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Birth registration in India: Are wealth inequities decreasing?

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ABSTRACT

Background: This study examines the geographic variation and the magnitude of wealth inequities in birth registration in India between 2005 and 2015.
Methods: Data came from India's 2005 (n = 51,940) and 2015 (n = 250,194) Demographic Health Surveys. We estimated absolute wealth inequities at the national and state-level and specified three-level logistic regression models (children, communities, and states) to calculate the variance partitioning coefficient attributable to each level to examine the variation in birth registration at each time point.
Results: National birth registration coverage was 41.2% in 2005 and improved to 79.6% in 2015. Between 2005 and 2015, coverage among children in the poorest quintile (Q1) improved from 23.9% to 63.8% while coverage among the wealthiest children (Q5) improved from 72.4% to 92.8%. Although the absolute wealth inequity decreased from 48.6%-points to 29.1%-points, children in Q1 still had levels of coverage in 2015 that were lower than children in Q5 in 2005. Between 2005 and 2015, birth registration improved in every state and coverage was higher than 90% in 13 states. Wealth inequities decreased in 21 states and increased in 8 states. In adjusted multi-level models the proportion of total variation in birth registration attributable to states (35.7% 2005 and 29% in 2015) was larger than the variation attributable to communities (15% in 2005 and 13.7% in 2015).
Conclusion: Birth registration is essential for ensuring inclusive population counts of birth and mortality rates. Efforts to reach universal birth registration in India will require a commitment to reducing wealth inequities within states.

1. Introduction

Civil Registration and Vital Statistics (CRVS) systems record births, deaths and other vital events, and are essential in generating and reporting inclusive population counts of birth, fertility and mortality rates. Two Lancet Series have underscored the importance of functional CRVS systems for governments, children, and adults and described the vital events excluded from CRVS systems as a 'scandal of invisibility' (Lo & Horton, 2015; Setel et al., 2007). A growing body of research from low and middle-income countries (LMICs) has linked birth registration to improved child growth and development outcomes, and to access to social and health services, including immunization (Brito, Corbacho, & Osorio, 2017; Clark et al., 2020; Comandini, Cabras, & Marini, 2016; Corbacho, Brito, & Osorio Rivas, 2012; Hunter, 2019; Jayaraman, Roberts, Wong, McDonald, & King, 2015; Jeong, Bhatia, & Fink, 2018; Shibuya & Gilmour, 2015).

Without birth registration proving age can be challenging, which is relied upon to determine vaccination schedules, measure malnutrition, enroll children in school, to identify cases of child marriage, to determine access to juvenile justice, and to protect child migrants (Apland et al., 2014; Comandini et al., 2016; Dunning, Gelb, & Raghavan, 2014; Hanmer & Elefante, 2016; Jayaraman et al., 2015; WHO, 2014). In addition, birth registration is a child's right and often a prerequisite for nationality: Article 7 of the Convention on the Rights of the Child (CRC) specifies that every child has the right to be registered at birth without discrimination (UN General Assemby, 2014). Universal birth registration was included as a Sustainable Development Goal (SDG), and is also implicated in the monitoring of other SDGs which rely upon timely and reliable data on births, marriages and deaths in the population (United Nations, 2016).

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However, birth registration remains incomplete and unequal in many contexts. Prior research has documented lower coverage of birth registration for children living in poor households, rural areas, and those who are ethnic or religious minorities (UNICEF, 2013; World Bank, 2016b; World Bank & WHO, 2014). These differences are unfair, unjust, and preventable and constitute inequities (Whitehead, 1992). Research has also shown poor and rural children most likely to be excluded, even when population-level averages improve (Bhatia, Krieger, Beckfield, Barros, & Victora, 2019; UNICEF, 2013; World Bank, 2016b; World Bank & WHO, 2014), and that many of the barriers to birth registration – e.g. cost of registration and challenges of traveling to registration points (World Bank, 2016a) – disproportionately affect poor households.

UNICEF estimates for South Asia suggest that birth registration is 60%, substantially lower than the global average of 71% (UNICEF, 2017, 2019). In India, approximately 1 in 5 children under five were not registered in 2015 (IIPS & ICF, 2017). In 2014, the Committee on the Rights of Child expressed concern about the low level of average birth registration in India, about sub-national inequities in birth registration, and about the insufficient awareness regarding the importance of universal birth registration (UN Committee on the Rights of the Child (CRC) (2014). A growing body of research examines birth registration in India and draws attention to low levels of investment and attention to civil registration at the national and state level, the low rates of facility births, challenges with access, limited efforts to raise awareness about birth registration, and a belief that birth registration is not important (A. Bhatia, Donger, & Bhabha, 2020; Gupta, Mahajan, & Lal, 2009; Mohanty & Gebremedhin, 2018; Rane, Mahanta, Islam, Gogoi, & Gogoi, 2020; Singh, Kaur, Jaswal, & Kumar, 2012). Evidence from a study in Varanasi highlights the challenges poor households face in accessing delayed birth registration which include repeat visits, and prohibitive registration fees (A. Bhatia et al., 2020), and a study in Assam underscores the limited infrastructure and equipment in civil registration offices (Rane et al., 2020).

India's approach to counting births and deaths is outlined in the 1969 Registration of Births and Deaths Act (Government of India, 1969) which made both birth and death registration compulsory, and created a governance structure for civil registration with a network of Registrars at the national, state, district and municipal, village or panchayat level where caregivers can register the birth of a child and receive a birth certificate. This structure raises important questions about the contribution of states, districts and smaller administrative units in improving birth registration in India and addressing social inequities. Yet no study has examined the geographic variation in birth registration in India, whether wealth gaps are declining in each state, and which children have benefited from efforts to improve birth registration.

In the context of India's efforts to achieve universal birth registration, we assess temporal changes in wealth inequity and geographic variability in birth registration between 2005 and 2015, and examine potential interaction between wealth inequities by macro geographies within and between states. Measuring wealth inequities is an essential step towards monitoring progress made to close wealth gaps, to ensure the poorest children benefit from improvements in birth registration, and to achieve universal birth registration coverage in India.

2. Methods

2.1. Data and design

Data came from India's 2005 and 2015 Demographic Health Surveys (DHS) which are standardized cross-sectional surveys representative at the national and state level. The 2005 survey used the sampling frame from the 2001 census and included 29 states and 109,041 households (IIPS & Macro International, 2007). The 2015 survey used the 2011 census sampling frame and included 29 states and 7 union territories, and 601,509 households (IIPS & ICF, 2017). The household response rate was 97.7% in 2005 (IIPS & Macro International, 2007) and 97.6% in 2015 (IIPS & ICF, 2017). Both surveys utilized a stratified multi-stage sampling design where Primary Sampling Units (PSUs) (e.g. census enumeration blocks or villages) were selected in each state with probability proportional to size followed by households. We restricted our sample to the 29 states included in both surveys and included all children under five years who were *de jure* residents of the household (usually lived there), and whose caregivers completed the household interview. Children were included even if their biological mother was not resident in the household.

2.2. Outcome and covariates

The primary outcome was the percentage of children under five with birth registration. This was caregiver reported and included all children with birth certificates, and all children whose births had been registered with the civil authorities but who did not have a birth certificate. The denominator was the number of children under five included in the nationally representative survey.

We included several sociodemographic covariates. At the household level we included wealth, religion, place of residence, caste/tribe, and number of children in the household. The DHS calculates wealth quintiles based on a household asset index that is constructed using principal components analysis and then divided into quintiles (Rutstein, 2008; Rutstein & Johnson, 2004). Using the wealth quintiles, we included wealth as a binary measure (quintiles 1 and 2 (reference group [ref])), and quintiles 3–5). Religion was included as a categorical variable (Hindu [ref], Muslim, Christian, Sikh, Buddhist/Neo-Buddhist, Other). Place of residence was included as a binary variable (rural [ref], urban). Caste was also included as a categorical variable (scheduled caste [ref], scheduled tribe, other backward class, none of the above, don't know). Number of children in the household was included as a continuous variable. At the child level we included age in years (<1 year [ref], 1, 2, 3, 4 years), and sex of the child (female [ref], male). The only maternal covariate we included was education (none [ref], primary, secondary, higher, don't know). All covariates were defined and operationalized the same way in 2005 and 2015.

2.3. Statistical analyses

We calculated point estimates, standard errors and 95% confidence intervals for birth registration coverage at the national level, for each state, and among the poorest two wealth quintiles (Q1 and 2) compared to the rest (Q3-5). To calculate wealth inequities we estimated the absolute difference in birth registration coverage at the national level and for each state at each time point. We also calculated the change in national and state-level birth registration, the change for each wealth group, and the change in wealth inequities between 2005 and 2015.

We then specified three-level logistic regression models to examine the variation in birth registration at each time point: children (level 1), nested within PSUs which we refer to as communities (level 2), nested within states (level 3). These levels follow the DHS sampling structure and correspond to community and state level governance for birth registration and health in India. Although district is an important administrative unit, the 2005 survey did not include district identifiers and we excluded district as a level to allow comparability between time points. We specified four sets of random intercept models at each time point: Model 0 did not include any covariates and allowed partitioning of the crude variation in birth registration by each level. Model 1 adjusted for child's age and sex. Model 2 additionally included all other covariates except for wealth. Model 3 additionally included wealth. We also specified a random slopes model (Model 4) with wealth effects allowed to vary at the state level to understand whether the relationship between wealth and birth registration was heterogeneous across states. Children with missing data on the covariates were not included in the multilevel models. We calculated the variance partitioning coefficient (VPC) based on the variance estimates in birth registration attributable

to each level (children, communities, and states) (Goldstein, Browne, & Rasbash, 2002). We also conducted sensitivity analyses to assess the effects of clustering within households on variance partitioning and to examine the effects of including district as a level in the 2015 survey.

All descriptive analyses were weighted to account for the multistage sampling design and to allow us to report nationally representative estimates of birth registration and wealth inequities. Multilevel models were not weighted as sampling weights for each level are not provided by DHS. Dataset preparation and descriptive analyses was conducted in Stata 15. Multilevel modeling was performed in MLwiN 3.0.

3. Results

3.1. Sample

Our sample included 51,940 children living in 3841 communities and 29 states in 2005, and 250,194 children living in 27,547 communities and 36 states/union territories in 2015.

3.2. National-level changes in birth registration

Fig. 1 shows national level birth registration coverage, on average, by wealth groups, and stratified by rurality. National birth registration coverage was 41.2% (95% CI: 40.1, 42.2) in 2005 and improved to 79.6% (95% CI: 79.2, 80.0) in 2015. In 2005, there was a 26.4%-point wealth inequity in birth registration: coverage was 27.2% among children in Q1&2 compared to 53.6% among children in Q3-5. Wealth inequities persisted after stratifying by urban and rural residence (Fig. 1c and d) and although birth registration coverage was lower among children in Q1&2 in both urban and rural areas, wealth gaps were larger in urban areas (32%-points) than rural areas (19%-points) in 2005.

In 2015, the wealth inequity declined to 18.1%-points: coverage was 70.1% among children in Q1&2 compared to 88.2% among children in Q3-5. In urban areas, wealth inequities declined to 13%-points, however in rural areas wealth inequities increased to 22%-points.

Between 2005 and 2015 coverage among children in the poorest quintile (Q1) improved from 23.9% to 63.8% while coverage among the wealthiest children (Q5) improved from 72.4% to 92.8%. Although by 2015 the absolute wealth inequity between the poorest and wealthiest children had decreased from 48.6%-points in 2005 to 29.1%-points, children in the poorest quintile still did not have the levels of coverage the wealthiest children had in 2005, and children in Q1&2 living in rural areas had the lowest coverage in 2015. These findings were supported by the fully adjusted random intercept model (Supplementary Table 1).

3.3. State-level changes in birth registration

Fig. 2 shows on-average birth registration coverage at the state level. In 2005 birth registration ranged from 5.8% (95% CI: 4.0, 8.3) in Bihar to 94.7% (95% CI: 92.5, 96.3) in Goa. In 13 out of 29 states, birth registration coverage was lower than 50%, and in 5 states, birth registration was below 30% (Bihar, Uttar Pradesh, Jharkhand, Rajasthan, and Madhya Pradesh), indicating that fewer than 1 in 3 children under five were registered. Only 2 states (Mizoram and Goa) had achieved birth registration above 90% in 2005.

In 2015 birth registration ranged from 60.2% (95% CI: 59.1, 61.3) in Uttar Pradesh to 98.9% (95% CI: 97.1, 99.6) in Goa. Birth registration coverage improved in every state: coverage was higher than 90% in 13 states and no state had coverage lower than 50%. In 6 states (Rajasthan, Assam, Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand)

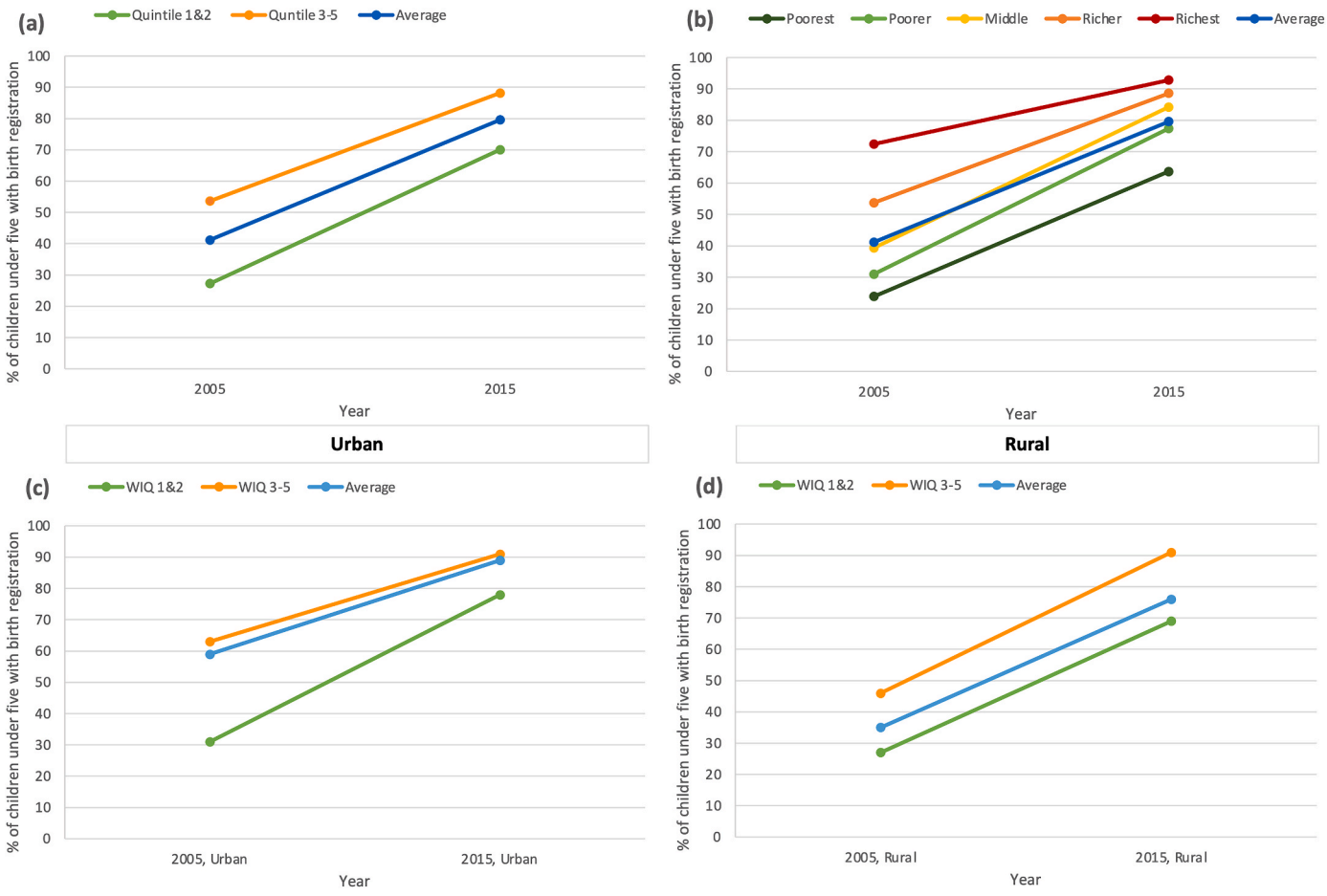

Fig. 1. National-level changes in birth registration by wealth quintile and stratified by rurality among children under five in India in 2005 and 2015.

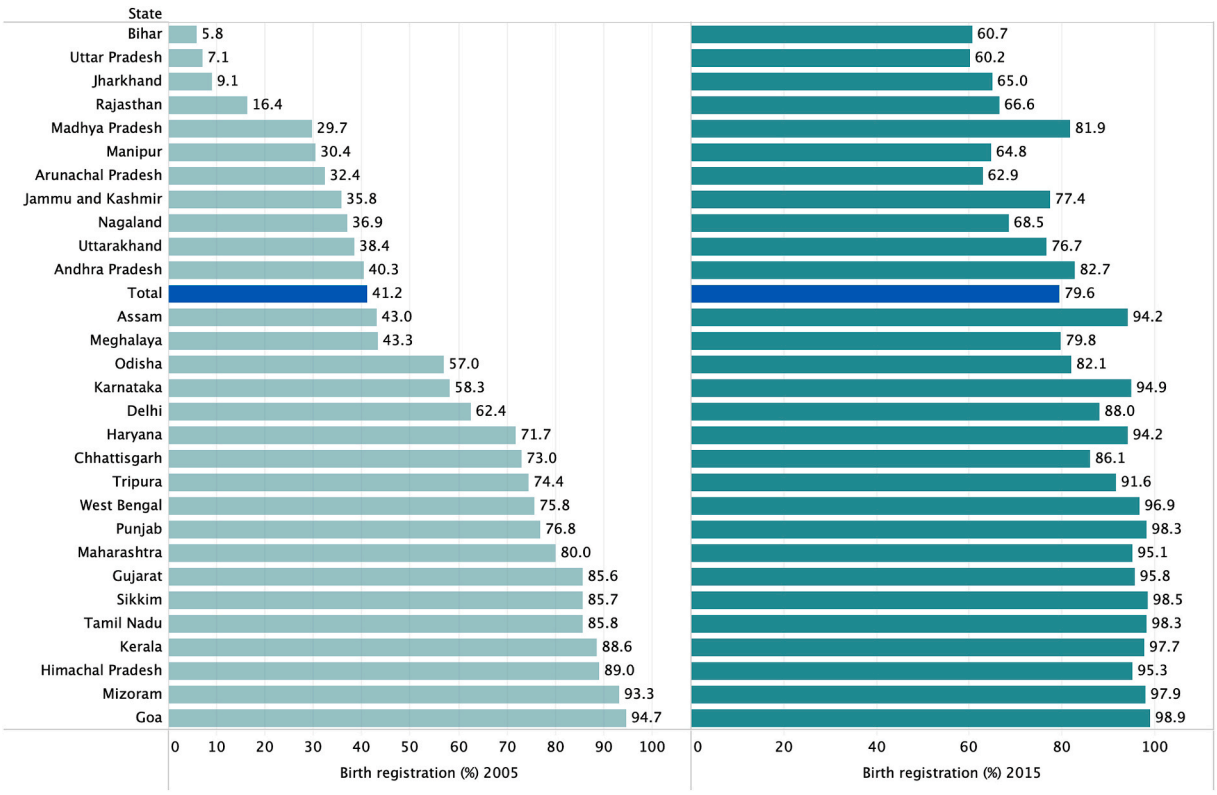

Fig. 2. Birth registration by state among children under five in India in 2005 and 2015.

improvements were larger than 50%-points between 2005 and 2015, and as large as 55.6%-points in Jharkhand.

3.4. State-level changes in wealth inequities

Fig. 3 shows state-level changes in wealth inequities in birth registration. In 2005, no state had achieved universal birth registration and the largest wealth inequities at the state level were in Delhi where there was a 43.7%-point difference between children in Q1&2 compared to Q3-5. Arunachal Pradesh, Meghalaya, and Assam all had wealth inequities larger than 30%-points. In 2015, wealth inequities had decreased in most states. Among the states with average birth registration coverage above 90%, Haryana had the largest wealth inequality (12.0%-points), followed by Tripura (7.8%-points). Most other states

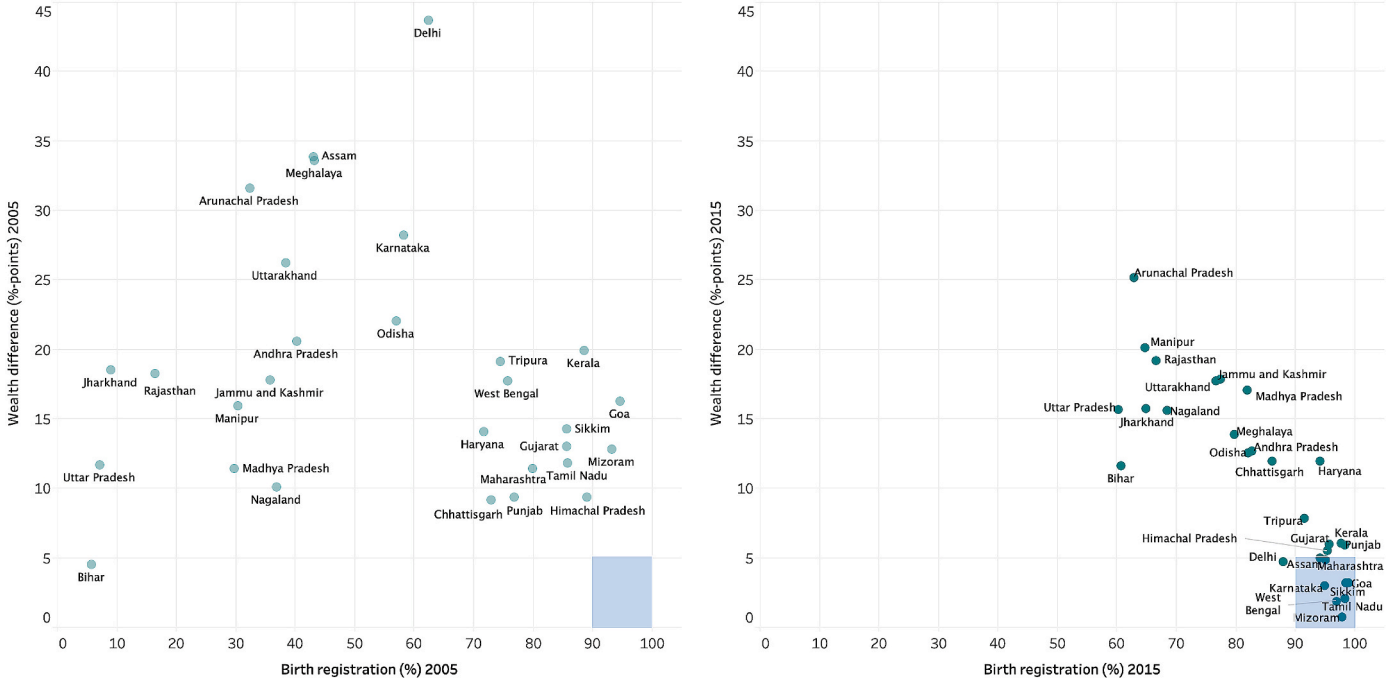

Fig. 3. State-level birth registration and wealth inequities among children under five in India in 2005 and 2015.

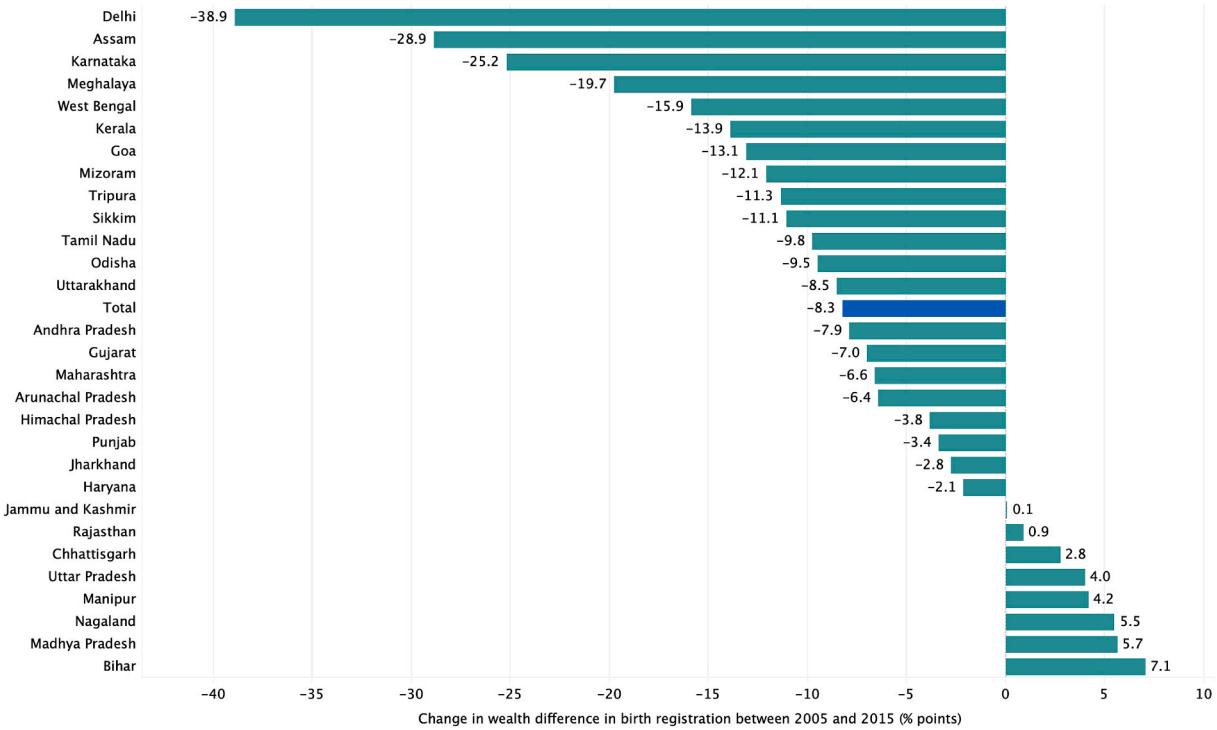

Fig. 4. Changes in wealth inequities in birth registration by state between 2005 and 2015.

with high average coverage had reduced wealth inequities to be less than 5%-points. However, among states where average birth registration coverage was lower than 90%, Arunachal Pradesh had the largest wealth inequality (25.2%-points) followed by Manipur (20.1%-points).

Fig. 4 quantifies the magnitude of the change in wealth inequities in each state. Wealth inequities decreased in 21 states between 2005 and 2015, ranging from 38.9%-points in Delhi to 2.1%-points in Haryana. In 8 states, wealth inequities increased, however the magnitude of increase was smaller and ranged from 0.08%-points in Jammu and Kashmir to 7.1%-points in Bihar. Supplementary Table 2 provides state level data on wealth inequities at each time point as well as changes in inequities.

3.5. *Within and between-state variation in birth registration*

Table 1 shows VPCs for unadjusted and adjusted random intercept models. In the fully adjusted model (Model 3), a larger proportion of the variation in birth registration was attributable to states than to communities at both time points. The between-state variation in birth registration decreased over time from 35.7% to 29.4% for states, and the between-community variation from 15.0% to 13.7%.

In Model 4 (Supplementary Table 1), the relationship between wealth and birth registration was allowed to vary by state. In 2005, the between-state variation was larger among children in the poorest two wealth quintiles (2.62) compared to children in quintiles 3–5 (2.25). However, in 2015, between state-variation was smaller among children in the poorest two wealth quintiles (1.43) compared to children in quintiles 3–5 (1.91). Between 2005 and 2015, there was a large decrease in the between-state variation for children in the poorest wealth quintiles. Sensitivity analyses showed that including household as a level did not change the variance partitioning, and in a four-level model which included districts using the 2015 data, the between-district variation was 4.4%.

4. Discussion

We draw on nationally representative data from 2005 and 2015 to show that India achieved a large on-average improvement in birth registration at the national level and in every state. However, we also show that these improvements were slowest for children living in the poorest households: by 2015, children in the poorest wealth quintile still did not have the level of coverage children in the wealthiest quintile had ten years prior in 2005. Although wealth inequities declined in 21 out of the 29 states included in this study, the wealth gap increased in 8 states. These findings are consistent with existing research on birth registration

Table 1
Variation in birth registration attributable to states and communities in India (2005 and 2015).

Level	Model 0		Model 1		Model 2		Model 3	
	2005	2015	2005	2015	2005	2015	2005	2015
State								
Var (SE)	2.76 (0.73)	2.10 (0.56)	2.77 (0.73)	2.10 (0.56)	2.44 (0.64)	1.78 (0.47)	2.39 (0.63)	1.70 (0.45)
VPC	37.2%	34.7%	37.2%	34.7%	36.2%	30.5%	35.7%	29.4%
Community (PSU)								
Var (SE)	1.37 (0.05)	0.66 (0.01)	1.38 (0.05)	0.66 (0.01)	1.02 (0.04)	0.76 (0.01)	1.00 (0.04)	0.79 (0.02)
VPC	18.5%	10.9%	18.5%	10.9%	15.1%	13.0%	15.0%	13.7%

Model 0 did not include any covariates. Model 1 adjusted for child's age and sex. Model 2 additionally included resident, maternal education, number of children in the household, caste, and religion. Model 3 additionally included wealth.

in India (Mohanty & Gebremedhin, 2018), as well as a larger body of research on child health outcomes in India which demonstrated large variations in outcomes and inequities between and within states (Kim, Mohanty, & Subramanian, 2016; Liu et al., 2019).

We find that Bihar (60.7%) and Uttar Pradesh (60.2%) had the lowest birth registration coverage in 2015, and large wealth gaps remained in 9 states (Uttarakhand, Uttar Pradesh, Rajasthan, Nagaland, Manipur, Madhya Pradesh, Jharkhand, Jammu and Kashmir, Arunachal Pradesh) where birth registration coverage was more then 15%-points lower among children in the poorest two wealth quintiles compared to children in the wealthier three quintiles, with children living in poor households in rural areas at the largest disadvantage. Findings from the multilevel analyses suggest that states play the most important role in birth registration. The use of the VPC can be instructive in understanding the level where program and policy action can be helpful (Kim & Subramanian, 2016) and findings from the multilevel analyses suggest that states play the most important role in birth registration. National and state-level government and other actors responsible for birth registration will have to address these inequities in order to achieve universal birth registration coverage in India. Given that prior work from other LMICs has shown that as average coverage improves the poorest households often do not contribute to improvements in coverage (Victora et al., 2017), efforts to both address existing inequities and prevent widening wealth gaps as average birth registration coverage improves will be particularly important, especially in Bihar and Uttar Pradesh.

However, our findings also show that by 2015 birth registration coverage was above 90% in 13 states indicating that universal birth registration coverage is possible in India and many states have achieved it. The reduction we document in between-state and between-community variation between 2005 and 2015 could be indicative of efforts to improve birth registration, and also driven by the reduction in wealth inequities we document. Reducing variation in birth registration should be a central goal of efforts to address wealth and geographic inequities in access to registration. In addition to closing the wealth gap, particularly in rural areas, addressing inequities in birth registration by religion, caste, and education that other studies have documented (Kumari, 2019; Mohanty & Gebremedhin, 2018) will also be crucial in ensuring historically marginalized populations are not denied their right to birth registration and excluded from on-average improvements in birth registration.

This study has several limitations. We conduct cross sectional analyses at two time points and therefore the associations we present are not causal. Although both surveys are nationally representative, the 2005 survey also has a substantially smaller sample size which may lead to less precise estimates. The DHS survey only includes children inside households and it is likely that we under-estimate birth registration. Furthermore, the definition of birth registration includes children who were registered without a birth certificate, and there is often discordance between the rate of birth registration and the issuance of birth certificates (UN Committee on the Rights of the Child (CRC), 2014). There are also limitations to the data that affect our analysis. First, although district is an important administrative unit, the 2005 survey does not include districts. However, our sensitivity analyses of the 2015 data show that when districts were included in multilevel models they only accounted for a small proportion of the variation. Second, there is no data on the date of registration, making it challenging to understand when, between birth and age five registration occurred, and no variables which capture reasons for non-registration. Third, the wealth quintiles may not be directly comparable between time points.

Future research should examine links between inequities in access to birth certificates and state-level policies in birth registration. Studies that uncover the role of access, cost, awareness and other barriers to birth registration, especially among rural and marginalized communities will be particularly instructive and should inform efforts to improve birth registration. Research comparing birth registration coverage from national surveys to surveillance sites, and to estimates published by the Registrar General of India could also inform efforts to improve civil registration systems. Lessons from states that have achieved universal birth registration could be valuable, and further research should specifically examine how these states addressed wealth inequities.

Our findings have several implications. First, we show that gaps that remain in birth registration coverage in India and using vital statistics data for monitoring, policy, or planning in many states and at the national level is not possible (Phillips, Adair, & Lopez, 2018). India had the largest number of under-5 deaths of all countries in 2015 and a recent study concluded that ten states in India must accelerate progress in order to meet the SDG for neonatal mortality: CRVS systems can play an important role in monitoring changes in infant mortality and we show civil registration still excludes poor and rural children in many states. Secondly, we identify states in India where resources and action to improve birth registration are particularly urgent. Efforts to improve birth registration for the poorest children in these states is essential to improve national birth registration coverage in India, which will also drive regional and global improvements in health data: the most notable change in global birth registration completeness occurred in 2011, when India began to publicly report its data (Phillips et al., 2018). Recommendations to improve birth registration include: mobile registration, particularly in rural areas, removing fees, increasing registration points and improving the infrastructure for registration, promoting awareness of the importance of birth registration among parents and relevant authorities on the rights and entitlements derived from the registration, linking birth registration to government schemes and Aadhaar registration, digitizing birth registration and monitoring the quality of CRVS systems to guide improvements (Kumar, Dandona, & Dandona, 2019; Suthar et al., 2019; UN Committee on the Rights of the Child (CRC) (2014); World Bank, 2016a).

5. Conclusions

Measuring wealth inequities is an essential step in monitoring progress made to close wealth gaps and ensure the poorest children benefit from improvements in birth registration. For India to achieve universal birth registration, efforts to improve birth registration in Bihar and Uttar Pradesh will be essential as will efforts to address wealth inequities within states.

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Ethical approval

We utilized secondary datasets for this analysis which were de-identified and available on the DHS website. The London School of Hygiene and Tropical Medicine Ethics Committee approved this study (Ref: 21274).

CRediT authorship contribution statement

Amiya Bhatia: Conceptualization, conceptualized and designed the study. Formal analysis, Writing - original draft, led the analysis and writing of the first draft of the manuscript. All authors approved the final submission of the study. **Rockli Kim:** Data curation, contributed to interpretation of data and provided critical revisions. All authors approved the final submission of the study. **S.V. Subramanian:**

Conceptualization, conceptualized and designed the study, Data curation, contributed to interpretation of data and provided critical revisions, Supervision, provided overall supervision to the study. All authors approved the final submission of the study.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2021.100728.

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