

**Trend and Determinants of Knowledge and Practice of Birth  
Registration in Nepal: Evidence from  
Nepal Multiple Indicator Cluster Survey**

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# **Trend and Determinants of Knowledge and Practice of Birth Registration in Nepal: Evidence from Nepal Multiple Indicator Cluster Survey**

## **Abstract**

### **BACKGROUND**

Nepal has made a notable progress on birth registration. However, there is lot more to do to meet the sustainable development goal of attaining universal coverage. Besides, it is also not clear as to what are the important factors contributing to the birth registration coverage. This study aimed at using multilevel approach to examine trend and determinants of birth registration and knowledge about how to register birth in Nepal.

### **METHODOLOGY**

Multiple Indicator Cluster Survey 2014 and 2019 data were used for the analysis. Frequency distribution, cross tabulation and random intercept multilevel logistic regression model were run to explore the determining predictors of knowledge and practice of birth registration.

### **RESULTS**

Birth registration coverage increased from 58% in 2014 to 77% in 2019 and knowledge about how to register birth increased from 86% in 2014 to 90% in 2019. The odds of birth registration among children in Nepal were 1.3 times higher in 2019 than in 2014 (OR 1.32, 95% CI 1.28-1.37). Twenty-nine percent of the variation in birth registration and 45% of the variation in knowledge about birth registration process were attributed to cluster. About 32% of the cluster level variation in birth registration and 16% of the cluster level variation in knowledge about process of birth registration were explained by the covariates included in the final model. Age of child, mother's education, exposure to radio, ethnicity, household wealth, district level infant mortality rate and province of residence were significant determinants of birth registration and knowledge about process of birth registration.

### **CONCLUSION**

Birth registration status and knowledge about process of birth registration in Nepal has increased over five-year period between 2014 and 2019. However, disparity on birth registration knowledge and practice exists across different individual, household and community level factors. Thus, additional efforts should be made to decrease the socio-economic disparity to achieve the universal birth registration in Nepal. Expanding birth registration facilities, integrating it with maternal and newborn care, mass media campaign to raise awareness on importance of birth registration, amendment in existing adverse legal and administrative provision and capacity building of local-level authority can help further to improve the status of birth registration in Nepal.

**KEYWORD:** Trend and determinants, knowledge and practice of birth registration Nepal

## 1. Introduction

Civil registration is defined as “universal, continuous, permanent and compulsory recording of vital events provided through decree of regulation in accordance with the legal requirement of each country” (United Nations Department of Economics and Social affair, 2014). History of registering vital events in Nepal goes back to 1950s, when a modern and databased Vital Event Registration System (VERS) started in line with Municipal Act, 1950 and Village Panchayat Act, 1961 (Gautam 2016). During the period, the vital event registration and related task were limited to the record keeping of personal events. Although Central Bureau of Statistics (CBS) conducted vital event registration in some of the Village Panchayats (Lowest administrative units during the Panchayat era) during 60s, it could not continue the process. Family Planning Association of Nepal (FPAN) also started similar registration in two districts, but the process had limited use and was discontinued later. Importance of vital event registration was realized only in 1970s when Marriage Registration Act, 1971 and Vital Event Registration Act, 1976 were enacted, which made registration of five vital events, birth, death, marriage, divorce and internal migration mandatory. The registration provision of the act in the districts came into force in a phase-wise manner and was implemented throughout Nepal only after 15 years in 1989 (Gautam 2016). Personal Event Registration Act, 1976 and Vital Registration Regulation, 1977 are replaced by National Identity Card and Registration Act, 2020 (Government of Nepal, 2020), National Identity Card, and Registration Regulation, 2021 (Government of Nepal, 2021). Key events on the development of the birth registration system in Nepal is as shown in Figure1.

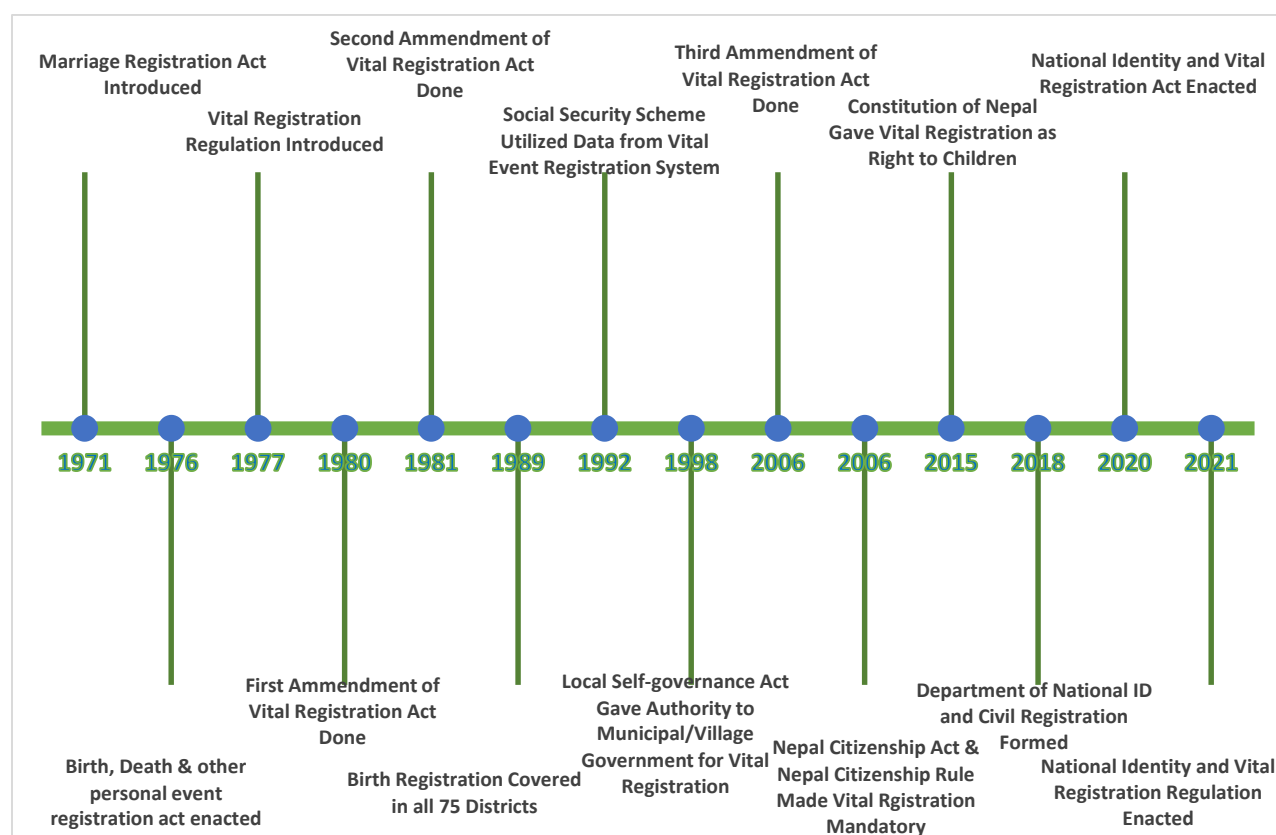


Figure 1. Milestone Chart of Birth Registration System Development in Nepal

Constitution of Nepal, 2015 has identified birth registration as a right to children and has given power to all the three levels of the government for registration of personal events (Government of Nepal 2015). Universal coverage, continuity, confidentiality and regular dissemination are the four basic principles underlying civil registration (United Nations Department of Economics and Social affair 2014). However, less effective vital event registration system due to legal complexities and ambiguities, lack of proper documentation, discrimination of poor and vulnerable groups have been found as barriers to establish civil registration system in line with the principles in Nepal (Gautam 2016). As a signatory to the United Nations Economic and Social Commission for Asia and Pacific (UN ESCAP) Ministerial declaration, Nepal is committed to attaining its three goals (attaining universal civil registration, accepting civil registration as legal document to claim identity, civil status and ensuring right to all individual, and production and dissemination of timely and complete vital statistics) (UN ESCAP, 2015). In order to facilitate the civil registration process, Nepal has established the Department of Civil Registration in 2015. Software for online civil registration has been developed and birth registration has been made mandatory for school admission. In addition, Civil Code, 2017 for registration of birth within three months of the event has been adopted. Those who fail to comply with the provision in the Civil Code have to pay some fine for registration (Forum for Women, Law and Development 2018).

Department of National ID and Civil Registration (DoNICR) is responsible for both registration of vital events and identity management. Currently, about 6,239 local registrars are deployed in 217 municipalities for registration and issuance of certificate. They can also take punitive action for registration related delays and frauds. Birth registration (BR) in Nepal is compulsory and has to be performed within 35 days of delivery from the local ward office. It requires signature and citizenship of parents. The completed BR forms are entered in the birth registration book. The ward secretary issues the birth certificate and the chairperson of the ward signs and stamps the birth certificate (International Development Research Center 2020).

Civil registration, a continuous process of birth and death recording, is an important source of information for policy, and planning purpose at all levels (Mohanty and Gebremedhin 2017). It is the most reliable source for tracking most of the SDG 3 targets and getting birth certificate is the right of each children (Mills, Lee, and Rassekh 2019). However, more than one-third (35%) births are not registered globally (Mikkelsen et al. 2015). Latest World Bank data indicates that BR coverage varied across countries in SAARC regions. Maldives has higher and universal BR coverage followed by Sri Lanka and Bhutan. Afghanistan (42%), Pakistan (42%) and Bangladesh (56%) have lower level of BR coverage. Nepal (77%) and India (86%) are somewhere in the middle among these countries (World Bank 2020) (Figure2).

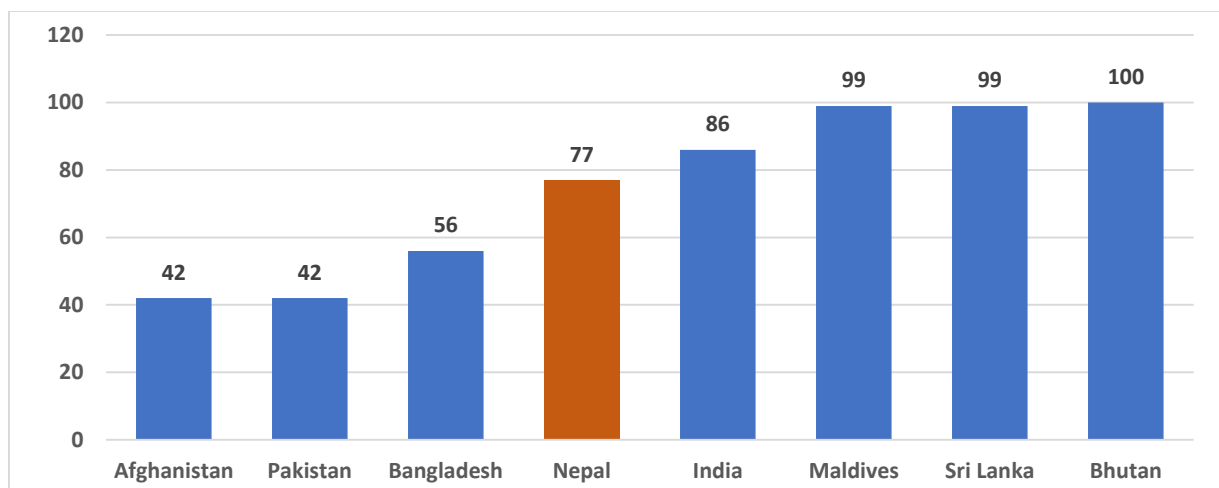


Figure 2. Birth Registration Coverage (%) of SAARC Countries in 2020

There has been substantial emphasis on promoting access to maternal and child health service over the last two decades. However, similar priority has not been given on completing birth registration around the globe (Mohanty and Gebremedhin 2017) and Nepal is not an exception. Even after more than 40 years of implementing vital event registration act, 2033, no systematic study on status of implementing the BR has been carried out in Nepal. The Nepal Multiple Indicator Cluster Survey (NMICS) and Nepal Demographic and Health Survey (NDHS) have included birth registration status related questions in their surveys. A mini survey on vital event registration conducted in 2015 shows that about 76% of the births, 75% of the deaths, 76% of the marriage, 86% of the divorces and 60% of the migrations were registered in Nepal (Department of Civil Registration, 2015). This survey was small in scale and did not represent the whole country. However, birth registration coverage found in the survey was similar to that of the result produced by NMICS report.

Over the thirteen years from 2006 to 2019, Nepal has made a significant progress on birth registration coverage. It has increased from 35% in 2006 (Ministry of Health, New ERA and Macro International Inc. 2007), to 42% in 2011 (Ministry of Health, New ERA and Macro International Inc 2012), 53% in 2014 (Central Bureau of Statistics 2015), 56% in 2016 (Ministry of Health, New ERA and ICF 2017) and 77% in 2019 (Central Bureau of Statistics 2020) (Figure3). However, there is still a long way to go to meet the SDG goal of universal birth registration. For this, focused interventions of promoting access and equitable health for all through universal health coverage (UHC), tracking the progress of health-related SDG goals, and removing barriers to birth registration are crucial (Fagernas and Odame 2013). However, adequate empirical studies identifying factors hindering the birth registration process in Nepal are not yet conducted.

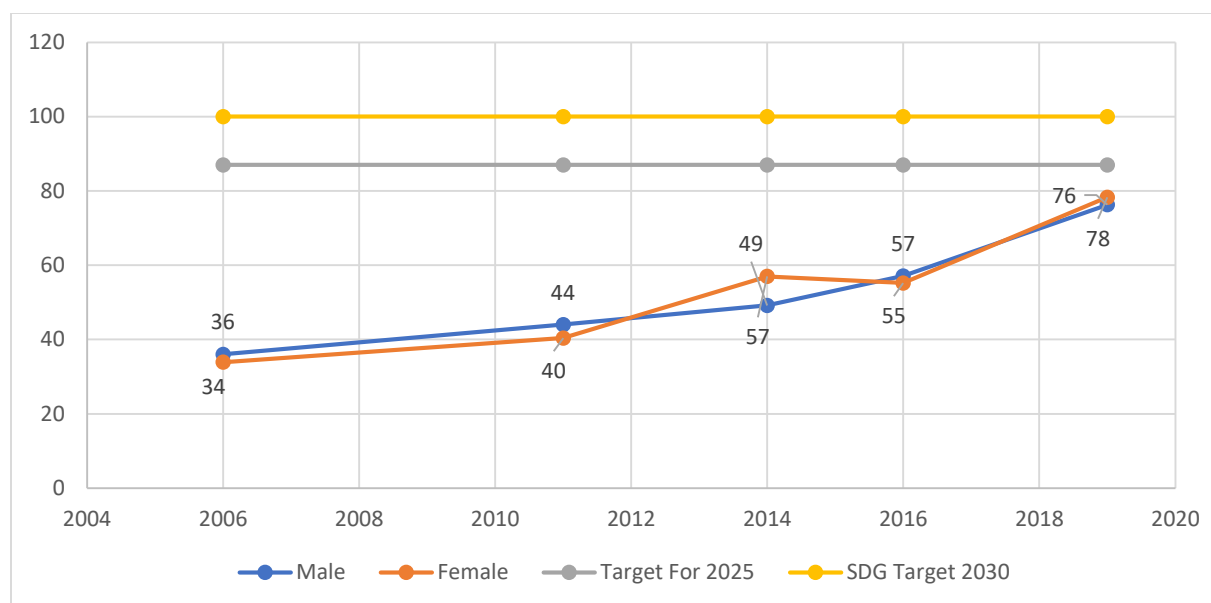


Figure 3. Trend of Birth Registration Coverage (%) and SDG Target in Nepal

A multilevel analysis conducted by Mohanthi and Gebremedhin (2017) shows that a considerable variation in probability of birth registration exist across individual and districts persists in India. For example, mother's socio-economic status measured in terms of her ability to independently move around and her exposure to outside world significantly increase the probability of BR. Institutional birth, mother's antenatal care seeking behavior, caste, religion, household wealth and parental education were also found to be significant determinants of BR in India. National commitment and the values that families and individual give on BR, existence of an adequate legislative framework and related infrastructure, marital status, education and occupation of mother/caregiver and place of delivery were significant predictors of BR in Nigeria (Isara and Atimat 2015). A number of distant reasons for not registering the births identified by other empirical evidences include age and sex of child, household income, place of residence, living arrangement and ethnicity (UNICEF 2005). Similarly, the proximate reasons include the place and type of birth attendant, utilization of child health care services including vaccination, treatment of acute respiratory infection (ARI) and vitamin A supplementation, mother's/care taker's knowledge about place of BR, childhood illness, malnutrition and mortality (UNICEF 2005). Geographic distance to BR facility was also found to be significant negative predictor of BR in Bolivia, Dominican Republic and Peru. On an average, increase in distance of 25 km from the household to BR office was associated with a 4% increase in the probability of not registering the birth in Bolivia and 12% points in Dominican Republic (Corbacho and Rivas 2012). There have been limited studies in the global literature to examine determinants of birth registration at multiple-level (Corbacho and Rivas 2012; Mohanty and Gebremedhin 2017; Okunlola et al. 2017; Bhatia, Kim and Subramanian 2021). However, we did not find any analytical studies to examine determinants of birth registration in Nepal. To improve the coverage of birth registration it is suggested to explore the relative importance of individual, household, community and district level enabling factors in determining the registration of birth and apply the knowledge on program improvement (Mohanty and Gebremedhin 2017).

This paper examines trend and association of individual, household, cluster, district and other geographic factors in relation to birth registration and knowledge about process of birth registration in Nepal using Nepal Multiple Indicator Cluster Survey (NMICS) 2014 and 2019. Understanding individual, household and contextual disparity in knowledge and practice of BR is an essential step towards monitoring progress of ensuring universal birth registration to achieve SDG target in Nepal.

## **1. Methods**

### **2.1. Study design and data source**

The study used data from 2014 and 2019 Nepal Multiple Indicator Cluster Survey (NMICS), which are standardized cross-sectional nationally representative household surveys conducted by Central Bureau of Statistics and UNICEF Nepal. Until now, two rounds of the MICS have been conducted in Nepal. Both the surveys used the sampling frame from the 2011 census. The surveys were designed to provide estimates for various maternal and child health indicators at the national level, for urban and rural areas of seven provinces. The urban and rural areas within each sub-region (provinces in NMICS 2019 and eco-development region in NMICS 2014) were identified as the main sampling strata. Kathmandu valley urban is included as a separate stratum as its characteristics differ from the rest. The sample of households was selected in two stages. Within each stratum, at the first stage a specified number of census enumeration areas (EA) was selected systematically with probability proportional to size. A household listing was carried out within the selected enumeration areas and a total of 25 households were selected in each sample enumeration area through systematic random sampling method. A total sample of 512 EAs and 12,800 households were selected for the survey in 2019 and 13,000 households in 520 sample EAs were selected for the survey in 2014. The design can be explored in detail from the survey reports (Central Bureau of Statistics (CBS) 2015; Central Bureau of Statistics (CBS) 2020).

Before 2015 when Nepal adopted the federal system of governance, the country consisted of 75 districts distributed across the different ecological zones and development regions. Following changes approved by Nepal's Constituent Assembly in September 2015, administratively Nepal has been divided into seven provinces (Province 1, Province 2, Bagmati Province, Gandaki Province, Lumbini Province, Karnali Province, and Sudurpaschim Province) and 753 municipalities. There are four categories of municipalities: metropolitan city, sub-metropolitan city, (urban) municipality, and rural municipality. Although the constitution does not recognize districts, there still exist 77 districts.

As the NMICS 2014 generated output tables by ecological development regions and urban and rural areas before restructuring of the country, the EAs sampled in 2014 were regrouped into newer urban and rural areas and seven provinces and tables were generated accordingly to make them comparable with NMICS 2019. Both survey data were pooled together and the analysis was conducted from pooled data.

The sampling design explained above suggests that the population structure of NMICS data is hierarchical with individual nested within EAs or clusters and the clusters nested within provinces. This type of structure helps to explain differences in the outcome variables by the higher-level clusters. The results derived by ignoring the clustering situation in the analysis may lead to misleading conclusion about the relative importance of different source of influence on the response variable (Okunlola et al. 2017). Therefore, multilevel modelling approach has been applied in the analysis.

### **2.2. Outcome and explanatory variables**

Primary outcome of this analysis is the birth registration status of children under five year, which was derived using two survey questions. The first question asked to the caregiver is, whether the specific child has a birth certificate. The possible responses to this question are “Yes, seen”, “Yes, not seen”, “No” and “Don’t know”. If the response is “No” or “Don’t know”, the caregiver is further asked if the birth has been registered with civil authorities. The children for whom the response to the first question is “Yes, seen” or “Yes, not seen”, or “Yes” to the second question, are considered to have their birth registered. Thus, the primary outcome variable is a binary with a value 1 “if the birth of the child has been registered” and 0 otherwise. Another outcome variable used in this analysis is caregiver’s knowledge about how to register the birth. The caregivers who reported that the birth of their child was not registered were further asked if they knew how to register birth. If the response was “Yes”, they were considered as having knowledge about how to register birth and the response was coded as 1 and if the response was “no” it was coded as 0. Thus, the caregiver’s knowledge about how to register birth was also binary outcome variable.

A range of individual, household, community and district-level explanatory variables were used based on their theoretical and empirical importance applied in international literature, considering the status and knowledge on process of BR as well as their availability in dataset. The year of survey was also included as explanatory variable to take into account the effect of time on the outcome variables. Brief description and reference of the selected variable are given in the introduction section. Names of variables and description are presented in Table1.

Table 1. Explanatory variables used in modelling the status and knowledge on process of BR

<b>Selected variables</b>	<b>Description</b>
Survey year	Year of NMICS conducted
<b>Individual-level variables</b>	
Age of child	Reported age of child (in months) at the time of survey, grouped as: 0-11 (Ref.), 12-23, 24-35, 36-47, 48-59
Sex of child	Sex of child, grouped as: male (Ref.), female
Mother’s/caregiver’s education	Highest level of education attained by mother/caregiver, grouped as: None (Ref.), Basic (Grade 1-8), Secondary (Grade 9-12), Higher
Exposure to newspaper	Mother's/caregiver read newspaper at least once a week, grouped as: No (Ref.), Yes
Exposure to radio	Mothers/caregivers listen to radio at least once a week, grouped as: No (Ref.), Yes
Exposure to television	Mothers/caregivers watch television at least once a week, grouped as: No (Ref.), Yes
<b>Household-level variables</b>	
Ethnicity of household head	Self-reported ethnicity of head of household, grouped as: Brahmin/Kshetri (Ref.), Terai/Madhese other caste, Dalit, Newar, Janjati, Muslim, other
Household wealth quintile	Index based on household amenities, assets and durables derived by factor analysis used for computation of wealth index, grouped as: poorest (Ref.), second, middle, fourth, richest
<b>Community-level variables</b>	
Place of residence	Women’s/caregiver’s current place of residence, grouped as: urban (Ref.), rural



Percent of mother/caregiver with primary or higher education in cluster	Percent of mother/caregiver with primary or higher education in cluster kept as it is in interval scale
<b>District-level variable</b>	
Infant mortality rate in districts/provinces	District level infant mortality rate kept in interval scale Province of residence, grouped as: Province1 (Ref.), Province2, Bagmati, Gandaki, Lumbini, Karnali and Sudurpaschim

The explanatory variables included in the analysis are grouped into two levels to reflect the hierarchical nature of the data. Level1 variables are related to child/household/maternal characteristics with cluster, district and province level contextual covariates. The level2 variables correspond to cluster as random effect. This helped to run a two-level mixed effect random intercept logit model.

### 2.3. Statistical analysis

As the outcome variables of the analysis were dichotomous, representing the BR status and the knowledge about process of BR and the data set used in the analysis had a hierarchical structure with the children nested within cluster; a multilevel modelling approach was used for the analysis. Multilevel modelling accounts for the hierarchical structure of the data and facilitates the estimation of cluster (PSU/EA) level influence on the outcome variables. The multilevel modelling strategy also corrects the estimated standard errors to allow clustering of observations within units. Using multilevel analysis, a range of individual, household, community and higher level factors influencing outcome variables analysis can be controlled and variances in outcome variable between the clusters can be estimated (Goldstein 1995). These variances represent the unexplained variation in the outcome variables that remains after accounting for the covariates included in the model. A significant variance might represent factors that influenced outcome variables that were omitted from the models, either because they could not be quantified in a large survey or were absent from the data set, or a significant variance might reflect the poor measurement of some factors thought to influence it (Stephenson et al. 2007). In addition, it provides more accurate standard error estimation by accounting for the non-independence of the individual observations and provides for distinguishing between contextual and compositional effects (Singh et al. 2013).

The outcome variable in this analysis is whether birth of a child under the age of five is registered, and if not registered, whether the mother/caregiver of the child knows how to register birth. Due to the binary nature of the outcome variable, the multilevel model with logit link function can be described as follows:

$$\ln\left(\frac{P_{ij}}{1 - P_{ij}}\right) = \text{logit}(P_{ij}) = x_{ij}\beta + u_{ij}$$

Where  $P_{ij}$  is the probability of BR of a child under the age of five or probability of mother/caregiver knowing how to register birth for  $i^{th}$  children in the  $j^{th}$  cluster.  $x_{ij}$  is a vector of covariates corresponding to the  $i^{th}$  children in the  $j^{th}$  cluster.  $\beta$  is a vector of estimated parameter coefficients and  $u_j$  is unexplained residual term at the cluster. Thus, a multilevel model with two level was fitted to assess the influences of measured individual, household, cluster, district and province level as fixed effects, and cluster level unexplained residual ( $u_j$ ) as random effect on the BR status and knowledge about BR process (Singh et al. 2013). The distribution of random effects is assumed to be normal with mean zero and variance  $s_u^2$ , when

$s_u = 0$  the model reduces to the ordinary logistic regression model, indicating that there is no significant correlation in BR and knowledge of BR process among clusters (Rabe-Hesketh, Skrondal, and Pickles 2004). The correlation between the probability of BR status and knowledge about BR process in the same cluster are represented by variance participation coefficients (VPC) or intra-class correlation( $\rho$ ), which is calculated as;  $\rho = \sigma_u^2 / (\sigma_u^2 + \pi^2/3)$  (Hox 2010). The multilevel model with logistic link function was fitted for the BR status and knowledge about process of BR using melogit command in Stata15 (StataCorp 2017). Since the study considered a range of covariates in the models, we examined for multicollinearity with correlation matrix and variance inflation factors (VIF). All of the VIF were less than 2.5, suggesting that the possibility of high multicollinearity was not present.

The analysis used a cumulative approach to model building. Model1 is the null model, run without any variables. Model2 includes only the year of survey. Model3 includes year of survey, individual and household factors. Finally, Model4 includes year, individual and household factors and community, district and province-level variables. This approach allows identification of relative importance of each set of factors in explaining community variation in relation to the status of BR and knowledge on process of BR. For each model, residual variation was estimated for the cluster (EAs). Changes in the cluster-level variances between the models were noted to test whether the addition of individual, household and other contextual factor in the analysis influenced the cluster-level variation in the status of BR and knowledge on process of BR.

### **3. Results**

#### **3.1. Sample**

The analysis is based on 5,272 children living in 517 enumeration areas in 2014 and 6,543 children living in 512 enumeration areas in 2019 for BR coverage. Similarly, for knowledge about how to register birth, the analysis is based on 2,264 children living in 484 enumeration areas in 2014 and 1,351 children living in 425 enumeration areas in 2019. Thus, in pooled data, the analysis is based on 11,815 children living in 1,029 enumeration areas for BR coverage and 3,615 children living in 909 enumeration areas for knowledge regarding how to register birth (among those whose birth was not registered).

#### **3.2. Bivariate analysis result**

A summary statistics of the variables is presented in Table2. Table2 shows that the BR coverage of child under five-year age increased from 58 % in 2014 to 77 % in 2019. Similarly, knowledge about process of BR among mother/caregiver of the child whose birth was not registered also increased from 86% in 2014 to 90 % in 2019. Almost an equal percentage (69%) of male and female children had their birth registered and an equal percentage (88%) of mother/caregiver of both gender whose birth was not registered, knew how to register birth. The BR coverage varied across age of child and it increased with age. For example, BR coverage was 81% among children of 48-59 months but it was only 48% among children under 12 months. However, percentage of mother/caregiver who knew how to register birth was higher among younger child (90% among children under 12 months and only 87% among children aged 48-59 months). No difference was found on BR coverage by gender and mother's/caregiver's knowledge about how to register birth. While BR coverage was similar, irrespective of weekly exposure to newspaper, radio and television, percentage of mother/caregiver who know how to register birth was higher among those who had weekly exposure to newspaper, radio and television. Some ethnic variation was observed in BR coverage of child as well as knowledge on how to register birth among mother/caregivers. BR coverage

was highest among Dalit (81%) and lowest among Muslim (64%), while knowledge about how to register birth was highest among Newar (96%) and lowest among Muslim (86%) (among those whose children were not registered). No specific pattern was observed regarding household wealth with BR coverage and knowledge on how to register birth. BR coverage was highest among children who belonged to middle household wealth group and lowest among those who belonged to the richest wealth group. Similarly, among those children whose birth was not registered, mother's/caregiver's knowledge about how to register birth was highest among those who belonged to middle wealth group and lowest among the poorest wealth group. There was no urban rural differences in BR coverage, but knowledge about how to register birth was higher among children living in urban area (89%) than in rural area (86%). Finally, there has been wide variation in BR coverage as well as knowledge about process of BR by provinces. Table2 indicates that the BR coverage was highest in Karnali Province (80%) and it was lowest in Bagmati Province (60%). Similarly, Knowledge about process of BR was highest in Gandaki Province (92%) and lowest in Sudurpaschim Paschhim (82%).

**Table2. Percent distribution of birth registration status of children under age 5 and mother/caregiver's knowledge on how to register birth by background characteristics from pooled data, NMICS 2014 and 2019**

Background characteristics	Status of birth registration				Mother/caregiver know how to register birth			
	No	Yes	Total	N	No	Yes	Total	N
<b>Survey year</b>								
2014	41.9	58.1	100	5272	13.6	86.4	100	2264
2019	22.8	77.2	100	6543	10.2	89.8	100	1351
<b>Age of child (in months)</b>								
0-11	52.0	48.0	100	2121	9.7	90.3	100	1079
12-24	37.3	62.7	100	2336	13.1	86.9	100	845
24-35	28.1	71.9	100	2325	11.6	88.4	100	649
36-47	23	77	100	2549	15.9	84.1	100	575
48-59	18.8	81.2	100	2484	13.4	86.6	100	467
<b>Sex of child</b>								
Male	31.3	68.7	100	6237	12.5	87.5	100	1900
Female	31.3	68.7	100	5578	12	88	100	1715
<b>Mother's education</b>								
None	34.3	65.7	100	3911	17.1	82.9	100	1350
Basic (Gr 1-8)	27.5	72.5	100	2962	12.0	88.0	100	811
Secondary (Gr 9-12)	29.1	70.9	100	3533	8.7	91.3	100	968
Higher	36.1	63.9	100	1409	7.0	93.0	100	486
<b>Exposure to newspaper</b>								
No	31.2	68.8	100	10767	12.7	87.3	100	3293
Yes	32.7	67.3	100	1048	8.6	91.4	100	322
<b>Exposure to radio</b>								
No	30.9	69.1	100	8338	13.7	86.3	100	2497
Yes	32.8	67.2	100	3477	8.6	91.4	100	1118

<b>Exposure to television</b>								
No	31.8	68.2	100	6647	14.7	85.3	100	2120
Yes	30.9	69.1	100	5168	9.7	90.3	100	1495
<b>Ethnicity of household head</b>								
Brahmin/Kshetri	31.8	68.2	100	4209	13.0	87.0	100	1307
Terai/Madhesi other caste	32.6	67.4	100	1366	13.6	86.4	100	442
Dalit	19.4	80.6	100	1994	10.5	89.5	100	378
Newar	33.1	66.9	100	359	3.7	96.3	100	116
Janjati	35.8	64.2	100	3331	12.0	88.0	100	1183
Muslim	36	64	100	432	13.6	86.4	100	154
Other	22.5	77.5	100	124	17.1	82.9	100	35
<b>Household wealth quintile</b>								
Poorest	31.1	68.9	100	3817	20.7	79.3	100	1228
Second	33.0	67.0	100	2409	9.5	90.5	100	786
Middle	29.0	71.0	100	2103	9.4	90.6	100	559
Fourth	30.9	69.1	100	2018	10.8	89.2	100	578
Richest	33.0	67.0	100	1468	9.5	90.5	100	464
<b>Mother/care giver with primary or higher education in cluster (mean)</b>								
	64.5	68.4	-	<b>11815</b>	65.7	68.4	-	<b>3615</b>
<b>District Infant mortality rate (mean)</b>								
	40.8	42.5	-	<b>11815</b>	40.5	42.5	-	<b>3615</b>
<b>Residence type</b>								
Urban	31.2	68.8	100	6450	11.1	88.9	100	1950
Rural	31.5	68.5	100	5368	14.2	85.8	100	1665
<b>Province</b>								
Province-1	27.1	72.9	100	1791	14.5	85.5	100	564
Province-2	32.2	67.8	100	1681	11.0	89.0	100	524
Bagmati	39.6	60.4	100	1889	9.5	90.5	100	680
Gandaki	34.5	65.5	100	1073	7.8	92.2	100	312
Lumbini	28.8	71.2	100	1867	14.1	85.9	100	535
Karnali	19.8	80.2	100	1559	16.9	83.1	100	278
Sudurpaschim	31.2	68.8	100	1955	17.6	82.4	100	772
<b>Total</b>	<b>31.3</b>	<b>68.7</b>	<b>100</b>	<b>11815</b>	<b>12.3</b>	<b>87.7</b>	<b>100</b>	<b>3615</b>

### 3.3 Multilevel analysis results

Multilevel logistic regression modelling was employed to examine the determinants of BR coverage and knowledge about how to register birth. Individual, household, community, district and province-level variables were included in the model in a sequence of three groups of variables. A null model with only community-level random effect and without including covariates was estimated first, second model included survey year as covariate to account the effect of time, individual and household-level covariates

were added in the third model and finally community, district and province-level covariates were added in the fourth model.

### **3.4 Random effects**

In the multilevel models, community (PSU) were modeled to be random. The results of the multilevel random intercept model are presented in Table3. Model1 in Table3 indicated that there was considerable unexplained community-level variance in BR coverage (1.34) and knowledge about how to register birth (2.74). The intra-class correlation coefficient (ICC) indicates that 29% of the total variation in birth registration and 45% of the total variation in knowledge about how to register birth in Nepal lies between communities. Figure4 below shows a caterpillar plot (for BR coverage) of the residuals for all 1,029 communities/clusters in the sample from model1 together with 95% confidence intervals. For a substantial number of communities, the 95% confidence interval does not overlap with the horizontal line at zero, indicating that birth registration coverage in these communities is significantly above average (above the zero line) or below average (below the zero line) (Mohanthy and Gebremedhin 2017). The ICC of the subsequent models suggests that adjusting for different level of covariates in the multilevel model, the community-level variance for both the BR coverage and knowledge about how to register birth have been reduced (ICC, decreased in subsequent models). The random part of the Model2, Model3 and Model4 further indicate that, 32.1% of the community-level random variance for BR coverage and 3.3% of the community-level random variance for knowledge about how to register birth was explained by the covariate (survey year) added in the Model2. Similarly, 22.4% of the community-level random variance for BR coverage and 12.4% of the community-level random variance for knowledge about how to register birth was explained by the covariates (Survey year, individual & household variables) included in the Model3. Likewise, 35.1% of the community-level random variance for BR coverage and 16.1% of the community-level random variance for knowledge about how to register birth was explained by the covariates (survey year, individual, household, community, district and province) included in the Model4.

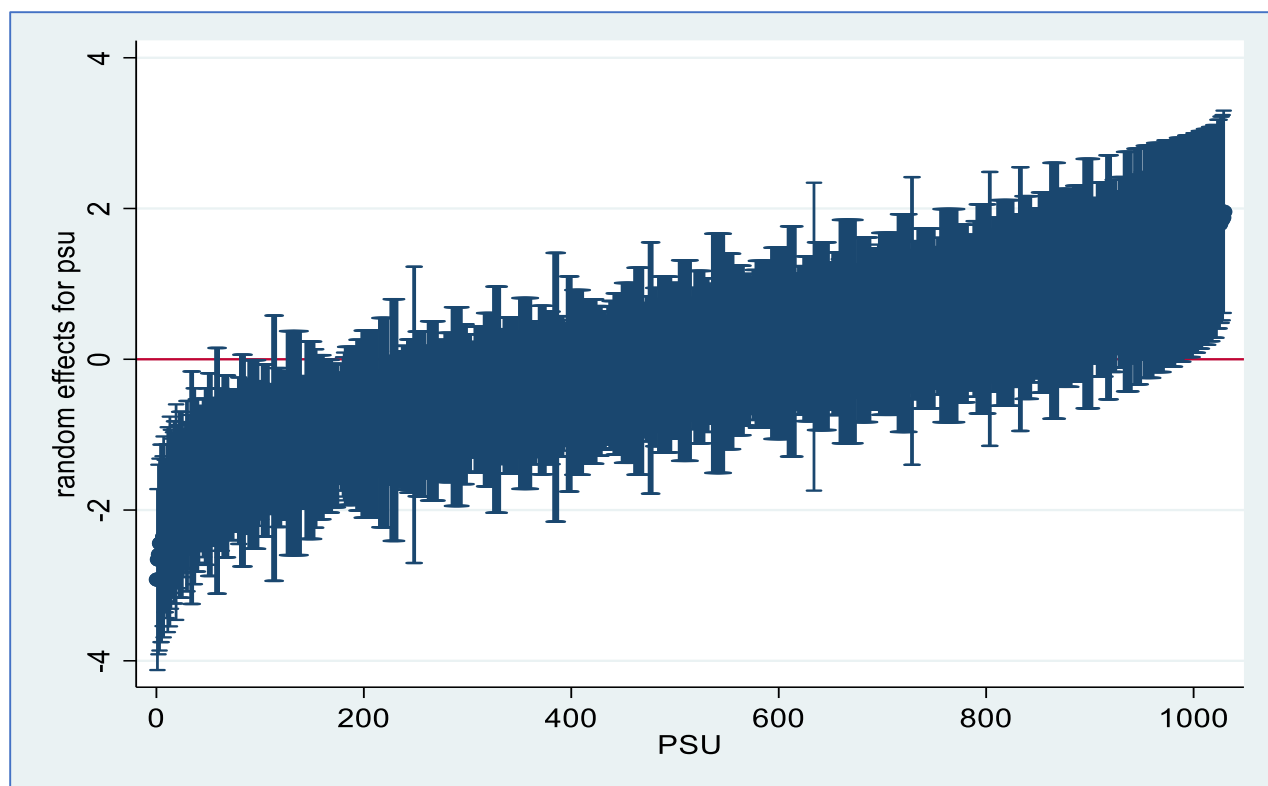


Figure 4. PSU level difference in birth registration coverage

**Table3. Parameter coefficients for the multilevel model (random intercept only model, without covariates) for BR coverage and knowledge about how to register birth (among children whose birth was not registered)**

Random effects	BR coverage			
	Model1 (Null)	Model2	Model3	Model4
Community (PSU) random variance (SE)	1.34 (0.10)	0.91 (0.07)	1.04 (0.09)	0.87 (0.08)
Community (PSU) ICC (%)	29%	22%	24%	21%
% of community-level variance explained	-	32.1%	22.4%	35.1%
Random effects	Know how to register birth (among birth unregistered children)			
	Model1 (Null)	Model2	Model3	Model4
Community (PSU) random variance (SE)	2.74 (0.42)	2.65 (0.41)	2.40 (0.40)	2.30 (0.39)
Community (PSU) ICC (%)	45%	45%	42%	41%
% of community-level variance explained	-	3.3%	12.4%	16.1%

Model1 (Null model) did not include any covariates. Model2 adjusted for survey year, Model3 additionally included individual and household, Model4 additionally included community, district and province. The % of community-level variance explained was estimated as,  $\% \text{variance explained} = (\text{community-level random variance in null model} - \text{community-level random variance in given model}) / \text{community-level random variance in null model}$ .

### 3.5 Fixed effects for BR coverage

Fixed effects of the multilevel random intercept model presented in Table4 (Model4) indicates that survey year, age of child, mother's education, exposure to radio, ethnicity, household wealth, district level infant mortality rate and the province significantly predicted BR coverage. The odds of BR of a child was 32% higher in 2019 compared to that in 2014. Similarly, the odds of BR of a child increases with the age of child. While the odds of BR was 2.2 times higher among children with age between 12 to 23 months, it was 7.3 times higher among children with age 48 to 59 month compared to children age below 12 months. The odds of BR of a child were 21% and 38% higher among mother/caregiver with secondary and higher level of education respectively compared to mother/caregivers with no education. Mother/caregivers who watch television at least once a week were 15% more likely to register birth of their child compared to mother/caregivers who do not have exposure to Television. The BR coverage also varied across ethnicity. Dalit had 2.4 times higher odds of BR and Muslim had 0.6 times lower odds of BR compared to the Brahmin/Kshetries. The BR coverage of children of other ethnic groups was not significantly different from the Brahmin/Kshetries. The odds of BR were consistently higher among children belonging to wealthier household, with 57% higher odds of BR among children living in the richest household compared to the children living in the poorest households. District-level infant mortality rate was also positively associated with BR coverage. With regard to the provincial variation in BR, the odds of BR was higher by the factor of 2.6 in Karnali Province but it was lower by the factor of 0.6 and 0.7 in Province 2 and Bagmati Province compared to Province 1. However, there was no significant difference in odds of BR in Gandaki, Lumbini and Sudurpaschim provinces when compared to Province1.

### 3.6 Fixed effects for knowledge about how to register birth

Table5 presents the multilevel random intercept model to predict the knowledge about how to register birth among mother/caregiver of the children whose birth was not registered. Fixed part of the adjusted model4 suggested that mother/caregiver's education, exposure to radio, ethnicity, household wealth, cluster-level mother/caregiver's education, district-level and province-level infant mortality rate and significantly predicted knowledge about how to register birth. The likelihood of mother/caregiver's knowledge on how to register birth were 1.5 times, 2.1 times and 3.7 times higher among those who had basic, secondary and higher-level of education, respectively compared to those who had no formal education. The odds of knowledge on how to register birth was 5% higher among mothers/caregivers who listened to radio at least once a week than those who were not exposed to radio. Dalit mothers/caregivers had 73% higher odds of knowing how to register birth than Brahmin/Kshetri. Terai/Madhesi, Newar, Janjati, and Muslim mothers/caregivers also had higher chances of knowing about the process of BR than Brahmin/Kshetri. However, the relation was not significant. The odds of knowing the process of BR also increased with household wealth. Children living in households belonging to the second and middle wealth group were significantly more likely to have their birth registered than children living in the poorest households were. Similarly, cluster-level proportion of mothers/caregivers with at least primary education was positively associated with knowledge about process of BR, but the district-level infant mortality rate was negatively associated with the knowledge about the process of BR. Finally, the probability of knowledge about BR process was higher in all provinces compared to province1. However, the relation was significant only for Province 2 and Sudurpaschim Province. Mothers/caregivers living in Province 2 and Sudurpaschim Province were 2.2 times and 2.1 times, respectively more likely to know about the process of BR compared to those living in Province1. Though it was not significant, knowledge

about the BR process among mothers/caregivers was 6% higher in 2019 compared to 2014, but the relation was not significant in the final adjusted model.



**Table 4. Logistic regression result to examine relationship between birth registration status of children under age 5 and socio-demographic and geographic characteristics from pooled data, NMICS 2014 and 2019**

	Model1 Null Model	Model2: Survey year		Model3: Year, individual and household variables		Model4: Year, individual and household and geographic variables	
Socio-demographic characteristics		aOR	CI	aOR	CI	aOR	CI
<b>Survey year</b>							
2014		1.00		1.00		1.00	
2019		1.29***	(1.25 – 1.33)	1.32***	(1.27 – 1.36)	1.32***	(1.28 – 1.37)
<b>Age (in months)</b>							
0-11 (Ref)				1.00		1.00	
12-23				2.22***	(1.92 – 2.56)	2.24***	(1.94 – 2.58)
24-35				3.67***	(3.16 – 4.26)	3.72***	(3.20 – 4.31)
36-47				5.20***	(4.47 – 6.06)	5.24***	(4.50 – 6.10)
48-59				7.21***	(6.15 – 8.46)	7.27***	(6.20 – 8.53)
<b>Sex</b>							
Male (Ref)				1.00		1.00	
Female				0.97	(0.88 – 1.07)	0.97	(0.89 – 1.07)
<b>Mother's education</b>							
None (Ref)				1.00		1.00	
Basic (Grade 1-8)				1.08	(0.94 – 1.24)	1.08	(0.94 – 1.25)
Secondary (Grade 9-12)				1.25**	(1.08 – 1.44)	1.21**	(1.04 – 1.40)
Higher				1.43***	(1.17 – 1.74)	1.38**	(1.12 – 1.68)
<b>Exposure to newspaper</b>							
No				1.00		1.00	
Yes				1.06	(0.87 – 1.30)	1.13	(0.93 – 1.38)
<b>Exposure to radio</b>							
No				1.00		1.00	
Yes				1.12*	(1.00 – 1.26)	1.15**	(1.02 – 1.29)
<b>Exposure to television</b>							
No				1.00		1.00	
Yes				1.01	(0.89 – 1.15)	1.06	(0.93 – 1.20)
<b>Ethnicity of household head</b>							

Brahmin/Kshetri (Ref)				1.00		1.00	
Terai/Madhesi other caste				0.90	(0.73 – 1.12)	1.00	(0.79 – 1.26)
Dalit				2.22***	(1.86 – 2.65)	2.36***	(1.98 – 2.83)
Newar				1.04	(0.76 – 1.41)	1.24	(0.91 – 1.68)
Janjati				0.81**	(0.70 – 0.94)	0.92	(0.79 – 1.07)
Muslim				0.55***	(0.40 – 0.75)	0.60**	(0.44 – 0.83)
Other				0.79	(0.47 – 1.31)	0.86	(0.52 – 1.44)
<b>Household wealth quintile</b>							
Poorest				1.00		1.00	
Second				1.00	(0.86 – 1.18)	1.19**	(1.01 – 1.40)
Middle				1.36**	(1.12 – 1.64)	1.69***	(1.39 – 2.06)
Fourth				1.26*	(1.03 – 1.55)	1.63***	(1.31 – 2.03)
Richest				1.10	(0.85 – 1.41)	1.57**	(1.20 – 2.06)
<b>Percent of mother/care giver with primary or higher education in cluster</b>						1.00	(0.99 – 1.00)
<b>Infant mortality rate in district</b>						1.01**	(1.0 – 1.02)
<b>Place of residence</b>							
Urban (Ref)						1.00	
Rural						1.13	(0.95 – 1.34)
<b>Province</b>							
Province-1 (Ref)						1.00	
Province-2						0.62**	(0.43 – 0.88)
Bagmati						0.66**	(0.50 – 0.87)
Gandaki						0.80	(0.58 – 1.10)
Lumbini						1.23	(0.77 – 1.35)
Karnali						2.56***	(1.82 – 3.62)
Sudurpaschim						0.82	(0.61 – 1.09)
<b>Cluster-level random intercept (SE)</b>	1.34 (1.16 – 1.55)	0.91	(0.76 – 1.07)	1.04	(0.88 – 1.22)	0.87	(0.73 – 1.03)
% of cluster-level variance explained		32.09		22.39		35.07	
<b>Intra-class correlation</b>	0.29 (0.26 – 0.32)	0.22	(0.19 – 0.25)	0.24	(0.21 – 0.27)	0.21	(0.18 – 0.24)
<b>Log likelihood</b>	-6696	-6570		-6079		-6023	
<b>Observations</b>	<b>11815</b>	<b>11815</b>		<b>11815</b>		<b>11815</b>	
CI Eform in parentheses; *** p<0.01, ** p<0.05, * p<0.1							

**Table 5. Logistic regression result to examine relationship between mother's/caregiver's knowledge on how to register birth of children under age 5 and socio-demographic and geographic characteristics from pooled data, NMICS 2014 and 2019**

	Model1 Null Model	Model2: Survey year		Model3: Year, individual and household variables		Model4: Year, individual and household and geographic variables	
Socio-demographic characteristics		aOR	CI	aOR	CI	aOR	CI
<b>Survey year</b>							
2014		1.00		1.00		1.00	
2019		1.10***	(1.95 – 3.59)	1.09**	(1.01 -1.18)	1.06	(0.97 – 1.14)
<b>Age (in months)</b>							
0-11 (Ref)				1.00		1.00	
12-23				0.83	(0.59 – 1.16)	0.81	(0.58 – 1.13)
24-35				1.07	(0.74 – 1.55)	1.05	(0.73 – 1.53)
36-47				0.71*	(0.50 – 1.02)	0.69*	(0.49 – 0.99)
48-59				0.93	(0.63 – 1.38)	0.91	(0.62 – 1.35)
<b>Sex</b>							
Male (Ref)				1.00		1.00	
Female				1.02	(0.81 – 1.30)	1.05	(0.83 – 1.33)
<b>Mother's education</b>							
None (Ref)				1.00		1.00	
Basic (Grade 1-8)				1.59**	(1.13 – 2.24)	1.49**	(1.05 – 2.12)
Secondary (Grade 9-12)				2.18***	(1.51 – 3.16)	2.05***	(1.39 – 3.01)
Higher				3.89***	(2.19 – 6.94)	3.65***	(2.03 – 6.56)
<b>Exposure to newspaper</b>							
No				1.00		1.00	
Yes				1.06	(0.57 – 1.98)	1.00	(0.53 -31.88)
<b>Exposure to radio</b>							
No				1.00		1.00	
Yes				1.59**	(1.17 -2.17)	2.05**	(1.16 – 2.15)
<b>Exposure to television</b>							
No				1.00		1.00	
Yes				1.01	(0.71 – 1.44)	0.99	(0.69 – 1.42)
<b>Ethnicity of household head</b>							

Brahmin/Kshetri (Ref)				1.00		1.00	
Terai/Madhesi other caste				1.07	(0.63 – 1.82)	1.26	(0.69 – 2.32)
Dalit				1.75**	(1.10 – 2.77)	1.73**	(1.08 – 2.77)
Newar				2.87*	(0.93 – 8.90)	2.63	(0.83 – 8.32)
Janjati				1.29	(0.90 – 1.86)	1.32	(0.89 – 1.97)
Muslim				1.02	(0.48 – 2.19)	1.27	(0.57 – 2.84)
Other				1.15	(0.32 – 4.16)	1.19	(0.34 – 4.18)
<b>Household wealth quintile</b>							
Poorest				1.00		1.00	
Second				1.83**	(1.25 – 2.69)	1.80***	(1.21 – 2.67)
Middle				2.09**	(1.29 – 3.40)	1.98***	(1.19 – 3.29)
Fourth				1.62*	(0.97 – 2.71)	1.43	(0.82 – 2.48)
Richest				1.46	(0.76 – 2.81)	1.19	(0.58 – 2.42)
<b>Percent of mother/care giver with primary or higher education in cluster</b>						1.01*	(1.00 – 1.02)
<b>Infant mortality rate in district</b>						0.98**	(0.97 – 1.00)
<b>Place of residence</b>							
Urban (Ref)						1.00	
Rural						1.16	(0.78 – 1.71)
<b>Province</b>							
Province-1 (Ref)						1.00	
Province-2						2.18*	(0.98 – 4.87)
Bagmati						1.42	(0.74 – 2.76)
Gandaki						1.16	(0.54 – 2.48)
Lumbini						1.45	(0.77 – 2.72)
Karnali						1.83	(0.83 – 4.03)
Sudurpaschim						2.07**	(1.06 – 4.04)
<b>Cluster-level random intercept (SE)</b>	2.74 (2.04 – 3.70)	2.65	(1.96 – 3.59)	2.40	(1.74 – 3.32)	2.30	(1.65 – 3.20)
% of cluster-level variance explained		3.28		12.41		16.06	
<b>Intra-class correlation</b>	0.45 (0.38 – 0.53)	0.45	(0.37 -0.52)	0.42	(0.35 – 0.50)	0.41	(0.33 – 0.49)
<b>Log likelihood</b>	-1308	-1305		-1252		-1246	
<b>Observations</b>	<b>3615</b>	<b>3615</b>		<b>3615</b>		<b>3615</b>	
CI Eform in parentheses; *** p<0.01, ** p<0.05, * p<0.1							

#### 4. Discussion

A number of studies examining determinants of BR are available in the global literature. However, most of the studies fitted single level logistic regression models to explore the determinants by assuming that the association of covariates to outcome variable are same across clusters in the study design. In fact, due to the multistage sampling design, the observations within the clusters are correlated and association of covariates to outcome variables may not be same across clusters. Therefore, ignoring the hierarchical structure of data can have serious implications (Okunlola et al. 2017). This study factored out the proportion of variance in the birth registration explained by the hierarchies by using multilevel modelling approach.

The level of BR of children under five-years old has increased from 58% in 2014 to 77% in 2019 and varied across clusters. Twenty-nine percent of the variation in BR is attributed to the clusters. Similarly, the mothers/caregivers with knowledge about the process of BR and whose children are not registered, has increased from 86% in 2014 to 90% in 2019. Forty-five percent of the variation in knowledge about how to register birth is attributed to the clusters. About 32% of the cluster-level variation in BR is explained by the year of survey, and all the covariates included in final model explained 35% of the cluster-level variation in BR. While only about 3% of the cluster-level variation in knowledge about how to register birth was explained by the year of survey and all the covariates included in final model explained 16% of the cluster-level variation in knowledge about process of BR in Nepal.

The fixed effect results indicate that year of survey, age of child, mother's education, weekly exposure to radio, mother's/caregiver's ethnicity, household wealth, district-level infant mortality and the province where the child lives were the significant determinants of the BR in Nepal. These factors except the year of survey and age of child were also the significant predictors of the knowledge about how to register birth. This information would be valuable for program managers and policy makers as a guide to focus on the weaker areas for BR. Findings of this study are in line with the studies conducted in other countries (Amo-Adjei and Ananim 2015; Isara and Atmati 2015; Makinde et al. 2016; Mohanty and Gebremedhin 2017; Okunlola et al. 2017; Abay and Gebre-egziabher 2020; Bhatia Kim and Subramanian 2021).

We found that probability of BR increased with age of children. Children aged between 1-2 years were two times and children aged between 4-5 years seven times more likely to have their birth registered as compared to those aged below one year. Similar finding was observed in a study conducted in Nigeria, which indicates that the children's births are more likely to be registered at the near school going age. Here, the schools were found as an important facilitator for the BR (Makinde et al. 2016; Candia 2019). However, from legal and rights perspective, it is important for a child to have its birth registered within the first year of life (Okunlola et al. 2017). Initiation for an incentive and regulation mechanism, such as, integrating BR service with reproductive, maternal, neonatal, child and other health care such as antenatal care, institutional delivery, immunization etc. are suggested as important interventions to improve BR within the first year of life (Muzzi 2010; Okunlola et al. 2017; Jackson et al. 2018). Though it is important to educate mothers/caregivers about the importance of birth registration immediately after birth during the antenatal care, institutional delivery, immunization services, practice of late BR is likely to persist in Nepal and other countries where government policy is relaxed with age 5 stipulated as legal age for BR (Makinde et al. 2016).

We also found that mother's/caregiver's level of education is positively associated with BR status. This finding may be linked with the mother's autonomy, which was found to be significant predictor for BR in

India (Mohanti and Gebremedhin, 2018). Educated mothers are more autonomous and may not have to wait for their husband for uptake of health care service as well as BR of their children. The educated mother/caregivers are also more likely to know the availability of service, have better bargaining power within household as well as outside household, exposed to progressive ideas from their surrounding and able to make decision to advance their children's welfare and are more likely to register the birth of their children (Mohanti and Gebremedhin, 2018). Our finding of Mother's/caregiver's basic, secondary and tertiary education as significant determinants of both knowledge and practice of birth registration was consistent with the finding reported by Isara and Atimati (2015) in Nigeria and Abay and Gebre-egziabher (2020) in Ethiopia. Public awareness campaign in local language, together with other social networking activities were recommended as critical action to increase awareness and practice of BR among less educated people.

Radio, television, newspaper, posters and billboards are common information, education and communication materials used to increase community awareness on knowledge and practice of BR (Isara and Atimati, 2015; Adebimpe and Akpatamu 2021). However, in our analysis, exposure to radio was only the significant predictor for BR and knowledge about how to register birth in Nepal. This may be because of the fact that there is limited coverage of the newspaper and television and wider access of radio particularly to rural areas. Television and newspaper may also be relatively expensive for poor households in rural area. Therefore, effective utilization of radio and mobile phone technologies to sensitize the importance and process about BR would be cost effective intervention to improve BR coverage (Candia 2019).

We also found that both the BR and knowledge about how to register birth increase by wealth quintile. Travel and other costs associated with the process of registration may prevent the households in lower wealth quintile from BR of their children (Mohanti and Gebremedhin, 2018). Although there has been a substantial decline of poverty in Nepal, about one-fifth (17%) of the Nepalese population are still multidimensional poor (National Planning Commission, 2021). Access to food, clothing and shelter as the means of surviving is problem for many households. Any costs associated with BR can thus be burden for most of such households. As BR is a human right, the BR should be free of charge, the BR services should be brought closer to the population all direct, and indirect cost associated with BR should be removed (Okunlola et al. 2017). Provision of conditional cash transfer scheme was found to be successful to improve the adoption of civil registration, particularly among poor in India and Nigeria (Baruah et al. 2012; Makinde et al. 2016).

Ethnicity has also been identified as a significant predictor for BR in Nepal. Existing literature indicate that health care service utilization varies across ethnicity. Minority and disadvantaged ethnic groups are less likely to utilize maternal health services in Nepal, India and other countries. For example, Muslim, Janjati and Dalits were less likely to use family planning services in 2011 in Nepal (Sharma et al. 2011). Similarly, Dalits had lower odds of treatment success and higher odds of death due to TB in 2021 in Nepal (Bhattachan et al. 2021). Studies also indicate that women from scheduled caste and schedule tribes were less likely to access maternal health services in India (Singh et al, 2012). Mohanty and Gebremedhin (2017) also found that child belonging to schedule casts and tribes were less likely to have their birth registered compared to the forward/general caste groups in India. Contrary to the above finding, we found that Dalit children had higher probability of registering their birth compared to their Brahmin/Kshetri counterparts (OR- 2.4) and Dalit mothers/caregivers, who did not register the birth of their children, were more likely to know the process of BR (OR-1.7). Muslim women were, however, less likely to register birth of their

children compared to Brahmin/Kshetri (OR-0.6). Although the case was not significant. Terai/Madhesi, Newar, Janjati and Muslim had higher odds of knowing how to register birth. Brahmin/Kshetris are considered advantaged ethnic groups in Nepal and health condition and health care service utilization indicators are in favor of Brahmin/Kshetris. However, reason for the poor BR coverage and knowledge about how to register birth in this group compared to Dalit is not well understood and needs further study to explore the causes.

With regard to community-level factor, we did not find any significant association of cluster-level proportion of women/caregivers with primary or higher education with BR. However, percentage of mother/caregiver with primary or higher education in cluster showed significant positive association with knowledge about how to register birth. It can be argued that communities with high concentration of educated women may have higher level of awareness on the importance of child health care need including birth registration. Higher level of education among women in a community also indicates higher level of autonomy (Singh et al. 2013). According to the hypothesis of the diffusion of innovations, awareness about new ideas are spread quickly around the community (Dearing and Cox 2018). This suggests that education is important not only at individual and household level but also at community level. We also found that district-level infant mortality rate positively associated with BR and negatively associated with knowledge about how to register birth.

It is assumed that unregistered children have higher level of mortality. However, UNICEF (2005) report indicates relatively small disparity in mortality level over registration status of childbirth. For example in Suriname, Trinidad and Tobago where BR is high (96%), children who die before the age of five were less likely to be registered than those who survive, but the reverse was true in Comoros. Our result also indicated that the district level infant mortality rate was positively associated with BR but negatively associated with knowledge on how to register birth in Nepal. The mother/caregivers living in high infant mortality district may have lower level of awareness on child health care as well as importance of BR.

In our regression result, Karnali Province has larger positive effect on BR than in Province1 (OR: 2.56). Province2 and Bagmati Province have significantly lower odds (OR: 0.62 and 0.66 respectively) of BR than in Province1. Similarly, Province2 and Sudurpaschim Province have significantly higher odds of knowledge about process of BR (OR: 2.18 and 2.07 respectively). This result contradicts with the evidence that poor Provinces may have poor health infrastructure, poor service delivery leading to poor BR. For example, low income and poor states in India have high BR coverage (Mohanty and Gebremedhin 2017). Likewise, a report by UNICEF (2005) indicates that the level of BR is higher around the capital and cities and the BR decreased in the areas away from major cities in some countries in Africa. However, in some other countries, very high level of registration was recorded in areas that are far away from the capital. Karnali Province, Far-west Province and Province2 are the multi-dimensionally poorest provinces in Nepal. Similarly, Bagmati, Gandaki and Province1 are relatively less poor provinces (National Planning Commission, 2021). Reasons behind this contrast in finding is not quite clear and further exploration is needed. However, based on India's experience it can be argued that due to focused registration campaign targeted in the poorer provinces, it is possible to see higher BR coverage in poorer provinces compared to the less poor provinces (Mohanty and Gebremedhin 2017).

### **Limitation**

This study has few limitations. Although the data used in the analysis were nationally representative surveys, the analysis used cross-sectional data collected at two times. Both the surveys included only a

limited variables measuring birth registration, knowledge about the process of registration and the variables influencing them. Thus, the associations presented are not causal. Here, birth registration was measured using two questions- first question was, whether a child had a birth certificate. If the response was no, they were further asked if the birth had ever been registered. In both the questions, we cannot be certain that the birth had actually been registered, as all those who said that the birth of their children had been registered did not show the birth certificate. As the surveys included only the children who were inside the household at the time of survey, it is likely that the estimated birth coverage was under-estimated. The source of data for this study was also based on the self-report of mothers and might have introduced recall bias.

## **5. Conclusion:**

This study examined the trend and determinants of birth registration and knowledge about process of registration in Nepal using multilevel hierarchical logistic regression model. Coverage of birth registration and knowledge about the process has increased substantially over the five-year period between 2014 and 2019. However, a lot needs to be done to decrease social and geographical disparity in terms of birth registration to meet the SDG target of universal coverage. Our results show that 29 percent of the variation in birth registration in Nepal lies between community and higher-level differences and 71 percent of the variation in birth registration lies between time and individual level differences. Similarly, 45 percent variation in knowledge about process of birth registration (among those who have not registered birth of their children) lies between community and higher level differences and 55 percent of variation in knowledge about process of birth registration lies between time and individual level differences. This suggests that the policy and interventions targeting to improve birth registration should focus on individual as well as community and higher-level factors. Out of 13 variables included in final adjusted model, eight variables (survey year, age of child, mother's/caregiver's education, exposure to radio, ethnicity, household wealth, district-level infant mortality rate and province) were found to be significant predictors of birth registration and knowledge about process of birth registration. Thus for Nepal to achieve universal birth registration additional efforts should be made to address the issues related to the predictor variables. Following recommendations are made to further improve the status of birth registration in Nepal.

## **6. Policy recommendation**

### **1. Expand BR facilities to birthing centers and integrate it with maternal and newborn health care**

Birth registration is lower among early age of child. To address the issue of late registration, provision of integrating birth registration with maternal and newborn health service should be introduced. Local-level registrars should be proactive to coordinate with birthing centers, immunization centers, hospitals and other maternal and child health care facilities for the integration. The birth, which occurs at home, should be notified and reported to birth registration centers by mobilizing community health workers/volunteers. Unregistered home births should be identified at the time of immunization and referred for birth registration.

### **2. Implement policy of mandatory free education up to the secondary level**

Childbirth registration as well as mother's knowledge on registration process increased with education of mother/caregiver (through the awareness of importance of birth registration). Therefore, Government of Nepal should strictly implement the policy of free education to women at least up to



secondary level to empower them to improve birth registration as well as maternal and child health service.

**3. Implement nationwide mass media campaign on legal provision and importance of BR in local language**

Exposure to radio was significant predictor of birth registration and knowledge about process of birth registration. Therefore, public awareness campaign including information on importance and process of birth registration should be conducted widely through national as well as local level radio stations. The information shared during the mass media campaign should be in the national as well as local language.

**4. Implement targeted interventions on BR among Jangati, Muslim and other minority groups**

There has been a significant ethnic and geographical variation in birth registration and related knowledge. People living in Province2 and Bagmati Province are relatively less likely to register birth. Reason for this ethno-geographical difference in birth registration could be due to the poor literacy rate among ethnic minorities, particularly among Janjati and Muslims. Thus, community based strategy targeting people living in Province2 and Bagmati Province and in the areas dominated by Janjati and Muslims should be developed and executed.

**5. Expand the conditional cash transfer program introduced for maternal health care to BR**

The poorest households were significantly less likely to register birth of their children and know the process of birth registration. Thus, birth registration promotion activities should be prioritized in the poorest communities. The conditional cash transfer program implemented for increasing antenatal care, and institutional delivery should be extended to birth registration.

**6. Include BR in health information and establish BR monitoring system in collaboration with MoHP and DONICR to ensure BR as right to children**

Access to health and birth registration service is the rights of children and the government has responsibility to guarantee these rights. Therefore, including birth registration in health information system and establishing birth registration monitoring system in collaboration with Ministry of Health and Population (MoHP) and Department of Civil Registration and National Identity (DoCRNI) will help to track the birth registration progress and reduce inequality in the access to birth registration among different groups.

**7. Amend existing BR laws to remove current barriers associated with fee and requirement of BR from permanent place of residence, need of parent's citizenship certificate, finger print and signature**

Requirement for father's citizenship, passport and other supporting documents for registering birth, denial for birth registration from places other than permanent residence and at the recommendation of close relatives are the barriers for birth registration. Therefore, some amendments in the existing birth registration laws and directives to ensure birth registration regardless of legal identity of the parents are required. Imposing penalty to the officials who cause delay or denial of birth registration, allowing birth registration from permanent as well as current place of residence, initiating and completing the process by close relatives, enacting provincial and local level laws for birth registration are other amendments suggested to maintain timely and accurate birth registration.

**8. Enhance technical capacity of Local Level Government (LLG) with provision of dedicated trained staff for community mobilization**

Provision of dedicated staff trained in birth registration process in local level government, mobilization of local bodies, school, media, health facilities and social mobilizers to create intensive publicity in community towards implementation of birth registration, expansion of community based birth registration centers and establishment of birth registration centers in health facilities will further improve and strengthen birth registration system in Nepal.

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Annex. Change in BR coverage and mother /caregiver's knowledge (%) on how to register birth (among children whose birth was not registered) by selected background variables

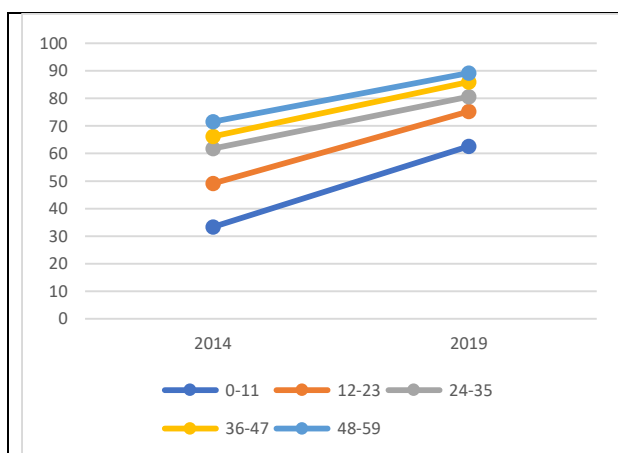


Figure 5. Change of BR Coverage (%) by age of child

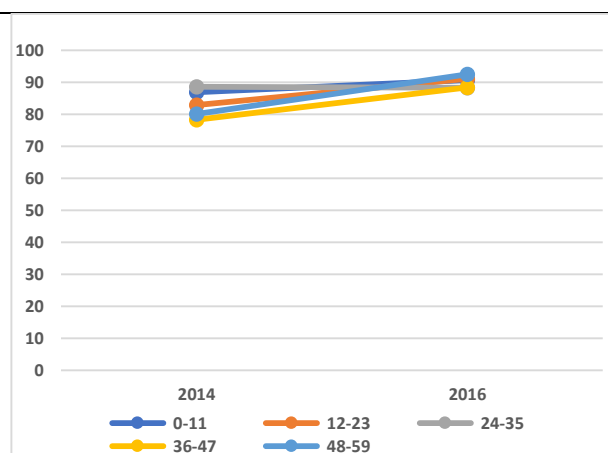


Figure 6. Change of mother's/caregiver's knowledge (%) on how to register birth (among the child whose birth was not registered) by age of child

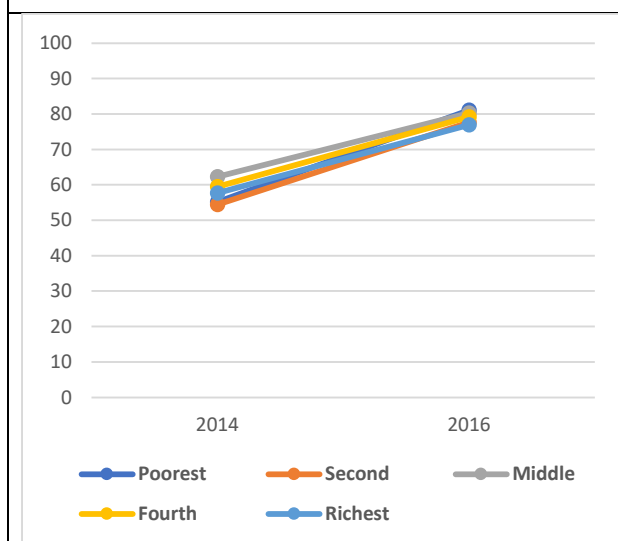


Figure 7. Change of BR coverage by household wealth quintile

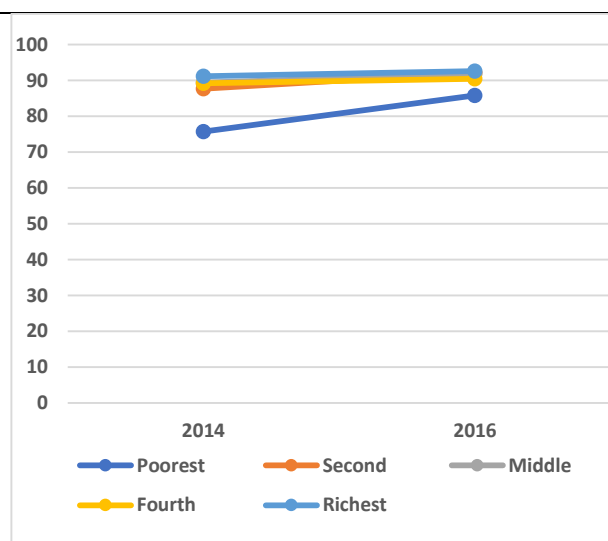


Figure 8. Change of mother's/caregiver's knowledge on how to register birth (among the child whose birth was not registered) by household wealth quintile

Annex1. Change in BR coverage and mother /caregiver's knowledge (%) on how to register birth (among the children whose birth was not registered) by selected background variables (Contd.)

