COMPLETENESS OF BIRTH AND DEATH REGISTRATION IN INDIA: A MIXED METHOD EVALUATION

Submitted by

Krishna Kumar

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Centre for the Study of Regional Development

School of Social Sciences

New Delhi-110067

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RECOMMENDATION FORM FOR EVALUATION BY THE EXAMINER/S

CERTIFICATE

This is to certify that the dissertation/thesis titled **COMPLETENESS OF BIRTH AND DEATH REGISTRATION IN INDIA: A MIXED METHOD EVALUATION** submitted by Mr. **KRISHNA KUMAR** in partial fulfillment of the requirements for award of degree of M.Phil. of Jawaharlal Nehru University, New Delhi, has not been previously submitted in part or in full for any other degree of this university or any other university/institution.

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Nandita Saikia

Signature of Supervisor
(Dr. Nandita Saikia)

Date: 25.01.2021

Signature of Chairperson
(Prof. Milap Punia)

Date: 27.1.21

Chairperson
Centre for the Study of Reg. Dev.
School of Social Sciences
Jawaharlal Nehru University
New Delhi - 110067

DEDICATION

This dissertation is dedicated to my mother for believing in me and providing all possible support.

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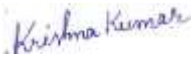

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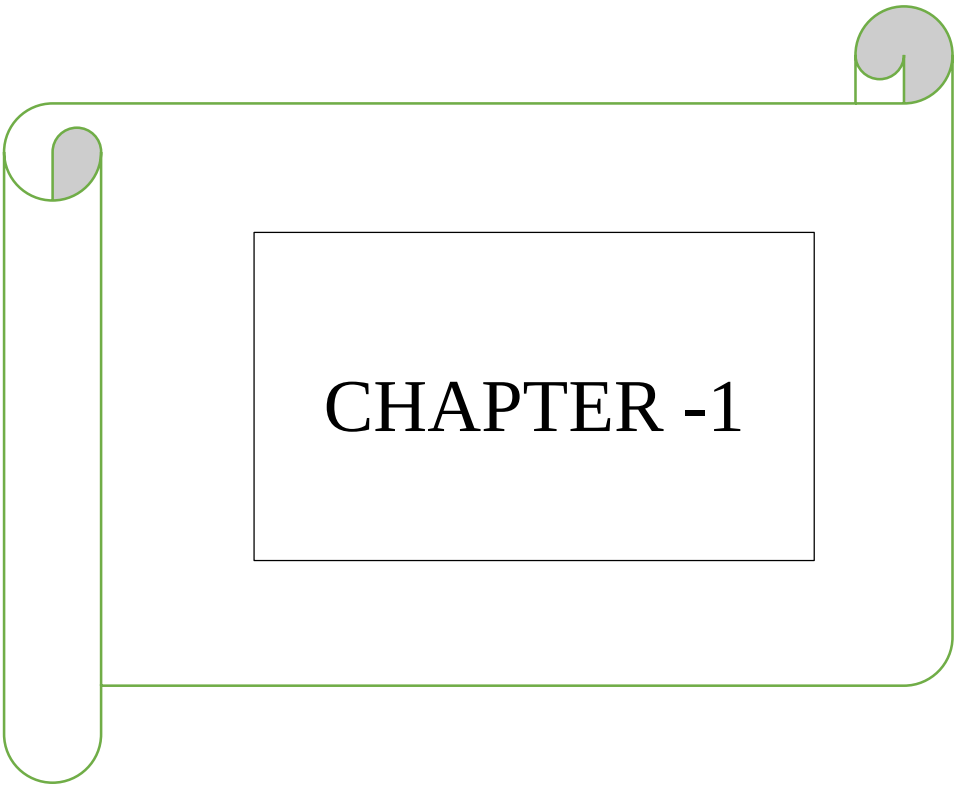
List of Abbreviation

- AHS- Annual Health Survey
- CDR- Crude Death Rate
- CRS- Civil Registration System
- CRVS- Civil Registration Vital Statistics
- DDM- Death Distribution Method
- GIS- Graphic Information System
- HMN- Health Metrics Network
- ICC- Intra Class Correlation
- IMR- Infant Mortality Rate
- IT- Information Technology
- NHM- National Health Mission
- NHM- National Health Mission
- ORGI- Office of Registrar General of India
- RBD- Registration of Birth and Death
- SDGs- Sustainable Development Goals
- SRS- Sample Registration System
- UN- United Nations
- UNICEF- United Nations Children`s Fund
- NFHS- National Family Health Survey
- VIF- Variance Inflation Factor
- AIC- Akaike Information Criteria
- BSO- Block Statistical Officer
- FGD- Focus Group Discussion
- KII- Key Informant Interview


CHAPTER -1

I Introduction

1.1 Background of the Study

Civil Registration System (CRS) is a permanent, continuous, compulsory, and universal recording of vital events with the legal requirements (UNICEF, 2013). “The vital rates generated through CRS are exact and real data certified by registering authority and therefore, legally acceptable” (ORGI, 2018). Vital statistics generated from CRS are not only a legal record but also have many utilities in administration and socioeconomic development. Besides, the administrative usefulness of this data, CRVS is mainly used by health officials and policymakers to track fertility, mortality, and epidemiological patterns in the population. UN documented, “a well-designed and well-maintained CRS remains the best source of information on vital events for administrative, demographic, and epidemiological purposes” (United Nations, 2014). A well maintained civil registration and vital statistics (CRVS) is essential to frame and monitor health policies, and monitoring progress towards SDGs (Handley, 2015).

A birth certificate is an official record that documents a child`s birth. It is issued by the registration offices. It is “the legal proof of one`s place of birth and family ties” (UNICEF, 2019). Registered legal status provides a child access to government provided health care, education and social security (Abouzahr et al., 2007; Hill et al., 2007; Duryea et al., 2006; Setel et al., 2007). Besides, birth registration provides legal protection against unlawful practice of child labour and trafficking (United Nations, 2013; Larsen et al., 2013). The unregistered children cannot prove their legal identity before the law; consequently, their overall development in society get negatively affected (UNICEF, 2002). Moreover, complete and up to date birth statistics enable a government to provide essential services for the vulnerable section of the society and monitor health indicators such as infant and under-five mortality. United Nations brought birth registration on the international platform with a dedicated target under Goal 16: "the aim of providing legal identity for all including birth registration, by 2030" (United Nations, 2015). Death registration is required for the removal of individuals from the population register and identification system. The identification system is used to update electoral records and providing resources and services (Abouzahr et al., 2015).

Besides, obtaining a birth certificate is difficult in parts of South Asia. According to the latest UNICEF`s report, about 77 million children under age five do not have a birth

certificate in South Asia (UNICEF, 2019). Besides, there is considerable disparity among countries in terms of birth registration. The developed countries like United States, United Kingdom, Australia, and Germany, etc. recorded 100 per cent birth and issued birth certificates to all registered children under age five years (World Bank, 2018).

Moreover, many countries lack a functional registration system that provides information on the required vital statistics for calculating demographic and health indicators (William, 2014). A study documented, half of the global deaths are unregistered due to the inadequate performance of the system (Abouzahr et al., 2015). Previous studies also highlighted that people do not report death until they don't see the benefits of the death certificate. Also, there is no strict surveillance of death by local registrars or health workers (Kumar et al.,2019; Oung et al., 2019; Zeng et al., 2020). The national or international partners made little effort into an assessment of the efficiency of the system and the quality of the data on health of the population (Mahapatra et al., 2007). Previous studies are based on the indirect method of estimation of completeness of deaths and had many limitations (Gupta et al., 2016; Yadav, 2014; Kumar et al., 2019). Indirect demographic methods for estimating completeness have limitation, mainly on account of the incomparable assumptions associated with individual methods (Murray et al., 2010; Adair & Lopez, 2018).

India`s CRS, which has been in effect for a century and the system are well established across length and breadth of India. After the enactment of the Registration of Births and Deaths (RBD) Act, 1969, recording of vital events and, compilation and dissemination of vital statistics throughout the country has become uniform and systematic. Despite the noticeable improvement in coverage and accuracy in the last five decades, this system lacks many counts. However, there is much scope for improvement in terms of promptness, completeness and accuracy. Lower completeness of vital registration with inaccurate data is mostly observed in developing countries (Murray et al., 2010). In India, the Registration of Births and Deaths (RBD) Act mandates registration of all births and deaths within 21 days of the event (ORGI, 2020). Despite the provision of mandatory registration, nearly 20 per cent of children under age five years were not registered, and only 38 per cent of registered children do not have birth certificates (NFHS, 2017). Also, there have been colossal disparity at the state level in terms of coverage and access to birth registration in India (ORGI, 2020). However, there has been considerable improvement in the level of birth

registration from 76% in 2008 to 89% in 2018 (ORGI, 2020). Besides, the completeness of death registration has increased from 66.4% in 2008 to 86% in 2018 (ORGI, 2020).

Accuracy of the vital statistics depends highly on the completeness and timeliness of registered events (ORGI, 2020). Recent studies also advocated for the quality assessment of the CRS (Gupta et al., 2016; Kumar et al., 2019; Oung et al., 2019; James et al., 2013). A study documented that there is an urgent need for focused effort in the assessment of quality of CRVS (Kumar et al., 2019). Therefore, this study examines the under-reporting and over-reporting of vital events in the CRS. Besides, there is a lack of peer-reviewed literature investigating predictors of birth registration in India where about 23 million (United Nations, 2019) of children under age five are not officially recorded. This study also investigates demographic, socioeconomic, and health care predictors associated with birth registration in the districts where registration coverage is lower than the national average. There are some previous efforts to examine the completeness of birth and death registration (Kumar et al., 2019; Gupta et al., 2016; James et al., 2013). Still, an exploratory or qualitative study investigating the context is missing. Previous studies clearly emphasised a need for an exploratory study at a lower administrative level or a specific area where coverage is inadequate (James et al., 2013; Oung et al., 2019). As of our knowledge, there are limited research on this subject, and previous literature focused on the need and benefits associated with the functional registration system. This study also aims to investigate the performance barriers of CRS in Bihar.

1.2 Literature Review

1.2.1 Civil Registration System

Civil Registration System conducts permanent, compulsory, continuous, and universal recording of the vital events with the legal requirements (ORGI, 2020). A study by Mahapatra et al. documented vital statistics based on CRS is the best source of data for continuous monitoring of public health programmes (Mahapatra et al., 2007). Another study by Abouzahr et al. 2015 stated that "universal and functional CRVS systems play a crucial role in the achievement of inclusive, equitable, people-centred development, and prevention of statelessness, improvement of humanitarian planning, and aiding of response to disasters" (Abouzahr et al., 2015). Moreover, a study highlighted countries that showed considerable development towards universal health coverage, indicated the importance of a functioning registration system (Tangcharoensathien et al., 2014). Despite the essential role of CRVS in developing healthcare facilities, the registration system is among lower priority by governments, donors and health agencies. However, the United Nations seek information on vital statistics from the countries anually. Results are also published yearly in the UN Demographic Yearbook. Thus, the results present a partial picture of the quality of vital statistics of different countries (United Nations, 2007).

According to the latest ORGI report (2020), vital statistics based on CRS is the best source on vital events at all administrative levels. Moreover, these data are accurate and real-time data which is verified by the registration authority, therefore, legally acceptable. CRVS systems are not only provide a legal document and social security to individuals but also generate crucial data for socioeconomic and healthcare planning (WHO, 2012). However, decades of negligence of the CRVS system in many countries has resulted in no recording of nearly half of global deaths (Abouzahr et al., 2015). According to UNICEF, 166 million children under age five don't officially exist (UNICEF, 2019). HMN documented reasons for incomplete vital registration data could be lack of a fair process of notification of vital events to the CRVS system, higher cost and lack of incentives, an inadequate legal framework and inadequate coordination among multiple partners to facilitate data transfer and compilation (Health Metrics Network, 2013). Moreover, ORGI undertook a comprehensive review of the statistical functions of the CRS in 1999 and revamped the systems, and provided fresh guidelines to the states and UT. The fresh guidelines were

adopted by most of states and UT by January, 2000 (ORGI, 2012). A study by Gupta et al. documented CRS lacks on many quality parameters such as timeliness, accuracy and completeness (Gupta et al., 2016). A recent study based on Myanmar registration system showed reliable and pivotal steps through a mixed-method approach (Oung et al., 2019).

India`s civil registration system is one of the oldest registration system and well established across the length and breadth of the country. In a research article, Padmanabha P documented that there is much scope of improvement in the registration system in terms of completeness and quality (Padmanabha, 1984). However, this study published long years back, and there has been considerable improvement in the level of registration of birth and death in CRS (ORGI, 2020). Recent estimates published by ORGI showed high variability across states in terms of completeness of birth and death (ORGI, 2020). Lack of skilled staff, irregular training and unawareness among people towards registration was most highlighted reasons for poor registration (ORGI, 2020). A previous study explored the barriers of civil registration on administrative, technical capacities and societal perspective, and suggested for a comprehensive assessment of the CRS in Myanmar (Oung et al., 2019).
In India, previous studies are either based on the use of CRS data for policymaking or trend in the level of registration over the years. Moreover, the previous studies are limited to quantitative method. As highlighted in studies from Myanmar, China, South Africa, future research investigating obstacles preventing specific communities from registering births could be encouraged (Oung et al, 2019, Li S, 2010; Nannan et al., 2012). NFHS (2017) report mentioned few predictors for low birth registration; however, those estimates are very crude and could not sufficient for Government official for designing intervention at the operational level of the registration system.

In 2007, a study highlighted that the due to negligence of the system, poorest and other vulnerable people remain uncounted in official register (Setel et al., 2007). Another study by Abouzahr et al. documented that low investment was the single most cause for not considerable improvement in the system over the past 30 years (Abouzahr et al., 2015). Most countries mandate registration of birth and death, however, related law are poorly implemented. A study showed the performance of CRVS depends on the extent to which individuals and families support in registration process. Many times, people were not aware of registration processes, and benefits associated with it. Besides, registration facilities might be inaccessible due to physical, economic, or societal challenges. However, a study

showed trend data suggest small improvements in terms of quality of birth and death registration, but overall development is disappointing and slow (UNICEF, 2013).

1.2.2 Birth Registration

UNICEF defines birth registration as the official recording of the occurrence and characteristics of birth by the civil registrar within the civil registry, following legal requirements of a country (UNICEF, 2019). Latest available data on the level of registration is provided for most countries at a single platform by the World Bank (World Bank, 2018). Moreover, the DHS survey also asked questions on children's birth registration and provided information for registered or unregistered children by their background characteristics (NFHS, 2017). Despite years of investment and registration practices by government, in a latest report, UNICEF documented that obtaining a birth certificate is especially challenging in parts of Africa and Asia. South Asia is the home to the largest share of children under age five without a birth certificate (UNICEF, 2019). Gupta M et al. (2016) assessed the existing system`s design in India and found the system lacks on many points.

Birth registration provides a legal recognition to a child. UNICEF stated “a child should be registered immediately after birth and shall have the right from birth to a name and right to acquire a nationality” (United Nations, 1990). A birth certificate is an official record that documents a child's birth. It is provided by registration offices after birth registration (UNICEF, 2019). A legal status ensures child accessibility in government aided services such as healthcare, education and legal protection. Also, a birth certificate facilitates long term protection for formal employment and land ownership (Abouzahr et al.,2007; Hill et al.,2007; Duryea et al., 2006; Setel et al., 2007). Despite much importance of birth certificate, the largest share of children under age five years without a birth certificate was observed in South Asian countries (UNICEF, 2019). Also, UNICEF`s report showed about 77 million children under age five do not have a birth certificate in South Asia. In India, nearly two-fifth children under age five don't have a birth certificate (NFHS, 2017). A study advocated for effective awareness program for government staffs and citizens. Besides, modification of unreasonable documents and deadlines, and coordination between different departments for improvement in the registration level was suggested (Li S et al., 2010).

Over time there have been many studies on the importance of effective civil registration system, but previous studies lack on many points. A study by Plan International in 2014 investigated how children`s right is associated with birth registration and role of vital statistics in good governance. This study was limited to only two states (UP and Maharashtra) of India. The study was also based on a small sample size; therefore, it failed to provide a generalise and robust findings applicable to the whole country. In his recent report, which was based on 174 countries, UNICEF documented the importance of birth registration, and vital statistics is pivotal in policymaking (UNICEF, 2019).

Predictors for birth registration is still not widely explored, and a previous study is based on a small sample and not much representative. Jackson et al. (2014) showed use of perinatal services increased likelihood for birth registration. However, this study was based on two provinces and surveyed only 389 households. But, the two provinces represented many of Indonesia`s poor and rural characteristics, so careful interpretations of results for a similar population can be done. Another study by Duff et al. (2016) conducted in three provinces of Indonesia which included a sample of 1067 children and results were only based on difficulties faced at an operational level such as distance, complicate process and waiting until a child goes to school. However, it did not include health and socioeconomic covariates, therefore, limited in many dimensions. DHS report, which is more representative for any country and mostly preferred by policymakers showed mother`s utilisation of health services during pregnancy increases the likelihood for children`s birth registration (NFHS, 2017).

A study by Isara & Atimati (2015) found that one-third of the parent who registered their children did not know that birth certificate should be obtained following birth registration. Moreover, this study showed that the mother`s age, level of education, marital status, occupation and place of delivery are significantly associated with the mother`s birth registration practice. This study can’t be generalised due to its small sample size (n=290) and surveyed only in Nigeria's urban community. In its recent report, UNICEF found similar findings, but that was based on analysis of data from 174 countries and presented robust and reliable findings (UNICEF, 2019).

1.2.3 Death Registration

Abuzahar et al. (2015) documented death registration is required for the removal of individuals from the population register and identification system. The identification system is used to update electoral records and providing resources and services. Moreover, mortality data by age and sex is used in calculation of life tables and death rates, categorised by age and sex. Besides, these data are essential for studying pattern of diseases. Oung et al. (2019) showed that reliable and up to date mortality statistics are important for policy formulations, adequate interventions and allocation of health care resources to improve health facilities. The study also highlighted reasons for under-registration of deaths: administrative challenges, poor technical capacities and unawareness among people. However, this study explored the barriers experienced at the operational stage but not at the overall functioning of the system. Besides, this study was based on only two townships of Myanmar (Oung et al., 2019).

CRS could be an important source of mortality at a national and lower administrative level, given its broader coverage and quality of data. A functional registration system could provide detailed, timely and reliable data on mortality (Gupta et al., 2016). Mortality statistics generated through CRS are essential for identifying health risks and evaluating health programmes. However, there are many limitations associated with the system particularly accuracy and cause of death data. A previous study identified incomplete registration as a problem in civil registration assessments in India (James et al. 2013).

Queiroz et al. (2017) used death distribution method for estimating completeness of deaths. The study showed there was a considerable increase in completeness of death count in Brazil since 1980. Moreover, it showed that a higher differential exists between the probability of death among males and females. However, the death distribution method has some limitations. Policymakers should use the model judiciously especially in case of small area estimation particularly, when migration rate is higher (Murray et al., 2010). Hill et al. (2017) documented that the DDM methods is much sensitive towards the assumptions and any violation of the assumptions may give incorrect results. However, Yadav A (2014) used Bennett and Horiuchi technique for indirect estimation. He showed a robust methodology for estimating the completeness of death.

Another method for the estimation of death is the capture-recapture method. It involves the matching of two independent data sources such as census and survey where good quality data are found. Since, this method is less dependent on assumptions, therefore, it may provide more accurate results. However, this method required independent data sources, same geographical boundaries and definition of the place of resident. Besides, this method is limited to time required, cost and complexity (Rao et al., 2010). A study documented existing methods for estimating death registration suffer from many problems. The authors stated, "current suits of methods to estimate the completeness of registration are confusing, complicated and unsuitable to their broad applicability by national and subnational governments" (Adair & Lopez, 2018).

Gupta et al. showed the trend for completeness of death registration from 1999 to 2011 in India. But these estimates are relatively crude as variations arising from a sampling design, sampling errors or differences due to sex and age were not counted. An indirect method for estimation of completeness of death was also used in previous studies, but it was based on a particular assumption which may not fit in all available data (Gupta et al., 2015; Yadav A, 2014). To overcome the above mentioned problem, Adair & Lopez proposed an empirical method to estimate the completeness of death registration. The model includes only three indicators and predicts accurate estimates (Adair & Lopez, 2018).

A study by Ram et al. (2013), estimated neonatal, 1-59 months, and overall under-5 mortalities by sex for 597 Indian districts. This study took data from different sources such as SRS, DLHS2, DLHS3, NFHS3, SRS mortality data (1998-2003), the first phase of the Million Death study (2001-03) and sex-specific birth and death totals for India, provided by UN. However, this study presented crude analysis, and several possible sources of error need to be considered. Moreover, survey data may not provide true death rates at district level (Ram et al., 2013). A study documented it is difficult to measure the causal factors and some intermediate determinants of disease in the absence of robust data (Awasthi et al., 2013). To overcome the above problems, investment in CRS is the best option for complete, reliable and real-time data as documented by ORGI (ORGI, 2020). Moreover, Abouzahr et al. (2015) documented CRVS system could provide accurate and reliable data on deaths at lower administrative level for policymakers and health officials.

In many countries, more births are registered than deaths. There are more direct and immediate benefits associated with birth registration as compared with death registration (Mahapatra,

2007). In 2009, the UN documented linking of death registration with mortuaries and institutions which issue burial or funeral permits could increase registration. For example, in Egypt, a law for mandatory burial permits resulted in completed death registration. Another study by Szwarcwald et al. (2013) showed that strict implementation of registration law is crucial in many countries. A large number of deaths are remained uncounted due to improper supervision and unavailability of licensed cemeteries.

A previous study showed that the main causes for lower death registration were a lack of awareness and no immediate incentives associated with death registration. Besides, there was no legal or administrative purposes associated with registration of children or infant deaths, therefore, people felt death registration is not necessary. Moreover, it is reasonable for people to ignore reporting for infant deaths whose births were not registered (Rao and Gupta et al., 2020). A study documented CRS cannot provide reliable data on infant deaths (Prasartkul & Vapattanawong et al., 2006).

In 2014, WHO documented that nearly two-thirds of deaths were not registered. Also, majority of WHO member obtain little or no data on mortality and cause of death. Besides, these data are not reliable and have less utilities for policy making (WHO, 2014). Another study showed that even when most deaths are registered, it can be challenging to ensure cause of death with certainty. This study also documented that due to inadequate skills among physicians, there is compromise with the accurate medical certification of cause of deaths (Nojilna et al., 2009; Rampatige et al., 2013). A study stated verbal autopsy can be a good alternative method to identify causes of death. However, there is huge challenges when adopted for large population (Lopez et al., 2011).

1.2.4 Issues of Data Quality

The importance of reliable and comparable death statistics in the measurement and improvement of population health is widely documented (Mathers et al., 2005). Joubert et al. (2007) showed an assessment of mortality data of South Africa. They evaluated “the quality of civil registration mortality data using 9 criteria: coverage, completeness, epidemiological consistency, temporal consistency, content validity, use of ill-defined and non-specific codes, use of age and sex improbable classification, timeliness and availability of sub-national data”. This study showed that mortality data are satisfactory for coverage and completeness.

However, results are not appreciable for epidemiological consistency and content validity. Besides, this study has limitations such as estimates are based on the indirect method of estimation and generated biased result for distribution of death by the province as data was captured by place of occurrence, not by place of usual residence. Another study documented periodic evaluation of mortality statistics by a responsible agency is important to find biasness of data due to local factors and further corrections (Mahapatra, 2007).

UNICEF (2019) documented data is incomplete and not reliable in most of developing countries. Moreover, studies confirmed there are challenges in all regions of the world, many countries have not produced death data whereas some countries generated low quality data. Besides, most countries do not have functional registration system which could identify the problem with data and suggest ways for further improvement for effective decision making. Periodical assessment of the data generated from the CRS should be done by responsible authorities (Mahapatra & Rao, 2001; Rao et al., 2005; Hill et al., 2007). A comprehensive study on vital statistics that focuses on data quality and control of CRVS is also suggested in previous literature (Padmanabha, 1984; Li et al., 2010; Gupta et al., 2016, Adair & Lopez, 2018; Oung et al., 2019).

James KS et al. conducted a preliminary assessment of CRS's quality for Kerala, Odisha and Rajasthan. They compared the CRS data with other important data sources such as Census, SRS and Annual Health Survey (AHS) data. The study suggested for adjustment in the crude death rate and the crude death rate for females under registered (James et al., 2013). Moreover, this study documented an excellent explanation for the variation of rates at the district level and suggested many points for further improvement in the system. This study also indicated that exploratory research in some selected locations and methodology for such study is required to developed. However, comparison with census estimates and AHS are subjected to limitation, as under-reporting of birth aged 0-6 years in the census and sampling errors in AHS are widely discussed. Besides, AHS estimates are not available for Kerala. Recent NFHS report could provide a reliable estimate of birth and death rate, and easily comparable with CRS data at the state and district levels. A large sample size of NFHS further ensures a robust estimate (NFHS, 2017).

Prasarkul & Vapattanawong (2006) attempted to assess the quality of mortality data from the civil registration system of Thailand. The quality of data was evaluated using completeness of the death registration. Deaths recorded in the annual censuses were compared with registered deaths by CRS. Then, the names of the deceased person were matched using the two data sources to find the level of under-registration. This study showed 12.5% of total deaths were not registered, and the percentage completeness of male deaths was slightly higher than that of females. Besides, the highest percentage of unregistered death was found among the young age group. However, this study is limited to a small sample size (1124) and based on only one province of Thailand. Therefore, results are limited to generalisation in all administrative areas (Prasarkul & Vapattanawong, 2006).

Fellegi (1995) stated that sound statistical system is characterised by capacity to produce reliable information for the users. The assessments of the quality of vital statistics are done previously, but the studies included a few criteria such as the completeness of registration (United Nations, 2003, Gaeta Darbo et al., 1964). Mahapatra et al. also showed little effort has been put by global partners in improving the quality of vital statistics (Mahapatra et al., 2007). Moreover, a review study showed that little improvement is observed in the quality of reporting of vital events (United Nations, 2006). Previous studies also documented countries need to assess the CRVS periodically. Such assessments are useful for observing structural weaknesses of the system. Besides, these assessments suggest correction and further improvement in quality of vital statistics (Hill et al., 2007; Yang et al., 2005).

A recent study by Verma et al. showed completeness of death under CRS. This study used Bennet Horiuchi method for estimating the completeness of death in India and the selected states. The study found completeness of death registration was lowest in Bihar (15.3%) and highest in Haryana (95.8). Also, the level of death registration was 45% at the national level during 2001-2010. This study also found gaps between actual death and registered death by the CRS. However, this study used an indirect estimation method based on certain assumptions (Verma et al., 2017). Another study by Zeng et al. showed completeness of death registration using empirical completeness method which provided a reliable estimate of completeness of death. This study also did sensitivity analysis to present a robust estimate and found that the method is accurate and valid for estimating the completeness of death at the sub-national level (Zeng et al., 2018).

1.3 Rationale and scope of the study

As we aim to realise the vision of birth registration for all under Sustainable Development Goals (SDGs), India needs accurate vital statistics at the national, state, district and sub-district levels. CRS is the only data source which provides vital statistics at a lower administrative level. These vital statistics are recorded on a real-time basis and has legal and policy utilities. Civil Registration System (CRS) has been functioning for 100 years and well established across length and breadth of India. However, it lacks many aspects such as completeness, coverage, timeliness and reliability.

Further, the RBD act in 1969, has brought uniformity in the system and mandates registration of all births and deaths (ORGI, 2012). Besides, previous studies showed impressive improvement in coverage and completeness of birth registration in most states after the National Health Mission (NHM) launch in 2005. However, focused states such as Bihar, Uttar Pradesh, Jharkhand etc. have not shown much improvement in birth and death registration in the last 15 years (ORGI, 2020). Previous studies also suggested for exploratory research in some selected locations of poor-performing states (James at al., 2013; Plan, 2014; Gupta et al., 2016; Kumar et al., 2018). Besides, as per our knowledge, there is limited peer-reviewed literature on socioeconomic predictors of birth registration of children, and there is no such study published in India in recent years. Previous studies showed only trends and completeness of deaths registration at the sub-national level in India (Gupta et al., 2016; Kumar et al., 2019). A study at the district level will be attempted using a large scale dataset to identify significant covariates of birth registration among children under age five. We also examine the under-reporting or over-reporting of CRS. This study aims an assessment of the completeness of vital statistics at the state and district levels.

Furthermore, there has been no assessment of the quality of CRVS in recent years. In 1999, ORGI conducted a comprehensive review of statistical functions of CRS, and after that, no evaluation is performed at a national and sub-national level. However, a study attempted to assess the quality of the CRS, but it was limited to three states, and results can`t be generalised at a national level (James et al., 2013). Further, as per our knowledge, no exploratory study was conducted in India in recent years, this study attempts to fill the gaps in the existing literature. Therefore, we propose an exploratory study on the performance barriers of Civil Registration System in Bihar. This study could also be useful in improving the level of registration of birth and death and designing a targeted intervention to reduce infant deaths and premature deaths.

1.4 Research Questions

1.4.1 Objective 1

- Is age and sex of children affect his/her birth registration?
- Is the mother`s age, education level and occupation associated with birth registration of their children?
- Is religion or caste of a child affect his/her birth registration?
- Is the wealth status of the household of a child affect his/her birth registration?
- Is the father`s education level and occupation associated with birth registration of their children?
- Is the utilisation of health care facilities such as antenatal care or institutional delivery associated with higher birth registration of children?

1.4.2 Objective 2

- Is CRVS accurate and comparable to other reliable data sources?
- Is there any variation across states and districts of India in terms of completeness of birth and death registration?
- What is the completeness of birth registration at national, state and district levels?
- What is the completeness of infant death registration at national, state and district levels?
- What is the completeness of all age death at the national and state level?
- Are estimates of completeness of birth and death provided by ORGI reliable?
- Does the trend of completeness of birth and death registration show consistent improvement over the years.

1.4.3 Objective 3

- Are registrars well aware of registration procedures and protocols?
- Is there any training provided to registrars or other related staffs on online registration?
- What are the challenges faced by staffs in the smooth functioning of CRS?
- Is there regular monitoring or specific inspection done by district or state level officers?
- Are people aware of registration procedures and their benefits?
- Is awareness on benefits of registration of births and deaths communicated to people?
- Are there any local customs or traditions behind the late registration of children?
- Is there any problem faced by people during the registration process?
- What can be done for further improvement in the CRS?

1.5 Research hypothesis

- H01: Socioeconomic and health factors are not associated with birth registration of children.
- H02: Completeness of birth and death registration do not vary across the states and districts of India.
- H03: There is no consistent improvement in completeness of birth and death registration.
- H04: People are not aware of the benefits of birth and death registration.
- H05: There is no administrative problem in the registration of birth and death.

1.6 Objectives

1. To investigate the predictors of birth registration in India
2. Under-reporting and over-reporting of vital events (birth and death statistics) in the Civil Registration System in India
3. An explorative study on the performance barriers of Civil Registration System in Bihar

1.7 The organisation of the dissertation

This dissertation contains six chapters which are as follows: -

- Chapter 1: Introduction **comprises of the background of the study, review of literature, rationale and scope of the study, research questions, hypothesis, and objectives of the study.**
- Chapter 2: Data and Methodology **give a detailed description of the data sources used, framework and methodology for the study.**
- Chapter 3: To investigate the predictors of birth registration in India **presents demographic and socioeconomic covariates of birth registration and spatial mapping of birth registration across districts of India.**
- Chapter 4: Under-reporting or over-reporting of vital events (birth and death statistics) in the Civil Registration System in India **shows the completeness of birth, infant death and all age death registration and its comparison with ORGI estimates.**
- Chapter 5: An explorative study on the performance barriers of Civil Registration System in Bihar **presents results of an exploratory study on the performance barriers of Civil Registration System in Bihar.**
- Chapter 6: Summary and conclusion **present conclusion, limitation of the study, policy implications and future research scope of the study**

CHAPTER - 2

2 Data and methodology

This section presents data sources and methodology used to fulfil the objectives of this study. We described data and methods for each objective separately and in detail below.

2.1 Objective 1

We used the country`s one of the significant demographic and health databases, known as National Family Health Survey, 2015-16 (NFHS-4). Two stages stratified random sampling approach was adopted in this survey. Primary Sampling Units (PSUs) (villages in rural areas and census enumeration blocks in urban areas) are selected using probability proportional to population size at the first stage. Subsequently, the equal number of households were selected from each PSUs through systematic random sampling. In total, 6,99,686 women and 112122 men were interviewed in this survey. This survey was conducted under the leadership of the Ministry of Health and Family Welfare (MoHFW) and managed by the International Institute of Population Sciences (IIPS), Mumbai.

It provides essential information on household populations, housing characteristics, basic demographic and socioeconomic characteristics of respondents, fertility, family planning, maternal and child health, infant and child mortality, nutrition, morbidity including adult health issues, women empowerment, and domestic violence at the nation, state and district level. Besides, NFHS provides information on the number of dejure children under age five who have been registered by the civil registrar. We included data for the districts (n=258) where the level of birth registration was found lower than the national average (79.3%). In the survey, a question on birth registration was asked as "*Does a child have a birth certificate or has child`s birth ever been registered by the civil authority*" (NFHS, 2017).

A dependent variable birth registered was defined as 1 equals to children under age five who have a birth certificate or ever been registered by the civil authority, otherwise 0.

We considered demographic, socioeconomic and healthcare characteristics to identify factors associated with birth registration of children under age five years. We categorised child age as 0-1,1-2 and 3-4 years, sex (male or female), and birth order as 1,2,3 and 3+. Other demographic and socioeconomic characteristics includes place of residence (urban or rural), parents alive (any one or both), sex of the head of household (male or female), mothers age in years (15-24,

25-34, 35-49), mother`s level of education (illiterate, primary, secondary and higher), religion (Hindus, Muslims or others), caste (SC, ST, OBC and others), wealth (poorest, poorer, middle, richer and richest), mother`s occupation (unemployed, professionals, clericals, sales, services, agriculture and production workers). Besides, we categorised marital status into two categories (currently married or separated/divorced/widow). Also, we defined mother`s exposure to media into three categories (no, partial and full) based on their response on how often they read the newspaper, listen to the radio and watch television.

Moreover, we considered health care facilities utilised by mother such as antenatal care visit (no, at least one), postnatal care within two months of delivery (no, yes), place of delivery (home, public health facility and private health facility) and vaccination received by children (no, partial, full). The categories no, partial and full refers to the child did not receive any vaccine, received few vaccines out of all the recommended vaccines and received all vaccines respectively. Besides, we considered the father`s characteristics such as level of education (illiterate, primary, secondary and higher) and occupation (unemployed, professionals, clericals, sales, services, agriculture and production workers). We also considered district-level factors such as the proportion of people belong to SC, the proportion of children (12-23 months) who received full Immunisation and the proportion of women who delivered birth in an institutional facility. We generated the district-level variable by aggregating individual or household level characteristics to district level. Besides, we calculated the aggregates for the district-level using mean of the proportions of children or mother in each category of a given variable.

We analysed bivariate distribution to examine the association of demographic and socio-economic variables with the birth registration of children. Also, we performed a chi-square test for identifying significance of such associations. We applied multilevel binary logistic regression models with random intercept and fixed slope to calculate beta coefficient (β) at three levels (level 1: Individual; level 2: district; level 3: state) with corresponding standard error (SE) and p-value. Multilevel analysis generates variance at each level, providing the technical advantage of assessing unobserved effects at every level. The application of multilevel modelling was justified by the hierarchical model of the survey. We fitted three models. Firstly, we run first model which includes demographic variables. Then after, we run second model which includes demographic and socioeconomic variables. Finally, we run third model which includes demographic, socioeconomic and district level variables. We used Akaike Information Criteria and log-likelihood for model comparison. Model with lowest

value of AIC and highest values of log-likelihood was considered best fit. Besides, we checked multicollinearity using Variance Inflation Factor (VIF). We found no evidence of collinearity among the included independent variables (mean VIF=1.39). We explained third model in detail as there was similar pattern in all three model. All analysis was performed using R (version 4.0.2). Further, we also mapped the district-wise proportion of registered children using Geographic Information System (GIS).

The mathematical equation of the three-level model is shown below:

$$logit(\pi ijk) = \log(\pi ijk/(1 - \pi ijk\ )$$

$$= \beta 0jk + \beta 1x1ijk + \beta 2x2ijk + \cdots\cdots \beta nxijk + u0jk + v0jk + eijk$$

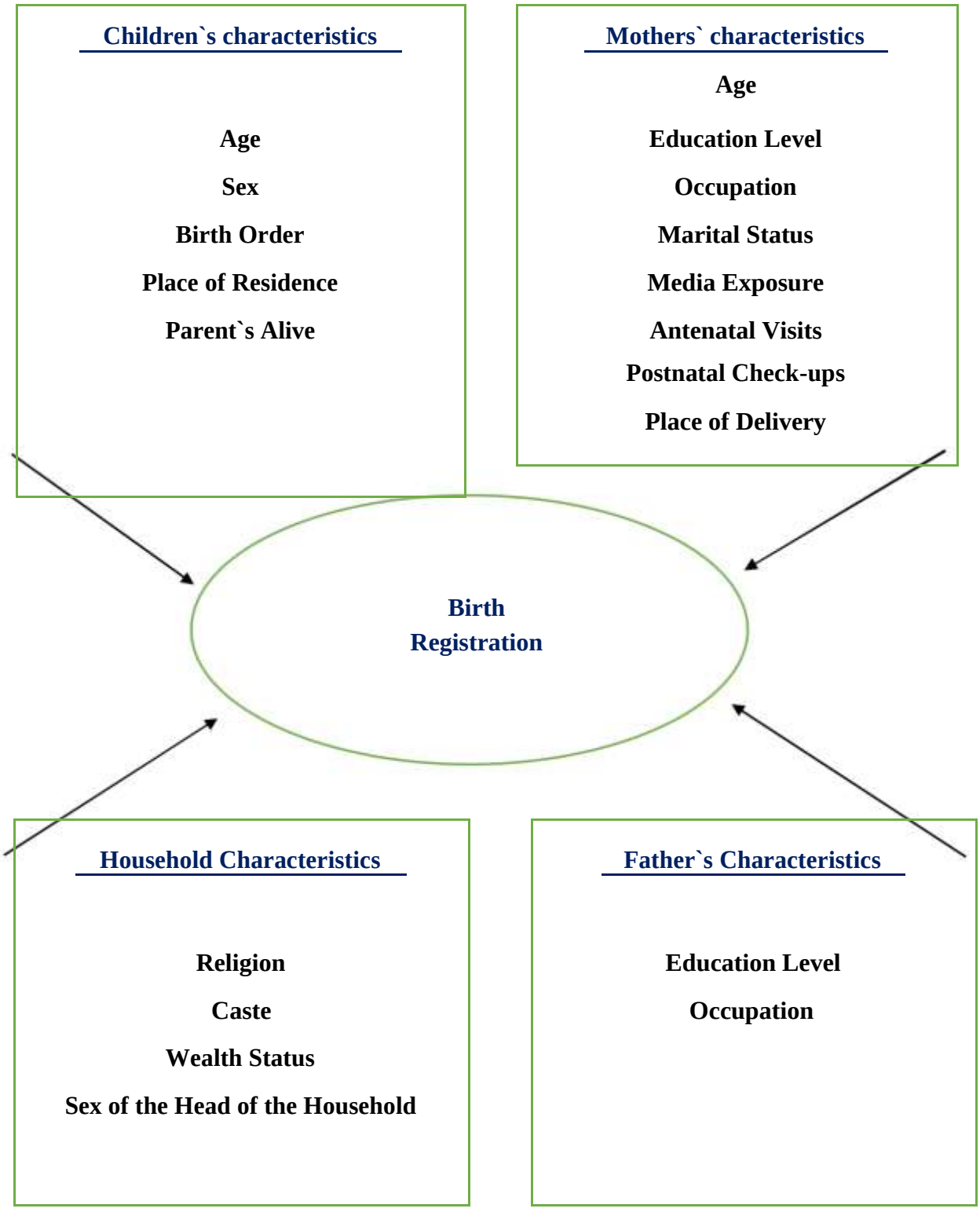
Where πijk=p(Yijk=1) is the probability of individual i in the district j, from state k, registered birth. Yijk would equal to 1 if a child was registered, otherwise 0. The probability is defined as a function of an intercept and the explanatory variables. $\beta 0\text{jk} = \beta 0 + \mu 0\text{jk}$, where $\beta 0jk$ shows that intercept was random at jth (district) and kth (state) levels. The variables $X1ijk\ to\ Xnijk$ were exploratory variables and their corresponding regression coefficients $(\beta 1, \beta 2, \ldots \beta n)$ were fixed effects.

u0jk is the random state effect assumed to be normally distributed with N(0,σu^2)

v0jk is the random district effect assumed to be normally distributed with N(0,σv^2)

eijk is the random errors assumed to be normal with N(0, σe^2) and independent of random effects at level 2 and level 3.

Figure 2-1 Framework shows the association of birth registration of children with socioeconomic, demographic and health care variables



2.2 Objective 2

We used data from the annual report of CRS for the year 2016. ORGI published the annual report on total registered birth, death, infant death and stillbirth at the state and district level. Besides, the level of registration for birth and death was also provided at the state level. Moreover, registered birth and death stratified by age group, sex and place of residence also provided in the report. We also used SRS data from SRS report 2016 for obtaining ASFR and IMR. We showed results of completeness of birth registration and infant death registration by districts of 22 states because SRS did not provide data for the remaining 14 smaller states/UTs.

We followed the following steps for estimating the completeness of birth registration at the district level.

1. First, we estimated the total number of women (15-49 years) for the mid-year 2016 using 2001 and population growth rate, and 2011 as base population.
2. We estimated the total number of birth by five-year age group of women for mid-year 2016 for each state by multiplying SRS 2016 ASFR to the estimated number of women by five-year age group for the mid-year 2016 for the respective state.
3. Further, we estimated the total number of birth by mid-year 2016 by adding the estimated number of births by five-year age group of women.
4. We estimated the number of births in each district by calculating the proportion of birth in the district to the birth in the state using NFHS 4 dataset, multiplying by the estimated total number of births in the state.
5. Finally, we compared the estimated number of births with the registered number of births by CRS for the year 2016 to evaluate the level of under-reporting or over-reporting of birth by CRS. Completeness of birth registration was also calculated as total registered birth divided by total estimated birth, multiplied by 100.

Furthermore, we used the following steps for estimating the completeness of infant death at the district level.

1. First, we estimated the total number of infant deaths for the state by multiplying the estimated number of births in the state to the IMR using SRS report, 2016.

2. Further, we estimated the total number of infant death in the district by multiplying the proportion of infant deaths in the district to the state using NFHS dataset, multiplying by the estimated number of infant death in the district.
3. Finally, we calculated the completeness of infant death registration as total registered infant death divided by estimated total infant death, multiplied by 100.

We also estimated all age completeness of death registration using the empirical model. This model is a function of registered crude death rate, estimates of under-five mortality rate, and the proportion of people aged above 65 years in the study population. The model equations were developed using population and mortality rates from 2541 country years which included 110 countries and the period between 1970 and 2015. We used the second variant of this model as the second variant is recommended for use when death registration completeness at all ages is not expected to be associated with completeness of child mortality registration (Adair & Lopez, 2020).

We estimated the crude death rate (CDR) for each State/UT. We defined CDR as registered number of death in the state/UT divided by estimated mid-year population for the year 2016 calculated using Census 2011 & 2001 population growth rate and Census 2011 population as the base population of the state/UT. We also estimated the proportion of people aged above 65 years for mid-year 2016 using census 2011 and 2001 population growth rate, and 2011 total population and people above 65 years as the base population. The proportion of people aged above 65 years for the mid-year 2016 is calculated as the total number of people aged above 65 years to the total mid-year population in 2016. The under-five mortality rate for all states is estimated using NFHS-4 dataset. Mathematically, the model is written as follows.

$$logit\left(C_{jk}^{All}\right) = \beta_0 + RegCDRsq_{jk} \times \beta_1 + RegCDR_{jk} \times \beta_2 + \%65_{jk} \times \beta_3 + ln(5q0)_{jk} \times \beta_4 + \mathrm{k} \times \beta_5 + e_{jk} + \gamma_j$$

where C_{jk}^{All} is the completeness of registration at all ages, *logit*(C_{jk}^{All}) is $ln\left(\frac{C_{jk}^{All}}{1-C_{jk}^{All}}\right)$, $RegCDR_{jk}$ is the registered crude death rate (CDR), $RegCDRsq_{jk}$ is the *RegCDR* square, $\%65_{jk}$ is the proportion of the people aged above 65 years, $ln(5q0)_{jk}$is the natural log of the under-five mortality rate, *k* is the calendar year, *e* is an error term, γ is a country-level random effect, *j* is country. β_0 is intercept and $\beta_1$to β_5 are the regression coefficients.

Completeness is predicted by using inverse logit formula, given by, $\frac{e^{logit(C_{jk}^{All})}}{e^{logit(C_{jk}^{All})}+1}$.

We included a square of registered CDR to predict completeness more accurately at the lower level of registered CDR. The proportion of people aged above 65 years was also added in the model to capture the impact of population age structure.

Furthermore, we compared the estimated completeness of death with the completeness of death reported by ORGI to check the accuracy of CRVS. Also, we considered estimates of completeness predicted by the empirical model as reference standard given its "robustness and validity demonstrated elsewhere by its high level of concordance with the completeness estimate in the national population" (Adair & Lopez, 2018).

We also used CRS data for completeness of birth and death registration for the period 2001 to 2018. ORGI computed completeness of birth/death as the number of registered birth/death divided by estimated birth/death. Estimated birth/death is calculated by multiplying mid-year population to the SRS crude birth/death rate for the same year.

2.3 Objective 3

We conducted a qualitative study to explore the performance barriers of the Civil Registration System. We conducted a primary survey from February 2020 to March 2020. Figure 2.2 shows the framework of the operation of CRS.

2.3.1 Study design and sample

A sample of 105 individuals belonging to the study area participated in the survey. Out of 38 districts in Bihar, we purposively chose two districts Patna and Vaishali, from which we randomly selected 4 blocks from each district. First, we chose Patna and Vaishali district to understand how registration practices differ in the two different contexts, i.e. highly urbanised Patna (43.1 %) and one of the least urbanised district Vaishali (6.7%). Second, these two districts were chosen due to feasible accessibility, time and financial constraints. Finally, we selected Patna Sadar, Sampatchak, Phulwarisarif and Danapur blocks from Patna district; and Hajipur, Vaishali, Desri and Raghopur from Vaishali district. We selected an Assistant Registrar or Block Statistical Officer, a Medical Officer, a Panchayat Chief or Ward Parsad (local leader) and an Aganwadi Sevika from each block for interviews. We selected key informants based on their position, working experience, availability and their consent for the interview. Also, we selected 8-10 people from each block for Focus Group Discussion. The inclusion criteria for FGD included: any community member aged between 18-65 years, belong to the household where birth or death occurred during the last 5 years and consented for participation.

2.3.2 Data collection

We conducted interviews and group discussion in the study area. Map 2.1 presents the study area. We obtained verbal consent from participants before conducting the interviews or group discussion. We noted all information during interviews with key informants to ensure no essential points are missed. We went to block offices, primary and community health centres, Panchayat chief or Ward Parsad office and Aganwadi centres which were accessible in the selected blocks. Assistant Registrar or Block Statistical Officers, Medicals Officers were invited for the interview. We also visited Panchayat chief or Ward Parsad`s office and Aganwadi centres and invited them to participate. The hierarchy of CRS in Bihar was shown in figure 5.3. Further, we visited household with assistance from a Panchayat Chief or Ward Parsad of the area and invited a household member to participate in FGD. Prior consent was taken before conducting the discussion. Also, we took consent for note-taking and audio recording from all participants. Few community members refused to participate in citing their personal reasons, and therefore, we excluded them from participation. Demographic profile of all participants was presented in Table 2.1.

2.3.3 Methodology

We used a qualitative method to obtain information on the barriers of the registration system. Specifically, this study is based on the narrative research approach, which relies on information given by participants verbally. We used Key Informant Interview (KII) and Focus Group Discussion (FGD) techniques to obtain information on operational barriers in the system, people`s knowledge and attitude towards the Civil Registration System. Question schedules and topic guides were designed using previous literature for KII and FGD (Oung, 2019; Li et al., 2010). We used a semi-structured open-ended questionnaire to capture informants` experiences, stories, ideas, and case studies. We also used FGD to understand people`s knowledge and attitude towards the system. Questions were asked in the Hindi language. Confidentiality of all participants was fully adhere to. Pseudonyms were also used for maintaining the privacy of participants

2.3.4 Data Analysis

We analysed this qualitative study using the guidelines for consolidated criteria for reporting qualitative studies (COREQ). The transcripts were transcribed in the local language (Hindi) to capture general feel of discussion. Further, the recorded transcripts were translated into English for the understanding of theme by the wider population (Pelto et al., 2015). We coded transcripts and organised by the subgroup of the participants. Qualitative data software Atlas ti-.8.0 was used for thematic analysis of data. We used direct quotes for exemplary purposes. We also reviewed typed transcripts for accuracy, completion and plausibility.

Figure 2-2 Framework presents operation of CRS from lower administrative level to ORGI

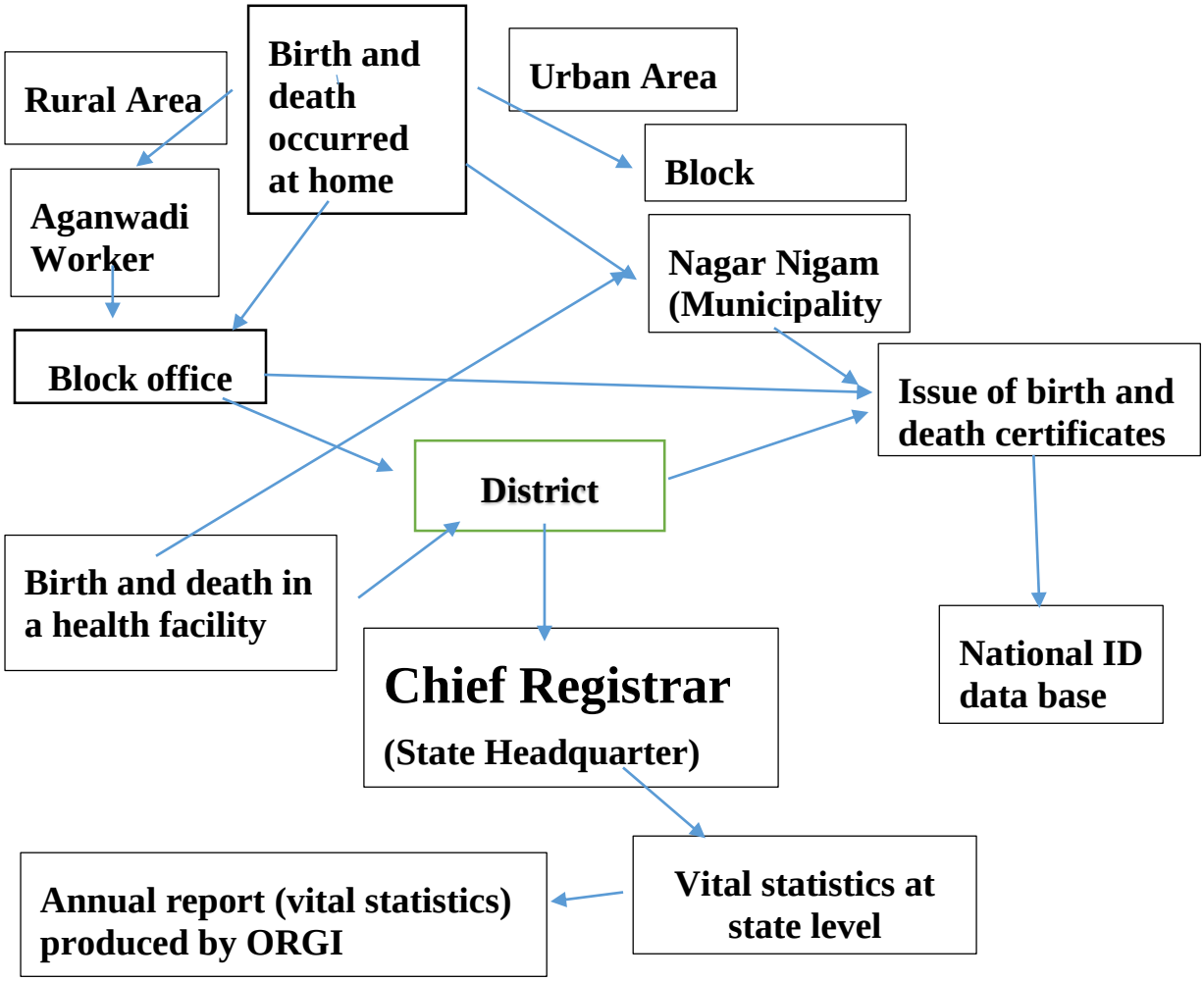


Figure 2-3 Hierarchy of Civil Registration System in Bihar

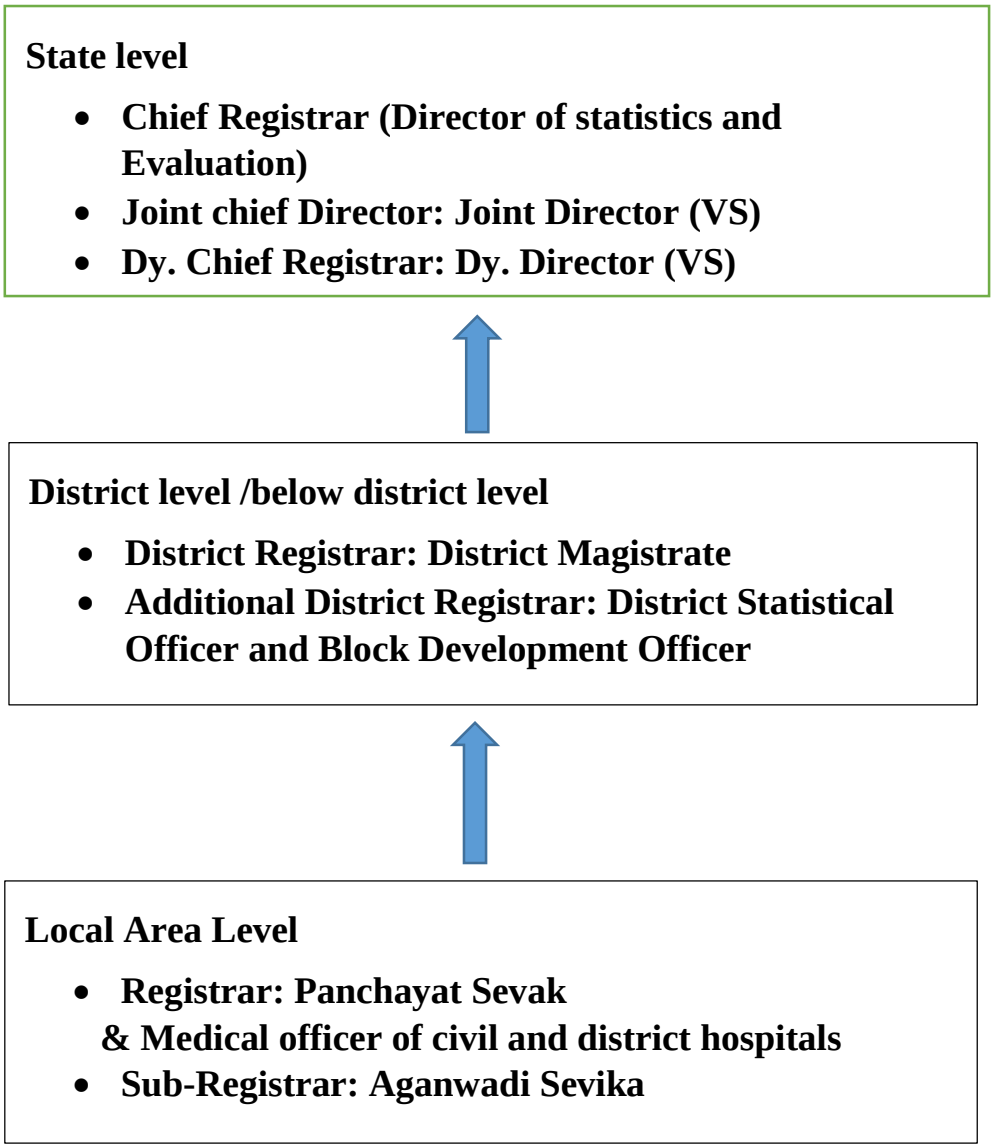


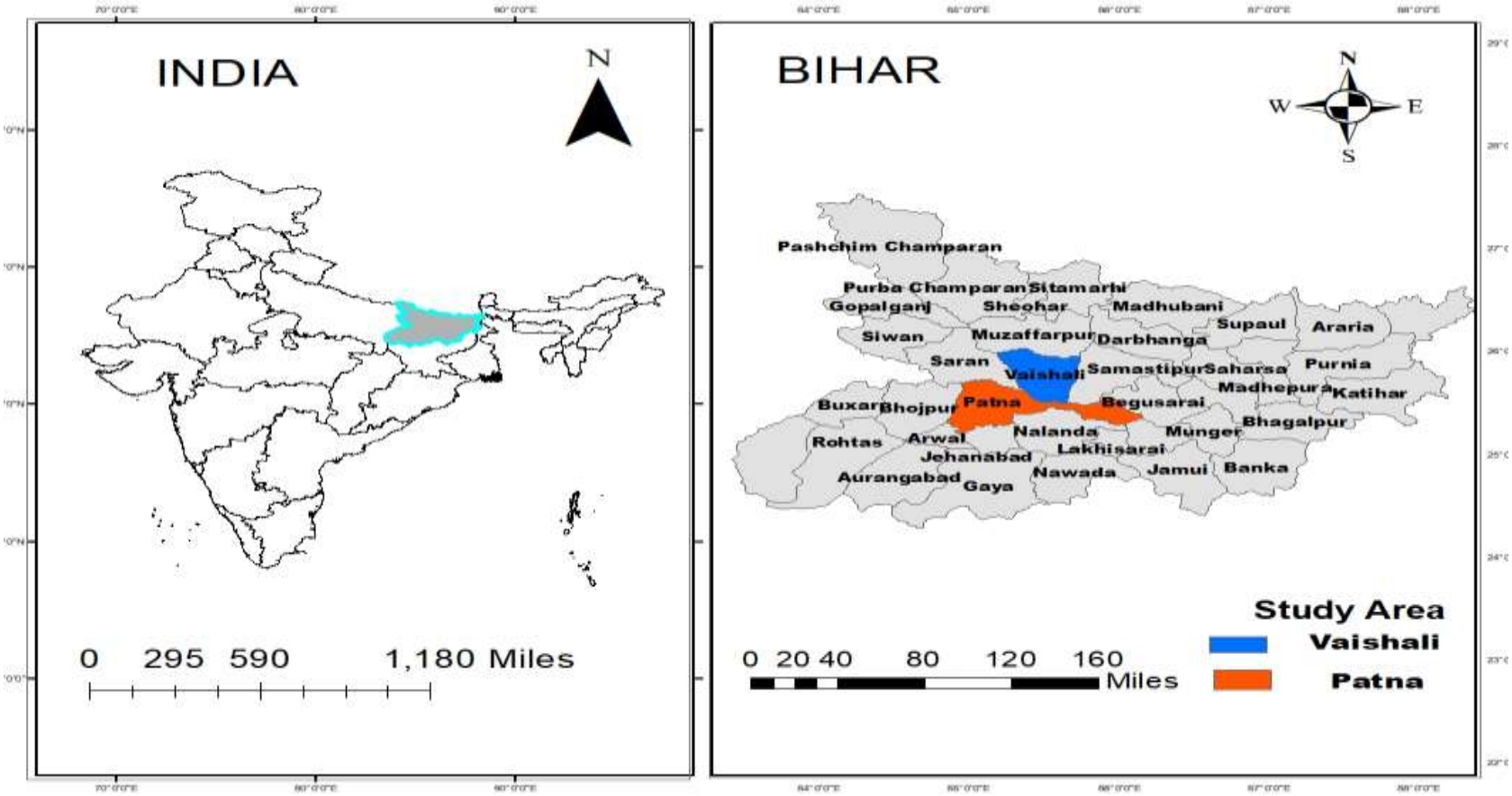
Table 2-1 Demographic profile of participants of this study

Study Population	Mean age (in years)	Study Area				Number of respondent	Method of data collection
		Patna		Vaishali			
		Male	Female	Male	Female		
Assistant Director	50	1	-	-	-	1	KII
System Manager	35	1	-	-	-	1	KII
BSO	41 (40-42)	1	-	1	-	2	KII
Aganwadi Sevika	44.3 (40-50)	-	2	-	2	4	KII
Medical officer	52.2 (45-62)	-	2	1	-	3	KII
Ward Parsad	295 (24-35)	1	-	1	-	2	KII
Nagar Nigam	36 (30-42)	1	-	1	-	2	KII
Community Member	35.6 (17-62)	30	13	25	22	90	FGD

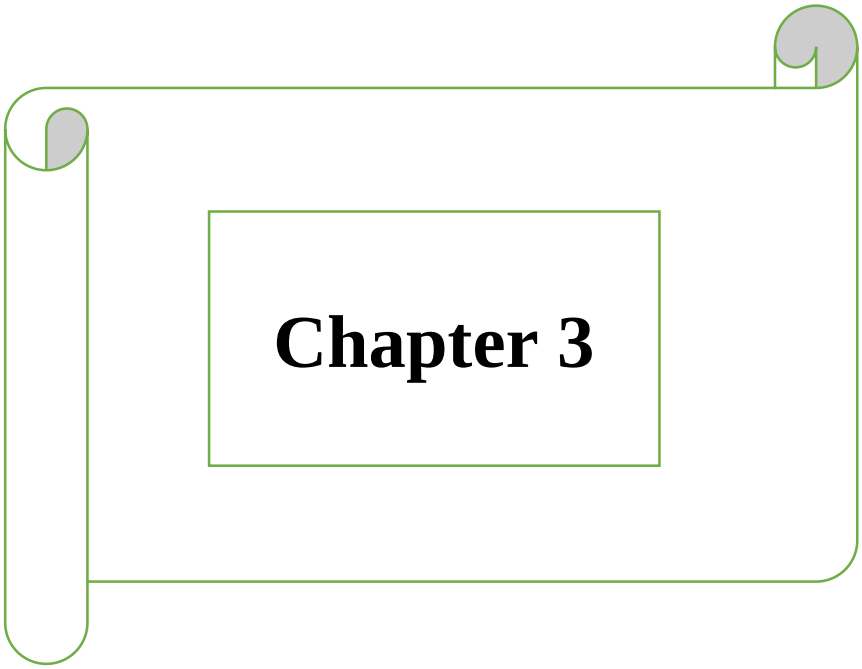
***figures in parenthesis are minimum and maximum value.**

BSO Block Statistical Officer, KII Key Informant Interview, FGD Focus Group Discussion

Maps 2-1 Study Area



Source- Author generated these maps using GIS


Chapter 3

3 To investigate the predictors of birth registration in India

3.1 Introduction

Birth registration is the official recording of birth by the civil registrar with the legal requirement (UNICEF, 2019). UN documented "The child should be registered immediately after birth and shall have the right from birth to a name and right to acquire nationality" (United Nations, 1990). Further, a birth certificate is an official record which documents a child`s birth. It is issued by registration offices after birth registration. It certifies one`s legal age, place of residence and family ties (UNICEF, 2019). In absence of a birth certificate, it is difficult to prove a child`s existence before the law. Consequently, a child`s access to public services and social security negatively affected. (UNICEF, 2002).

Despite government, civil society, international organisation, particularly UNICEF`s efforts to universalise birth registration globally, nearly 166 million children under age five and 40 million infants do not officially exist (UNICEF, 2019). South Asia is a home of the largest share of children under age five without a birth certificate. Approximately 77 million children under age five did not have a birth certificate in South Asia (UNICEF, 2019). Besides, nearly one out of five children under age five were not registered, and approximately 40 per cent of registered children did not have a birth certificate (NFHS, 2017). However, there has been considerable improvement in the level of registration of birth from 76% in 2008 to 89% in 2018 (ORGI, 2020). There was also colossal disparity at state and district level in terms of coverage and access to birth registration in India (ORGI, 2020).

There is a lack of peer-reviewed literature, investigating predictors of low reporting of birth in India where about 2.7 million (United Nations, 2019) of children under age five do not officially exist. This study investigates demographic, socioeconomic and healthcare predictors associated with birth registration at the districts where the level of registration is lower than the national average.

3.2 Results

Table 3.1 shows the proportion of children under age five years whose birth has ever been registered by baseline characteristics. Results show that there is marginal difference in birth registration by sex of the child (male-62.01%, female- 63.01%) and highest among children age between 1 to 2 (64.85%). Moreover, the low proportion of children among birth order 3+ are found to be registered compared with children among birth order 1 and 2, and it is found significant (Table 3.1). There is significant association between place of residence and birth registration, showing lower proportion of birth registration in rural areas as compared with urban areas (72% vs 62%). About 40% children are registered among non-vaccinated children where as 67% children are registered among fully vaccinated children. Lower registration was found among children whose any one of both parent (father and mother) alive as compared with children whose both parent was alive (63% vs 50%). Besides, 67 % children was registered among younger mothers (15-24 years). Also, we found lower practice of child`s birth registration among illiterate (54%) and unemployed mothers (63%).

We found nearly 63% of children are registered among currently married mothers, whereas 58% of children was registered among mothers belong to separated or divorced or widow marital status. Practice of child`s birth registration was low among mothers who had no exposure to media (55%). Lower percentage of registered children is found among mothers who did not visit for the antenatal facility (51%) and delivered at home (44%). Besides, nearly 71% of children are found registered among mothers who received postnatal check-up compared to 61% registered children among mothers who did not receive postnatal check-up within two months of delivery. Moreover, we found household characteristics is significantly associated with birth registration. This study shows that lower proportion of registered children belong to Muslims (59%) as compared with Hindus (64%). Besides, lower percentage of children was registered among SC (61%)and ST (62%). Nearly 81% of children are registered among the richest household whereas about 55% of children registered among poorest household. It is also found that the proportion of registered children were lower among female headed household (male-63%, female-62%). Also, we found lower practice of child`s birth registration among illiterate (54%) and unemployed fathers (56%).

Table 3-1 Proportion (%) of children under age five ever been registered by baseline characteristics

Independent variable	Weighted Frequency	Weighted Percentage	P-value
Sex of the child			
Male	56677	62.01	
Female	51775	63.01	<0.001
Child`s age (in year)			
0_1	20957	64.47	
1_2	42322	64.85	<0.001
3_4	45174	59.35	
Birth order			
1	29241	70.96	
2	27251	65.28	
3	17797	59.30	<0.001
3+	21956	52.22	
Place of residence			
Urban	19216	72.22	
Rural	89237	60.39	<0.001
Child Vaccination			
No	9492	39.99	
Partial	28706	59.42	<0.001
Full	51653	67.09	
Parents alive			
Any one	1306	50.55	
Both	107094	62.64	<0.001
Mother`s age			
15-24	29854	66.95	
25-34	55737	62.36	<0.001
40-49	10653	54.52	
Mother`s education level			
Illiterate	44661	53.91	
Primary	13771	64.35	
Secondary	30798	71.35	<0.001
Higher	7014	80.42	
Mother`s occupation			
Unemployed	12453	63.35	
Professional	194	78.16	
Clerical	34	65.56	
Sales and service	406	62.92	<0.001
Agriculture	1981	59.23	
Production worker	683	58.62	
Marital status			
Married	95313	62.97	
Widow/Divorced Separated	847	57.50	<0.001
Media			

No	41456	54.88	
Partial	50222	68.51	<0.001
Full	4567	74.47	
Number of antenatal visit during pregnancy			
No	18350	50.92	
At least one	49822	69.24	<0.001
Baby postnatal check-up within two months			
No	47052	61.48	<0.001
Yes	21241	70.76	
Place of delivery			
Home	29701	43.94	
Public hospital	47432	71.43	<0.001
Private hospital	18829	71.51	
Sex of head of household			
Male	93190	62.64	
Female	15263	61.56	<0.001
Religion			
Hindus	76769	63.79	
Muslims	17290	58.81	<0.001
Other	1563	67.50	
Caste			
SC	20619	60.71	
ST	10223	61.54	
OBC	49046	62.53	<0.001
Others	15275	67.63	
Wealth			
Poorest	38013	54.76	
Poorest	23026	62.03	
Middle	15369	67.35	<0.001
Richer	11418	72.31	
Richest	8418	81.35	
Father`s education level			
No	4086	53.91	
Primary	2347	60.02	<0.001
Secondary	7598	65.19	
Higher	1823	75.50	
Father`s occupation			
Unemployed	809	56.46	
Professional	931	72.69	
Clerical	348	60.91	
Sales and service	3008	67.97	<0.001
Agriculture	4805	60.09	
Production worker	5780	62.10	
Total (N)	**108453**	**62.50**	

Table 3.2 shows the result of multilevel binary logistic regression of demographic, socioeconomic and healthcare factors. We showed β-coefficient and SE of explanatory variables associated with birth registration. Individual-level variance is much higher (20.5%) compared to random variance at the district (0.6%%) and state levels (0.03%%). We found, compared with children age 0-1 years, children between age 1-2 and 3-4 years have higher (β=0.010; SE=0.004; p=0.007) and lower (β=-0.028; SE=0.004; p<0.001) likelihood of birth registration respectively. Interestingly, female children have more likelihood of birth registration as compared with male children (β=0.010; SE=0.003; p<0.001). Children belong to birth order 2 (β=-0.044; SE=0.004; P<0.001), 3 (β=-0.069; SE=0.004; P<0.001) and 3+ (β=-0.105; SE=0.005; P<0.001) are significantly inversely associated with birth registration as compared with children of birth order 1. As expected, compared with children living in urban areas, children living in rural areas have a lower likelihood of birth registration (β=-0.036; SE=0.004; P<001). Moreover, parents` and mother`s characteristics are found to be significantly associated with the child`s birth registration. Mothers among the age group 25-34 (β=0.019; SE=0.004, P<0.001) and 35-49 (β=0.035; SE=0.006; P<0.001) years have a significantly higher likelihood of birth registration for their children as compared with mothers among age group 15-24 years. Besides, secondary (β=-0.023; SE=0.006; p<0.001) and primary (β=-0.047; SE=0.007; p<0.001) educated mothers are less likely to register the birth of their children as compared to higher educated mothers. Mothers among Muslims (β=-0.028; SE=0.004; P<0.001) and other religion (β=-0.053; SE=0.010; P<0.001) have a lower likelihood of birth registration for their children as compared with mothers belong to the Hindu religion. As expected, mothers who exposed to partial (β=-0.013; SE=0.006; P<0.035) and no (β=-0.043; SE=0.007; P<0.001) exposure to media have a lower likelihood of birth registration of their children as compared with mothers having full exposure to media. Furthermore, district-level variable, the proportion of people belong to SC caste is positively associated with birth registration of children (β=0.001; SE=0.001; p=0.292). However, result was insignificant. Also, the proportion of children who received immunisation (β=0.001; SE=0.001; p<0.001) and the proportion of mothers who delivered birth in the institutional facility (β=0.001; SE=0.000; p<0.001) have shown a significant positive association with birth registration. Map 3.1 shows the level of birth registration of children under age five years who have ever been registered by districts of India. We found lower birth registration was recorded in the Uttar Pradesh, Bihar, Arunachal Pradesh, Jharkhand and Rajasthan. In Uttar Pradesh, 11 out of 75 districts recorded lower than 50 per cent birth registration. Besides, 4 districts of Arunachal Pradesh, Purba Champaran in Bihar, Rajouri in J&K and Dholpur in Rajasthan recorded lower than 50 per cent birth registration.

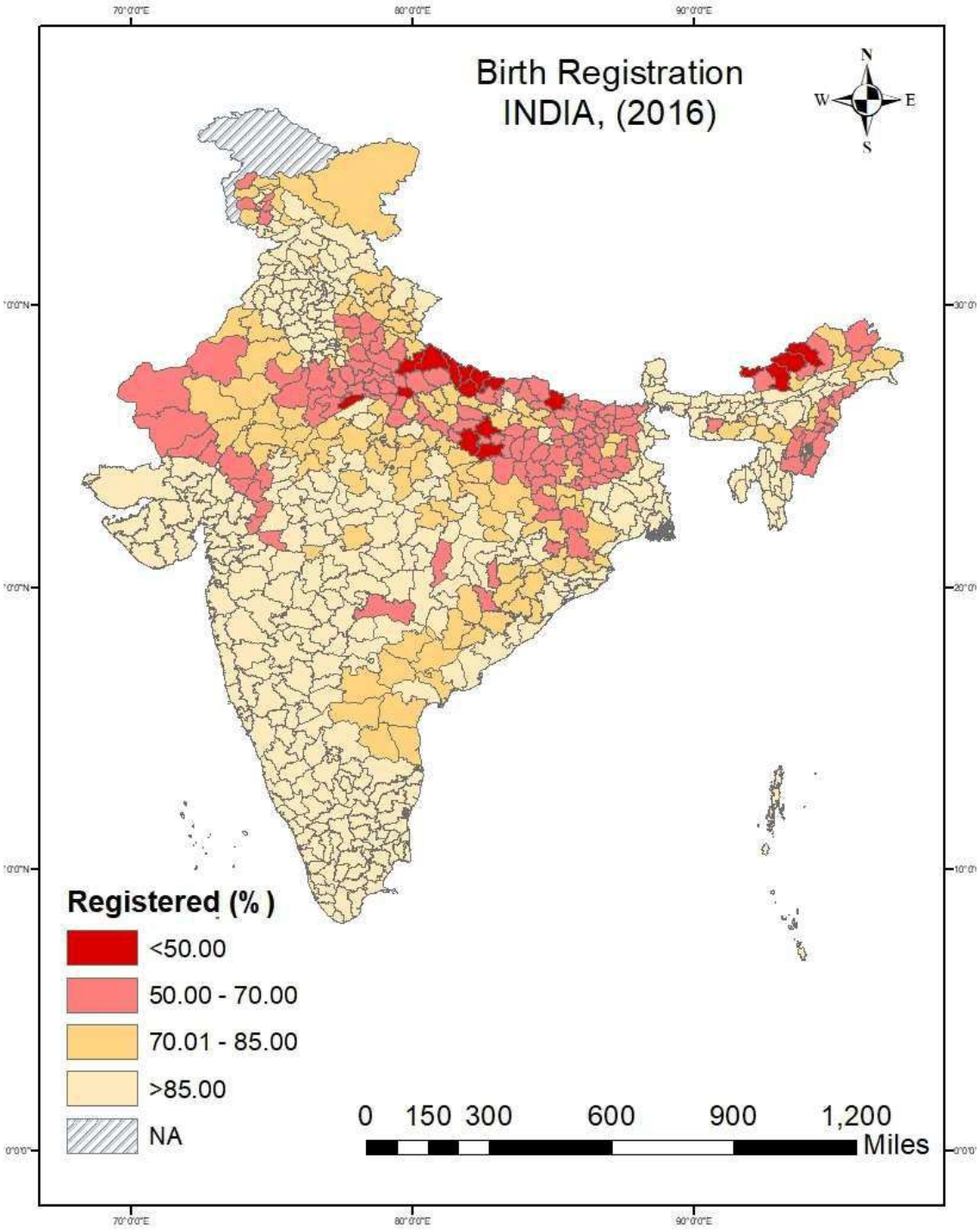
Table 3-2 :Results of multilevel binary logistic regression

	Model 1			Model 2			Model 3		
Fixed effect parameter	**β-coefficient**	**SE**	**P-value**	**β-coefficient**	**SE**	**P-value**	**β-coefficient**	**SE**	**P-value**
Intercept	0.922	0.016	0.000	0.971	0.018	0.000	0.794	0.035	0.000
Child`s age (Years)									
0-1®									
1_2	0.005	0.004	**0.197**	0.010	0.004	0.007	0.010	0.004	0.007
3_4	-0.039	0.004	0.000	-0.028	0.004	0.000	-0.028	0.004	0.000
Sex of the child									
Male®									
Female	0.008	0.003	0.004	0.010	0.003	0.000	0.010	0.003	0.000
Birth order									
1®									
2	-0.059	0.004	0.000	-0.044	0.004	0.000	-0.044	0.004	0.000
3	-0.107	0.004	0.000	-0.069	0.004	0.000	-0.069	0.004	0.000
3+	-0.173	0.005	0.000	-0.106	0.005	0.000	-0.105	0.005	0.000
Place of residence									
Urban®									
Rural	-0.099	0.004	0.000	-0.036	0.004	0.000	-0.036	0.004	0.000
Mother`s age (years)									
15-24®									
25-34	0.027	0.004	0.000	0.019	0.004	0.000	0.019	0.004	0.000
35-49	0.037	0.006	0.000	0.035	0.006	0.000	0.035	0.006	0.000
Mother`s education									
Higher®									
Middle				-0.022	0.006	0.000	-0.023	0.006	0.000
Primary				-0.047	0.007	0.000	-0.047	0.007	0.000
Illiterate				-0.102	0.007	0.000	-0.102	0.007	0.000
Media Exposure									
Full®									
Partial				-0.013	0.006	0.032	-0.013	0.006	0.035
No				-0.044	0.007	0.000	-0.043	0.007	0.000
Wealth Quintile									
Richest®									
Richer				-0.051	0.006	0.000	-0.051	0.006	0.000
Middle				-0.074	0.006	0.000	-0.074	0.006	0.000
Poorer				-0.117	0.006	0.000	-0.116	0.006	0.000
Poorest				-0.154	0.007	0.000	-0.153	0.007	0.000
Religion									
Hindus®									
Muslims				-0.029	0.004	0.000	-0.028	0.004	0.000

Others				-0.061	0.010	0.000	-0.053	0.010	0.000
SC							0.001	0.001	**0.292**
Full Immunisation							0.001	0.000	0.009
Institutional Birth							0.001	0.000	0.001
Random effect parameter									
District level variance	0.007	0.086		0.007	0.082		0.006	0.075	
State level variance	0.002	0.046		0.002	0.046		0.003	0.056	
Residual	0.209	0.458		0.205	0.452		0.205	0.452	
AIC	147825			142260			142231		
Log-likelihood	-73900			-71106			-71089		
Number of groups in districts	258			258			258		
Number of groups in State	17			17			17		
Observations	115223			113053			113053		
Mean VIF	1.390								

Source –Author`s calculation

Maps 3-1 Birth registration of children under age five years by districts, India, 2016



Source: Author generated this map using GIS.

3.3 Discussion

Birth registration is not only a legal process, but it is essential for proving fundamental rights and essential services such as education, health facility to children etc. Besides, it protects children from unlawful activities such as child labour, trafficking and child marriage. RBD act, 1969, mandates registration of all births and deaths within 21 days of the event (ORGI, 2020). We found 258 districts in India where the level of registration of birth was below the national average (79.77%). There has been significant improvement in coverage of birth registration in the last ten years. The level of registration of birth increased to 80% in 2016 from 41% in 2005 (NFHS, 2007; NFHS, 2017). However, there is an uneven improvement in birth registration across the nation and within states. This study found demographic, socioeconomic and healthcare variables are significant covariates of birth registration of children.

This study showed higher birth registration among female children. A previous study documented a similar finding (Jackson et al., 2014). A higher registration among female children could be attributed to financial benefits schemes such as Balika Samridhi Yojna in which each female child is entitled to 500 rupees post-birth and also receive a scholarship for completing set years of schooling (Government of India). Children among age group 1-2 are more likely to register than children who have not completed their first birthday. Previous literature showed similar findings (UNICEF, 2005; Jackson et al., 2014). Children among rural areas are less likely to registered, which is not unusual; the far distance to the registration centre includes higher financial and opportunity cost for the family. Previous studies also supported our findings (Li et al., 2010; UNICEF, 2005; UNICEF, 2019; ORGI, 2020).

Children who stayed with any one or both parent showed higher likelihood for birth registration. Previous literature documented a similar finding (UNICEF, 2005; UNICEF, 2013). Also, this study showed younger mothers (15-24 years) have lower likelihood of birth registration of their children. A lower practice of birth registration among young mothers could be attributed to less awareness on the registration process and lack of experience on childcare. This study also showed significant positive association between children`s birth registration and the mother`s level of education. Mothers who completed formal years of education have more access to institutional health care, media exposure and knowledge on the registration process. Previous studies documented similar findings (Amo Adjei et al 2015; Isara et al., 2015; UNICEF, 2005; Jackson et al., 2014; UNICEF, 2014; UNICEF, 2019). As expected, mother`s and father`s occupation have a significant association with birth registration of their children.

Professional parents are generally more educated and have more exposure of formal health care which may increase their likelihood of registering their children. This finding is also supported by previous literature (Amo Adjei et al., 2015; UNICEF, 2019).

Children are more likely to being registered among currently married mothers. It is a fact that married woman has better knowledge of childcare, coupled with the assistance from a husband who may have better knowledge on birth registration. Caring of children by both parent may affect the quality of care and children`s well-being. (Amo Adjei et al., 2015; Jackson et al., 2014). Also, in many countries, a single mother is not allowed to register their children (UNICEF, 2019). Exposure to different kinds of media is significant for gaining knowledge and awareness regarding various government laws and schemes. This study also shows a strong association of media exposure among mothers and birth registration of their children which is consistent with other studies (UNICEF, 2013; ORGI, 2020). As evident in previous literature, children belong to minority groups such as those of Muslims, SC caste and production workers have lower birth registration. (Amo Adjei et al., 2015; UNICEF, 2005; Isara et al., 2015). In particular culture or community, more preference is given on traditional norms (such as name ceremony) rather than formal birth registration of children. Also, minority groups like some tribal people in India are more likely to live in remote areas where access to birth registration services are difficult. Further, children among richer and richest household is a consistent positive covariate of birth registration (UNICEF,2013; UNICEF, 2019; Li et al., 2010). Also, the cost associated with registration is a barrier to birth registration (Amo Adjei et al., 2015; Oung et al., 2019).

Moreover, this study showed institutional delivery and full dose of vaccination was significantly positive associated with birth registration. Considering the fact, registration centres are open within some healthcare facilities may have contributed to this finding. The result is consistent with previous studies (Amo Adjei et al., 2015; UNICEF, 2005; Isara et al., 2015). Establishment of community-based birth registration unit i.e. registration unit at PHC and CHC, may ensure accessibility and improve level of birth registration. The findings of this study provides a way forward towards improving the level of birth registration and focused intervention to overcome existing barriers.

Despite a comprehensive analysis, this study has some limitations. Quality of finding may be affected by recall or reporting biases. Particularly, possession of birth certificate is socially desirable behaviour and may lead to overestimation of registered birth, however, we requested

for the birth certificate to confirm their reporting. Also, causal analysis cannot be done due to the cross-sectional nature of data.

3.4 Conclusion

Birth registration is mandatory and a fundamental right. It provides access to government aided essential services such as healthcare, education and legal protection. Birth registration data is frequently used by health officials and policymakers in framing health policies and socioeconomic development programs. This study shows age, sex and birth order of children are significant predictors of birth registration. Also, children among illiterate mothers, minor groups (Muslims, SC, marginal workers), poorest wealth quintile have lower likelihood of registration. Child`s birth registration is positively associated with institutional birth and immunisation. Adequate intervention to facilitate under privileged groups and lower performing districts could improve the completeness of birth registration. Further, linking of birth registration facilities with health institutions and periodic awareness campaign on benefits of birth registration is strongly suggested.

CHAPTER 4

4 Underreporting or over-reporting of vital events (birth and death statistics) in the Civil Registration System in India

4.1 Introduction

Effective Civil Registration and Vital Statistics (CRVS) is important for monitoring the indicators associated with SDGs (Handley et al., 2015). The developed countries highlighted the importance of the functioning registration system in achievement of universal health care (Tangcharoensathien et al., 2014). Also, a previous study documented a quality CRVS is highly associated with improved healthcare outcomes, including low mortality risks among children (Phillips et al., 2015; Kumar et al., 2019). Also, reliable and up to date mortality statistics are essential for an immediate intervention and resource allocation during health emergency (Oung et al., 2019).

CRVS is incomplete and not reliable in most developing countries (UNICEF, 2019). Moreover, previous studies documented many countries do not have data on mortality and some countries have recorded poor quality data. Also, governments need to assess CRVS periodically (Mahapatra & Rao, 2001; Rao et al., 2005; Hill et al., 2007).

In India, RBD act, 1969 mandates registration of all birth and death within 21 days of events. However, late registration is allowed after the submission of an affidavit and fine (ORGI, 2020). ORGI also documented the accuracy of the vital statistics depends on the completeness and timeliness (ORGI, 2020). Recent studies advocated for quality assessment of the Civil Registration System (Gupta et al., 2019; James et al., 2013). In this study, we examine under-reporting and over-reporting of vital events in Civil Registration System of India.

4.2 Results

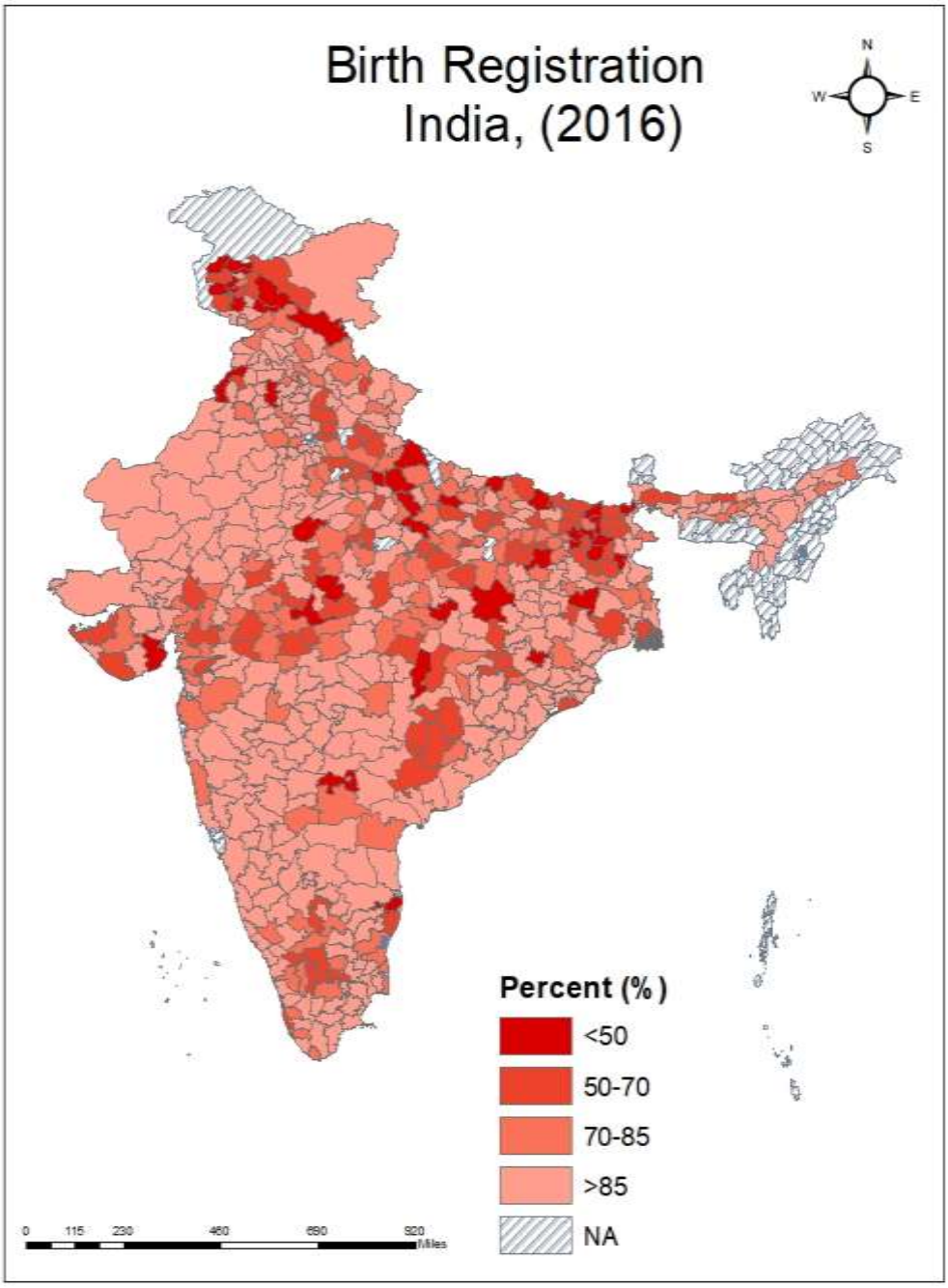
This study shows the completeness of birth registration, infant death and all age death registration. Moreover, the trend of completeness of birth and death registration for the period 2001 to 2018 is also presented. Table 4.1 (see appendix) shows estimated completeness of birth registration at the national level in 2016 was 89.83% which is 4 per cent more than completeness reported by ORGI for the same year. It is found that completeness of birth registration highly varies across states and districts of India, ranging from 61.58% in Bihar to 137% in Delhi and 133% in Uttrakhand. State such as Delhi, Andhra Pradesh, Punjab, Kerala with advance healthcare facilities and high urbanisation reported high registration of birth. As expected, the variation of completeness of birth registration is found higher at district level than the state level, indicating the policy value of assessing the completeness at the district level. It was found that level of completeness of birth registration was lowest in Hardoi district in UP (2.57%), Punch district in J&K (10.47%), Madhepura in Bihar (11.42%) etc. and highest in districts like Mumbai (338%) in Maharashtra, Kolkata (215%) in West Bengal, Sangrur district in Punjab (263%) etc.

Table 4.2 shows the top ten poorest and best performing districts in terms of birth registration. The districts which showed completeness higher than 100 per cent are districts with better health facilities, and registered birth might have included birth that belongs to neighbouring districts or states who seek health facility in the advance tertiary hospitals situated in these developed districts. Therefore, it increases the numerator for calculating the level of birth registration. Districts which showed low completeness are lacking advance health care facilities and performed low in socioeconomic indicators. Moreover, these districts are mostly concentrated in Bihar, UP and J&K, these states performed low in health and development indicators. Nearly 40 districts had completeness of birth registration less than 50% in 2016. However, there were 315 districts which had completeness above 85 per cent. Surprisingly, some states with low completeness of birth registration have districts with high completeness. For example, in Bihar, though completeness of birth registration was less than 80% in 30 out of 38 districts, however, three districts of Bihar reported completeness more than 92%, and one district named Gopalganj reported completeness above 125%. These observations might look counterintuitive but indicate the presence of strong local factors which appear to affect the completeness of birth registration in unpredictable ways. The findings highlight the policy utility of assessing completeness at a district or lower administrative level to make effective

and adequate targeted health intervention. Map 4.1 represents the spatial distribution of completeness of birth registration.

Table 4.3 (see appendix) presents completeness of infant death at the national, state and district levels. It is found that only 17.25% of infant death was registered in India in 2016. The completeness of infant death registration had high variation across states in India, which ranges from nearly 3% in Bihar to 52% in Tamilnadu and 162% in Delhi. State with better health care facilities showed higher reporting of infant death. Delhi showed completeness of infant death registration above 100 percentages. Infant death reported in the state New Delhi might have included infant death that may belong to neighbouring states who seek advance tertiary hospital care in the state. In case of death occurred, death is registered in the Delhi`s hospitals, which increased numerator in the estimation of completeness of infant deaths. The variation in the completeness was higher at the district level as compared to the state level. The range of completeness was less than 2% in 142 districts and more than 50% in almost 46 districts. Many districts that showed poor completeness are concentrated in poor-performing states in terms of health and development indicators. Surprisingly, it is found that some states with low development status and poor health facilities have districts which reported completeness of infant death registration nearly 100 per cent. For example, completeness of infant death was found low in MP; however, Indore districts reported more than 100 % infant death. Similarly, Bulandshahr, Deoria and Pratapgarh reported more than 50% infant death while completeness level in UP was less than 6% for infant death registration. Table 4.4 shows the top ten poorest and best performing districts in terms of infant death registration. The presence of strong local factors might be the reason for higher registration of infant deaths in some districts which need to be researched further. The importance of completeness of infant death at the lower level cannot be ignored as it has vast utility in framing targeted intervention in health care facilities and evaluation of the effectiveness of health care programmes. Map 4.2 represents spatial distribution completeness of infant death registration.

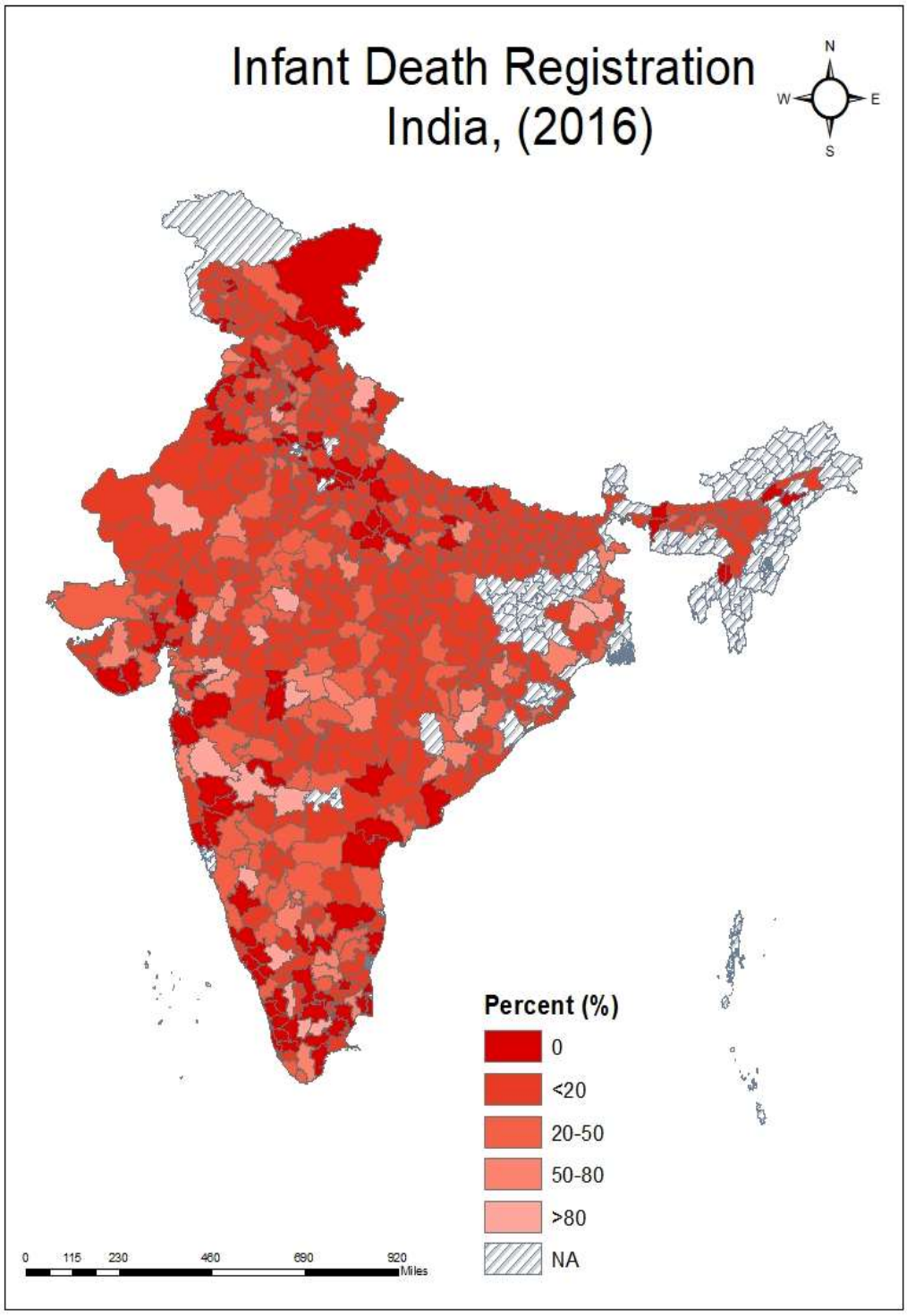
Maps 4-1 Completeness of birth registration by districts, India



Source: Author generated this map using GIS

Note - We considered data for only 22 states because SRS does not provide data for 14 smaller states and UTs.

Maps 4-2 Completeness of infant death registration by districts, India



Source: Author generated this map using GIS

Note- We considered data for only 22 states because SRS does not provide data for 14 smaller states and UTs.

Table 4-1 Ten poorest and best performing districts in terms of birth registration

Poorer Performance		Good Performance	
District	**Completeness (%)**	**District**	**Completeness (%)**
Hardoi	2.57	Jammu	201.03
Punch	10.47	Jashpur	201.90
Madhepura	11.42	Leh	203.24
Kupwara	17.54	Raigarh	213.67
Bandipore	18.97	Nainital	241.30
Vidisha	20.31	Kolkata	241.47
Faizabad	20.55	Srinagar	245.86
Badgam	21.93	Sangrur	263.07
Rangareddy	21.99	Mumbai	322.22
Gaya	24.78	Uttar Bastar Kanker	333.72

Source: Author`s Calculation

Table 4-2 Ten poorest and best performing districts in terms of infant death registration

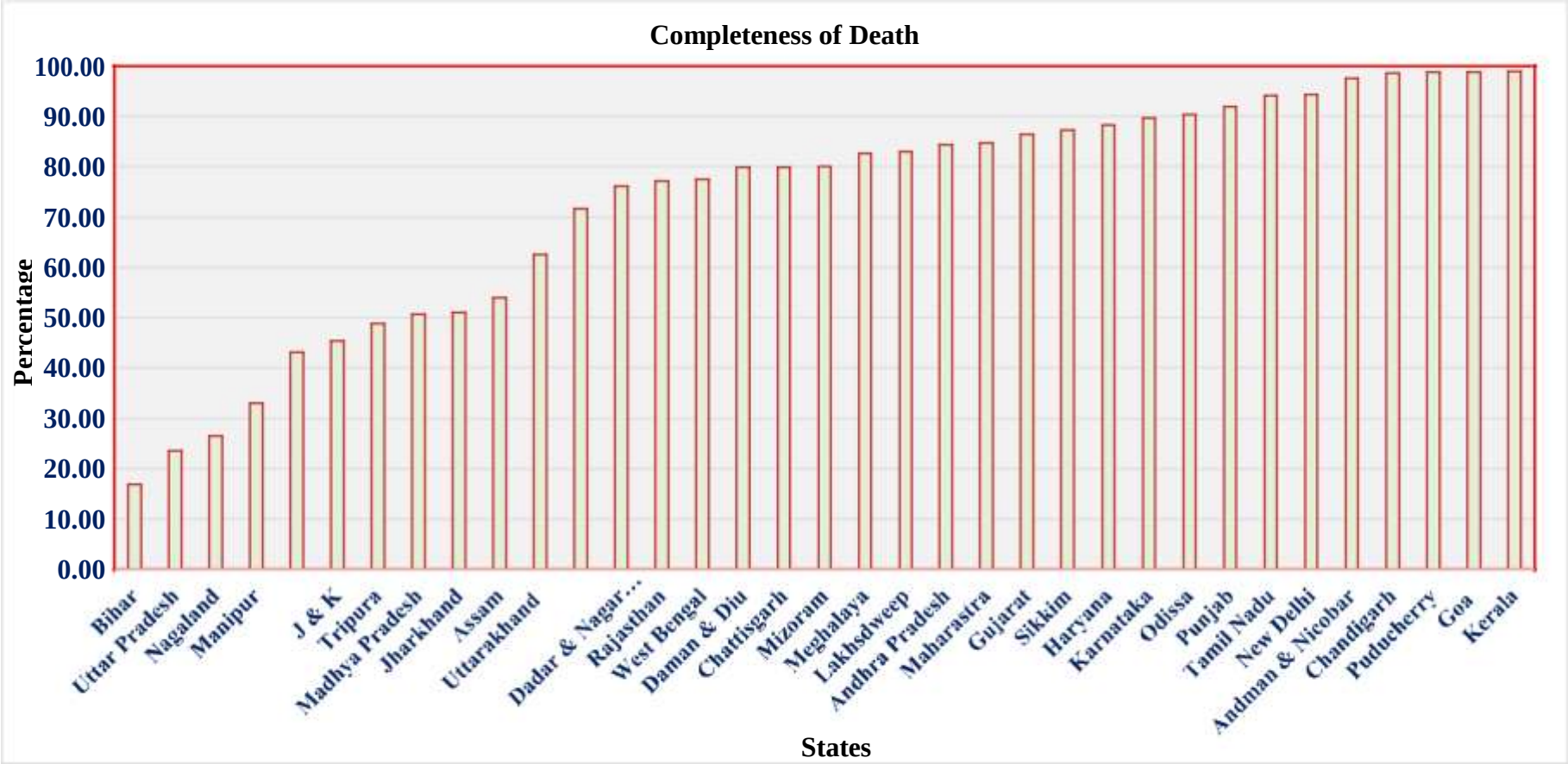
Poor performance		Better Performance	
District	**Completeness (%)**	**District**	**Completeness (%)**
Leh	0.00	Valsad	137.70
Srinagar	0.00	Nandurbar	137.97
Pulwama	0.00	Panchmahal	140.48
Jammu	0.00	New Delhi	162.90
Lahul and Spiti	0.00	Bankura	172.53
Hamirpur	0.00	Madurai	178.03
Shimla	0.00	Mumbai	179.80
Jalandhar	0.00	Gulbarga	211.28
Hoshiarpur	0.00	Mysore	245.95
Firozpur	0.00	Hyderabad	657.23

Source: Author`s Calculation

Furthermore, this study estimated the completeness of all age death using the empirical method developed by Adair & Lopez and compared with ORGI estimates. Table 4.5 (see appendix) shows the estimated completeness of death registration at the national level is 70% for the year 2016 which is 8% lower as compared to ORGI estimate (78.1%) for the year 2016. Completeness of death registration found to be highly varying across states, ranging from 16.8 % in Bihar to 99% in Kerala. Moreover, all EAGs states showed completeness of death registration of less than 80%. On the other hand, South Indian states and western states like Gujarat and Maharashtra showed higher level of completeness which ranges from 82% to 99%. Moreover, some north Indian states like Punjab, Haryana, Delhi also reported completeness above 88%. Data for Telangana and Andhra Pradesh were combined. In case of Manipur and Meghalaya, registered death for the year 2015 was considered and compared with ORGI estimates for the year 2015 due to unavailability of data for these two states in ORGI report for the year 2016. This study clearly shows that states which performed well in development indicators and have advance tertiary health care facilities performed better in terms of completeness of all age death registration. Graph 4.1 represents the completeness of death registration.

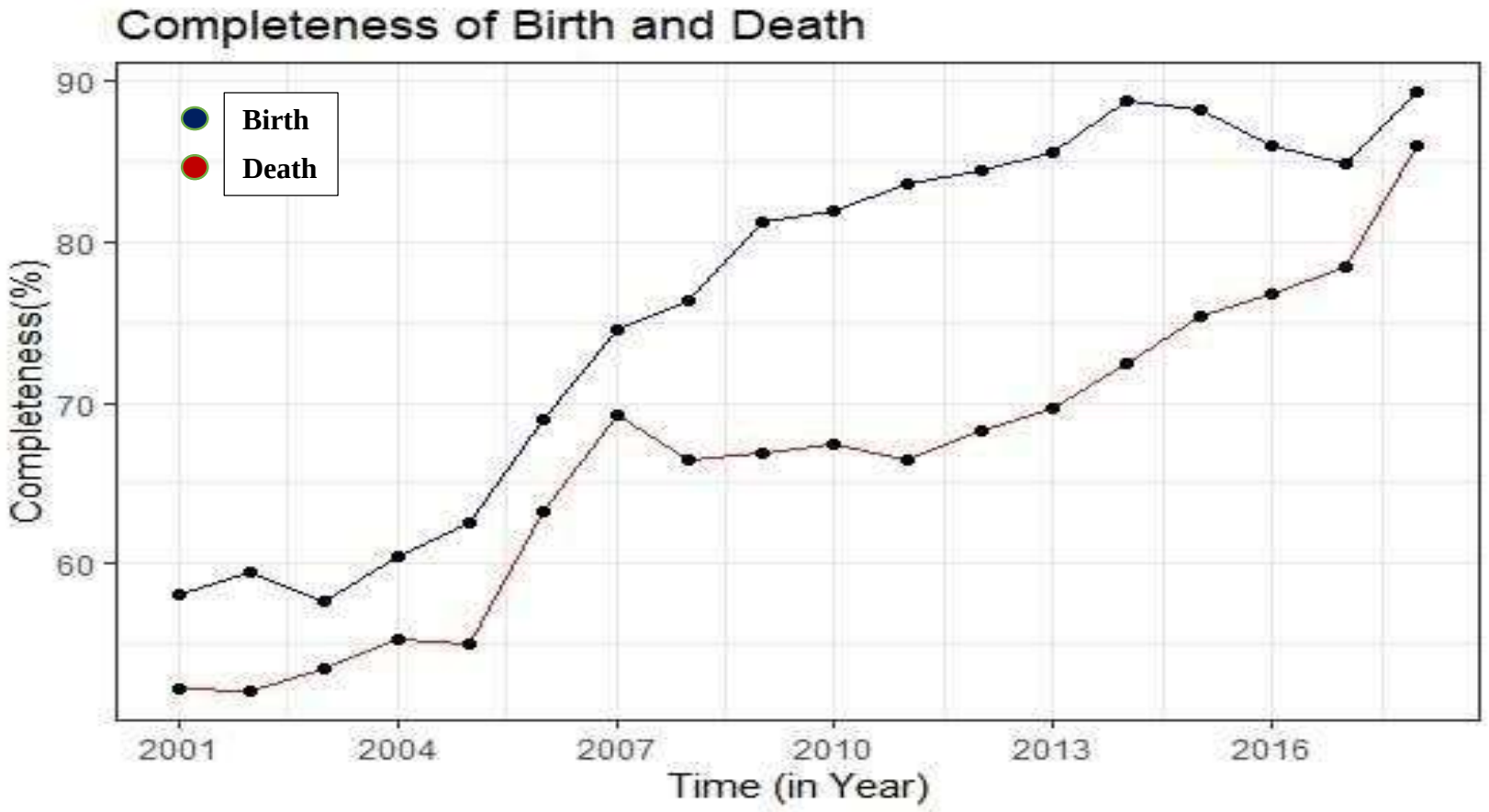
Graph 4.2 shows the trend of completeness of birth and death registration at the national level during the period 2001 to 2018. There has been considerable improvement in birth registration from 58% in 2001 to 89% in 2018. Similarly, the level of registration of death increased from 52.2% in 2001 to 86% in 2018. However, the pattern of year to year change in registered birth and death does not reveal a continuously increasing trend. It is also observed that registration of birth has increased sharply after 2005. However, in 2018, a gap of about 11% in case of registration of births and about 14% for registration of deaths at all India level remains a cause of concern. We also observed that the gap between completeness of birth and death registration has been narrowing down over the year.

Graphs 4-1 Completeness of death registration by states, India



Source: Author`s calculation

Graphs 4-2 Completeness of birth and death Registration, India, 2001-18



Source : ORGI

4.3 Discussion

This study shows the estimated completeness of birth registration, infant death registration and all age death registration for the year 2016. The estimated completeness is also compared with ORGI estimate to check the quality of CRS data. Previous studies also checked the quality of CRS data in terms of completeness of registration (Kumar et al., 2019; Gupta et al., 2018; Rao & Gupta, 2020; James et al., 2013). This study shows the completeness of birth and infant death registration at the district level which is essential for the local government to put more efforts in improving death registration in the districts where lower level of registration is observed. Moreover, the results will help public health officers and researchers to adjust deficient birth and death registration data at the district level in order to produce more reliable and accurate vital statistics.

There is huge variation in completeness of birth and death across states. States like Delhi, Maharashtra, Punjab, Tamilnadu, Kerala had completeness of birth registration above 94%. These states have better health care facilities, highly urbanised, performed better in development indicators and counted among more prosperous states. A similar finding is documented by previous studies (Kumar et al., 2019; Gupta et al., 2018; Rao & Gupta, 2020). On the other hand, Bihar, UP, Madhya Pradesh reported less than 80% birth. As expected, variation in terms of completeness is higher across districts as compared to the states. Also, surprisingly, there are many poor-performing states which had districts where higher completeness is recorded. This estimates are unpredictable but point to influence of strong local factors which appear to affect the level of registration of birth and death. Further research is needed to identify these strong local factors to improve the registration of birth and death. The findings highlight the policy utility of assessing completeness level at local levels to introduce an effective and adequate targeted intervention strategy. In India, every one out of five children is not registered (NFHS, 2017). Knowledge on low completeness of birth registration would alert the registration authority, and some efforts may be put to record the left-behind children. Also, effective intervention to register all children would be in achieving SDG`s goal 16, which "aims to provide legal identity for all, including birth registration by 2030" (United Nations, 2015).

We found very low completeness of infant deaths at the national, state and district levels. There was only 17% infant death registration in the year 2016. The estimated completeness of infant

death registration varies high across the states and districts. Those districts where completeness of infant death registration is low mostly concentrated in impoverished states such as Bihar, UP, Madhya Pradesh etc. Since no property issues are attached to an infant`s name, parents do not see the benefits of registering infant death. Previous studies also documented a similar reason (James et al., 2013; Kumar et al., 2019). Besides, many infants die outside health care facilities in India. Also, the lack of adequate surveillance by registrars and health worker may result in the low level of registration of infant deaths. A previous study documented "length of the reporting period for birth registration in India is 21 days, however, most infant death occurs within third weeks, limiting the likelihood of bereaved families to report both the birth and death" (Rao & Gupta, 2020). An alternative reporting system could be designed through the involvement of notifiers, health workers. Also, providing immediate benefits for reporting infant death, such as financial help for burial or cremation. However, recently ORGI instructed, "to strengthen infant death recording, closely monitoring of registration levels and calculation of vital rates at the state and district levels commencing from 2018" (ORGI, 2017).

We found completeness for all age death registration is 70% at the national level. The estimates of completeness are found to vary widely across states. A reasonable extent of these variations in the data can be understood by the implementation of the statute is vested with State governments who appoints Chief Registrar for this purpose. Moreover, each state has an independent structure of administration. Previous studies documented similar reasons for variation in completeness across states (Kumar et al., 2019; James et., 2013). Southern states and some northern states of India such as Delhi, Punjab, Haryana etc. performed better in terms of completeness of death registration. These states are developed and wealthier states of India. Previous studies also documented that "it is reasonable to expect that higher socioeconomic development might contribute substantially to death registration completeness, given the experience of more developed countries where very few deaths go unrecorded" (Phillips et al., 2015; Zeng et al., 2020). States like Bihar, UP, Jharkhand and Madhya Pradesh have completeness of all age death registration below 52%. These states are EAGs states, and have poor health care facilities, and also not performing good in other health and development indicators. A study also highlighted that lower access to health care may contribute to the low registration completeness (Zeng et al., 2020). Besides, the role of state government in providing funds to support registration system, periodic training to staffs, an awareness program for the

public could be the main factors in recording birth and death. The similar argument is also documented in previous studies (Kumar et al., 2019; Oung et al., 2019; ORGI, 2020).

Trend analysis shows that the registration of birth and death has improved over the years. It is observed that the completeness of birth registration has increased sharply after 2005. The reason for a sharp increase in birth registration could be the introduction of Janni Suraksha Yojna because deliveries are registered for providing services and benefits. Moreover, conditional cash transfer for institutional deliveries and mandatory birth certificates for school enrolment is more cited reasons for the increase in birth registration (James et al., 2013). Further, there was a slow improvement in the completeness of death registration over the years. The reason could be due to inadequate reporting by the local registrar to the district office. It is observed that considerable decline in registered death in the year 2008 was due to incomplete reporting from some of the bigger states namely Bihar, Andhra Pradesh, Chhattisgarh, Jammu & Kashmir and UP (ORGI, 2013). Moreover, there has been a sharp increase in birth and death registration after 2015 because of digitisation of the registration process which resulted in faster registration and timely distribution of certificates (ORGI, 2018).

Death registration is not considered a priority in India due to the absence of immediate benefits, unlike the benefits of birth certificate. However, some of the facilitators for death registration could be seeking family pension after the death of government employee, a succession of property owned by deceased and claim for insurance by family members after the death of insurance holder. Linkage of death registration to burial services, compensation to notifiers and health worker for registering death could be the possible driver for improvement in death registration. Moreover, focused research about how local factors influence the completeness of birth and death at the district level could be explored to reduce the barriers and improve completeness. It is time for India to consider CRVS a priority and invest in enhancing CRS. The importance of the CRS as an indispensable health information system and its benefits for public health policymaking cannot be undermined (Setel et al., 2007). Recently, the government of India showed an interest in transformational changes in the CRVS using IT to register births and deaths on a real-time basis (MHA, GOI, 2017). This study would benefit understanding the data quality in terms of completeness of birth and death registration.

This comprehensive study that shows estimated completeness of birth, infant death and all age death registration has some limitations. First, Adair and Lopez method (empirical method) was developed using the GBD data, which is themselves based on demographic and statistical models. Second, 5q0 estimates are taken from NFHS, which also suffer from sampling errors. However, NFHS estimates are reliable and widely used among researchers and policymakers. Third, the mid-year population for the year 2016 are extrapolated figure, which could be a source of uncertainty, which is based on assumption of constant growth rate.

4.4 Conclusion

Although there has been considerable improvement in completeness of birth and death registration over the years, there is high variation in completeness of birth, infant death and all age death registration across states. Moreover, variation in completeness at the district level is even higher than the states. Developed states like Kerala, Tamilnadu, Andhra Pradesh, Delhi, Punjab, Haryana etc. performed better in the registration of birth and death as compared with poor states like Bihar, UP and Madhya Pradesh. Availability of advance health care facility in some states could be the main reason for higher completeness of birth, infant death and all age death. Moreover, each state has an independent structure of administration which may influence completeness level across states. Local factors that influence the registration negatively is needed to identify and improve for achieving higher completeness. Besides, the estimates of completeness would be helpful for researchers and medical officers to adjust deficient vital statistics to present accurate and reliable data. Periodic review of vital statistics for data quality, regular training of registrars and raising awareness among the general public on benefits of birth and death registration is needed for accurate and complete vital statistics. Also, making death registration mandatory before cremation or burial would improve the completeness of death registration.

CHAPTER 5

5 An explorative study on the performance barriers of Civil Registration System in Bihar

5.1 Introduction

Civil Registration System (CRS) records permanent, continuous, compulsory vital events with legal requirements of a country (UNICEF, 2013). The vital rates based on CRS data are exact and real-time data. Besides, the data are verified by a registering authority (ORGI, 2018). CRS data is essential for health officials and policymakers for observing the pattern of fertility, mortality and epidemiology. "A universal and well maintained CRS remains single best source of information on vital events for administrative, demographic and epidemiological purposes" (United Nations, 2014).

Nearly 166 million children under age five and 40 million infants do not officially exist and of these 30 per cent and 27.5 per cent live in South Asia, respectively (UNICEF, 2019). Also, a study documented half of the global deaths are unregistered due to inadequate performance by the system (Abouzahr C, 2015).

Previous studies also emphasized a need for an exploratory study at a lower administrative level or a specific area where coverage is poor (James et al., 2015; Oung et al., 2019). As of our knowledge, there has been limited research on this subject. Besides, the previous literature was focused on the benefits and need for an adequate registration system. This study is an attempt to investigate the performance barriers of CRS in Bihar.

5.2 Results

Based on FGD, we identified three themes at the community level: 1) Awareness on procedure and benefits of registration of births and deaths, 2) Fees and documents required for registration and 3) Corruption issues faced by participants and indirect opportunity cost attached with registration.

1) Awareness of procedure and benefits of registration of births and deaths

We found more than three fourth of participants (>75) were aware of the procedures and benefits of registration. Most of the participants reported that birth certificate is an essential document required in much official work such as seeking admission for children in school,

applying for adhar card. A birth certificate was also required in taking benefits of government schemes such as postnatal care, vaccination for children and financial support after birth delivery. Majority of participants agreed that birth certificate is conclusive proof of age.

" A birth certificate is an essential document. It is mostly required for seeking admission in school for their children, applying for adhar card and taking benefits of governmental schemes such as vaccination and fellowship for study. I reported the birth of my children and received birth certificates from the block". (Nisant Jha, 40 years old man)

" A birth certificate is an important proof of citizenship and age of an individual. It is also required in seeking admission in school for children and taking benefits of government schemes such as vaccination for children. I received a birth certificate of my son from a hospital". (Mukesh Misra, 35-years-old man)

Most of the participants reported the birth of their children or other younger member of their family in block or municipality office. However, only one-fifth participants received a birth certificate from health centres since the birth was delivered in an institutional facility and registered there. Participants resided in rural areas reported to Aganwadi Sevika irrespective of birth delivery occurred at home or primary health centre. However, it was highlighted in group discussion that Aganwadi Sevika could register the birth within 21 days of the occurrence of birth. People are required to report at the block office after 21 days of the occurrence of birth. Participants in rural areas told they experienced some difficulties in registration for their children as Aganwadi Sevika did not provide a birth certificate on time. Also, only one-fourth participant told they received the birth certificate of their children.

"I reported the birth of my two daughters to Aganwadi Sevika, but I did not receive a certificate yet. Aganwadi Sevika told me that registration forms had not been provided to her from block office; therefore, she cannot provide a birth certificate. She also told me to wait for some months for the certificate". (Santi Devi, 38 years old woman)

Unlike high reporting for birth registration, we found few participants reported deaths to a registrar. Most of the participants were aware of the procedure and benefits of death registration. Many participants told a death certificate are required for seeking family pension if the deceased was employed in a public sector, insurance claim and transfer of property to

other`s name after the death of property holder. However, they did not report until it was essential for them. Also, participants told, it is not mandatory to report the death to a registrar before cremation or burial of the dead body. It was also found that people don't register infant death as there are no issues of property and any immediate benefits attached to it. Moreover, some participants told there are some cultural or traditional norms behind no reporting of infant deaths.

"A death certificate is required for seeking family pension, claiming insurance if any and transfer of property to another name after the death of property holder. Reporting of death is useful for medical officers to study the cause of death". (Sneha, 26 years old woman)

"I was aware that death is reported at block or municipality office. However, I did not report the death of my son because there were no benefits attached to it". (Mohanlal, 35 years old man)

"The Hindu religion, a father cannot fire a dead body of his children. Death of an infant is considered a sin of parents` previous birth; therefore, people hide information of infant death from society members and hence don't report". (Banti, 38 years old man)

Surprisingly, we also found a considerable number of participants were not aware of the procedure and benefits of birth and death registration. Some participants told they did not report birth or death to a register because they did not see any benefits attached to it. Moreover, they also mentioned they did not know where and to whom they can report. They also did not find another person who could assist them in the registration process. Many participants agreed that there were no official advertisements on benefits of birth and death registration system and no strict enforcement of RBD act in their village or city.

"I don't know how to report the birth to a registrar. I did not find anyone who could assist me in reporting the birth of my son. I also don't know the benefits attached to birth registration. There was no awareness campaign organised by government officers on the benefits and procedures of birth or death registration". (Munni Devi, 29 years old woman)

Lower reporting was found in rural areas as compared with urban areas. We found no formal set up at funeral places, and no strict implementation of RBD act were the main reasons for the low reporting of death. We also found most participants who resided in urban areas reported the death of any member of their household and received the death certificate. Availability and easy accessibility of registration units, and the presence of an adequate number of registrars were the main reasons for high reporting in urban areas. Besides, we found most people die in institutional settings in urban areas; therefore, more death is likely to be registered in urban areas.

2) Fees and documents required for registration

We found that most of the participants were aware of the fees and documents required for registration. Many participants told they did not pay any fees for birth registration of their children. Few participants paid five to ten rupees' fees for late reporting of birth of their children. We also found that participants were well aware of documents required for registration of birth or death. Participants mentioned that adhar card of parents, residential certificates and ration card is mostly required for registration. Sometimes, a letter from Panchayat Chief, which certifying credentials of applicants was also required at the time of registration of birth or death. Few participants told they did not know about fees and documents required for registration. They mentioned that no awareness was provided to them by any registrar or other authority of the system.

"I reported the birth of my children in the block office. I attached adhar card, a letter from Ward Prasad and affidavit made before notary along with registration form. Also, I paid 10 rupees' fees as I reported birth after 6 months of my son is born". (Avijit Mishra, 42 years old man)

" I reported the death of my father in the municipality office. I attached adhar card of my father along with death registration application form. I did not pay any fees to the registrar. He provided me a death certificate after 20 days of reporting". (Pankaj, 42 years old man)

"I did not know about the required documents for registration. Also, I did not find anyone who could assist me in submitting the application form at the block office; therefore, I did not report the birth of my daughter yet". (Savitri Devi, 28 years old man)

3) Corruption issues faced by participants and indirect opportunity cost attached with the registration

Based on FGD, we found that corruption issues in registration offices discouraged people for not reporting births or deaths. Many participants told that officers or staffs in the municipality office and block demanded 100-300 rupees for providing birth or death certificate on time. Participants highlighted staffs working in the certificate distribution section generally tell applicants to come next week for receiving certificate but ready to provide same certificate day, provided bribe is given.

"***An officer told me there is no fixed time to provide the certificate. If you need the certificate urgently, you have to provide 100 rupees for it".*** (Somerjeet, 33 years old man).

"***Staff in a block office demanded 200 rupees for providing the certificate. He also told if I don't pay, he would not provide a certificate".*** (Gopal Ji, 52 years old man)

"An Aganwadi Sevika registered the birth of my daughter, but she demanded 300 rupees for providing the certificate. I did not have money at that time, so I did not receive a certificate. Later, I ignored as I was not willing to give her 300 rupees for a birth certificate". (Sita Devi, 35 years old woman)

Many participants told there was a long queue in the municipal and block office for reporting birth or death. On regular days, it took 3-4 hours to report birth or death to a registrar. They also told they lost their one-day wage or took leave from the job to report birth or death to a registrar. Few participants told they were asked to come another day as they missed one of the required documents. Some participants highlighted that the block office is too far from their home, and they spent approx. one hundred rupees to reach there.

"I reached block office at 10 AM, but the staff did not take my application form till 11 AM. Then, he asked permission letter of the ward Parsad or an affidavit from Notary along with application form and told me to come the next day since I did not have the required affidavit. I lost the one-day wage because of such delay. I did not go for reporting

birth the next day as I did not want to lose wage for another day". (Hemant Ji, 42 years old man)

" I stood in a queue for 4 hours to report the birth of my son. I had to take one day leave from the job for this work. Also, I stood 2 hours in the queue for receiving the birth certificate, and it was very disturbing as they did not arrange shades for us and I had to stand before the sun for a long time". (Rupesh Ji, 35 years old man)

"I travelled 2 hours to reach the block office and stand 3 hours at the block office to report the death of my father. I experienced much fatigue that day and lost one day wage. I also spent 100 rupees on travelling". (Nisant Ji, 38 years old man)

Again, based on an interview with staffs associated with administration, we identified four main theme: 1) Staffs` knowledge and attitude towards registration system, 2) Challenges experienced by staffs due to shortage of required logistics and 3) Problem faced by staffs due to lack of training and 4) Poor performance by staffs in the absence of review meeting and monitoring. Word cloud of the qualitative analysis is shown in figure 5.1

1) Staffs` knowledge and attitude towards registration system

We found the administrative staffs associated with CRS have a good understanding of laws and protocols etc. It was highlighted during an interview that it is mandatory to register all birth and death under the RBD Act, 1969. The registrar can only register birth or death at the mother`s place of residence in case of birth or usual place of residence of a deceased person. They also told birth or death certificate is issued free of charge within the prescribed time limit of 21 days. It was their duty to post the certificate to an applicant doorstep if they did not come for receiving a certificate. Late registration is also allowed on submission of late fine, an affidavit made before the notary public and other required documents. Some Staffs also told they were asked by district officers to pay the penalty for negligence in reporting all births and deaths occurred in their authorised area.

"It is mandatory for us to register all births and deaths under RBD act, 1969. We aim to register all births and deaths; however, people don't report until it is

essential for their work. We request the local registrar to register all births and deaths occurred in their area. Moreover, we organised an awareness campaign in the areas where reporting is less than the expected level". (XYZ, an officer in chief Registrar office, Patna)

" I am required to register all births or deaths occurred at this hospital. I provide a birth or death certificate before they discharge from the hospital. The hospital provides a birth certificate free of cost. I think the birth certificate is an essential document for all official work and taking benefits of government schemes such as vaccination, the financial benefits to parents after birth delivery, post-natal care and its related financial assistance. A death certificate is also needed for an insurance claim, transfer of property after the death of property holder and seeking the family pension".
(XYZ, data entry operator cum registrar at district hospital)

2) Challenges experienced by staffs due to lack of required logistics and staffs

Informants revealed that they experienced many challenges due to the lack of required logistics in performing their duty adequately. They told there was a shortage of staffs, multiple tasks performed by a staff, frequent electricity cut and no separate office dedicated to a registrar and other staffs related to the registration system. Also, computers and internet are not provided in the office for online registration in some of the registration offices.

"*There are 17 posts assigned in this office, but only 3 staffs are working at present. Moreover, some staffs belong to other department and don't give much priority to vital registration".* (XYZ, a district officer)

"*There is only one operator at this block who also belongs to another department. Therefore, there is a high workload on us to update data on the system and share records with the district office. I look after entire work at the block. Moreover, I am often given the task of an invigilator during state board examination, which delays verification of application forms and, after that, late registration and distribution of certificates. Furthermore, frequent electricity cut causes a problem in the smooth functioning of this system".* (XYZ, a block statistical officer)

We also found that Aganwadi Sevika does multiple tasks such as providing pre-natal and post-natal care, assistance during birth delivery and vaccination to children. They also teach children

and serve mid-day meal at their centre. The pressure of performing multiple tasks limited their role as sub-registrar and may result in compromise with the quality of registration data.

" Block officer provides me with multiple tasks. I am required to provide vaccination to children, run Aganwadi centre where I teach children and serve mid-day meal to them. I also register birth or death occurs in this area. Sometimes, I fail to register all births and deaths because I am also required to go for vaccination and other government programs such as baby shower rituals". (Seema Devi, an Aganwadi Sevika)

" I have not registered a single event for the last 3 months because I was not provided with required forms for registration and issuing certificates. Block office normally provide a red form for birth registration and a yellow form for death registration, but this time they told that they would provide forms after one month but did not provide even after 3 months". (Babita Devi, an Aganwadi Sevika)

3) The problem faced by staffs due to lack of training

Many staffs told that they did not receive adequate training. We found that there were 1-2 training programs conducted for sub-registers and block-level staffs on online registration system in the last two years. Few Aganwadi Sevika told they did not receive any training in the previous five years. Some medical officers or district officers told they did not receive fund for conducting training last year. We also found that some staffs did not see manual published by ORGI.

"I didn`t attend any training program in the last 5 years. I need some guidance on online registration system, but block staffs are not providing training to me". (Sunita Devi, an Aganwadi Sevika)

"I have not received any training in the last two years. I attended a training program on organising awareness programs on the benefits of births and deaths registration before 2 years. I need training on how to work on CRS software and other related issues".
(Sandeep, a Block Statistical Officer).

"***We organised two training programs on online registration system before one year but there was no fund provided for conducting training last year, therefore, we did not organise any training programs. Periodic training for staffs is very important for***

maintaining accuracy and efficiency in the system". (Jitaram, Chief Medical Officer of a community health centre)

4) Poor performance by staffs due to the absence of regular monitoring and review meeting

Aganwadi Sevika and block-level staffs told that there had not been any review meeting conducted by district or state level officers in last one year. Also, there was no regular monitoring at the local level by higher authorities.

"There was no review meeting in recent years. I was invited to a review meeting 5 years ago". (Sanjeet, Ward Parsad (local leader))

"Block-level officers don't call us in the review meeting. I did not attend such a meeting ever. I think monthly, or quarterly review meeting is required to clear doubts on issues related to registration". (Sunita Devi, an Aganwadi Sevika)

Figure 5-1 Word cloud from qualitative analysis

5.3 Discussion

This study explores the performance barriers of CRS in Bihar. We selected Bihar for this study because the level of registration of birth and death has not been improved much in Bihar in the last 10 years as compared with other states. Besides, we chose two districts Patna and Vaishali of Bihar to show the operational status of the registration system in two different contexts, i.e. more urbanised Patna and one of least urbanised district Vaishali. Complete and up to date vital statistics based on CRS are an indispensable tool for policymakers and medical officers to design health care programs and social welfare. CRS data is also useful for monitoring and evaluation of designed health and socioeconomic development programs.

We found that most participants have good knowledge of procedures and benefits of registration of births and deaths. Most people reported birth because there are immediate benefits attached to birth registration. Birth registration is essential for seeking admission in school for children, vaccination and other government schemes such as financial assistance after birth delivery. A previous study also showed that in 20 countries, children need to have a birth certificate to receive the vaccination. Besides, in 30 countries, a birth certificate is required to access health facilities (Wenz & Abouzahr, 2016). UN also documented lacking a legal proof of age may risk to their social security. Besides, having proof of age is the best tool for protecting against child trafficking, child labour and child marriage (United Nations, 1989).

Unlike birth registration, there is no immediate benefit attached to death registration. People reported death when death certificate is required for the insurance claim or seeking pension. This study highlighted that it is not mandatory to register death before burial or cremation of a dead body. Lower priority for death registration among people and no strict implementation of the law could be reasons for lower reporting for death. A previous study documented irregularities and perception of the low utility of death reporting resulted in lower registration for death in rural areas (Tobin EA et al., 2015). Linking death registration with specific financial support could improve the completeness of death registration (Oung et al., 2019). Also, in many countries, reporting for birth and death is mandatory and fine is strictly imposed for not reporting the event within the prescribed time (HSRI, 2015; ORGI, 2018; UNICEF, 2015). This study also shows lower reporting for infant death because there is no property issue attached to an infant. Besides, cultural norms are associated with lower reporting for infant deaths. A previous study documented a similar reason (James et al., 2013, UNICEF, 2019). This study shows some people did not report birth or death because they did not know the

procedures and benefits attached with it. A previous study also documented people awareness is the main factor for lower reporting of birth and death (Tobin et al., 2015; Li et al., 2016).

This study showed registration of birth and death is higher in urban areas than in rural areas. Many births and deaths took place in institutional setup, available in urban areas and registered there, could be the main reason for higher registration in urban areas. Besides, many patients from rural areas are transferred to tertiary hospitals for better treatment available in urban areas. In case of patients died during treatment, death is registered by the concerned authority at the hospital. A study by James et al. also documented a similar reason for higher birth and death registration in urban areas. Also, UNICEF documented children among urban residents are one and half times more likely to registered than children among rural residents (UNICEF, 2015).

Demand for a bribe by staffs for providing a birth or death certificate could be a discouraging factor for registration and results in low reporting. Also, the indirect opportunity cost associated the registration system is too high for some people. Many people had forgone their one-day wage and spent more than 100 rupees in travelling to the registration office. A mobile registration unit in areas far from block or municipal office could be helpful for people who neglect reporting of birth or death due to long distance and money required for travelling to the registration office. A previous study suggested a similar point (Li et al., 2010).

Furthermore, this study showed the majority of staffs associated with the administration were well aware of laws and procedures for registering births and deaths. Previous reports also documented that knowledgeable and well-trained staff is an essential for effective vital registration system (United Nations, 2014; PAHO, 2017; WHO, 2015). However, this study also found many staffs experienced challenges due to shortage of required logistics. Regular electricity cut, lack of staffs and lack of required logistics such as a separate office for registration work, photocopier machine etc. were mainly highlighted problems during an interview with staffs. Also, there was no availability of computer in some registration units which restricted online registration of births and deaths. Timely fund for required logistics and an adequate number of staffs are essential for the efficient functioning of the system. A WHO report also documented investment in vital registration system is needed for adequate decision making (WHO, 2012).

This study highlights the problem faced by staffs in the smooth functioning of the system due to lack of regular training. Refresher training is essential for updating and solving their problems encountered in the fields (United Nations, 2014). Besides, this study also showed no monitoring and review meeting by state or district level officers, which resulted in poor performance by staff. A study revealed that severe problem arises when local registrars do not report the registered event to head office (PAHO, 2017). The previous study also documented specific supervision and quality check of data are an integral part of the vital registration system (WHO, 2012; WHO,2014; Oung T, 2019; PAHO, 2017). Adequately funded evaluation activities of CRVS must be regarded as an essential component of functional registration system (PAHO, 2017).

This study suggests mandatory registration of death before cremation or burial of dead bodies and provision for financial support for organising funeral rites could improve reporting for death. Awareness of the benefits of birth and death registration should be provided through different media such as television, radio, posters, and pamphlets distribution. Periodic evaluation of the working of this system would be useful for generating accurate and up-to-date data. Further, ensuring the interest of political parties and administration for optimisation of resources should be encouraged.

Although, this study presents comprehensive findings on performance barriers of CRS. However, this study has some limitations. First, this study covers only two districts of Bihar; therefore, generalisation could be made for the districts or states with a similar development level with care. Second, this study is mainly focused on barriers at the operational level and does not look for the quality of vital statistics generated by the system. Third, the cross-section nature of this study limited further causal analysis.

As a future course of action, a complete assessment of the CRVS system is strongly suggested. Besides, identification of significant predictors for birth and death registration could be useful for policy purpose.

5.4 Conclusion

This study highlights community member and staffs associated with the administration have good knowledge of procedures and benefits of registering births and deaths. Corruption issues and high opportunity cost associated with birth or death registration discouraged some people for registration. Reporting for death is lower because no immediate benefits attached to death registration, unlike birth registration. We found significantly less or no reporting for infant deaths because there is no property issues or financial benefit linked to infant deaths. Besides, registration of births and deaths was found higher in urban areas. Staffs of registration systems experienced many challenges due to the shortage of required logistics, lack of staff, multiple tasks, and regular training. Besides, there was no review meeting and monitoring of work done by local level registrars. This study suggests mandatory registration for death before burial or cremation, strict implementation of laws by concerned authorities. Awareness program for the general public and regular evaluation of the working of this system could improve the level of registration of births and deaths.

CHAPTER 6

6 Summary and conclusion

Civil Registration System provides reliable vital statistics which is recorded on a real-time basis. Besides, it is an only data source which provides vital statistics annually at state and district levels. Vital statistics based on CRS have many utilities for policymakers and health officials. These statistics are mainly used for tracking the pattern of birth, death and causes of death. The government needs birth statistics to plan health and social welfare programmes such as health care, vaccination and education facilities etc. Also, mortality data enables health officials to examine the prevalence and distribution of factors associated with deaths. According to ORGI, there has been considerable improvement in birth and death registration in the last ten years, but the birth and death registration level is still below 90 per cent.

Birth certificate serves the legal identity of an individual. It provides access to essential public services such as health care, education and legal protection to an individual. Despite its many usefulness, we found only 38 per cent of children under age five had a birth certificate. We also found socioeconomic characteristics were significantly associated with birth registration of children. Child`s age, sex, birth order, place of residence, vaccination status, and living parent were significantly associated with birth registration of children. Besides, mother`s characteristics such as mother`s age, level of education, types of occupation, media exposure, current marital status, antenatal and postnatal care, and place of birth delivery were significantly associated with birth registration for children. Moreover, we found sex of the head of a household, caste, religion, and wealth status had a significant association with birth registration of children under age five years. Besides, father`s characteristics, such as level of education, occupation, were also associated with children's birth registration. The multilevel binary logistic regression results showed significant effects of birth registration at different levels, i.e. individual, district and state level. We mainly conclude that children belong to the marginalised community, poorer wealth status, rural residence, and illiterate mother had less likelihood of birth registration. We strongly suggest focused intervention to improve coverage for birth registration for the marginalised community. Besides, linking of health facility with birth registration could improve reporting for birth registration. We found lower birth registration was recorded in the Uttar Pradesh, Bihar, Arunachal Pradesh, Jharkhand and Rajasthan. In Uttar Pradesh, 11 out of 75 districts recorded lower than 50 per cent birth registration. Besides, 4 districts of Arunachal Pradesh, Purba Champaran in Bihar, Rajouri in J&K and Dholpur in Rajasthan recorded lower than 50 per cent birth registration.

Furthermore, we investigated underreporting or over-reporting of vital statistics in CRS of India. We found estimated completeness of birth registration varies widely at the state level. Lower completeness of birth registration was observed in Bihar, Uttar Pradesh, Madhya Pradesh. As expected, variation at district level was higher than the state level. Surprisingly, we found many districts of poor-performing states where higher birth was recorded. This finding could be attributed to the availability of advance health care system in these districts. Information on the registration of birth at the district level would alert local government officials to design intervention for improving coverage for birth registration.

Further, we found less reporting for infant death. EAGs states such as Bihar, UP, Madhya Pradesh, Rajasthan, Assam recorded significantly fewer infant deaths. We found high variation at the state level and district level in recording of infant deaths. Besides, there were many districts of less developed states which recoded higher infant deaths. We also found the estimated completeness of death using an empirical method was lower than estimates provided by ORGI. Given the robustness and broader acceptability of the empirical method, we conclude that the estimates provided by ORGI were over-reported. Also, ORGI estimate did not take account of age and sex distribution of population and calculated mid-year population figure for 2016 using population projection based on the year 2001, which is much older data. Trend analysis for completeness of birth and death registration showed considerable improvement in the last 18 years. Besides, the gap between the level of birth and death registration has narrowed over the year. Correct information on the birth and death registration level would be useful for researchers and medical officers for calculating adjustment factors for accurate estimation of fertility and mortality rate. This study suggests focused intervention for improving birth and infant death registration in districts where reporting is low. Also, periodic evaluation of the quality of vital statistics is strongly suggested.

We also explored the performance barriers of CRS using qualitative technique. We used KII and FGD techniques to obtain information on operational barriers in the CRS. We found that most people were aware of the procedures and benefits of registration of births and deaths. There was a higher demand for birth registration as the birth certificate has immediate benefits. We found that birth certificate is mostly required for vaccination, seeking admission in school and taking benefits of public services such as financial assistance on birth delivery, fellowship for girls for set years of schooling. However, we found lesser reporting for death. People did not report death until they required a death certificate. Besides, there was no strict

implementation of the law for recording all deaths. We found death certificate is needed for seeking family pension, transfer of property and insurance claim if any. Surprisingly, we found significantly low reporting for infant death. People did not see any benefit associated with reporting of infant death. Besides, we found many people did not report infant death due to tradition or cultural norms. Also, corruption and high indirect opportunity cost associated with birth registration discouraged many people for reporting birth or death.

Furthermore, we found staff associated with CRS were well aware of the procedures and benefits of registering birth and death. We also found that staff were experiencing many challenges due to lack of adequate staff and shortage of required logistics. Many staffs had to perform multiple tasks. Besides, they were not provided regular training which may decrease their efficiency in performing their duty. Regular supervision by higher-level authorities was also not found, which resulted in poor performance by local level registrars.

Mandatory registration before cremation or burial would improve death registration. Provision for little financial support for performing funeral rites may encourage people for reporting. Moreover, adequate funding for the smooth operation of the system and periodic evaluation of the quality of vital statistics may be quite useful in generating quality CRVS. Also, providing awareness to people through different media such as television, newspaper, radio, poster on benefits of registration for birth and death would increase reporting for birth and death.

As a future course of actions, a comprehensive assessment of CRS is strongly suggested. Also, a study on the quality of cause of death statistics and the use of automated verbal autopsy tools would help policymakers and health officials to determine the causes of death accurately and design adequate health programs. Moreover, an explorative study in districts where the level of registration of birth and death is lower than the national average would provide plausible information on local factors which have been negatively affecting the system.

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8 Appendix

Table 4.1. Estimates of completeness of birth registration by states and districts of India

State/District	Registered (R)	Estimated (A)	E-A	Completeness(%)
Jammu & Kashmir	151935	172818	20883	87.92
Kupwara	1938	11051	9113	17.54
Badgam	1654	7542	5888	21.93
Leh	2853	1404	-1449	203.24
Kargil	1178	1684	506	69.93
Punch	1210	11557	10347	10.47
Rajouri	5602	13266	7664	42.23
Kathua	6917	8436	1519	82.00
Baramula	7323	10645	3322	68.80
Bandipore	1079	5687	4608	18.97
Srinagar	37836	15389	-22447	245.86
Ganderbal	2068	4419	2351	46.80
Pulwama	4185	5301	1116	78.95
Shupiyan	1234	3092	1858	39.91
Anantnag	7811	13184	5373	59.25
Kulgam	2944	5848	2904	50.34
Doda	3545	7391	3846	47.96
Ramban	4162	4869	707	85.47
Kishtwar	1841	4016	2175	45.84
Udhampur	7990	8445	455	94.62
Reasi	2980	6413	3433	46.47
Jammu	37427	18618	-18809	201.03
Samba	8158	4562	-3596	178.81
Himachal Pradesh	101595	107773	6178	94.27
Chamba	6797	9656	2859	70.39
Kangra	22462	20475	-1987	109.70
Lahul and spiti	109	314	205	34.67
Kullu	6362	6466	104	98.39
Mandi	13802	17048	3246	80.96
Hamirpur	7127	7350	223	96.96
Una	8027	8526	499	94.14
Bilaspur	6226	6235	9	99.86

Solan	8189	9721	1532	84.24
Sirmaur	5815	8246	2431	70.52
Shimla	15802	12732	-3070	124.11
Kinnaur	877	1045	168	83.92
Punjab	463788	425032	-38756	109.12
Gurdaspur	26035	31578	5543	82.45
Kapurthala	14588	9750	-4838	149.63
Jalandhar	39384	32818	-6566	120.01
Hoshiarpur	20697	22564	1867	91.72
Sangrur	22177	8430	-13747	263.07
Fatehgarh sahib	6784	8674	1890	78.21
Ludhiana	73388	54926	-18462	133.61
Moga	15125	15761	636	95.96
Firozpur	13698	30211	16513	45.34
Muktsar	13434	14012	578	95.88
Faridkot	9720	15023	5303	64.70
Bathinda	21812	18040	-3772	120.91
Mansa	12673	12801	128	99.00
Patiala	32997	34038	1041	96.94
Amritsar	48501	38797	-9704	125.01
Tarn Taran	16466	18677	2211	88.16
Rupnagar	11014	10139	-875	108.63
Sahibzada Ajit Singh	12515	16018	3503	78.13
Shahid Bhagat Singh Nagar	10772	24653	13881	43.69
Barnala	8575	8122	-453	105.58
Uttarakhand	226175	170060	-56115	133.00
Uttarkashi	4332	5099	767	84.97
Chamoli	9279	5869	-3410	158.10
Rudraprayag	2130	3275	1145	65.03
Tehri Garhwal	13398	10718	-2680	125.01
Dehradun	44257	25796	-18461	171.56
Garhwal	10718	9637	-1081	111.21
Pithoragarh	12114	6712	-5402	180.48
Bageshwar	6023	4280	-1743	140.73
Almora	7700	9437	1737	81.59
Champawat	4179	3962	-217	105.49
Nainital	33392	13838	-19554	241.30

Udham Singh Nagar	30861	30866	5	99.98
Hardwar	47792	40535	-7257	117.90
Haryana	570747	552786	-17961	103.25
Panchkula	13628	8450	-5178	161.28
Ambala	20415	19732	-683	103.46
Yamuna Nagar	24780	18685	-6095	132.62
Kurukshetra	20675	14472	-6203	142.86
Kaithal	23135	21817	-1318	106.04
Karnal	29408	34266	4858	85.82
Panipat	30653	18508	-12145	165.62
Sonipat	32476	25429	-7047	127.71
Jind	23060	28131	5071	81.97
Fatehabad	21017	18121	-2896	115.98
Sirsa	25634	32321	6687	79.31
Hisar	42482	33743	-8739	125.90
Bhiwani	28773	35978	7205	79.97
Rohtak	26209	22526	-3683	116.35
Jhajjar	13878	18172	4294	76.37
Mahendragarh	16376	15654	-722	104.61
Rewari	18210	19547	1337	93.16
Gurgaon	35827	41230	5403	86.89
Mewat	46544	48421	1877	96.12
Faridabad	50317	51475	1158	97.75
Palwal	27250	26080	-1170	104.49
New Delhi	379161	276080	-103081	137.34
North west	NA	NA	NA	NA
North	NA	NA	NA	NA
North East	NA	NA	NA	NA
East	NA	NA	NA	NA
New Delhi	NA	NA	NA	NA
Central	NA	NA	NA	NA
West	NA	NA	NA	NA
South West	NA	NA	NA	NA
South	NA	NA	NA	NA
Rajasthan	1806205	1639660	-166545	110.16
Ganganagar	49330	44089	-5241	111.89

Hanumangarh	51370	32199	-19171	159.54
Bikaner	62464	57384	-5080	108.85
Churu	59306	45084	-14222	131.55
Jhunjhunun	51216	44741	-6475	114.47
Alwar	78136	88959	10823	87.83
Bharatpur	66505	78942	12437	84.25
Dhaulpur	34867	33112	-1755	105.30
Karauli	33722	39153	5431	86.13
Sawai Madhopur	35833	39149	3316	91.53
Dausa	36033	37872	1839	95.14
Jaipur	194629	130544	-64085	149.09
Sikar	75132	62411	-12721	120.38
Nagaur	81093	65215	-15878	124.35
Jodhpur	103619	89761	-13858	115.44
Jaisalmer	21545	20007	-1538	107.69
Barmer	76062	77110	1048	98.64
Jalor	50224	54686	4462	91.84
Sirohi	29884	28483	-1401	104.92
Pali	61426	49331	-12095	124.52
Ajmer	76923	62690	-14233	122.70
Tonk	31938	32761	823	97.49
Bundi	23860	22592	-1268	105.61
Bhilwara	63230	51174	-12056	123.56
Rajsamand	28009	30494	2485	91.85
Dungarpur	33232	39751	6519	83.60
Banswara	48218	49650	1432	97.12
Chittaurgarh	34113	28473	-5640	119.81
Kota	57243	39005	-18238	146.76
Baran	27794	29640	1846	93.77
Jhalawar	33774	28729	-5045	117.56
Udaipur	72532	81960	9428	88.50
Pratapgarh	22943	24549	1606	93.46
Uttar Pradesh	3488980	4990809	1501829	69.91
Saharanpur	50661	90223	39562	56.15
Muzaffarnagar	55065	106006	50941	51.95
Bijnor	121059	89681	-31378	134.99
Moradabad	72029	126780	54751	56.81
Rampur	41383	59363	17980	69.71

Jyotiba Phule Nagar	NA	50560	NA	NA
Meerut	68278	121069	52791	56.40
Baghpat	36090	31171	-4919	115.78
Ghaziabad	69796	127749	57953	54.64
Gautam Buddha Nagar	53070	55873	2803	94.98
Bulandshahr	77637	98489	20852	78.83
Aligarh	68484	102662	34178	66.71
Mahamaya nagar	NA	38422	NA	NA
Mathura	53854	73373	19519	73.40
Agra	107109	113289	6180	94.54
Firozabad	46370	62440	16070	74.26
Mainpuri	35204	42521	7317	82.79
Budaun	81837	114113	32276	71.72
Bareilly	71903	108823	36920	66.07
Pilibhit	44226	51097	6871	86.55
Shahjahanpur	62645	87636	24991	71.48
Kheri	49777	122790	73013	40.54
Sitapur	92986	123339	30353	75.39
Hardoi	2770	107725	104955	2.57
Unnao	0	75399	75399	0.00
Lucknow	79701	67564	-12137	117.96
Rae bareli	50478	71860	21382	70.24
Farrukhabad	18556	50115	31559	37.03
Kannauj	38170	42806	4636	89.17
Etawah	35278	36884	1606	95.65
Auraiya	19170	30903	11733	62.03
Kanpur Dehat	50991	38644	-12347	131.95
Kanpur Nagar	69290	85096	15806	81.43
Jalaun	31714	27974	-3740	113.37
Jhansi	21440	36034	14594	59.50
Lalitpur	28091	26157	-1934	107.40
Hamirpur	20274	21374	1100	94.85
Mahoba	NA	17913	NA	NA
Banda	35184	30680	-4504	114.68
Chitrakoot	19837	28369	8532	69.92
Fatehpur	22740	45692	22952	49.77
Pratapgarh	63172	63699	527	99.17
kaushambi	30423	41683	11260	72.99
Allahabad	105564	144151	38587	73.23

Bara banki	60306	76587	16281	78.74
Faizabad	11524	56076	44552	20.55
Ambedkar nagar	60551	53081	-7470	114.07
Sultanpur	44235	78525	34290	56.33
Bahraich	NA	117635	NA	NA
Shrawasti	29696	39838	10142	74.54
Balrampur	59363	64142	4779	92.55
Gonda	78209	100114	21905	78.12
Siddharth Nagar	64568	73679	9111	87.63
Basti	49543	69359	19816	71.43
Sant Kabir Nagar	35107	46887	11780	74.88
Mahrajganj	21164	77103	55939	27.45
Gorakhpur	87219	97459	10240	89.49
Kushinagar	83221	102963	19742	80.83
Deoria	54881	71391	16510	76.87
Azamgarh	57399	93822	36423	61.18
Mau	34493	51616	17123	66.83
Ballia	76270	78191	1921	97.54
Jaunpur	98806	99788	982	99.02
Ghazipur	66547	79913	13366	83.27
Chandauli	NA	55913	NA	NA
Varanasi	56948	77269	20321	73.70
Sant Ravidas Nagar	28785	45208	16423	63.67
Mirzapur	53204	59592	6388	89.28
Sonbhadra	41308	49604	8296	83.28
Etah	23617	45696	22079	51.68
Kanshiram Nagar	28627	41169	12542	69.53
Bihar	1697762	2757216	1059454	61.58
Pashchim champaran	60286	103027	42741	58.51
Purba champaran	80068	161501	81433	49.58
Sheohar	9628	22526	12898	42.74
Sitamarhi	60098	108893	48795	55.19
Madhubani	66671	118683	52012	56.18
Supaul	24546	74754	50208	32.84
Araria	47892	89963	42071	53.24
Kishanganj	18362	49817	31455	36.86
Purnia	64095	102460	38365	62.56
Katihar	54525	82452	27927	66.13

Madhepura	7683	67277	59594	11.42
Saharsa	46404	59087	12683	78.53
Darbhanga	82934	123110	40176	67.37
Muzaffarpur	110198	111592	1394	98.75
Gopalganj	73420	58594	-14826	125.30
Siwan	68014	73209	5195	92.90
Saran	53742	91905	38163	58.48
Vaishali	65222	90518	25296	72.05
Samastipur	70637	114046	43409	61.94
Begusarai	40200	87617	47417	45.88
Khagaria	14567	51347	36780	28.37
Bhagalpur	42754	92140	49386	46.40
Banka	25242	52761	27519	47.84
Munger	18716	30684	11968	61.00
Lakhisarai	10653	24059	13406	44.28
Sheikhpura	15367	16562	1195	92.79
Nalanda	51574	61658	10084	83.65
Patna	110893	133786	22893	82.89
Bhojpur	49726	58668	8942	84.76
Buxar	30368	38014	7646	79.89
Kaimur (Bhabua)	29874	35696	5822	83.69
Rohtas	42616	64207	21591	66.37
Aurangabad	29759	45062	15303	66.04
Gaya	31106	125551	94445	24.78
Nawada	36916	46730	9814	79.00
Jamui	28800	49086	20286	58.67
Jehanabad	13382	23606	10224	56.69
Arwal	10824	16597	5773	65.22
Assam	734454	706045	-28409	104.02
Kokrajhar	20977	17944	-3033	116.90
Dhubri	49994	54955	4961	90.97
Goalpara	25721	25794	73	99.72
Barpeta	48836	38795	-10041	125.88
Morigaon	30350	26485	-3865	114.59
Nagaon	77087	71764	-5323	107.42
Sonitpur	41922	32656	-9266	128.37
Lakhimpur	20150	21759	1609	92.61
Dhemaji	16907	16476	-431	102.62

Tinsukia	23833	28827	4994	82.68
Dibrugarh	25355	26438	1083	95.90
Sivasagar	16293	21910	5617	74.36
Jorhat	19638	20187	549	97.28
Golaghat	20440	21219	779	96.33
Karbi Anglong	24093	21080	-3013	114.29
Dima Hasao	5545	4844	-701	114.46
Cachar	54351	41832	-12519	129.93
Karimganj	41610	36675	-4935	113.46
Hailakandi	16548	18044	1496	91.71
Bongaigaon	15547	16091	544	96.62
Chirang	8698	11093	2395	78.41
Kamrup	22785	31959	9174	71.29
Kamrup Metropolitan	41570	20784	-20786	200.01
Nalbari	17585	14893	-2692	118.08
Baksa	15500	22566	7066	68.69
Darrang	17379	22992	5613	75.59
Udalguri	15740	17972	2232	87.58
West Bengal	1415228	1428882	13654	99.04
Darjiling	21583	21056	-527	102.50
Jalpaiguri	32840	51204	18364	64.14
Koch Bihar	55350	43202	-12148	128.12
Uttar Dinajpur	61683	68466	6783	90.09
Dakshin dinajpur	16269	22064	5795	73.73
Maldah	104516	81680	-22836	127.96
Murshidabad	146726	148657	1931	98.70
Birbhum	63678	53136	-10542	119.84
Barddhaman	81004	109571	28567	73.93
Nadia	61903	74267	12364	83.35
North Twenty Four Par	122144	137240	15096	89.00
Hugli	88694	69507	-19187	127.60
Bankura	61831	53140	-8691	116.36
Puruliya	22214	56673	34459	39.20
Haora	85767	66252	-19515	129.46
Kolkata	112518	46597	-65921	241.47
South Twenty Four Par	95310	157209	61899	60.63
Paschim Medinipur	55670	86897	31227	64.06
Purba Medinipur	107136	82077	-25059	130.53

Jharkhand	698026	745413	47387	93.64
Garhwa	30144	39554	9410	76.21
Chatra	27254	34414	7160	79.19
Kodarma	21612	18609	-3003	116.13
Giridih	57582	62104	4522	92.72
Deoghar	21558	42805	21247	50.36
Godda	20853	32292	11439	64.58
Sahibganj	32680	31305	-1375	104.39
Pakur	11449	25175	13726	45.48
Dhanbad	52221	45834	-6387	113.93
Bokaro	33674	40615	6941	82.91
Lohardaga	13389	10182	-3207	131.50
Purbi Singhbhum	41315	37610	-3705	109.85
Palamu	37410	42987	5577	87.03
Latehar	14999	16057	1058	93.41
Hazaribagh	44959	40712	-4247	110.43
Ramgarh	16458	16921	463	97.27
Dumka	18369	28959	10590	63.43
Jamtara	15941	22634	6693	70.43
Ranchi	81630	51984	-29646	157.03
Khunti	13545	10570	-2975	128.14
Gumla	27578	18506	-9072	149.03
Simdega	14216	12103	-2113	117.46
Pashchimi Singhbhum	33512	36107	2595	92.81
Saraikela Kharsawan	15678	27422	11744	57.17
Odissa	772665	748476	-24189	103.23
Bargarh	18758	27748	8990	67.60
Jharsuguda	10058	8681	-1377	115.87
Sambalpur	24683	17574	-7109	140.45
Debagarh	3095	6489	3394	47.70
Sundargarh	36934	33293	-3641	110.94
Kendujhar	33167	40324	7157	82.25
Mayurbhanj	43331	45507	2176	95.22
Baleshwar	40694	40470	-224	100.55
Bhadrak	29515	28080	-1435	105.11
Kendrapara	29851	28221	-1630	105.77
Jagatsinghapur	16967	15934	-1033	106.48

Cuttack	51667	40770	-10897	126.73
Jajapur	32084	31199	-885	102.84
Dhenkanal	19377	21344	1967	90.78
Anugul	25553	24137	-1416	105.86
Nayagarh	14385	16097	1712	89.36
Khordha	48773	39219	-9554	124.36
Puri	19474	28826	9352	67.56
Ganjam	71590	53246	-18344	134.45
Gajapati	12535	11339	-1196	110.54
Kandhamal	15096	16574	1478	91.08
Baudh	6681	9010	2329	74.15
Subarnapur	7637	11629	3992	65.67
Balangir	31965	36420	4455	87.77
Nuapada	13371	15028	1657	88.97
Kalahandi	25779	30187	4408	85.40
Rayagada	22603	19302	-3301	117.10
Nabarangapur	26184	29973	3789	87.36
Koraput	26951	28875	1924	93.34
Malkangiri	14177	17157	2980	82.63
Chattishgarh	763878	605092	-158786	126.24
Korea (Koriya)	13464	15328	1864	87.84
Surguja	21816	55230	33414	39.50
Jashpur	40111	19867	-20244	201.90
Raigarh	65379	30598	-34781	213.67
Korba	32218	30550	-1668	105.46
Janjgir - champa	47790	29875	-17915	159.96
Bilaspur	84005	84180	175	99.79
Kabirdham	21514	19546	-1968	110.07
Rajnandgaon	35451	45949	10498	77.15
Durg	44167	65988	21821	66.93
Raipur	65379	93331	27952	70.05
Mahasamund	21190	23932	2742	88.54
Dhamtari	19725	15675	-4050	125.84
Uttar Bastar Kanker	45358	13592	-31766	333.72
Bastar	21431	36370	14939	58.92
Narayanpur	2895	4310	1415	67.17
Dakshin Bastar Dantew	7286	12871	5585	56.61
Bijapur	4075	7898	3823	51.60

Madhya Pradesh	1465779	1827664	361885	80.20
Sheopur	8983	19049	10066	47.16
Morena	45597	47121	1524	96.77
Bhind	31826	38347	6521	82.99
Gwalior	51165	49358	-1807	103.66
Datia	14215	18802	4587	75.60
Shivpuri	35321	47228	11907	74.79
Tikamgarh	27479	33414	5935	82.24
Chhatarpur	46090	45202	-888	101.96
Panna	18207	25408	7201	71.66
Sagar	76519	61551	-14968	124.32
Damoh	22137	33100	10963	66.88
Satna	39298	50966	11668	77.11
Rewa	44094	63642	19548	69.28
Umaria	12432	16891	4459	73.60
Neemuch	15299	18872	3573	81.07
Mandsaur	22732	32740	10008	69.43
Ratlam	31377	35042	3665	89.54
Ujjain	41440	49430	7990	83.83
Shajapur	16543	32842	16299	50.37
Dewas	32142	40276	8134	79.80
Dhar	33878	60325	26447	56.16
Indore	73015	86676	13661	84.24
Khargone (West Nimar)	35241	43576	8335	80.87
Barwani	33615	48253	14638	69.66
Rajgarh	28288	41893	13605	67.52
Vidisha	8974	44189	35215	20.31
Bhopal	80417	51549	-28868	156.00
Sehore	7904	31688	23784	24.94
Raisen	22463	37501	15038	59.90
Betul	26715	33922	7207	78.75
Harda	8467	13299	4832	63.67
Hoshangabad	25583	31000	5417	82.53
Katni	46004	27808	-18196	165.44
Jabalpur	42806	47462	4656	90.19
Narsimhapur	22424	22592	168	99.26
Dindori	12686	17092	4406	74.22
Mandla	15967	21424	5457	74.53

Chhindwara	46971	46643	-328	100.70
Seoni	22931	27990	5059	81.93
Balaghat	25288	43562	18274	58.05
Guna	23641	39684	16043	59.57
Ashoknagar	17600	21159	3559	83.18
Shahdol	20383	23655	3272	86.17
Anuppur	6911	18143	11232	38.09
Sidhi	26158	35251	9093	74.21
Singrauli	25454	37251	11797	68.33
Jhabua	25257	33820	8563	74.68
Alirajpur	20009	27824	7815	71.91
Khandwa (East Nimar)	21150	33529	12379	63.08
Burhanpur	15666	19599	3933	79.93
Gujarat	1252090	1235706	-16384	101.33
Kachchh	49401	48778	-623	101.28
Banaskantha	84759	74788	-9971	113.33
Patan	34197	28837	-5360	118.59
Mahesana	38161	44508	6347	85.74
Sabarkantha	32581	53467	20886	60.94
Gandhinagar	28433	34346	5913	82.78
Ahmadabad	138003	132740	-5263	103.96
Surendranagar	33024	37596	4572	87.84
Rajkot	62052	64629	2577	96.01
Jamnagar	25061	37070	12009	67.60
Porbandar	9972	11095	1123	89.88
Junagadh	24666	48283	23617	51.09
Amreli	29478	19821	-9657	148.72
Bhavnagar	25115	51842	26727	48.45
Anand	41586	49114	7528	84.67
Kheda	38838	54569	15731	71.17
Panchmahal	39584	55130	15546	71.80
Dohad	65549	43541	-22008	150.55
Vadodara	49842	81681	31839	61.02
Narmada	11206	14211	3005	78.86
Bharuch	25115	34635	9520	72.51
The Dangs	7356	6269	-1087	117.33
Navsari	19937	23551	3614	84.66
Valsad	32730	35584	2854	91.98

Surat	101832	134489	32657	75.72
Tapi	10373	15150	4777	68.47
Maharastra	1801451	1898167	96716	94.90
Nandurbar	26042	30224	4182	86.16
Dhule	32426	34568	2142	93.80
Jalgaon	66702	63872	-2830	104.43
Buldana	46171	41926	-4245	110.13
Akola	42727	29964	-12763	142.59
Washim	19271	20339	1068	94.75
Amravati	43437	40643	-2794	106.87
Wardha	18069	14904	-3165	121.24
Nagpur	66452	65435	-1017	101.55
Bhandara	19172	17031	-2141	112.57
Gondiya	20433	20091	-342	101.70
Gadchiroli	18539	13398	-5141	138.37
Chandrapur	27549	34009	6460	81.00
Yavatmal	50807	48640	-2167	104.45
Nanded	70390	72868	2478	96.60
Hingoli	20246	19780	-466	102.36
Parbhani	35849	35408	-441	101.25
Jalna	31847	40344	8497	78.94
Aurangabad	90564	73094	-17470	123.90
Nashik	125324	157540	32216	79.55
Thane	149079	180466	31387	82.61
Mumbai Suburban	NA	NA	NA	NA
Mumbai	152972	47475	-105497	322.22
Raigarh	32494	54716	22222	59.39
Pune	124817	139407	14590	89.53
Ahmadnagar	75899	83407	7508	91.00
Bid	55998	47548	-8450	117.77
Latur	48242	40309	-7933	119.68
Osmanabad	28378	23090	-5288	122.90
Solapur	86717	78092	-8625	111.05
Satara	43405	47342	3937	91.68
Ratnagiri	17467	24635	7168	70.90
Sindhudurg	8518	9458	940	90.06
Kolhapur	53131	51899	-1232	102.37
Sangli	52317	45064	-7253	116.10

Andhra Pradesh	814754	809085	-5669	100.70
Srikakulam	50219	43831	-6388	114.57
Vizianagaram	34924	40699	5775	85.81
Visakhapatnam	61540	60611	-929	101.53
East Godavari	87957	81620	-6337	107.76
West Godavari	62699	52015	-10684	120.54
Krishna	62953	67103	4150	93.82
Guntur	86839	68951	-17888	125.94
Prakasam	48537	63759	15222	76.13
Sri Potti Sriramulu	45946	53242	7296	86.30
YSR	53734	54361	627	98.85
Kurnool	79619	90678	11059	87.80
Anantapur	58223	64081	5858	90.86
Chittoor	81564	68143	-13421	119.70
Karnataka	1107258	1089175	-18083	101.66
Belgaum	94861	89747	-5114	105.70
Bagalkot	47401	38315	-9086	123.71
Bijapur	54769	40856	-13913	134.05
Bidar	47339	31667	-15672	149.49
Raichur	28902	40757	11855	70.91
Koppal	28822	27104	-1718	106.34
Gadag	19458	18290	-1168	106.39
Dharwad	37364	34841	-2523	107.24
Uttara kannada	25936	23438	-2498	110.66
Haveri	26453	25980	-473	101.82
Bellary	55388	57222	1834	96.79
Chitradurga	24773	24356	-417	101.71
Davanagere	34760	39082	4322	88.94
Shimoga	33753	27370	-6383	123.32
Udupi	19356	16539	-2817	117.03
Chikmagalur	15005	15675	670	95.72
Tumkur	39942	34585	-5357	115.49
Bangalore	160161	180709	20548	88.63
Mandya	19949	25526	5577	78.15
Hassan	25452	25847	395	98.47
Dakshina Kannada	41383	31811	-9572	130.09
Kodagu	8179	10106	1927	80.93

Mysore	54649	53860	-789	101.46
Chamarajanagar	11102	15359	4257	72.28
Gulbarga	63707	56531	-7176	112.69
Yadgir	25872	25002	-870	103.48
Kolar	24614	26927	2313	91.41
Chikkaballapura	16996	19069	2073	89.13
Bangalore rural	10697	16787	6090	63.72
Ramanagara	10215	15783	5568	64.72
Kerala	496292	496929	637	99.87
Kasaragod	20701	21735	1034	95.24
Kannur	43711	37242	-6469	117.37
Wayanad	14678	14071	-607	104.32
Kozhikode	55998	42851	-13147	130.68
Malappuram	91242	78545	-12697	116.17
Palakkad	37346	52887	15541	70.61
Thrissur	46620	36163	-10457	128.91
Ernakulam	43775	43437	-338	100.78
Idukki	12011	12193	182	98.51
Kottayam	23531	28728	5197	81.91
Alappuzha	17854	26488	8634	67.41
Pathanamthitta	15957	16102	145	99.10
Kollam	28018	38884	10866	72.06
Thiruvananthapuram	44850	47571	2721	94.28
Tamilnadu	1062388	1137189	74801	93.42
Thiruvallur	23899	49629	25730	48.16
Chennai	104866	65593	-39273	159.87
Kancheepuram	41373	61281	19908	67.51
Vellore	73015	68426	-4589	106.71
Tiruvannamalai	29354	34511	5157	85.06
Viluppuram	45525	56098	10573	81.15
Salem	51912	58574	6662	88.63
Namakkal	19704	25786	6082	76.41
Erode	30142	44000	13858	68.50
The Nilgiris	5849	11600	5751	50.42
Dindigul	30093	37687	7594	79.85
Karur	12435	21212	8777	58.62
Tiruchirappalli	46019	43762	-2257	105.16

Perambalur	10657	7599	-3058	140.24
Ariyalur	9466	9360	-106	101.13
Cuddalore	32976	46006	13030	71.68
Nagapattinam	18201	23256	5055	78.26
Thiruvarur	19141	21044	1903	90.96
Thanjavur	47238	35762	-11476	132.09
Pudukkottai	27430	26649	-781	102.93
Sivaganga	23047	22278	-769	103.45
Madurai	50873	45661	-5212	111.41
Theni	20375	17586	-2789	115.86
Virudhunagar	32544	26223	-6321	124.11
Ramanathapuram	25195	21532	-3663	117.01
Thoothukkudi	29636	25485	-4151	116.29
Tirunelveli	47127	38929	-8198	121.06
Kanniyakumari	29221	34910	5689	83.70
Dharmapuri	26069	22357	-3712	116.61
Krishnagiri	27673	33073	5400	83.67
Coimbatore	47523	59858	12335	79.39
Tiruppur	23810	41463	17653	57.42
Telanana	624581	628834	4253	99.32
Adilabad	47164	45181	-1983	104.39
Nizamabad	53403	42209	-11194	126.52
Karim Nagar	65264	56375	-8889	115.77
Medak	45635	48752	3117	93.61
Hyderabad	215978	108430	-107548	199.19
Rangareddy	24241	110214	85973	21.99
Mahaboob Nagar	49352	66392	17040	74.33
Nalgonda	49362	57887	8525	85.27
Warangal	49762	46764	-2998	106.41
Khamman	24420	46629	22209	52.37

Note-Data are not available for Alipurdur district of West Bengal, Fazilka and Pathankot district of Punjab, nine districts of Chhattisgarh, 7districts of Gujarat and Mumbai Suburban district of Maharashtra. Also, we considered data for 22 states because SRS did not provide data for 14 smaller states and UTs.

Table 4.3. Estimates of completeness of infant death registration by states and districts of India

State/District	Registered (R)	Estimated (A)	E-R	Completeness(%)
Jammu & Kashmir	2180	4148	1968	52.56
Kupwara	14	111	97	12.60
Badgam	13	169	156	7.70
Leh	5	0	-5	0.00
Kargil	6	29	23	20.48
Punch	15	358	343	4.19
Rajouri	11	257	246	4.29
Kathua	11	392	381	2.80
Baramula	24	146	122	16.40
Bandipore	15	98	83	15.31
Srinagar	1288	0	-1288	0.00
Ganderbal	15	321	306	4.68
Pulwama	14	0	-14	0.00
Shupiyan	16	40	24	39.73
Anantnag	20	550	530	3.64
Kulgam	8	287	279	2.78
Doda	12	400	388	3.00
Ramban	10	178	168	5.63
Kishtwar	13	233	220	5.57
Udhampur	13	297	284	4.37
Reasi	10	217	207	4.61
Jammu	638	0	-638	0.00
Samba	9	64	55	14.13
Himachal Pradesh	766	2694	1928	28.43
Chamba	27	457	430	5.90
Kangra	220	683	463	32.21
Lahul and Spiti	0	15	15	0.00
Kullu	42	347	305	12.09
Mandi	44	443	399	9.93
Hamirpur	23	0	-23	0.00
Una	55	286	231	19.26
Bilaspur	27	97	70	27.89

Solan	26	125	99	20.83
Sirmaur	48	200	152	24.06
Shimla	250	0	-250	0.00
Kinnaur	4	42	38	9.56
Punjab	3119	8926	5807	34.94
Gurdaspur	169	1219	1050	13.86
Kapurthala	59	446	387	13.24
Jalandhar	492	0	-492	0.00
Hoshiarpur	187	0	-187	0.00
Sangrur	2	297	295	0.67
Fatehgarh sahib	8	187	179	4.29
Ludhiana	466	1822	1356	25.58
Moga	83	530	447	15.65
Firozpur	22	0	-22	0.00
Muktsar	70	887	817	7.89
Faridkot	312	0	-312	0.00
Bathinda	68	713	645	9.54
Mansa	19	287	268	6.61
Patiala	19	459	440	4.14
Amritsar	707	1049	342	67.41
Tarn Taran	224	454	230	49.39
Rupnagar	20	135	115	14.83
Sahibzada Ajit Singh	8	204	196	3.92
Shahid Bhagat Singh Nagar	41	237	196	17.29
Barnala	15	0	-15	0.00
Uttarakhand	327	6462	6135	5.06
Uttarkashi	7	76	69	9.26
Chamoli	68	67	-1	102.01
Rudraprayag	2	46	44	4.31
Tehri Garhwal	5	347	342	1.44
Dehradun	114	1082	968	10.54
Garhwal	34	189	155	18.00
Pithoragarh	3	428	425	0.70
Bageshwar	1	0	-1	0.00
Almora	66	298	232	22.11
Champawat	5	128	123	3.92
Nainital	8	674	666	1.19

Udham Singh Nagar	8	1190	1182	0.67
Hardwar	6	1938	1932	0.31
Haryana	5794	18242	12448	31.76
Panchkula	94	0	-94	0.00
Ambala	114	308	194	36.99
Yamuna Nagar	134	468	334	28.60
Kurukshetra	132	0	-132	0.00
Kaithal	247	302	55	81.72
Karnal	218	812	594	26.86
Panipat	217	300	83	72.23
Sonipat	329	0	-329	0.00
Jind	128	698	570	18.33
Fatehabad	151	400	249	37.72
Sirsa	182	2188	2006	8.32
Hisar	456	2001	1545	22.78
Bhiwani	221	2658	2437	8.31
Rohtak	1606	0	-1606	0.00
Jhajjar	48	904	856	5.31
Mahendragarh	66	289	223	22.87
Rewari	76	275	199	27.62
Gurgaon	280	3177	2897	8.81
Mewat	541	2702	2161	20.02
Faridabad	410	0	-410	0.00
Palwal	144	758	614	18.99
New Delhi	8095	4969	-3126	162.90
North west	NA	1236	NA	NA
North	NA	388	NA	NA
North East	NA	0	NA	NA
East	NA	0	NA	NA
New Delhi	NA	127	NA	NA
Central	NA	75	NA	NA
West	NA	1449	NA	NA
South West	NA	341	NA	NA
South	NA	1354	NA	NA
Rajasthan	12004	67226	55222	17.86
Ganganagar	135	2367	2232	5.70

Hanumangarh	256	0	-256	0.00
Bikaner	124	2717	2593	4.56
Churu	58	879	821	6.60
Jhunjhunun	132	1501	1369	8.79
Alwar	563	4006	3443	14.05
Bharatpur	262	2207	1945	11.87
Dhaulpur	366	1322	956	27.68
Karauli	23	3093	3070	0.74
Sawai Madhopur	265	2317	2052	11.44
Dausa	68	2313	2245	2.94
Jaipur	2212	6758	4546	32.73
Sikar	207	1273	1066	16.26
Nagaur	187	2900	2713	6.45
Jodhpur	1772	1487	-285	119.16
Jaisalmer	71	904	833	7.86
Barmer	276	4572	4296	6.04
Jalor	102	3081	2979	3.31
Sirohi	47	1603	1556	2.93
Pali	212	1662	1450	12.76
Ajmer	1272	1856	584	68.54
Tonk	161	1140	979	14.12
Bundi	129	1714	1585	7.53
Bhilwara	580	2108	1528	27.52
Rajsamand	85	1337	1252	6.36
Dungarpur	295	1320	1025	22.34
Banswara	461	914	453	50.45
Chittaurgarh	145	1991	1846	7.28
Kota	230	681	451	33.78
Baran	173	646	473	26.79
Jhalawar	567	1303	736	43.51
Udaipur	423	4806	4383	8.80
Pratapgarh	145	445	300	32.55
Uttar Pradesh	12312	214605	202293	5.74
Saharanpur	582	3783	3201	15.39
Muzaffarnagar	28	2461	2433	1.14
Bijnor	269	3125	2856	8.61
Moradabad	114	4498	4384	2.53
Rampur	20	2609	2589	0.77

Jyotiba Phule Nagar	NA	1158	NA	NA
Meerut	0	3624	3624	0.00
Baghpat	2	432	430	0.46
Ghaziabad	0	6543	6543	0.00
Gautam Buddha Nagar	354	1080	726	32.78
Bulandshahr	1	4018	4017	0.02
Aligarh	0	4525	4525	0.00
Mahamaya nagar	NA	2216	NA	NA
Mathura	34	3300	3266	1.03
Agra	23	4879	4856	0.47
Firozabad	278	2193	1915	12.68
Mainpuri	42	1845	1803	2.28
Budaun	0	8784	8784	0.00
Bareilly	198	3039	2841	6.52
Pilibhit	233	952	719	24.48
Shahjahanpur	0	4630	4630	0.00
Kheri	543	5845	5302	9.29
Sitapur	30	12838	12808	0.23
Hardoi	0	5892	5892	0.00
Unnao	168	3824	3656	4.39
Lucknow	433	1596	1163	27.14
Rae bareli	640	3358	2718	19.06
Farrukhabad	31	3525	3494	0.88
Kannauj	44	3130	3086	1.41
Etawah	73	2183	2110	3.34
Auraiya	15	246	231	6.11
Kanpur Dehat	0	681	681	0.00
Kanpur Nagar	0	2899	2899	0.00
Jalaun	0	1506	1506	0.00
Jhansi	1	922	921	0.11
Lalitpur	328	1659	1331	19.77
Hamirpur	141	1012	871	13.93
Mahoba	55	838	783	6.56
Banda	716	1367	651	52.39
Chitrakoot	102	886	784	11.51
Fatehpur	0	1918	1918	0.00
Pratapgarh	294	482	188	60.99
kaushambi	302	4072	3770	7.42
Allahabad	48	2662	2614	1.80

Bara banki	523	3344	2821	15.64
Faizabad	347	738	391	47.00
Ambedkar nagar	0	2725	2725	0.00
Sultanpur	53	2082	2029	2.55
Bahraich	976	6268	5292	15.57
Shrawasti	148	2308	2160	6.41
Balrampur	128	3016	2888	4.24
Gonda	54	4921	4867	1.10
Siddharth Nagar	108	4013	3905	2.69
Basti	149	3528	3379	4.22
Sant Kabir Nagar	127	1028	901	12.36
Mahrajganj	0	6900	6900	0.00
Gorakhpur	12	3916	3904	0.31
Kushinagar	0	3349	3349	0.00
Deoria	408	3346	2938	12.19
Azamgarh	729	1288	559	56.60
Mau	6	3826	3820	0.16
Ballia	105	1395	1290	7.53
Jaunpur	0	3993	3993	0.00
Ghazipur	324	4098	3774	7.91
Chandauli	217	1192	975	18.20
Varanasi	4	2305	2301	0.17
Sant Ravidas Nagar	14	909	895	1.54
Mirzapur	148	4881	4733	3.03
Sonbhadra	269	1324	1055	20.32
Etah	0	2259	2259	0.00
Kanshiram Nagar	0	2618	2618	0.00
Bihar	2790	104774	101984	2.66
Pashchim Champaran	31	5111	5080	0.61
Purba Champaran	92	7798	7706	1.18
Sheohar	32	1062	1030	3.01
Sitamarhi	18	4555	4537	0.40
Madhubani	9	5707	5698	0.16
Supaul	18	2756	2738	0.65
Araria	4	3276	3272	0.12
Kishanganj	25	1321	1296	1.89
Purnia	60	3004	2944	2.00
Katihar	657	3567	2910	18.42

Madhepura	3	1467	1464	0.20
Saharsa	18	3649	3631	0.49
Darbhanga	30	2405	2375	1.25
Muzaffarpur	51	5776	5725	0.88
Gopalganj	27	667	640	4.05
Siwan	21	2937	2916	0.71
Saran	5	3772	3767	0.13
Vaishali	93	2539	2446	3.66
Samastipur	23	3851	3828	0.60
Begusarai	2	3010	3008	0.07
Khagaria	6	1452	1446	0.41
Bhagalpur	33	2635	2602	1.25
Banka	3	1181	1178	0.25
Munger	7	1357	1350	0.52
Lakhisarai	2	623	621	0.32
Sheikhpura	198	410	212	48.34
Nalanda	65	1350	1285	4.81
Patna	372	5512	5140	6.75
Bhojpur	35	1471	1436	2.38
Buxar	30	2168	2138	1.38
Kaimur (Bhabua)	5	1770	1765	0.28
Rohtas	217	5081	4864	4.27
Aurangabad	73	509	436	14.35
Gaya	473	6526	6053	7.25
Nawada	32	671	639	4.77
Jamui	1	2144	2143	0.05
Jehanabad	12	1075	1063	1.12
Arwal	7	609	602	1.15
Assam	2808	31066	28258	9.04
Kokrajhar	0	321	321	0.00
Dhubri	0	700	700	0.00
Goalpara	72	2172	2100	3.32
Barpeta	36	572	536	6.30
Morigaon	48	1619	1571	2.96
Nagaon	312	2007	1695	15.55
Sonitpur	96	2760	2664	3.48
Lakhimpur	0	1063	1063	0.00
Dhemaji	96	882	786	10.89

Tinsukia	12	890	878	1.35
Dibrugarh	288	0	-288	NA
Sivasagar	0	1255	1255	0.00
Jorhat	240	0	-240	NA
Golaghat	204	1205	1001	16.92
Karbi Anglong	12	521	509	2.31
Dima Hasao	36	283	247	12.71
Cachar	492	2650	2158	18.57
Karimganj	0	3486	3486	0.00
Hailakandi	0	1325	1325	0.00
Bongaigaon	192	810	618	23.70
Chirang	12	331	319	3.63
Kamrup	132	568	436	23.24
Kamrup Metropolitan	228	1131	903	20.16
Nalbari	60	2223	2163	2.70
Baksa	48	362	314	13.28
Darrang	84	1004	920	8.36
Udalguri	108	928	820	11.64
West Bengal	14721	35722	21001	41.21
Darjiling	76	501	425	15.18
Jalpaiguri	13	0	-13	NA
Koch Bihar	46	911	865	5.05
Uttar Dinajpur	146	0	-146	NA
Dakshin dinajpur	328	1538	1210	21.33
Maldah	1689	2992	1303	56.45
Murshidabad	2180	4949	2769	44.05
Birbhum	699	1928	1229	36.25
Barddhaman	1979	2078	99	95.22
Nadia	346	1774	1428	19.51
North Twenty Four Par	945	0	-945	NA
Hugli	125	2289	2164	5.46
Bankura	1443	836	-607	172.53
Puruliya	259	3741	3482	6.92
Haora	454	1900	1446	23.89
Kolkata	1380	0	-1380	NA
South Twenty Four Par	1262	0	-1262	NA
Paschim Medinipur	577	8368	7791	6.90
Purba Medinipur	491	1917	1426	25.61

Jharkhand	NA	21617	NA	NA
Garhwa	NA	1289	NA	NA
Chatra	NA	1329	NA	NA
Kodarma	NA	251	NA	NA
Giridih	NA	1946	NA	NA
Deoghar	NA	519	NA	NA
Godda	NA	615	NA	NA
Sahibganj	NA	1095	NA	NA
Pakur	NA	922	NA	NA
Dhanbad	NA	1333	NA	NA
Bokaro	NA	204	NA	NA
Lohardaga	NA	180	NA	NA
Purbi Singhbhum	NA	497	NA	NA
Palamu	NA	2014	NA	NA
Latehar	NA	420	NA	NA
Hazaribagh	NA	1289	NA	NA
Ramgarh	NA	549	NA	NA
Dumka	NA	1376	NA	NA
Jamtara	NA	547	NA	NA
Ranchi	NA	1324	NA	NA
Khunti	NA	91	NA	NA
Gumla	NA	485	NA	NA
Simdega	NA	562	NA	NA
Pashchimi Singhbhum	NA	1874	NA	NA
Saraikela Kharsawan	NA	903	NA	NA
Odissa	11618	32933	21315	35.28
Bargarh	76	1900	1824	4.00
Jharsuguda	30	465	435	6.45
Sambalpur	756	1179	423	64.12
Debagarh	45	125	80	35.97
Sundargarh	274	1531	1257	17.89
Kendujhar	527	2854	2327	18.46
Mayurbhanj	631	953	322	66.22
Baleshwar	216	0	-216	NA
Bhadrak	81	2062	1981	3.93
Kendrapara	64	1585	1521	4.04
Jagatsinghapur	34	1281	1247	2.65

Cuttack	2094	0	-2094	NA
Jajapur	36	0	-36	NA
Dhenkanal	88	0	-88	NA
Anugul	78	1907	1829	4.09
Nayagarh	54	376	322	14.36
Khordha	287	1021	734	28.11
Puri	112	2436	2324	4.60
Ganjam	1128	0	-1128	NA
Gajapati	114	553	439	20.60
Kandhamal	290	609	319	47.64
Baudh	40	354	314	11.30
Subarnapur	52	699	647	7.43
Balangir	502	704	202	71.36
Nuapada	332	1294	962	25.67
Kalahandi	540	674	134	80.08
Rayagada	627	3483	2856	18.00
Nabarangapur	1008	2648	1640	38.06
Koraput	857	1122	265	76.36
Malkangiri	645	1117	472	57.75
Chattishgarh	7182	23599	16417	30.43
Korea (Koriya)	105	807	702	13.01
Surguja	435	3796	3361	11.46
Jashpur	196	1075	879	18.23
Raigarh	538	797	259	67.46
Korba	119	1580	1461	7.53
Janjgir - champa	85	854	769	9.95
Bilaspur	997	2836	1839	35.15
Kabirdham	109	852	743	12.80
Rajnandgaon	924	1298	374	71.21
Durg	293	1908	1615	15.35
Raipur	1195	3198	2003	37.36
Mahasamund	195	1075	880	18.14
Dhamtari	67	1168	1101	5.73
Uttar Bastar Kanker	60	814	754	7.37
Bastar	403	0	-403	NA
Narayanpur	24	65	41	37.20
Dakshin Bastar Dantew	144	1079	935	13.34
Bijapur	51	395	344	12.90

Madhya Pradesh	10729	85900	75171	12.49
Sheopur	158	593	435	26.64
Morena	12	1879	1867	0.64
Bhind	100	496	396	20.17
Gwalior	157	1600	1443	9.81
Datia	58	904	846	6.41
Shivpuri	324	996	672	32.54
Tikamgarh	189	346	157	54.68
Chhatarpur	17	4295	4278	0.40
Panna	342	2880	2538	11.87
Sagar	171	3062	2891	5.58
Damoh	349	1479	1130	23.60
Satna	370	2226	1856	16.62
Rewa	551	3574	3023	15.42
Umaria	10	231	221	4.33
Neemuch	25	1017	992	2.46
Mandsaur	350	2143	1793	16.33
Ratlam	53	1626	1573	3.26
Ujjain	515	1575	1060	32.70
Shajapur	135	420	285	32.15
Dewas	107	2733	2626	3.92
Dhar	141	2269	2128	6.21
Indore	2503	2373	-130	105.49
Khargone (West Nimar)	413	2175	1762	18.98
Barwani	37	1716	1679	2.16
Rajgarh	310	4063	3753	7.63
Vidisha	202	2300	2098	8.78
Bhopal	395	1668	1273	23.69
Sehore	146	1445	1299	10.11
Raisen	41	1088	1047	3.77
Betul	271	885	614	30.62
Harda	49	444	395	11.04
Hoshangabad	164	1630	1466	10.06
Katni	101	1927	1826	5.24
Jabalpur	103	3725	3622	2.77
Narsimhapur	118	413	295	28.57
Dindori	38	1237	1199	3.07
Mandla	90	1648	1558	5.46

Chhindwara	358	3987	3629	8.98
Seoni	234	1152	918	20.32
Balaghat	244	2663	2419	9.16
Guna	46	1110	1064	4.14
Ashoknagar	139	907	768	15.32
Shahdol	292	2451	2159	11.91
Anuppur	17	610	593	2.79
Sidhi	12	2040	2028	0.59
Singrauli	187	1959	1772	9.55
Jhabua	24	622	598	3.86
Alirajpur	11	1709	1698	0.64
Khandwa (East Nimar)	43	819	776	5.25
Burhanpur	0	790	790	0.00
Gujarat	14328	37071	22743	38.65
Kachchh	443	2068	1625	21.42
Banaskantha	596	3882	3286	15.35
Patan	221	894	673	24.71
Mahesana	268	1669	1401	16.06
Sabarkantha	466	0	-466	0.00
Gandhinagar	182	478	296	38.10
Ahmadabad	2692	0	-2692	0.00
Surendranagar	251	1834	1583	13.68
Rajkot	1478	1609	131	91.85
Jamnagar	47	1573	1526	2.99
Porbandar	39	351	312	11.11
Junagadh	532	0	-532	0.00
Amreli	101	0	-101	0.00
Bhavnagar	478	1243	765	38.46
Anand	473	0	-473	0.00
Kheda	229	4956	4727	4.62
Panchmahal	723	515	-208	140.48
Dohad	336	2973	2637	11.30
Vadodara	283	2299	2016	12.31
Narmada	192	320	128	59.99
Bharuch	494	1412	918	34.99
The Dangs	69	152	83	45.38
Navsari	149	954	805	15.62
Valsad	569	413	-156	137.70

Surat	1901	7476	5575	25.43
Tapi	202	0	-202	0.00
Maharastra	18495	36065	17570	51.28
Nandurbar	429	311	-118	137.97
Dhule	306	532	226	57.49
Jalgaon	310	2856	2546	10.85
Buldana	253	0	-253	0.00
Akola	930	813	-117	114.38
Washim	97	324	227	29.92
Amravati	280	474	194	59.13
Wardha	439	768	329	57.16
Nagpur	433	1234	801	35.10
Bhandara	44	315	271	13.98
Gondiya	210	670	460	31.35
Gadchiroli	51	440	389	11.59
Chandrapur	457	908	451	50.31
Yavatmal	168	802	634	20.94
Nanded	231	3659	3428	6.31
Hingoli	105	1767	1662	5.94
Parbhani	117	1229	1112	9.52
Jalna	54	1029	975	5.25
Aurangabad	993	6465	5472	15.36
Nashik	2517	0	-2517	0.00
Thane	401	0	-401	0.00
Mumbai Suburban	0	0	0	0.00
Mumbai	3723	2071	-1652	179.80
Raigarh	43	1952	1909	2.20
Pune	2328	2556	228	91.08
Ahmadnagar	547	1171	624	46.70
Bid	333	1006	673	33.10
Latur	17	1220	1203	1.39
Osmanabad	87	0	-87	0.00
Solapur	814	834	20	97.56
Satara	252	0	-252	0.00
Ratnagiri	45	658	613	6.84
Sindhudurg	4	0	-4	0.00
Kolhapur	638	0	-638	0.00
Sangli	635	0	-635	0.00

Andhra Pradesh	7815	27509	19694	28.41
Srikakulam	275	3844	3569	7.15
Vizianagaram	59	2047	1988	2.88
Visakhapatnam	1034	5209	4175	19.85
East Godavari	1290	0	-1290	0.00
West Godavari	115	2065	1950	5.57
Krishna	791	2601	1810	30.41
Guntur	1063	0	-1063	0.00
Prakasam	195	0	-195	0.00
Sri Potti Sriramulu	236	1137	901	20.76
YSR	44	5689	5645	0.77
Kurnool	1283	3019	1736	42.50
Anantapur	614	1899	1285	32.33
Chittoor	816	0	-816	0.00
Karnataka	10732	26140	15408	41.06
Belgaum	623	2087	1464	29.85
Bagalkot	190	897	707	21.19
Bijapur	305	1804	1499	16.90
Bidar	310	1212	902	25.58
Raichur	581	2513	1932	23.12
Koppal	20	274	254	7.30
Gadag	189	541	352	34.92
Dharwad	752	1531	779	49.13
Uttara kannada	110	466	356	23.60
Haveri	180	181	1	99.24
Bellary	296	3276	2980	9.04
Chitradurga	230	806	576	28.55
Davanagere	392	958	566	40.93
Shimoga	484	0	-484	0.00
Udupi	120	299	179	40.16
Chikmagalur	68	389	321	17.47
Tumkur	764	1048	284	72.89
Bangalore	1313	2285	972	57.46
Mandya	193	967	774	19.96
Hassan	275	872	597	31.54
Dakshina Kannada	449	0	-449	0.00
Kodagu	68	0	-68	0.00

Mysore	1343	546	-797	245.95
Chamarajanagar	160	840	680	19.04
Gulbarga	1011	479	-532	211.28
Yadgir	63	662	599	9.52
Kolar	142	611	469	23.26
Chikkaballapura	50	380	330	13.17
Bangalore rural	32	217	185	14.73
Ramanagara	19	0	-19	0.00
Kerala	2777	4969	2192	55.88
Kasaragod	69	423	354	16.31
Kannur	174	0	-174	0.00
Wayanad	53	0	-53	0.00
Kozhikode	697	0	-697	0.00
Malappuram	325	1275	950	25.49
Palakkad	95	0	-95	0.00
Thrissur	354	0	-354	0.00
Ernakulam	138	0	-138	0.00
Idukki	21	0	-21	0.00
Kottayam	199	0	-199	0.00
Alappuzha	52	0	-52	0.00
Pathanamthitta	79	0	-79	0.00
Kollam	44	1007	963	4.37
Thiruvananthapuram	477	2274	1797	20.98
Tamil nadu	9985	19332	9347	51.65
Thiruvallur	47	476	429	9.88
Chennai	1995	0	-1995	0.00
Kancheepuram	238	0	-238	0.00
Vellore	667	3224	2557	20.69
Tiruvannamalai	157	482	325	32.56
Viluppuram	301	1944	1643	15.49
Salem	636	1046	410	60.78
Namakkal	72	298	226	24.19
Erode	138	0	-138	0.00
The Nilgiris	20	115	95	17.45
Dindigul	74	0	-74	0.00
Karur	43	0	-43	0.00
Tiruchirappalli	545	3620	3075	15.06

Perambalur	53	0	-53	0.00
Ariyalur	34	180	146	18.89
Cuddalore	120	670	550	17.91
Nagapattinam	14	0	-14	0.00
Thiruvarur	166	0	-166	0.00
Thanjavur	669	1269	600	52.72
Pudukkottai	106	0	-106	0.00
Sivaganga	107	0	-107	0.00
Madurai	1156	649	-507	178.03
Theni	272	297	25	91.58
Virudhunagar	117	0	-117	0.00
Ramanathapuram	84	420	336	20.00
Thoothukkudi	181	0	-181	0.00
Tirunelveli	564	876	312	64.39
Kanniyakumari	129	434	305	29.70
Dharmapuri	411	576	165	71.35
Krishnagiri	147	0	-147	0.00
Coimbatore	661	762	101	86.80
Tiruppur	61	1995	1934	3.06
Telanana	5805	19494	13689	29.78
Adilabad	242	2003	1761	12.08
Nizamabad	278	1824	1546	15.24
Karim Nagar	43	1797	1754	2.39
Medak	275	1369	1094	20.09
Hyderabad	4304	655	-3649	657.23
Rangareddy	NA	3388	NA	NA
Mahaboob Nagar	163	2572	2409	6.34
Nalgonda	314	2501	2187	12.56
Warangal	75	0	-75	0.00
Khamman	111	3385	3274	3.28

Note-Data are not available for Alipurdur district of West Bengal, Fazilka and Pathankot district of Punjab, nine districts of Chhattisgarh, 7districts of Gujarat and Mumbai Suburban district of Maharashtra. Also, we considered data for 22 states because SRS did not provide data for 14 smaller states and UTs.

Table 4.5. Estimates of completeness of all age death registration by states of India

	Completeness (%)	
	A L Method	**ORGI**
India	69.93	78.10
J & K	45.39	58.50
Himachal Pradesh	71.60	75.00
Punjab	91.89	100.00
Uttrakhand	62.53	67.40
Haryana	88.25	100.00
New Delhi	94.27	100.00
Rajasthan	77.12	93.00
Uttar Pradesh	23.66	40.20
Bihar	16.89	28.30
Arunachal Pradesh	43.16	31.70
Nagaland	26.49	19.90
Manipur	33.06	34.00
Mizoram	80.02	100.00
Tripura	48.85	49.40
Meghalaya	82.67	78.20
Assam	54.10	59.80
Jharkhand	51.07	70.30
Odissa	90.40	100.00
Chattisgarh	79.97	95.20
Madhya Pradesh	50.67	60.90
Gujarat	86.45	100.00
Maharastra	84.75	93.70
Andhra Pradesh	84.47	88.70
Karnataka	89.77	100.00
Lakhsdweep	83.01	65.20
Kerala	99.00	94.30
Tamil Nadu	94.18	100.00
West Bengal	77.52	81.90

Sikkim	87.31	100.00
Goa	98.84	98.70
Daman & Diu	79.90	81.40
Andman & Nicobar	97.65	81.60
Chandigarh	98.71	100.00
Dadar & Nagar Haveli	76.23	100.00
Puducherry	98.74	100.00

Note- Data for Andhra Pradesh and Telangana are combined. For Manipur and Meghalaya, data are not available for 2016. Therefore, estimates are calculated for year 2015 and compared with ORGI estimates of year 2015.

Schedule for primary survey (Objective-3)

Key informant interview - Medical Officers and Health Assistant

1. Background characteristics
   Age, sex, residence, education, type of health facilities, years of working experiences
2. What is the role of medical officer/health assistant in birth/death registration?
3. Who are the other stakeholders involved at PHCs in terms of birth and death registration?
4. How does birth and death certification perform within and outside hospitals?
5. Is there any law which regulate birth/death registration in this area? If yes, what are they?
6. Is there any document required for birth/death registration? If yes, what are those documents?
7. Is birth registration and issue of certificate done before discharge from PHCs or parents need to come again? What is the time gap between registration of birth/death and issue of certificate in your hospital?
8. Is there any gap between the number of deliveries reported and number of births registered at the health centre? If yes, what are the possible reason? How do you clear backlog, if any?
9. Is there any evaluation method for completeness of birth/death registration in this hospitals? If Yes, what is the method? How frequently do you evaluate?
10. How do you evaluate the quality of cause of death data reported in this area?
11. Is there any HR and logistics gap? If yes, what steps have been taken to overcome it?
12. What support do you receive from DSO/BSO in implementation of vital statistics system?
13. Is there any supervision? Any regular report review or meeting for smooth functioning of vital registration?
14. Have you and other health assistant received any training on registering vital events? If yes, when did you receive last training and what was the content?
15. What do you think about awareness, knowledge and attitude of the people towards registration of birth/death?
16. The success of registration of vital event to a great extend depends on awareness level of the communities? Were there any activities undertaken by you and other staffs of this hospital? If yes, please explain.
17. What are the challenges for you and other staffs faced in registration of birth/death and issue of certificate? Please explain in detail.
18. What are the suggestions for further improving the level of the birth/death in the PHCs?

KII-BSO (Block Statistical Officer)

1. Background characteristics
   Age, Sex, education level, Position, Years of experience
2. What role do you have in overall management of vital registration system?
3. What is the target and coverage of your block?
4. What are the method of setting target and monitoring completeness of registration?
5. How do you get information on number of institutional deliveries? Is there any gap between the number of deliveries reported and number of births registered at the health institutions? If yes, what are the possible reasons? What actions are undertaken to reduce this gap?
6. How do you monitor birth registration in case of home deliveries?
7. How do you manage delay registration and, what step do you take to decrease such registration?
8. What are the necessary logistics required for registration of birth/death? Is there any gap in HR and logistic required for smooth functioning of this system?
9. What support do you received from district office for strengthened implementation of birth/death registration?
10. Is there any separate funding for smooth function of vital statistics system? Could you please explain different funding required for this system?
11. Have you received any training pertaining to birth and death registration? If yes, when did you receive last training and, what was the content of training?
12. Is there any time gap between birth/death registration and issue of birth certificate? If yes, what are the possible factors?
13. Is there any significant difference between block in terms of birth/death registration? If yes, what are the possible factors?
14. Do communities perceive any benefits of registering vital events? If yes, what are the perceived benefits?
15. What are the suggestions for further improving the level of birth/death registration in the districts?

KII-Gram Panchayat/ Nagar Nigam

1. Background characteristics
   Age, Sex, education level, position and years of experience
2. What is the role of gram Panchayat/Nagar Nigam in terms of birth/death registration?
3. Who are the other stakeholders involved? What are their roles and responsibilities?
4. What are the documents required for registering vital events?
5. Is there any way to know the number of children not having birth registration? If yes, what is that way and how frequently the system updates? How do you address issue of delay registration?
6. What is the time gap between birth registration and issuance of birth certificate? What are the reason for the gap and what could be done to reduce this gap?
7. What are the necessary logistics required for registration of birth/death? Is there any gap in HR and logistic required for smooth functioning of this system?
8. What support do you receive from block or district office for smooth functioning of birth/death registration?
9. Have you received any training on birth/death registration? If yes, when did you receive last training and, what was the content of such training?
10. Are review meetings on birth and death registration held at block or district level? If yes, what are frequency of such meetings/ what issues are generally discussed? Is there any feedback mechanism?
11. Do communities perceive any benefits of registering vital events? If yes, what are the perceived benefits?
12. The success of registration of vital event to a great extent depends on awareness level of the communities? Were there any activities undertaken by you and other staffs of this office? If yes, please explain.
13. What challenge do you face in registering of vital events in your village/city?
14. What are your suggestions for further improving the level of registration of vital events?

KII- Aganwadi Sevika

1. Background characteristics
   Age, Sex, Position and Years of experience
2. What is the role of the Aganwadi Sevika in birth/death registration? Who are the other stakeholders involved within the gram panchayat for birth and death registration process? What are their roles and responsibilities?
3. Is there any documentation required for registering the birth/death or is it an automated process? If yes, what are the documents required?
4. Is there any way to know the number of children within the gram panchayat whose birth registration was not done? If yes, what is that way and how frequently is the data updated? How is the issue of delayed registration addressed?
5. How is the information about the number of home deliveries collected? Is there any gap between the number of home deliveries reported and number of births registered? If yes, what are the possible reasons? How do you clear the backlog, if any?
6. What is the time gap between birth registration and issuance of birth certificate? What are the reasons for the gap and what could be done to reduce this gap?
7. What support do you receive from the DSO / BSS / GP/ CDPO for strengthened implementation of birth/death registration?
8. Have you received any training on birth/death registration? If yes, when was the training received and what was the content of the training? Do you feel there is any need for refresher training? If yes, what should be the content?
9. Are review meetings on birth/death registration held at the block / district/ Gram Panchayat/ CDPO level? If yes, what is the frequency of such meetings? What issues are generally discussed? Is there any feedback mechanism?
10. Do communities perceive any benefits of registering vital events, particularly in terms of access to government services? If yes, what are the perceived benefits?
11. The success of birth/death registration to a greater extent depends on the awareness level of the communities. Was there any IEC activities undertaken by you for birth/death registration? If yes, what were those?

12. What according to you are the other challenges in terms of birth/death registration in your gram panchayat?
13. What are your suggestions for further improving the level of birth/death registration in your area?

FGD-Community Members

1. Background characteristics

   Age, Sex, Education level, Occupation, Residence (Rural/Urban), Duration of living in current residence (years)

2. Opinions and experiences of the public about death registration

a) Where and when did you register, when birth takes place in your household?

b) What is the process of registration and, what are the documents required to register birth?

c) Could you all please share your experiences in registering the birth event? Did you face any problems?

d) What do you think about the registration procedure in your area? (Simple or Complicated)? Why do you think so?)

e) Have you received birth certificate from the offices you applied at?

I. if no- why?

II. if yes- why?

Death registration

f) Do you think people in your area usually register deaths? if yes, where do they report?

g) What is the process and which documents are required for it?

h) Could you all please share your experiences in registering the death event? Did you face any problems?

i) What do you think about the registration procedure in your area? (Simple or Complicated? Why do you think so?)

j) Did you request death or burial certificate when the death event occurred in the household? I.If no, why?

II. If yes, why?

k) Which circumstances do you think can encourage/discourage people registering deaths?

l) Tell me about your opinions on how registration of deaths can be improved in your area?

Pictures clicked during field survey

Pic 1- Image clicked after focus group discussion with study participants, Patna, Bihar

Note: - Author took consent from the study participants for the publication of the pictures.

Pic 2 – Image shows focus group discussion with community members, Vaishali, Bihar

Pic 3- Image shows focus group discussion with study participants, Patna, Bihar

Pic 4- Image shows registration centre, Sampatchak block, Patna, Bihar

Note: - Author took consent from the study participants for the publication of the pictures.

INSTITUTIONAL ETHICS REVIEW BOARD
Jawaharlal Nehru University
New Delhi-110067

Name of the Ethics Committee: IERB-JNU **IERB Ref.No.2019/Student/235**

Title of the Ph. D Proposal: Completeness of Birth and Death Registration in India: A Mixed Method Evaluation submitted by Mr. Krishna Kumar (M. Phil Student CSRD/SSS/JNU) Supervisor: Dr. Nandita Saikia (Faculty/CSRD/SSS/JNU)

Mobile: 8452981507 **Email: krishna94@gmail.com**

Sponsors: NA

Collaborators' Name: NA

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The proposal was reviewed in a meeting held on 31st May 2020 . The following members attend this meeting

1. Professor Shiv K.Sarin, Chairperson
2. Advocate Omika Dubey, Member
3. Advocate Rukhsana Chaoudhary, Member
4. Prof. S.C. Malik Member
5. Prof. Paul Raj, Member
6. Prof. Ravinder Gargesh, Member
7. Dr. Sushil Kumar Jha, Officiating Member Secretary

The committee resolved to

[X] Approve - indicating that the proposal is approved as submitted;

[X] Approve – after clarifications – indicating that the proposal is approved if the clarifications Requested are provided to the satisfaction of designated committee members;

[√] **Approved after amendment/s** – indicating that the proposal is approved subject to the incorporation of the specified amendments verified by designated committee members;

[X] Defer – indicating that the proposal is not approved as submitted but it can be reassessed after revision to address the specified reason/s for deferment;

[X] Disapprove – indicating that the proposal is not approved for the reason specified.

Comments:

26/08/20

Dr. Sushil K. Jha
Member Secretary,
IERB, Ethics Committee

Date of Approval: August 26th, 2020 (after acceptance of revisions)

*(1st part to be filled in by PI and presented at the time of Review (Periodic, Continuing, Interim)).