.) and physical structure of the dwelling (material used for floor, roof, wall etc.) was used to estimate an asset score for each district with principle component analysis (Filmer and Pritchett, 2001). These scores were used to rank districts from poorest (lowest score) to richest. The 62 divisions in nine states were similarly ranked according to their SES.

3.2. Inequalities in utilization of institutions for delivery: concentration curve and concentration index (CI) (O'Donnell and Wagstaff, 2008)

The *concentration curve* was drawn to display the degree of inequality by plotting the cumulative percentage of institutional births on the Y-axis against the cumulative percentage of births on the X-axis beginning from the poorest district. If everyone has exactly the same value of the health variable, the concentration curve will be a 45-degree line called *line of equality*. The further the curve is from the line of equality the higher the degree of health inequality. Curves were plotted for the periods of 2004–2006 and 2010.

The CI which indicates the magnitude of inequality, was computed using the formula proposed by Fuller and Lury (Fuller and Lury, 1977). The CI ranges from -1 to $+1$ where a negative value indicates the concentration of an outcome variable

(institutional births) in disadvantaged group, a positive value indicates the concentration in an advantaged group while zero represents perfect equality.

3.3. Decomposition of concentration index

CI was decomposed to understand the relative contribution of different predictor variables to the inequality. District-level proportion of male literacy, vulnerable population and poor households; which indicated SES of the district and caesarean section rate in public facilities which indicated the level of availability of free EmOC, are used as predictors (Ref Annex-1). The method proposed by Wagstaff et al. (2003) has been used to decompose socioeconomic inequalities in the uptake of institutional deliveries in 2010.

Disparity in EmOC availability was examined by analysing the caesarean rate (as a proxy indicator to EmOC) in the different socioeconomic groups.

3.4. Inequalities in maternal mortality: slope index of inequality (SII) and relative index of inequality (RII) (Schneider et al., 2005)

We examined absolute and relative socioeconomic inequalities in MMR at the division level using SII and RII. SII was calculated by regressing MMR of divisions against the division's relative rank in the cumulative distribution of socioeconomic position. The slope of this regression line (β) represents the SII; the estimated difference in MMR between poorest and richest division). $RII_{(mean)}$ was calculated by dividing the SII estimate by the mean MMR of all divisions. The $RII_{(mean)}$ indicates the proportionate difference in MMR between poorest and richest division.

To assess the change in MMR in different socioeconomic groups during the JSY, MMR for each division quintile was estimated using raw data on the number of maternal deaths and live births in the survey population in each division during 2007–2009 and 2010.

4. Ethics statement

The study is based on the data available in the public domain.

5. Results

Comparison of district-level institutional birth proportions before JSY (2004–06) and during JSY in 2010 by SES of the districts shows about similar average increase across all groups. Among the 20% births that occurred in the poorest districts, institutional

deliveries increased from an average of 16%–45%, while among those in the richest districts, the increase was from an average of 40%–69% (Fig. 1).

Concentration curves for institutional delivery uptake before JSY (2004–06) and during the JSY (2010) both lie below the line of equality (Fig. 2), indicating a disproportionately lower concentration of institutional deliveries in poor areas than in rich ones during these periods. However, the degree of inequality during the JSY period (2010) was lower than in the period before JSY (2004–06), since the concentration curve for the 2010 period lies closer to the equality line. The CI for institutional delivery decreased from 0.19 in 2004–06 to 0.09 in 2010 indicating inequality has reduced after introduction of JSY.

The decomposition analysis (Table 1) revealed that the degree of inequality in male literacy contributes 30% to overall inequality in institutional delivery, followed by that of EmOC availability (as measured by proportion of caesarean in public facilities in each district) which contributed 20% and the proportion of poorest households in district contributed 18%. Although the proportions of the vulnerable population (SC and ST) in a district were statistically significant predictors of uptake of institutional births, their contribution to inequality was negligible. Variables included in the decomposition model explain major portion (69%) of inequality, the remaining unexplained (31%) part could be due to factors not included in this model.

Of the total deliveries in the poorest district quintile, 1.4% had caesarean sections in public hospitals while in the richest quintile it was 3.3% (Fig. 3). Utilization of caesarean services from private hospitals was 2.3% in the poorest quintile compared with 5.5% in the richest quintile.

The SII in MMR for the period of 2007–2009 was –97 and in 2010 it was –135. This implies that, the richest division experienced 97 fewer maternal deaths per hundred thousand live births than did the poorest division during 2007–09 and 135 fewer maternal deaths during 2010. The greater SII in 2010 (–135 vs –97) reveals increased inequality as a consequence of a lower decline in MMR in poorer divisions than in richer ones (Fig. 4). The RII in MMR was –0.30 in 2007–2009 and –0.49 in 2010 indicating 30% and 49% lower MMRs respectively in the richest division than in the poorest one. The greater RII in 2010 indicates increasing inequality over the period.

Reduction in the MMR during JSY (2007–2009 to 2010) was estimated as being four times higher in richest division quintile than in the poorest one.

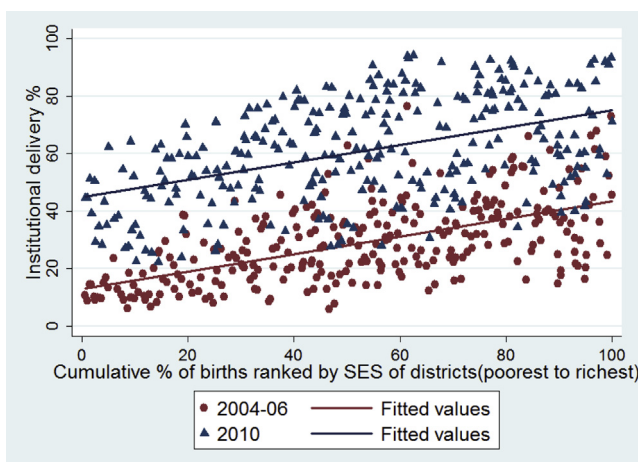


Fig. 1. Institutional birth percentage by socioeconomic status of districts.

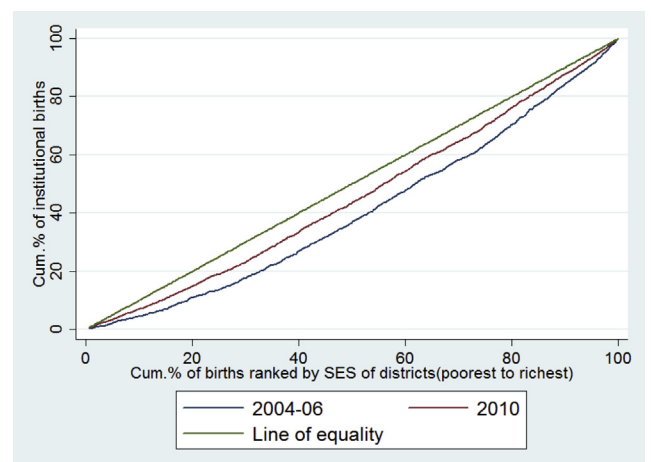


Fig. 2. Concentration curve for institutional births in 2004–06 and 2007–09.

Table 1
Decomposition of concentration index of institutional deliveries.

Predictors	Cl. of predictors	Elasticities	Absolute contribution	Relative contribution (%)
Male literacy%	0.042	0.6427	0.027	30
Poor households% in district	-0.178	-0.0910	0.016	18
Cesarean% in public facilities	0.150	0.1186	0.018	20
Vulnerable population%	0.012	0.0941	0.001	1
Subtotal			0.062	69
Residual			0.028	31
Total			0.09	100

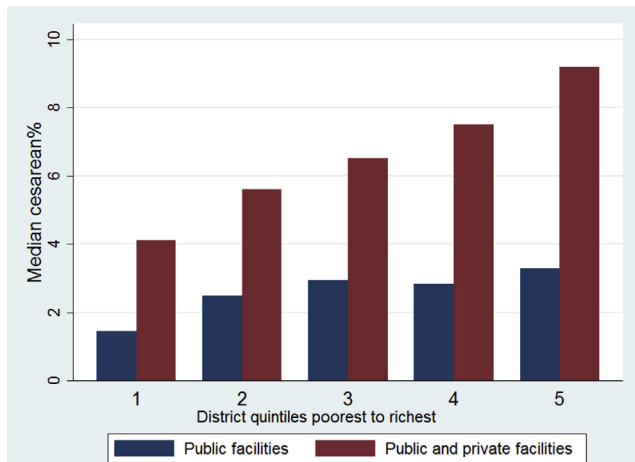


Fig. 3. Median caesarean% by district quintiles ranked from poorest to richest.

6. Discussion

This paper presents the first analysis of the JSY program from an equity perspective. The results show persisting although reduced inequalities in institutional deliveries during the JSY program and that maternal mortality decline was slower in the poorest areas compared to richest ones. It draws attention to improved targeting of poor population for cash incentive program and ensuring the availability of quality obstetric care services.

6.1. Inequality in institutional deliveries and EmOC

Despite well documented dysfunctionality of the public health facilities in poor areas (Ministry of Health and Family Welfare, 2012), the JSY was possibly viewed as a solution (Shibuya, 2008) to overcome chronic issues of underutilization of institutional care during childbirth, specifically among poor populations. Our analysis shows that more than half of the women in the poorest districts still deliver at home. While absolute increase in proportion of institutional deliveries during JSY program was about similar across all socioeconomic groups, the differential rate of relative increase (i.e. from 16% to 45% in poorest district quintile vs from 40% to 69% in richest ones) has helped to reduce inequalities. These findings suggest that in poor areas, either the cash incentive itself was insufficient to induce the expected behaviour change or there were other barriers to accessing institutional care that outweighed the benefit of the cash incentive. Decomposition analysis revealed that the degree of inequality in male literacy, EmOC availability, and in economic deprivation explain most of the existing inequality in accessing institutional delivery care. The relative contribution of male literacy was about 30% while there was surprisingly no

significant association between female literacy and institutional delivery (tested but not shown). This may be due to the household decisions being taken largely by men. More educated men are possibly better informed about the cash incentive program, the availability of health facilities and may better understand the advantages of a hospital delivery.

The level of availability of EmOC in public facilities indicates the kind of public health care services available in the area. Poor availability of functional public health services could make access to care more difficult, resulting in low levels of utilization. This explains the contribution of inequality in EmOC availability to inequality in institutional delivery uptake. Poverty is a well-known barrier to utilizing health services and shows up in our decomposition results also.

The contribution of illiteracy and poverty to inequality in institutional deliveries were reported by an Indian study conducted prior to the JSY, though this study reported an effect of literacy among women and men (Goli et al., 2013). Experience from neighbouring Bangladesh also suggest that although a demand side financing program raised the utilization of maternal health services in poor population groups, a pro-rich slant in utilization persisted which indicates that a demand-side financing program alone is not a sufficient measure (Ahmed and Khan, 2011). Our findings are also consistent with other literature indicating that barriers to accessing health services could emerge either from supply side factors like unavailability of health services and/or demand side factors like low levels of education, poverty etc. and that solving the access problem requires tackling both demand and supply side issues (Ensor and Cooper, 2004; O'Donnell, 2007; Say and Raine, 2007).

Access to institutional deliveries provided by JSY was expected to reduce the risk of maternal death by providing better access to lifesaving EmOC, including caesarean sections. Although there are no standard recommendations for what proportion of births in a given setting should be caesarean, a previously suggested reasonable limit is 5–15% (Bailey et al., 2009). Our analysis shows that the proportion of caesarean sections in public facilities was lower than this minimum recommended in all socioeconomic groups indicating a gross unavailability of free EmOC during the JSY program. In the poorest areas, only 2% women had caesarean births in private hospitals as compared to 5.5% in the richest areas. This finding suggests that women in richest areas could purchase EmOC in the case that it was unavailable in public facilities, while women from the poorest areas were unlikely to have this option as it is either unavailable or unaffordable. Choice of caesarean section rate as a proxy measure for EmOC availability is appropriate in our setting of very low caesarean rates, however we caution its use in other

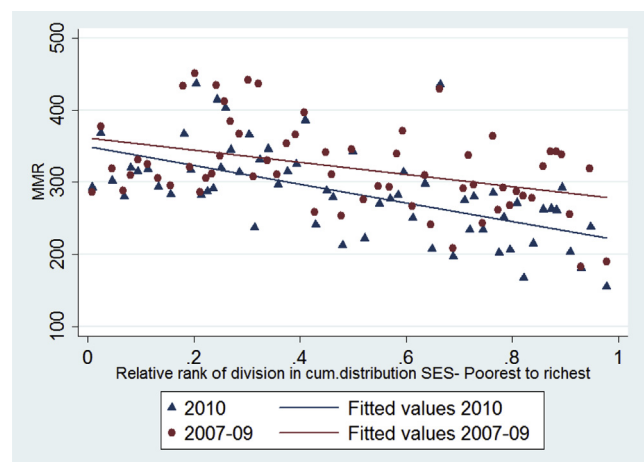


Fig. 4. Maternal mortality ratio and cumulative % of births ranked by SES of divisions.

dissimilar settings given the negative consequences of excessive use of caesarean section.

6.2. Inequality in maternal mortality

Higher levels and slower decline of maternal mortality in the poorest areas could possibly be due to the fact that more than half of all mothers in these areas still deliver at home without SBA and those that do deliver in institutions are less likely to get access to critical life-saving care (EmOC). Studies exploring the link between the JSY benefit and maternal mortality were unable to detect any significant association between the JSY uptake or increased institutional deliveries and maternal mortality reduction; this raises questions about the quality of care offered at facilities (Registrar General and I, 2011; Denny and Davidson, 2012). In a multi-country analysis, Paxton et al. showed that countries with a low MMR had a high proportion of SBA with high proportions of maternal complications managed with high quality EmOC services (Paxton et al., 2005). Poor areas in our analysis have neither a high proportion of SBA, nor have high proportion of complications managed. These findings highlight the need to strengthen the supply-side (i.e. EmOC) and improve targeting of disadvantaged populations for the cash incentive program.

6.3. Methodological considerations

Although ABSM provide an opportunity to account for contextual factors as well as individual-level socioeconomic status it has some limitations like those living in a highly deprived area not necessarily all are of low SES (or vice versa). We used ABSM since it has advantage of characterizing the entire population and was suitably applicable to the currently available secondary data. A study which compared estimates of disparities using ABSM and individual-based socioeconomic measures concluded that area-based estimates are analogous to those yielded by individual measures (Subramanian et al., 2006).

We have compared the proportion of institutional delivery uptake before the JSY program with the uptake five years after the program began with the implicit assumption that all deliveries were JSY births. However, some of these deliveries could have occurred in private hospitals (non-accredited for JSY). However given that the proportion of deliveries in private hospitals reported in an Annual Health Survey was about 25% (Ontario Agency for Health Protection and Promotion (Public Health Ontario), 2013), and some of which may have been JSY deliveries in accredited

private facilities, the actual proportion of deliveries which were not under JSY program is likely to be small. Furthermore, it was also shown that the JSY program shifted mothers from the private to the public sector (Powell-Jackson and September 29, 2011). Therefore bias due to deliveries outside the JSY program is likely to be small.

Since the decision to utilize health care services is influenced by multiple factors, there may be factors contributing to the inequality in uptake of institutional care other than those included in our decomposition analysis. Although our analysis includes few factors, they are important and good proxies for supply and demand-side barriers (Jacobs et al., 2011).

Changes in the MMR during JSY were analysed over a short period of time (2007–09 and 2010). These Changes in MMR could be attributable also to factors other than institutional births promoted by JSY, therefore a cautious interpretation of these results is necessary. Despite these limitations, this study makes an important contribution by exploring the existence of area-based socioeconomic inequalities in the context of large-scale cash incentive program using the latest available data.

6.4. Conclusions

Our analysis confirms that although inequality in access to institutional delivery persists, it has been reduced since the JSY program began. The presence of higher maternal mortality with slower pace of decline in the poorest area as well as inequalities in the availability of EmOC facilities during the cash incentive program suggest that the cash incentive alone is not sufficient to achieve equity in maternal health outcomes. Rather, the cash incentive program needs to be supported by the provision of quality health care services including EmOC and improved targeting of disadvantaged populations for the cash incentive program could be considered.

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Annex-I. Description of variables used in analysis.

Data and variables used in analysis	Data source	Description
Total population (district-wise)	Census 2011	Total population residing in a district
Crude birth rate (CBR) 2010	AHS-2	Number of births per 1000 population in a given area in one year
District wise total births	Author estimated	Calculated as a product of district population in respective year and CBR
Institutional birth proportion 2004–06	DLHS-3	Proportion of births in health facility
Institutional birth proportion 2010	AHS-2	
Institutional births in each district	Author estimated	Calculated as a product of district institutional birth proportion and total births.
Caesarean rate in public hospitals	Author estimated	Proportion of caesarean that took place in public hospital out of total deliveries in a district. This was calculated as a product of proportion of deliveries in government hospital out of total deliveries that took place in district and proportion of caesarean deliveries out of total deliveries that took place in government hospital.
Number of live births in division (2007–09 and 2010)	AHS-1 & AHS-2	AHS 1 & 2 listed all number of live births in survey population during survey reference period
Number of maternal deaths in division(2007–09 and 2010)	AHS-1 & AHS-2	AHS 1 & 2 listed all number of maternal deaths in survey population during survey reference period
Maternal mortality ratio (MMR) 2007–09	AHS-1	Maternal deaths per hundred thousand live births
Maternal mortality ratio (MMR) 2010	AHS-2	

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(continued)

Data and variables used in analysis	Data source	Description
Proportion of poorest households in district	AHS-1	Proportion of households from each district that was in poorest quintile of respective state.
Households assets data	Census 2011	Provide information on proportion of households in each district possessing household assets (such as size and structure of house, ownership of land, vehicle etc) and utilizing facilities (such as electricity, drinking water, toilet etc.)
Proportion of Scheduled castes (SC) and Scheduled tribes (ST) population 2011	Census 2011	Scheduled castes and tribes are those communities that were historically subject to social disadvantage and exclusion. They are accorded special status by the Constitution of India and are recipients of special social benefits as part of a programme of positive affirmation.
District-wise total population 2011	Census 2011	Total population residing in a district
District-wise male literacy 2011	Census 2011	Proportion of literate male population in district

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