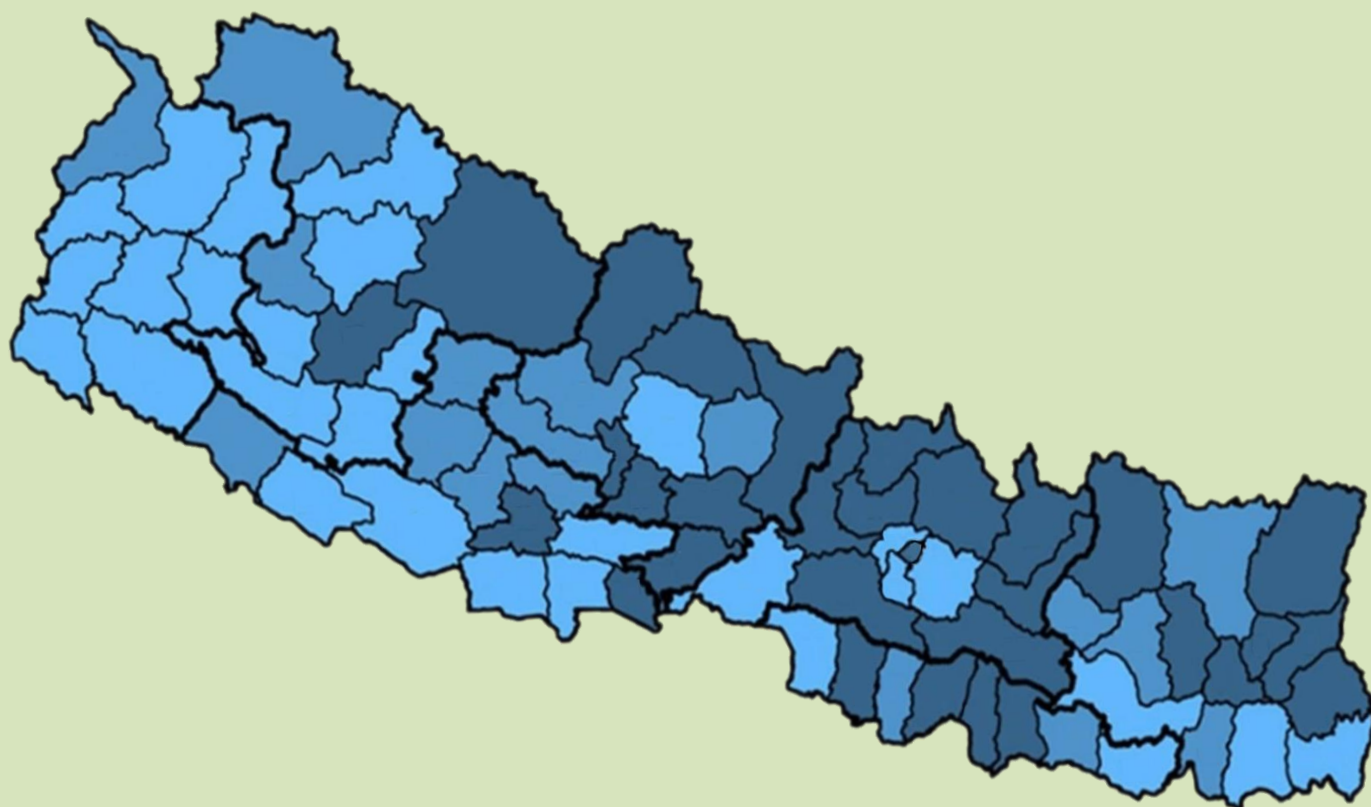


Determinants of Maternal Health and Family Planning Service Coverage in Nepal: Modelling of Routine Data



Government of Nepal
Ministry of Health and Population
Department of Health Services
Teku, Kathmandu

October 2020

Disclaimer: This analysis was carried out under the aegis of Integrated Health Information Management Section (IHIMS), Management Division, Department of Health Services (DoHS), Ministry of Health and Population (MoHP). This analysis is made possible with the UKaid through the Nepal Health Sector Programme 3 (NHSP3), Monitoring, Evaluation and Operational Research (MEOR) project and by the generous support of the American people through United States Agency for International Development (USAID)'s Strengthening Systems for Better Health (SSBH) Activity. The content of this report is produced by IHIMS, Abt Associates Inc., SSBH program and NHSP3, MEOR project. The views expressed in the report are of those who contributed to carry out and complete the analysis and do not necessarily reflect the views of USAID or the United States Government and British Embassy Kathmandu or the UK Government.

Additional information about the analysis may be obtained from the IHIMS, Management Division, DoHS, MoHP, Teku Kathmandu; Telephone: +977-1-4257765; internet: <http://www.mddohs.gov.np>; or UKaid/NHSP3/MEOR project, email: meor@abtassoc.com.au.

Recommended Citation

Department of Health Services (DoHS), Ministry of Health and Population (MoHP), Nepal; UKaid Nepal Health Sector Programme 3 (NSHP3)/Monitoring, Evaluation and Operational Research (MEOR), USAID's Strengthening Systems for Better Health (SSBH). 2020. *Determinants of maternal health and family planning service coverage in Nepal: modelling of routine data*. Kathmandu, Nepal: DoHS, MoHP, Nepal.

Determinants of Maternal Health and Family Planning Service Coverage in Nepal: Modelling of Routine Data

(Determinants of Maternal Health and Family Planning Service Coverage in Nepal)



Integrated Health Information Management Section
Management Division
Department of Health Services
Ministry of Health and Population

Technical Support

UKaid Nepal Health Sector Programme 3
Monitoring, Evaluation and Operational Research Project
and
USAID's Strengthening Systems for Better Health Activity



FOREWORD



4-261712
4-261436
Fax: 4-262268

Pachali, Teku
Kathmandu, Nepal

Date: 15 October 2020


Ref No.:

Foreword

Safe motherhood programme and family planning programme have been priority programme of the Ministry of Health and population (MoHP) with a series of policy initiatives to improve the service coverage. With the vision of leaving no one behind, Department of Health Services (DoHS), MoHP has been working to expand the coverage of services in low coverage areas. However, beyond the health system, multiple factors like poverty, literacy rates possession of assets, overall human development etc. play a role in determining the service coverage rates in any district. In this context, this analysis intended to identify determinants of maternal health and family planning service coverage using routine health data and data from population atlas. Different statistical models have been used in identifying the determinants of service coverage. These findings could be useful in having a better understanding of service coverage and factors on which service coverage depends.

This analysis was implemented under the aegis of the DoHS, MoHP with Integrated Health Information Management Section (IHIMS), Management Division, DoHS leading and coordinating the activity. The UKaid Nepal Health Sector Programme 3 (NHSP3), Monitoring Evaluation and Operational Research (MEOR) project and USAID's Strengthening Systems for Better Health (SSBH) Activity provided technical assistance in data analysis.

I would like to congratulate the IHIMS, Management Division, DoHS for being able to successfully complete this task. I would like to extend my appreciation to UK Foreign, Commonwealth and Development Office Nepal and USAID Nepal for their financial support for this analysis.


Dr Dipendra Kumar Singh
Director General
Department of Health Services

LETTER OF ACKNOWLEDGEMENT



Government of Nepal
Ministry of Health and Population
DEPARTMENT OF HEALTH SERVICES
Management Division

Phone No. 4262063
4252483

Pachali, Teku
Kathmandu, Nepal

Ref: 510

Date: 15th October, 2020



Acknowledgements

This analysis was performed under the leadership of the Department of Health Services (DoHS), Ministry of Health and Population (MoHP) and the process was coordinated by Integrated Health Information Management Section (IHIMS), Management Division, DoHS. The UKaid Nepal Health Sector Programme 3 (NHSP3), Monitoring Evaluation and Operational Research (MEOR) project in collaboration with USAID's Strengthening Systems for Better Health (SSBH) Activity provided technical assistance to perform the analysis.

This analysis intended to identify determinants of maternal health and family planning service coverage using data from different sources. Different statistical models have been used in identifying the determinants of service coverage. These findings could be useful in having a better understanding of service coverage and factors on which service coverage depends.

I would like to extend my sincere thanks to Badri Nath Jnawali, chief of the IHIMS and the then chief of IHIMS Dr Sharad K Sharma, and all the IHIMS team for their contribution and constructive feedback to finalize the report. I appreciate the contribution of UKaid NHSP3 MEOR project and the USAID's SSBH Activity for their technical support. The statistical analysis part was completed by Data Analysis Expert Dr. Sampurna Kakchapati and I express my sincere gratitude to him. I appreciate the contribution of Dr Krishna Aryal, Mr. Peter Godwin, Mr. Achyut Raj Pandey and Dr. Fiona Mactaggart of MEOR project; Dr Deepak Paudel, Mr. Madhav Chaulagain, and Mr. Swadesh Gurung of USAID's SSBH Activity for their contribution in executing this analysis. I would like to sincerely appreciate the financial support from UK Foreign, Commonwealth and Development Office Nepal and USAID Nepal for this activity through the UKaid NHSP3 MEOR project and USAID's SSBH Activity respectively.

Dr Ramesh Kumar Kharel
Director
Management Division
Department of Health Services

CONTENTS

List of tables	II
List of figures.....	II
Acronyms	III
Terms and definitions	IV
Executive summary	VI
1. Introduction.....	1
1.1 Nepalese context.....	1
1.2 Policy response in Nepal.....	2
1.3 Rationale for this study	3
1.4 Objectives.....	3
2. Methodology	4
2.1 Data sources:	4
2.2 Variables in the analysis	4
2.3 Statistical analysis	5
3. Results	7
3.1 Maternal health services	7
3.1.1 ANC visits	7
3.1.2 IFA coverage.....	10
3.1.3 Institutional delivery	11
3.1.4 Predictors of PNC visits.....	13
3.1.5 Composite coverage of maternal health services.....	16
3.2 FP Service.....	19
4. Conclusions and recommendations.....	24
4.1 Conclusions.....	24
4.2 Recommendations	24
5. Limitations	26
6. Dissemination and utilization of findings	27
6.1 Dissemination of study findings	27
6.2 Utilisation of research findings	27
6.3 Research open and enhanced access policy	27
7. References.....	28

LIST OF TABLES

Table 1: Dependent and independent variables used in different statistical models	5
Table 2: Descriptive statistics of variables	7
Table 3: Determinants of first ANC visit coverage	8
Table 4: Determinants of four ANC visits coverage	9
Table 5: Determinants of IFA coverage (180 days)	10
Table 6: Determinants of institutional delivery coverage	12
Table 7: Determinants of the coverage of PNC visit within 24 hours	13
Table 8: Determinants of three PNC visits coverage	15
Table 9: Determinants of composite coverage maternal health services	18
Table 10: Determinants of mCPR	22

LIST OF FIGURES

Figure 1: Proportion of maternal health service coverage (composite index) by district	16
Figure 2: Schematic map of proportion of maternal health service coverage in Nepal	17
Figure 3: Proportion of mCPR by district	20
Figure 4: Schematic map of the mCPR in Nepal	21

ACRONYMS

ANC	Antenatal care
CI	Confidence intervals
mCPR	Modern contraceptive prevalence rate
DFID	Department for International Development
DHIS2	District Health Information Software 2
FP	Family Planning
GoN	Government of Nepal
HDI	Human development index
HF	Health facility
IFA	Iron and folic acid
IHIMS	Integrated Health Information Management Section
MDGs	Millennium development goals
MMR	Maternal mortality ratio
NHSS	Nepal health sector strategy
NHSSP	Nepal Health Sector Support Programme
PNC	Postnatal care
SBAs	Skilled birth attendants
SD	Standard deviation
SDGs	Sustainable development goals
TFR	Total fertility rate
UHC	Universal health coverage
VIF	Variance inflation factor
WHO	World Health Organization

TERMS AND DEFINITIONS

Dependent variable: A dependent variable is a variable whose value depends on the values of one or more other independent variables. In other words, it is the variable that is used to describe or measure the problem under study.

Independent variables: The variables that are used to describe or measure the factors that are assumed to cause or influence the dependent variable are called the independent variable. For example, in a study of the association between district characteristics like literacy rates, mean age at marriage etc. and FP service utilization, district characteristics are considered as independent variable and FP service utilization is considered as dependent variable.

Standard deviation (SD): It is a statistic that measures the dispersion of a dataset relative to the mean. It is a measure of the average distance between the values of the data set and the mean. High SD indicates that the data points are spread out over a large range of values whereas a low SD means that the data points are very close to the mean. For example, if the mean value of female literacy rates of 75 districts is 56% with SD of 11 and the mean value of male literacy rate is 75% with SD of 8, data points on female literacy rate of districts are considered more spread than male literacy rate.

Regression analysis: It is a form of modelling technique which investigates the relationship between a dependent and independent variable. Regression model are used to understand how changes in the independent variable values are associated with changes in the dependent variable. For example, regression analysis helps to understand how the contraceptive prevalence rate can change if the literacy rates, age at marriage and economic status of the district change.

Regression coefficient: It is the measure of the degree of dependence of dependent variable on the independent variables.

95% Confidence interval: The interval in regression analysis is the set of values that has a probability of 95% to contain the true value of regression coefficient.

p-value: The p-value is the probability of obtaining result more extreme if null hypothesis is true. Conventionally, it is considered that if the p-value is less than 0.05, there is significant evidence to reject null hypothesis.

Multicollinearity: It is a state of high correlation among the two or more independent variables in the regression model. If there is high degree of multicollinearity, the coefficient estimates may become very sensitive to even the small changes in the model. The presence of multicollinearity also reduces the precision of coefficient estimates.

Variance inflation factor (VIF): It is the measure of severity of multicollinearity in the regression analysis. VIF value above 10 is generally considered to reflect high degree of multicollinearity.

EXECUTIVE SUMMARY

The risk of obstetric complications during pregnancy and unwanted pregnancies are linked to higher maternal deaths. Increasing availability and the use of modern contraceptives and providing high-quality pregnancy and childbirth care can reduce the number of maternal deaths. However, service utilization and coverage are influenced by multiple other factors like the poverty gap, literacy rates, overall human development index, and other external factors. Expansion of the coverage of maternal health and family planning (FP) services has been a priority for the health sector in Nepal, and the Government of Nepal is working to ensure that all citizens have access to such services through a series of policy initiatives. It is often critical to evaluate whether these public health initiatives have been effective. In this context, this analysis used statistical models to identify the factors that determine the coverage of maternal and FP services.

The analysis used the service coverage data from the Health Management Information System, and district characteristics data from 'Population Atlas of Nepal 2014' published by Central Bureau of Statistics. The district is the unit of analysis. Eight statistical models were used to identify district characteristics associated with coverage of maternal health and FP services. Coverage of first antenatal care (ANC) visit, four ANC visits, intake of iron and folic acid for 180 days (IFA coverage), institutional delivery, postnatal care (PNC) visit within 24 hours, three PNC visits, and composite coverage of maternal health services were the dependent variables used to assess determinants of maternal health service coverage. Similarly, the modern contraceptive prevalence rate (mCPR) was used as a dependent variable for FP service coverage. A log-transformed linear regression model was used for statistical analysis. All statistical analyses were performed in R software.

The analysis revealed that the coverage of institutional delivery increases with increase in the proportion of female household heads in the districts. Of the 77 districts, 31 districts had higher than average and 30 districts had lower than average composite coverage of maternal health services. Compared to districts with Brahmin as the predominant caste, districts with Magar as predominant caste had 17% higher composite coverage of maternal health services. Similarly, compared to districts in Province 1, Gandaki Province, Province 2 and Bagmati province had 27%, 26% and 15% lower composite coverage of maternal health services. With one unit increase in female mean age at marriage in the district, the composite coverage of maternal health services decreased by approximately 10%.

The mCPR of 21 districts was above the average value while the other 37 districts had below the average value. Compared to districts with Brahmin as predominant caste, Districts with Gurung, Magar and Tharu as predominant caste had 32%, 26% and 18% higher mCPR. On the other side, compared to districts with Brahmin as predominant caste, districts with Rai, Chhetri, Limbu and Newar had 29%, 28%, 27% and 21% lower mCPR. Compared to districts in Province 1, Gandaki Province, Lumbini Province and Bagmati Province had almost 37%, 18% and 12% lower prevalence of mCPR.

The analysis reveals predominant caste, female mean age at marriage and province as determinants of composite coverage of maternal health services. Similarly, HDI, predominant caste of the district and province were key determinants of the mCPR. Targeted interventions in low coverage districts for both the maternal health services and FP services could be useful.

1. INTRODUCTION

Maternal mortality remains a leading cause of death among women of reproductive age, particularly in developing countries.¹ It was estimated that in 2017, approximately 295,000 women died during pregnancy and childbirth globally.² Almost 94% of these deaths occurred in low-resource settings with high fertility rates, low literacy, poverty, lack of access to health services and poor quality medical care.²⁻⁴ The majority of these maternal deaths are preventable through appropriate birth spacing, antenatal care (ANC) during pregnancy, deliveries by skilled birth attendants (SBAs), and the care and support in the weeks after childbirth.^{2,5} If all women who wanted to prevent or delay pregnancies used contraceptives, and all the pregnant women and their newborns received health care services as recommended by World Health Organization (WHO), maternal deaths would drop by 67% and newborn deaths would drop by 77% globally.⁵

The developing world is in a protracted, global epidemiological transition^{6,7}, where non-communicable diseases (NCDs) have emerged as the predominant disease burden. However, many countries still face a notable burden of other conditions, including maternal health disorders. This can lead to a situation of competing priorities about which services to include in essential service delivery, and at what cost, to the entire population.^{7,8} Maternal health services that consume 15.8% of total health budget (highest proportion compared to any other health conditions) and 37% of free health care budget⁹ can be particularly vulnerable to de-prioritization as health system is facing increasing trade off of resources.

1.1 Nepalese context

Nepal is particularly troubled by the dilemma of competing public health priorities. NCDs, in recent years, have emerged as the leading cause of death in Nepal claiming almost 49% of total deaths in women of reproductive age.¹⁰ Maternity-related risk factors account for 9% of deaths among women of the reproductive age group,¹ which is still a notable burden.^{7,8} Nepal has a maternal mortality ratio (MMR) of 239 per 100,000 live births¹¹ with lifetime risk of maternal deaths of 1 in 150.¹² The recently released estimates caution that Nepal is likely to miss the sustainable development goal (SDG) target of reaching 70 maternal deaths per 100,000 live births with the projected MMR at 199 per 100,000 live births by 2030.¹³

The need for expanding service coverage has been further justified by the fact that the tremendous gains Nepal has made in reducing maternal mortality and improving maternal services should not be lost. The decline in MMR in Nepal outpaced global decline between the years 1990 to 2017 (a

decline of 2.9% in Nepal and 2.0% globally); though the pace has been slower in recent years. Between 2005 and 2017, the MMR declined in Nepal at the rate of 0.9% per year compared to 2.9% globally. The percentage of mothers who received any ANC from a skilled provider increased from 28% to 84%, four ANC consultations increased from 14% to 69%, the institutional delivery rate increased from 6% to 57%, and total fertility rate (TFR) declined from 4.1 to 2.3 children born per woman from 2001 to 2016.¹⁴ The strategy to further reduce MMR is to expedite the progress in ensuring universal access to maternal health services expanding services and increasing utilisation in previously low coverage areas.⁸ As a signatory to the SDGs, Nepal has set the ambitious targets of achieving 90% coverage nationally of four ANC visits, institutional delivery, SBA delivery, and three postnatal care (PNC) visits by 2030. Similarly, Nepal aims to increase modern contraceptive prevalence rate (mCPR) to 60% and reduce TFR to 2.1 children per woman.¹⁵

Nepal's health system is thus faced with a trade-off: expediting the progress in improving maternal health and economising on resources whilst NCDs claim an ever-increasing share of mortality. This trade-off demands better understanding of the determinants of service coverage^{16,17}, so that the efficiency and effectiveness of resources allocated to maternal health can be maximised. This analysis attempts to provide such insights.

1.2 Policy response in Nepal

Maternal health has been a priority area for the Government of Nepal (GoN)¹⁸ which is also reflected in a series of policy initiatives. The maternity incentive scheme introduced in 2005 encourages women to visit health facilities for maternity care and improve access to maternity care services.^{18,19} In 2006, policy on SBAs emphasised the importance of SBAs at every birth and embodied the commitment in training and deploying skilled doctors, nurses, and auxiliary nurse midwives across the country.²⁰ In 2008/09, the full birth preparedness package was rolled out across the country, aiming to improve timely access to delivery care services.¹⁹ The Nepal Health Sector Strategy (NHSS) 2015/16-2020/21 also aims to expand equitable access to and utilisation of quality family planning (FP) services, increase the availability of modern FP methods and satisfy the demand for FP.¹⁸ In addition, National Neonatal Health Strategy was endorsed in 2004²¹, and the country's Every Newborn Action Plan was endorsed in 2016, which are related to maternal and child health.²²

One of the strategies to increase efficiency and effectiveness in reducing MMR is to expedite the progress in ensuring universal access to maternal health services.²³ An equity-oriented approach

in achieving universal health coverage (UHC) stresses that accelerated and early gains have to be realised by disadvantaged population subgroups, thereby improving overall indicators of the country and reducing inequalities at the same time.²⁴ Moving from millennium development goals (MDGs) to the SDGs, one of the major change in approach was the inclusion of the concept of leaving no-one behind which has also been reflected in the NHSS.²⁵ The idea that no goal should be considered as being met unless it is met for everyone is well established in the rhetoric around the new goals.²⁶ Thus, reducing MMR in all population subgroups is essential, which requires identification of subgroups lagging behind in coverage of maternal health services. Furthermore, this analysis builds upon the previous analysis on identifying inequalities in maternal health service utilization carried out under the aegis of Policy, Planning and Monitoring Division, within the MOHP and Integrated Health Information Management Section, Department of Health Services and supported by the UKaid Nepal Health Sector Support Programme (NHSSP).²⁷

1.3 Rationale for this study

The risk of dying from maternal causes is related to unwanted pregnancies and the risk of having obstetric complications.²⁸ Thus, many women could be saved by increasing the availability and use of modern contraceptives to delay pregnancy, and provision of high-quality pregnancy and childbirth care. However, several other factors like poverty, literacy rates, overall human development and status as a household head influence a woman's ability to utilise services and thus receive optimal care. For a long time, expanding coverage of maternal health and FP services has been a priority for the GoN, which has led to a series of policy initiatives aiming to overcome these barriers and improve access to high-quality services.^{15,18-21} Moreover, public health officials are often required to evaluate on a regular basis whether such initiatives have been effective. Statistical models are used to understand the determinants of coverage of different services, the incidence of different maternal conditions and to predict the effects of different interventions. Such analysis could be useful to guide the policy decision related to the expansion of service coverage and make the rationale use of limited resources.

1.4 Objectives

This analysis identifies the determinants of maternal health and FP services coverage in Nepal using statistical models.

2. METHODOLOGY

2.1 Data sources:

Data on coverage of health services was extracted from the Health Management Information System (HMIS) in coordination with the Integrated Health Information Management Section (IHIMS). We analysed data for first ANC visit, four ANC visits, intake of iron and folic acid (IFA) for 180 days (IFA coverage), institutional deliveries, PNC within 24 hours, three PNC visits and mCPR for the last five fiscal years for all districts in Nepal (2014/15 to 2018/19). District-wide data for proportion of absentee population^a, male and female literacy rates^b, male and female mean age at marriage, human development index (HDI), poverty gap^c, population per health facility, the proportion of female household heads, a predominant caste^d of the district were obtained from 'Population Atlas of Nepal 2014' published by Central Bureau of Statistics.²⁹

Former 75 districts structure was converted into 77 districts splitting Nawalparasi and Rukum districts into two each during state restructuring process post federalization of the country. Nawalparasi district was divided into Nawalparasi East and Nawalparasi West falling in Gandaki Province and Province 5 respectively. Similarly, Rukum district was divided into Rukum East and Rukum West falling in Province 5 and Karnali Province respectively. For data before 2015/2016 that were not available for separately for these split districts, same values have been assumed for both the districts in calculation in analysis process.

2.2 Variables in the analysis

Eight different statistical models were used in the analysis with the district as the unit of analysis. The dependent and independent variables used in the analysis are shown in Table 1.

^a Persons away or absent from birth place or usual place for employment or study or business purpose is considered absent population

^b The literacy rates are calculated in 5 years and above population. A person who can both read and write in any language was defined as a 'literate'.

^c Poverty gap, also referred to as depth of poverty provides information regarding how far off households are from the national poverty line. This measure provides the mean aggregate income or consumption shortfall relative to the national poverty line across the whole population. It is calculated by adding up all the shortfalls of the poor assuming that the nonpoor have a shortfall of zero and dividing the total by the population. It estimates the total resources needed to bring all the poor to the level of the poverty line (divided by the number of individuals in the population).

^d The classification is based on categorisation of 126 caste/ethnic groups into 10 broader categories as per National Population and Housing Census 2011, Central Bureau of Statistics, Nepal.

Table 1: Dependent and independent variables used in different statistical models

Domain	Dependent variable	Independent variables	Statistical model
Maternal health service coverage	First ANC visit	Absentee population, male literacy rates, female literacy rates, male mean age at marriage, female mean age at marriage, HDI, poverty gap, population per health facility (HF), the proportion of female household head, the predominant caste of the district, reporting status	Model one
	Four ANC visit		Model two
	IFA coverage (180 days)		Model three
	Institutional deliveries		Model four
	PNC within 24 hours		Model five
	Three PNC visits		Model six
	Composite coverage of maternal health services		Model seven
FP service coverage	mCPR	Same as above	Model eight

The first seven statistical models attempted to identify the determinants of maternal health service coverage with 1st ANC visit, four ANC visits, IFA coverage, PNC visit within 24 hours, three PNC visits, institutional delivery and composite coverage of maternal health services as dependent variables. Composite coverage index of maternal health services was formed combining the coverage of first ANC visit, four ANC visits, institutional delivery and PNC visit within 24 hours. Each variable was given equal weight while combining to composite coverage index.

Independent variables in each of these (seven) models were: absentee population, male literacy rates, female literacy rates, male mean age at marriage, female mean age at marriage, HDI, poverty gap, population per HF, the proportion of female household head, year and predominant caste of the district. For the regression analysis, HDI was converted in the scale of 100 with a value ranging from 1 to 100. For population per health facility, 100 was considered as one unit.

The dependent variable for analysis of determinants of FP service coverage was the mCPR. The same set of independent variables as in maternal health service coverage were used in this (eighth) model too.

2.3 Statistical analysis

A log-transformed linear regression model was used in the analysis. The conventional model for handling data where the dependent variable is continuous is linear regression.^{14,15} In the analysis, the service coverage indicators were generally positively skewed distributions and thus were transformed by taking logarithms to obtain the outcome as

$$y_{ijt} = \ln \left(1000 \times \frac{n_{ijt}}{P_{ij}} \right).$$

The log-transformed linear model with normally distributed errors for modelling is defined as

$$y_{ijt} = \mu + \alpha_i + \beta_j + \eta_q + \gamma_t.$$

The parameter μ is a constant encapsulating the overall mean, α_i , β_j , η_q ... are the main effect corresponding to determinants.

Multicollinearity was checked to determine whether independent variables in a regression model are correlated. For a given predictor (p), multicollinearity was assessed by computing a score called the variance inflation factor (VIF), which measures how much the variance of a regression coefficient is inflated due to multicollinearity in the model. The smallest possible value of VIF is one (absence of multicollinearity). A VIF value that exceeds 10 indicates a problematic amount of collinearity. In our analysis, VIF value did not exceed 10, so can conclude that there are no problems of multicollinearity.

The coefficient (referred to as coeff in tables in result section) obtained from fitting the regression model is exponentiated, subtracted one from this number and which was then multiplied by 100 to get the desired value. The desired value is interpreted as the percent change in the dependent variable with one-unit change in independent variables. All the statistical analyses were performed in R software.

3. RESULTS

The mean, standard deviation (SD) and 95% confidence intervals (CI) of different descriptive statistics is shown in Table 2. The average proportion of the absentee population in 75 districts was 7%. Similarly, the mean male literacy rate was 75% whereas the mean female literacy rate was 56%. The mean age at marriage for male and female were 21 years and 18 years respectively. Average HDI of 75 districts was 0.47 and the poverty gap was 7%. The average of proportion of female headed households was 26%. The coverage of first ANC visit and four ANC visits were 95% and 49% respectively. Similarly, the coverage of PNC visit within 24 hours of delivery was 48% and coverage of three PNC visits was 18%. Both the proportion of IFA coverage and institutional delivery across Nepal were 50%. The average mCPR was 39%. The indicators in the Table 2 are computed as an average of 77 districts and could vary slightly with other reports based on methods used in calculation.

Table 2: Descriptive statistics of variables

Variables	National average	95% CI
Absentee population (in %)	6.98	6.6-7.34
Male literacy rate (in %)	75	74.1-75.9
Female literacy rate (in %)	56	54.9-57.1
Male mean age at marriage (in years)	20.8	20.7-20.9
Female mean age at marriage (in years)	17.8	17.6-17.9
HDI (expressed from 0 to 1)	0.47	0.46-0.48
Poverty gap (in %)	6.76	6.33-7.17
Female household head (in %)	25.8	24.9-26.8
First ANC visit (in %)	95.4	92.7-98.2
Four ANC visits (in %)	48.6	46.7-50.4
PNC visit within 24 hours (in %)	48.4	45.9-50.8
Three PNC visits (in %)	17.7	16.5-18.9
IFA coverage (in %)	49.7	47.8-51.5
Institutional deliveries (in %)	49.8	47.1-52.4
mCPR (in %)	38.9	35.5-39.81

3.1 Maternal health services

3.1.1 ANC visits

Table 3 shows the findings of the log-transformed linear regression of determinants of first ANC visit. The results of the regression analysis indicated that the model explained 27% of the variance

and that the model was a significant predictor of FP service coverage (p-value <0.001). The HDI, predominant caste and province contributed significantly to the first ANC visit coverage (p-value <0.05). To calculate the percent change, one was subtracted from the coefficient (coeff) and was multiplied 100 referred to as desired value in the tables. For a unit increase in HDI (converted in a scale of 1 to 100) of the district, the first ANC visit coverage increased by 2%. Compared to districts with Brahmin as predominant caste, districts with Tharu as the predominant caste had almost 13% lower coverage of first ANC visit. Compared to districts in Province 1, districts in Province 2, Bagmati Province and Gandaki Province had around 19%,18% and 14% of lower coverage of first ANC visit respectively.

Table 3: Determinants of first ANC visit coverage

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	1.001	0.990	1.013	0.851	0.109
Male literacy rate	0.996	0.985	1.007	0.451	-0.412
Female literacy rate	0.993	0.984	1.001	0.095	-0.748
Male mean age at marriage	0.972	0.928	1.019	0.234	-2.789
Female mean age at marriage	0.979	0.942	1.018	0.293	-2.062
HDI	1.020	1.007	1.034	0.003	2.026
Poverty gap	1.007	0.997	1.016	0.161	0.671
Population per HF	1.001	1.000	1.001	0.101	0.067
Proportion of female household head	1.003	0.999	1.007	0.108	0.321
Reporting Status	0.997	0.992	1.001	0.098	-0.344
Predominant caste (Ref=Brahmin)					
Chhetri	0.941	0.851	1.041	0.236	-5.878
Gurung	0.950	0.854	1.057	0.343	-5.017
Limbu	0.911	0.801	1.037	0.157	-8.891
Magar	1.075	0.992	1.165	0.079	7.462
Musalman	0.972	0.844	1.119	0.692	-2.795
Newar	1.060	0.928	1.211	0.390	6.005
Rai	0.988	0.877	1.112	0.839	-1.220
Tamang	1.030	0.900	1.179	0.663	3.035
Tharu	0.867	0.788	0.953	0.003	-13.343
Yadav	1.084	0.924	1.273	0.320	8.447
Year (Ref=2014/2015)					
2015/2016	0.989	0.945	1.036	0.646	-1.061
2016/2017	1.001	0.956	1.048	0.964	0.104
2017/2018	0.992	0.947	1.038	0.715	-0.843

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
2018/2019	1.000	0.955	1.047	0.998	0.005
Province (Ref= Province 1)					
Province 2	0.812	0.691	0.955	0.012	-18.810
Bagmati Province	0.819	0.747	0.899	<0.001	-18.079
Gandaki Province	0.856	0.775	0.946	0.002	-14.412
Lumbini Province	0.956	0.867	1.055	0.374	-4.366
Karnali Province	1.092	0.993	1.200	0.071	9.151
Sudurpashchim Province	0.983	0.857	1.127	0.805	-1.712

Adjusted R square=0.27, F-statistic: 5.67 on 30,354 DF, p-value: < 0.001

The log-transformed linear regression as shown in Table 4 explained 35% of the variance and the model was a significant predictor of four ANC visits coverage of the district (p-value <0.001). The female mean age at marriage, predominant caste and province contributed significantly to the four ANC visits coverage of the district (p-value <0.05). For one unit (one year) increase in female mean age at marriage, there was a drop of four ANC visits coverage by around 19%. Compared to districts with Brahmin as the predominant caste, districts with Tamang as the predominant caste had almost 31% lower coverage of first ANC visits. Compared to districts of Province 1, districts in Province 2 had 23% lower coverage of four ANC visits.

Table 4: Determinants of four ANC visits coverage

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.998	0.974	1.023	0.863	-0.215
Male literacy rate	1.002	0.979	1.026	0.848	0.226
Female literacy rate	0.999	0.980	1.018	0.924	-0.093
Male mean age at marriage	1.027	0.929	1.136	0.598	2.731
Female mean age at marriage	0.813	0.747	0.883	<0.001	-18.746
HDI	1.018	0.989	1.047	0.220	1.790
Poverty gap	0.999	0.980	1.020	0.956	-0.057
Population per HF	1.000	0.998	1.001	0.713	-0.032
Proportion of female household head	1.000	0.992	1.008	0.995	-0.002
Reporting Status	1.003	0.994	1.011	0.565	0.258
Predominant caste (Ref=Brahmin)					
Chhetri	0.905	0.729	1.123	0.363	-9.514
Gurung	0.809	0.644	1.018	0.070	-19.056
Limbu	0.860	0.652	1.135	0.287	-13.975
Magar	1.069	0.899	1.271	0.448	6.904

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Musalman	0.955	0.705	1.293	0.764	-4.512
Newar	1.159	0.870	1.543	0.313	15.862
Rai	0.963	0.746	1.242	0.768	-3.749
Tamang	0.691	0.517	0.923	0.013	-30.898
Tharu	1.047	0.855	1.284	0.655	4.730
Yadav	1.237	0.877	1.744	0.226	23.660
Year (Ref=2014/2015)					
2015/2016	0.972	0.881	1.072	0.570	-2.793
2016/2017	1.008	0.913	1.111	0.880	0.753
2017/2018	1.012	0.917	1.116	0.815	1.173
2018/2019	1.076	0.975	1.186	0.144	7.564
Province (Ref= Province 1)					
Province 2	0.768	0.401	0.995	0.002	-23.169
Bagmati Province	1.002	0.821	1.223	0.983	0.211
Gandaki Province	0.891	0.719	1.104	0.290	-10.933
Lumbini Province	0.937	0.758	1.158	0.547	-6.292
Karnali Province	0.953	0.776	1.169	0.640	-4.744
Sudurpashchim Province	1.094	0.814	1.469	0.551	9.354

Adjusted R square=0.35 F-statistic: 7.917 on 30,354 DF, p-value: < 0.001

3.1.2 IFA coverage

Table 5 shows the determinants of IFA coverage. The model predicts 35% of the variance in dependent variable ($p < 0.001$) The female mean age at marriage, population per HF, reporting status and province contributed significantly to the IFA coverage in the model (p -value < 0.05). For one unit increase in female mean age at marriage, there was a decrease in IFA coverage by 14% in the district. When the population per HF increased by 100 (considered as one unit), the coverage of IFA decreased by 0.2%. Compared to districts in Province 1, districts in Province 2 and Bagmati Province had around 21% and 20% of lower coverage of IFA coverage. Districts with better reporting status had higher IFA coverage.

Table 5: Determinants of IFA coverage (180 days)

Variables	Coeff	95% CI		p-value	Desired Value
		Lower	Upper		
Proportion of absentee population	0.997	0.972	1.023	0.827	-0.286
Male literacy rate	0.994	0.970	1.019	0.641	-0.577
Female literacy rate	0.981	0.962	1.001	0.063	-1.881
Male mean age at marriage	1.100	0.990	1.223	0.076	10.029

Variables	Coeff	95% CI		p-value	Desired Value
		Lower	Upper		
Female mean age at marriage	0.859	0.695	0.999	<0.001	-14.109
HDI	1.030	0.999	1.061	0.055	2.976
Poverty gap	0.995	0.974	1.016	0.611	-0.547
Population per HF	0.998	0.996	1.000	0.014	-0.228
Proportion of female household head	0.995	0.987	1.004	0.301	-0.465
Reporting Status	1.010	1.000	1.019	0.043	0.962
Predominant caste (Ref=Brahmin)					
Chhetri	0.949	0.756	1.191	0.651	-5.104
Gurung	0.922	0.724	1.174	0.509	-7.801
Limbu	1.008	0.753	1.351	0.955	0.836
Magar	1.100	0.917	1.320	0.304	10.007
Musalman	0.777	0.565	1.069	0.120	-22.317
Newar	1.242	0.919	1.680	0.158	24.249
Rai	1.006	0.769	1.316	0.964	0.622
Tamang	0.747	0.550	1.013	0.060	-25.343
Tharu	1.118	0.902	1.385	0.306	11.818
Yadav	0.991	0.690	1.424	0.961	-0.891
Year (Ref=2014/2015)					
2015/2016	0.955	0.862	1.059	0.386	-4.456
2016/2017	0.927	0.836	1.028	0.152	-7.265
2017/2018	0.913	0.823	1.012	0.084	-8.708
2018/2019	0.942	0.850	1.045	0.260	-5.750
Province (Ref= Province 1)					
Province 2	0.794	0.611	0.987	0.005	-20.616
Bagmati Province	0.799	0.648	0.986	0.036	-20.062
Gandaki Province	1.014	0.809	1.272	0.902	1.430
Lumbini Province	1.027	0.821	1.284	0.816	2.673
Karnali Province	0.965	0.778	1.197	0.745	-3.501
Sudurpashchim Province	0.998	0.732	1.362	0.992	-0.156

Adjusted R square=0.35, F-statistic: 7.936 on 30,354 DF, p-value: < 0.0013

3.1.3 Institutional delivery

Results of regression analysis to predict institutional deliveries explained 36% of the variance and the model was a significant predictor of coverage of institutional deliveries (p-value <0.001) as shown in Table 6. The proportion of absentee population, male mean age of marriage, female mean age at marriage, the proportion of female household head, predominant caste, year and province contributed significantly to the model. With one unit increase in proportion of absentee

population in the district, the coverage of institutional delivery decreased by 6%. With one unit increase in male mean age of marriage in the district, coverage of institutional delivery increased by 11%. However, with one unit increase in female mean age at marriage in the district, coverage of institutional delivery decreased by almost 11%. With one unit increase in proportion of households with a female as household head, coverage of institutional deliveries increased by 1.5%. Compared to districts with Brahmin as predominant caste, districts with Magar as predominant caste had 26% higher coverage while districts with Rai as predominant caste had 24% lower coverage of institutional deliveries. Compared to fiscal year 2014/2015 as the reference year, institutional delivery increased by 23% for the year 2018/2019. Similarly, compared to districts in Province 1, districts in Province 2 and Gandaki Province had 31% and 25%, lower coverage of institutional delivery respectively.

Table 6: Determinants of institutional delivery coverage

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.940	0.908	0.972	<0.001	-6.038
Male literacy rate	1.014	0.981	1.048	0.404	1.395
Female literacy rate	0.992	0.966	1.019	0.549	-0.811
Male mean age at marriage	1.113	1.001	1.327	0.048	11.256
Female mean age at marriage	0.893	0.714	0.993	<0.001	-10.682
HDI	1.009	0.970	1.051	0.644	0.944
Poverty gap	1.009	0.981	1.038	0.535	0.896
Population per HF	1.002	0.999	1.004	0.176	0.167
Proportion of female household head	1.015	1.003	1.027	0.013	1.504
Reporting Status	1.005	0.992	1.017	0.470	0.455
Predominant caste (Ref=Brahmin)					
Chhetri	0.815	0.601	1.104	0.185	-18.527
Gurung	1.094	0.793	1.510	0.582	9.436
Limbu	0.836	0.566	1.234	0.366	-16.432
Magar	1.259	1.144	1.861	0.002	25.921
Musalman	1.001	0.654	1.533	0.994	0.150
Newar	0.774	0.517	1.157	0.211	-22.630
Rai	0.762	0.393	0.980	0.002	-23.791
Tamang	0.861	0.573	1.295	0.472	-13.855
Tharu	0.913	0.686	1.216	0.534	-8.654
Yadav	1.076	0.663	1.744	0.767	7.552
Year (Ref=2014/2015)					
2015/2016	1.105	0.963	1.268	0.155	10.506

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
2016/2017	1.084	0.944	1.244	0.251	8.383
2017/2018	1.103	0.961	1.266	0.161	10.344
2018/2019	1.227	1.069	1.408	0.004	22.677
Province (Ref= Province 1)					
Province 2	0.687	0.360	0.995	0.033	-31.315
Bagmati Province	0.868	0.656	1.148	0.319	-13.224
Gandaki Province	0.750	0.407	0.944	<0.001	-25.020
Lumbini Province	0.923	0.685	1.244	0.599	-7.660
Karnali Province	1.241	0.931	1.655	0.140	24.148
Sudurpashchim Province	1.211	0.932	1.954	0.104	21.065

Adjusted R square=0.36, F-statistic: 8.346 on 30, 354 DF, p-value: < 0.001

3.1.4 Predictors of PNC visits

Table 7 shows the determinants of the coverage of PNC visit within 24 hours. The model predicts 22% of the variance in the dependent variable (p -value<0.001). Female mean age at marriage, predominant caste and province contributed significantly to the coverage PNC visit within 24 hours in the model (p -value <0.05). With an increase in female mean age at marriage by one unit, the coverage of PNC service within 24 hours decreased by 15%. Compared to districts with Brahmin as predominant caste, districts with Magar, Musalman and Yadav as predominant caste had 29%, 23% and 14% higher coverage of PNC visit within 24 hours respectively. Compared to districts in Province 1, districts in Province 2 and Gandaki Province, had 11% and 24% lower coverage of PNC service within 24 hours.

Table 7: Determinants of the coverage of PNC visit within 24 hours

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.971	0.935	1.009	0.131	-2.867
Male literacy rate	1.001	0.966	1.038	0.957	0.098
Female literacy rate	1.008	0.979	1.038	0.591	0.807
Male mean age at marriage	1.136	0.973	1.327	0.107	13.597
Female mean age at marriage	0.845	0.742	0.961	0.011	-15.536
HDI	0.994	0.951	1.039	0.782	-0.617
Poverty gap	1.006	0.975	1.038	0.702	0.608
Population per health facility	0.999	0.997	1.002	0.558	-0.079
Proportion of female household head	1.007	0.994	1.020	0.315	0.666
Reporting Status	1.000	0.987	1.014	0.947	0.046

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Predominant caste (Ref=Brahmin)					
Chhetri	1.039	0.744	1.452	0.822	3.910
Gurung	1.374	0.964	1.959	0.079	37.382
Limbu	0.884	0.576	1.359	0.574	-11.576
Magar	1.287	1.138	1.843	0.004	28.708
Musalman	1.235	1.086	1.771	0.021	23.475
Newar	1.201	0.771	1.871	0.417	20.111
Rai	0.726	0.489	1.077	0.111	-27.394
Tamang	1.021	0.652	1.598	0.928	2.082
Tharu	1.363	0.995	1.868	0.054	36.328
Yadav	1.144	1.000	1.480	0.009	14.351
Year (Ref=2014/2015)					
2015/2016	1.099	0.944	1.279	0.223	9.860
2016/2017	0.966	0.830	1.125	0.657	-3.373
2017/2018	1.000	0.859	1.164	1.000	0.002
2018/2019	1.154	0.991	1.343	0.064	15.383
Province (Ref= Province 1)					
Province 2	0.893	0.588	0.986	0.010	-10.669
Bagmati Province	0.820	0.603	1.115	0.205	-18.009
Gandaki Province	0.764	0.304	0.986	0.001	-23.624
Lumbini Province	0.882	0.635	1.225	0.453	-11.785
Karnali Province	1.142	0.832	1.567	0.409	14.229
Sudurpashchim Province	1.209	0.956	1.582	0.077	20.905

Adjusted R square=0.22, F-statistic: 4.688 on 30, 354 DF, p-value: < 0.001

Table 8 reveals the results of fitting a log-transformed linear regression to three PNC visits as a dependent variable. The model predicts 24% of the variance in dependent variable ($p < 0.001$). Proportion of absentee population, male literacy rate, population per HF, predominant caste and province contributed significantly to the proportion of three PNC visits in the model (p -value < 0.05). With one unit increase in proportion of absentee population in the district, the coverage of three PNC visits decreased by 5%. With an increase in male literacy rate by one unit, the coverage of three PNC visits decreased by 8%. Similarly, with one unit increase in population per HF, the coverage of three PNC visits decreased by 0.5%. Compared to districts with Brahmin as predominant caste, districts with Tamang, Limbu and Musalman predominant caste had 58%, 26% and 23% lower coverage of three PNC visits respectively. Compared to districts in Province 1, districts in Sudurpashchim Province had 30% higher coverage of three PNC visits.

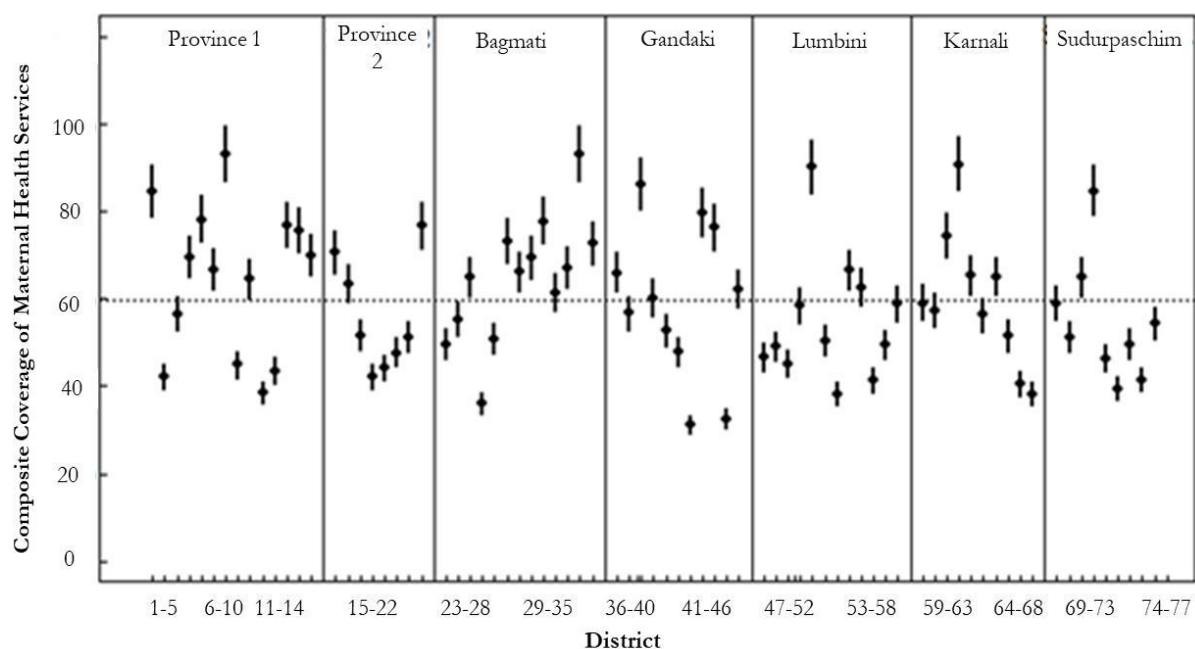
Table 8: Determinants of three PNC visits coverage

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.949	0.903	0.998	0.042	-5.060
Male literacy rate	0.923	0.880	0.968	0.001	-7.680
Female literacy rate	1.031	0.991	1.072	0.126	3.087
Male Mean age at marriage	0.934	0.760	1.148	0.517	-6.572
Female Mean age at marriage	0.897	0.755	1.065	0.212	-10.345
HDI	1.047	0.988	1.110	0.123	4.693
Poverty gap	1.025	0.983	1.068	0.249	2.456
Population per HF	0.995	0.992	0.999	0.009	-0.469
Proportion of female household head	1.011	0.994	1.029	0.200	1.131
Reporting Status	0.991	0.973	1.009	0.321	-0.908
Predominant caste (Ref=Brahmin)					
Chhetri	0.692	0.444	1.078	0.104	-30.799
Gurung	0.724	0.453	1.160	0.179	-27.556
Limbu	0.739	0.248	0.994	0.005	-26.086
Magar	0.859	0.603	1.225	0.401	-14.075
Musalman	0.766	0.250	0.988	0.016	-23.369
Newar	1.802	1.001	3.246	0.050	80.212
Rai	0.612	0.363	1.034	0.066	-38.770
Tamang	0.412	0.227	0.746	0.004	-58.848
Tharu	0.984	0.648	1.495	0.941	-1.555
Yadav	0.868	0.379	1.555	0.462	-13.247
Year (Ref=2014/2015)					
2015/2016	0.966	0.790	1.181	0.733	-3.430
2016/2017	1.041	0.851	1.273	0.693	4.131
2017/2018	0.934	0.763	1.142	0.503	-6.634
2018/2019	0.992	0.811	1.213	0.935	-0.834
Province (Ref= Province 1)					
Province 2	0.789	0.288	1.204	0.146	-21.121
Bagmati Province	0.754	0.501	1.134	0.174	-24.619
Gandaki Province	0.918	0.590	1.426	0.702	-8.237
Lumbini Province	0.976	0.632	1.509	0.913	-2.382
Karnali Province	1.214	0.798	1.847	0.364	21.393
Sudurpashchim Province	1.297	1.072	1.942	0.001	29.714

Adjusted R square=0.24, F-statistic: 5.066 on 30, 354, p-value: < 0.001

3.1.5 Composite coverage of maternal health services

Figure 1 shows 95% CI for the proportion of the composite coverage maternal health service by districts. The horizontal line denotes the mean proportion of composite coverage maternal health service (60%).

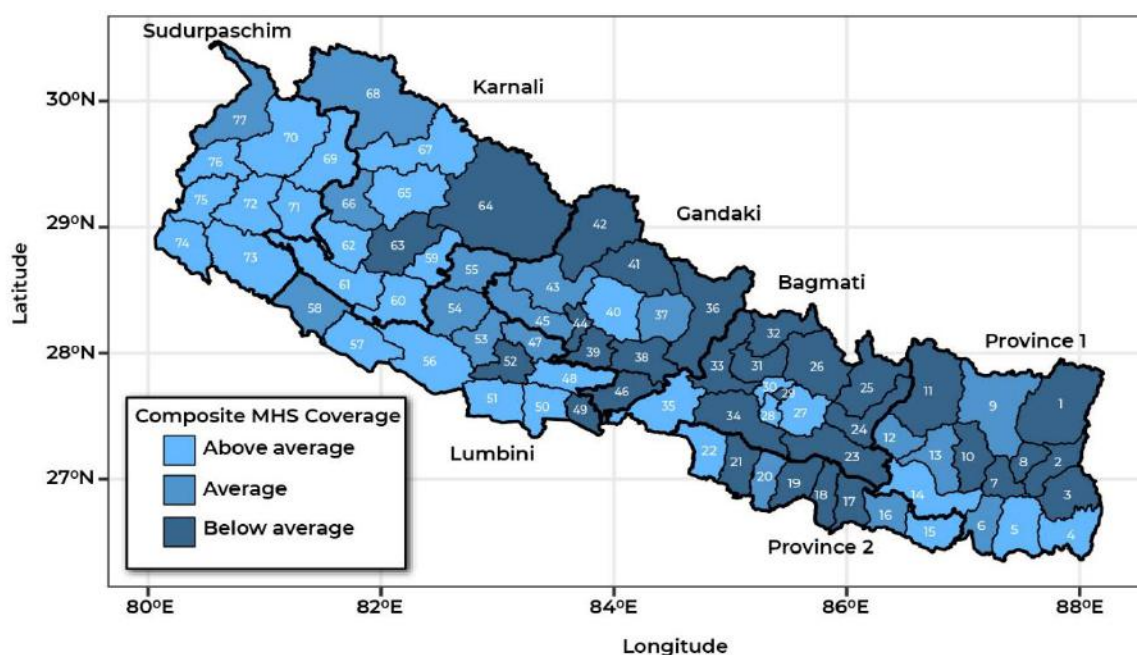


Id	District	Id	District	Id	District	Id	District	Id	District	Id	District
1	Taplejung	14	Udayapur	27	Kavre	40	Kaski	53	Pyuthan	66	Kalikot
2	Panchthar	15	Saptari	28	Lalitpur	41	Manang	54	Rolpa	67	Mugu
3	Ilam	16	Siraha	29	Bhaktapur	42	Mustang	55	Rukum East	68	Humla
4	Jhapa	17	Dhanusa	30	Kathmandu	43	Myagdi	56	Dang	69	Bajura
5	Morang	18	Mohattari	31	Nuwakot	44	Parbat	57	Banke	70	Bajhang
6	Sunsari	19	Sarlahi	32	Rasuwa	45	Baglung	58	Bardiya	71	Achham
7	Dhankuta	20	Rautahat	33	Dhading	46	Nawalparasi East	59	Rukum West	72	Doti
8	Terhathum	21	Bara	34	Makwanpur	47	Gulmi	60	Salyan	73	Kailali
9	Sankhuwasabha	22	Parsa	35	Chitwan	48	Palpa	61	Surkhet	74	Kanchanpur
10	Bhojpur	23	Sindhuli	36	Gorkha	49	Nawalparasi West	62	Dailekh	75	Dadeldhura
11	Solukhumbu	24	Ramechhap	37	Lamjung	50	Rupandehi	63	Jajarkot	76	Baitadi
12	Okaldhunga	25	Dolkha	38	Tanahu	51	Kapilvastu	64	Dolpa	77	Darchula
13	Khotang	26	Sindhupalchowk	39	Syngja	52	Arghakhanchi	65	Jumla		

Figure 1: Proportion of maternal health service coverage (composite index) by district

Of the 77 districts, 31 districts were categorised as having a higher than average coverage, 16 districts were categorised as having average coverage and 30 districts were categorised as having a lower than average coverage value of composite coverage of maternal health services.

The map in Figure 2 depicts the categorization of the district based on composite coverage of maternal health services. Districts with 95% CIs above the mean were categorised as having a higher than average coverage value (lightest shade), while districts with 95% CIs below the mean were categorised as having a lower than average coverage value (darkest shade) and districts with CIs not evidently different from the mean were categorised as average coverage value (intermediate shade).



Id	District	Id	District	Id	District	Id	District	Id	District	Id	District
1	Taplejung	14	Udayapur	27	Kavre	40	Kaski	53	Pyuthan	66	Kalikot
2	Panchthar	15	Saptari	28	Lalitpur	41	Manang	54	Rolpa	67	Mugu
3	Ilam	16	Siraha	29	Bhaktapur	42	Mustang	55	Rukum East	68	Humla
4	Jhapa	17	Dhanusa	30	Kathmandu	43	Myagdi	56	Dang	69	Bajura
5	Morang	18	Mohattari	31	Nuwakot	44	Parbat	57	Banke	70	Bajhang
6	Sunsari	19	Sarlahi	32	Rasuwa	45	Baglung	58	Bardiya	71	Achham
7	Dhankuta	20	Rautahat	33	Dhading	46	Nawalparasi East	59	Rukum West	72	Doti
8	Terhathum	21	Bara	34	Makwanpur	47	Gulmi	60	Salyan	73	Kailali
9	Sankhuwasabha	22	Parsa	35	Chitwan	48	Palpa	61	Surkhet	74	Kanchanpur
10	Bhojpur	23	Sindhuli	36	Gorkha	49	Nawalparasi West	62	Dailekh	75	Dadeldhura
11	Solukhumbu	24	Ramechhap	37	Lamjung	50	Rupandehi	63	Jajarkot	76	Baitadi
12	Okaldhunga	25	Dolkha	38	Tanahu	51	Kapilvastu	64	Dolpa	77	Darchula
13	Khotang	26	Sindhupalchowk	39	Syngja	52	Arghakhanchi	65	Jumla		

Figure 2: Schematic map of proportion of maternal health service coverage in Nepal

Table 9 shows the findings of log-transformed linear regression analysis of determinants of composite coverage of maternal health services. The results of the regression analysis indicated that the model explained 35% of the variance and the model was a significant predictor of composite coverage of maternal health services (p-value <0.01).

The proportion of absentee population, female mean age at marriage, predominant caste, year and province contributed significantly to the composite coverage of maternal health service.

With one unit increase in the proportion of absentee population the composite coverage of maternal health services decreased by 2%.

Similarly, with one unit increase in proportion of female mean age at marriage, the composite coverage of maternal health service decreased by 10%.

Considering districts with Brahmin as predominant caste as reference, districts with Rai and Limbu as predominant caste had 21% and 18% lower composite coverage of maternal health services respectively. The district with Magar as predominant caste had 17% higher composite coverage of the maternal health services compared to district with Brahmin as predominant caste.

Around 10% increase in composite coverage of maternal health services was seen in the year 2018/2019 compared to 2014/2015.

Compared to districts in Province 1, districts in Gandaki Province, Province 2 and Bagmati Province had 27%, 26% and 15% lower composite coverage of maternal health services.

Table 9: Determinants of composite coverage maternal health services

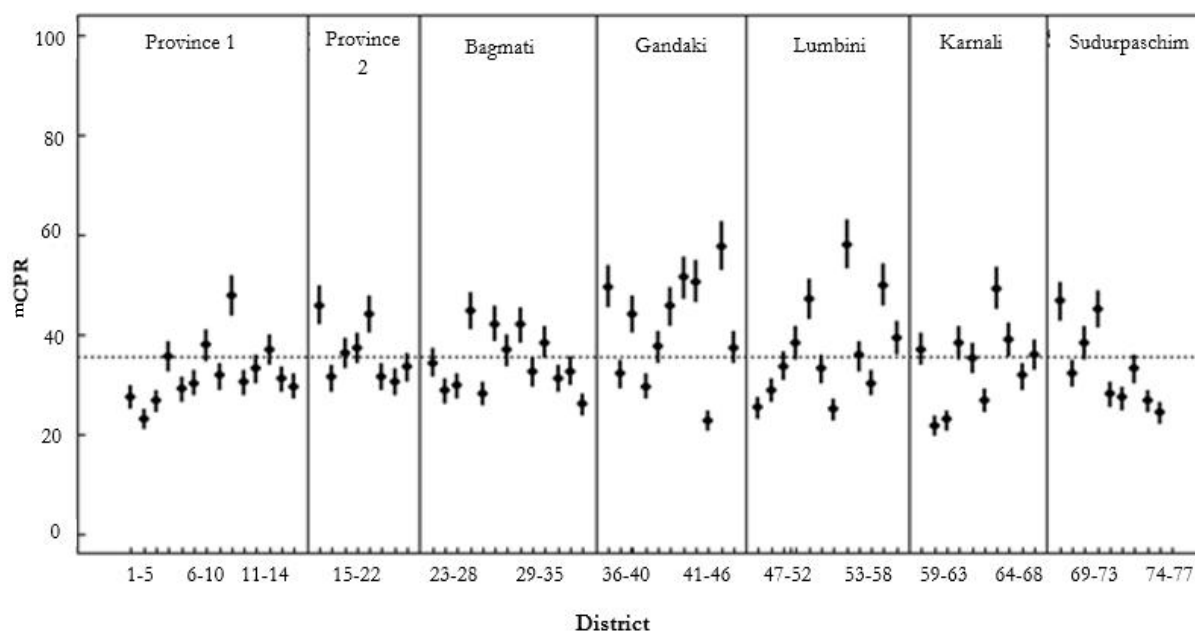
Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.981	0.963	0.998	0.031	-1.945
Male literacy rate	1.000	0.983	1.017	0.963	-0.040
Female literacy rate	0.997	0.983	1.011	0.687	-0.284
Male mean age at marriage	1.022	0.950	1.100	0.559	2.206
Female mean age at marriage	0.902	0.849	0.959	0.001	-9.773
HDI	1.019	0.998	1.041	0.073	1.919
Poverty gap	1.007	0.992	1.022	0.357	0.692
Population per HF	1.000	0.999	1.002	0.685	0.026
Proportion of female household head	1.006	1.000	1.012	0.057	0.597
Reporting Status	1.000	0.994	1.007	0.962	0.015

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Predominant caste (Ref=Brahmin)					
Chhetri	0.880	0.751	1.030	0.112	-12.025
Gurung	0.967	0.818	1.143	0.692	-3.326
Limbu	0.816	0.666	0.999	0.049	-18.443
Magar	1.174	1.035	1.332	0.013	17.396
Musalman	1.051	0.842	1.312	0.657	5.131
Newar	0.978	0.793	1.206	0.835	-2.202
Rai	0.786	0.652	0.947	0.012	-21.391
Tamang	0.871	0.705	1.077	0.201	-12.885
Tharu	0.953	0.821	1.106	0.526	-4.687
Yadav	1.261	0.980	1.622	0.071	26.088
Year (Ref=2014/2015)					
2015/2016	1.023	0.952	1.099	0.536	2.283
2016/2017	1.010	0.940	1.085	0.781	1.019
2017/2018	1.016	0.946	1.092	0.659	1.625
2018/2019	1.096	1.021	1.178	0.012	9.643
Province (Ref= Province 1)					
Province 2	0.735	0.492	0.919	0.001	-26.496
Bagmati Province	0.850	0.735	0.983	0.028	-15.041
Gandaki Province	0.735	0.628	0.860	<0.001	-26.539
Lumbini Province	0.937	0.802	1.094	0.409	-6.308
Karnali Province	1.117	0.962	1.298	0.145	11.747
Sudurpashchim Province	1.217	0.981	1.510	0.075	21.677

Adjusted R square=0.35, F-statistic: 7.85 on 30, 354 DF, p-value: < 0.01

3.2 FP Service

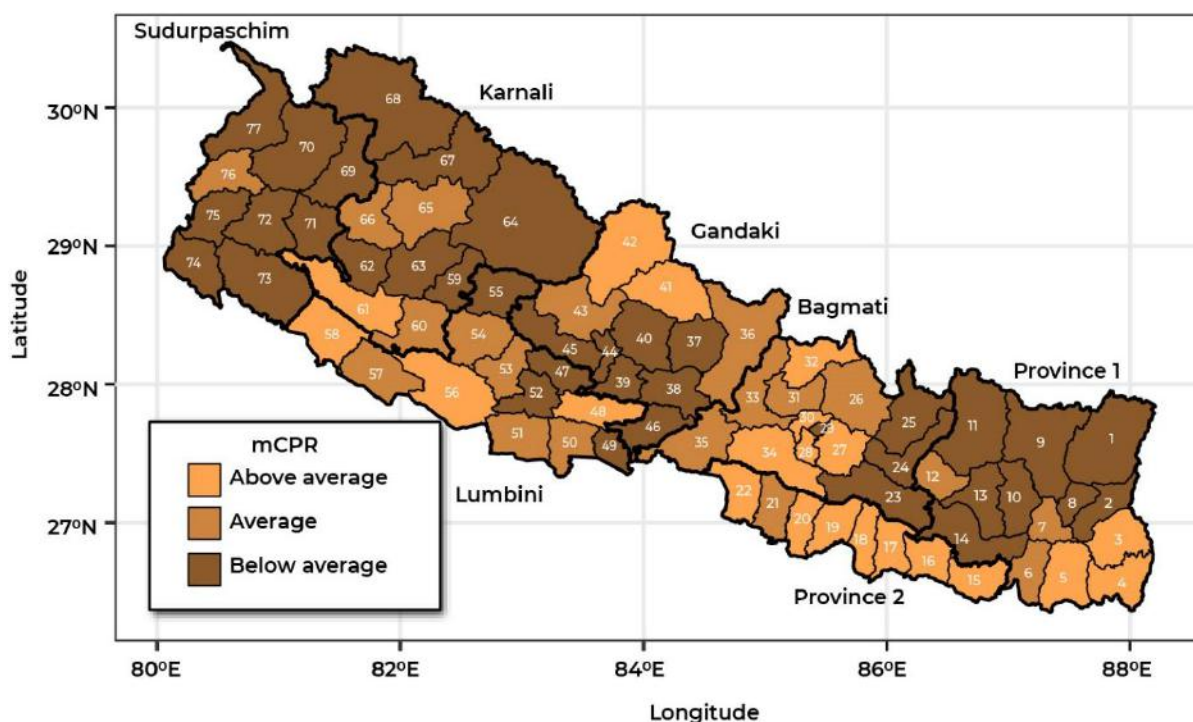
For assessing the determinants of FP service coverage, mCPR was considered as outcome variable. Figure 3 shows 95% CI for the mCPR by districts. The horizontal line denotes the mean mCPR (38.9%).



Id	District	Id	District	Id	District	Id	District	Id	District	Id	District
1	Taplejung	14	Udayapur	27	Kavre	40	Kaski	53	Pyuthan	66	Kalikot
2	Panchthar	15	Saptari	28	Lalitpur	41	Manang	54	Rolpa	67	Mugu
3	Ilam	16	Siraha	29	Bhaktapur	42	Mustang	55	Rukum East	68	Humla
4	Jhapa	17	Dhanusa	30	Kathmandu	43	Myagdi	56	Dang	69	Bajura
5	Morang	18	Mohattari	31	Nuwakot	44	Parbat	57	Banke	70	Bajhang
6	Sunsari	19	Sarlahi	32	Rasuwa	45	Baglung	58	Bardiya	71	Achham
7	Dhankuta	20	Rautahat	33	Dhading	46	Nawalparasi East	59	Rukum West	72	Doti
8	Terhathum	21	Bara	34	Makwanpur	47	Gulmi	60	Salyan	73	Kailali
9	Sankhuwasabha	22	Parsa	35	Chitwan	48	Palpa	61	Surkhet	74	Kanchanpur
10	Bhojpur	23	Sindhuli	36	Gorkha	49	Nawalparasi West	62	Dailekh	75	Dadeldhura
11	Solukhumbu	24	Ramechhap	37	Lamjung	50	Rupandehi	63	Jajarkot	76	Baitadi
12	Okaldhunga	25	Dolkha	38	Tanahu	51	Kapilvastu	64	Dolpa	77	Darchula
13	Khotang	26	Sindhupalchowk	39	Syngja	52	Arghakhanchi	65	Jumla		

Figure 3: Proportion of mCPR by district

Districts with 95% CIs above the mean in Figure 3 were categorised as having a higher than average value (lightest shade), districts with 95% CIs below the mean were categorised as having a lower than average value (darkest shade) and districts with CIs not evidently different from the mean were categorised as average value (intermediate shade) of mCPR as shown in map in Figure 4. Out of 77 districts, 21 districts were categorised as having a higher than average coverage value, 19 districts were categorised as having average coverage value and 37 districts were categorised as having a lower than average coverage value (lightest shade) of mCPR.



Id	District	Id	District	Id	District	Id	District	Id	District	Id	District
1	Taplejung	14	Udayapur	27	Kavre	40	Kaski	53	Pyuthan	66	Kalikot
2	Panchthar	15	Saptari	28	Lalitpur	41	Manang	54	Rolpa	67	Mugu
3	Ilam	16	Siraha	29	Bhaktapur	42	Mustang	55	Rukum East	68	Humla
4	Jhapa	17	Dhanusa	30	Kathmandu	43	Myagdi	56	Dang	69	Bajura
5	Morang	18	Mohattari	31	Nuwakot	44	Parbat	57	Banke	70	Bajhang
6	Sunsari	19	Sarlahi	32	Rasuwa	45	Baglung	58	Bardiya	71	Achham
7	Dhankuta	20	Rautahat	33	Dhading	46	Nawalparasi East	59	Rukum West	72	Doti
8	Terhathum	21	Bara	34	Makwanpur	47	Gulmi	60	Salyan	73	Kailali
9	Sankhuwasabha	22	Parsa	35	Chitwan	48	Palpa	61	Surkhet	74	Kanchanpur
10	Bhojpur	23	Sindhuli	36	Gorkha	49	Nawalparasi West	62	Dailekh	75	Dadeldhura
11	Solukhumbu	24	Ramechhap	37	Lamjung	50	Rupandehi	63	Jajarkot	76	Baitadi
12	Okaldhunga	25	Dolkha	38	Tanahu	51	Kapilvastu	64	Dolpa	77	Darchula
13	Khotang	26	Sindhupalchowk	39	Syngja	52	Arghakhanchi	65	Jumla		

Figure 4: Schematic map of the mCPR in Nepal

Log-transformed linear regression was carried out to investigate whether district characteristics like proportion of absentee population, male and female literacy rates, male and female mean age at marriage, HDI, poverty gap, population per HF, proportion of female household head predominant caste, year and province could significantly predict the mCPR as an outcome variable for FP service coverage.

The results of regression indicated that the model explained 48% of the variance and the model was a significant predictor of mCPR, (p -value <0.001). The HDI, reporting status, predominant caste of the district, year and province contributed significantly to the model.

With one unit increase in HDI of the district, the mCPR of the district increased by almost 3%. With one unit increase in reporting status, the mCPR increased by approximately 1%. Compared to districts with Brahmin as predominant caste, districts with Gurung, Magar and Tharu as predominant caste had almost 32%, 26% and 18% higher mCPR respectively. While districts with Rai, Chhetri, Limbu and Newar as predominant caste had 29%, 28%, 27% and 21% lower mCPR respectively. Around 9% decrease in mCPR was seen in year 2018/2019 compared to 2014/2015. Compared to districts in Province 1, districts in Gandaki Province, Lumbini Province and Bagmati Province had 37%, 18% and 12% lower mCPR.

Table 10: Determinants of mCPR

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
Proportion of absentee population	0.990	0.974	1.006	0.233	-0.991
Male literacy rate	1.007	0.991	1.022	0.408	0.658
Female literacy rate	0.998	0.985	1.010	0.709	-0.242
Male mean age at marriage	0.973	0.910	1.041	0.431	-2.662
Female mean age at marriage	1.033	0.977	1.093	0.255	3.315
HDI	1.026	1.007	1.046	0.008	2.625
Poverty gap	1.005	0.991	1.018	0.485	0.481
Population per HF	0.999	0.998	1.001	0.339	-0.056
Proportion of female household head	0.995	0.989	1.001	0.084	-0.496
Reporting Status	1.009	1.003	1.015	0.004	0.863
Predominant caste (Ref=Brahmin)					
Chhetri	0.723	0.625	0.836	<0.001	-27.69
Gurung	1.315	1.214	1.651	<0.001	31.54
Limbu	0.629	0.522	0.758	<0.001	-27.12
Magar	1.257	1.119	1.411	<0.001	25.67
Musalman	1.043	0.851	1.278	0.685	4.286
Newar	0.789	0.651	0.956	0.016	-21.13
Rai	0.709	0.597	0.841	<0.001	-29.14
Tamang	1.058	0.871	1.285	0.570	5.791
Tharu	1.178	1.027	1.350	0.019	17.77
Yadav	1.154	0.916	1.454	0.223	15.43
Year (Ref=2014/2015)					

Variables	Coeff	95% CI		p-value	Desired value
		Lower	Upper		
2015/2016	0.992	0.928	1.059	0.802	-0.835
2016/2017	1.020	0.955	1.089	0.561	1.969
2017/2018	0.957	0.896	1.022	0.188	-4.31
2018/2019	0.913	0.855	0.976	0.007	-8.66
Province (Ref= Province 1)					
Province 2	1.181	0.934	1.492	0.164	18.06
Bagmati Province	0.874	0.765	0.999	0.049	-12.57
Gandaki Province	0.626	0.542	0.723	<0.001	-37.42
Lumbini Province	0.819	0.710	0.944	0.006	-18.12
Karnali Province	1.037	0.904	1.189	0.605	3.678
Sudurpashchim Province	1.092	0.896	1.331	0.383	9.195

Adjusted R square=0.48, F-statistic: 11.3 on 30, 354 DF, p-value: < 0.001

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This analysis aimed to identify the determinants of maternal health and FP service coverage linking routine data with characteristics of the district like proportion of absentee population, literacy rates, mean age at marriage, HDI, poverty gap, population per HF, the proportion of female household head, predominant caste, year and province. The analysis revealed that districts with a higher proportion of female household heads had higher coverage of institutional delivery. The potential reason could be that the women who were household head were more able to make independent decision relating to service utilization.

Compared to districts in Province 1, districts in Province 2, Bagmati Province, and Gandaki province had lower composite coverage of maternal health services. Regarding caste, districts with Limbu and Rai as the predominant cast had lower composite coverage of maternal health services, while the districts with Magar as predominant caste had higher coverage compared to districts with Brahmin as predominant caste. These variations in coverage based on predominant caste of the district could be because of variations in cultural beliefs and practices among different caste groups. Compared to fiscal year 2014/2015, the coverage of maternal health services improved significantly in the year 2018/2019.

Regarding FP services, districts with Rai, Limbu, Chhetri and Newar as predominant caste had lower mCPR while districts with Magar, Gurung and Tharu as predominant caste had higher mCPR compared to districts with Brahmins as predominant caste. Compared to Province 1, Gandaki Province, Lumbini Province and Bagmati Province had lower mCPR while other provinces did not differ significantly.

Based on 95% CI, study revealed significant variation in composite coverage of maternal health services as well as FP service. The number of districts with less than the average value of composite coverage of maternal health services and mCPR was 30 and 37 respectively out of 77 districts.

4.2 Recommendations

Based on study results, the following recommendations have been generated:

- With the current federal structure where delivery of essential health services has been devolved to local level governments (LLGs), there is greater opportunity for tailored

targeted interventions in districts with low coverage of maternal health services and FP services. Low coverage districts for both the maternal health and FP services should be a priority focus.

- Similar analysis can be replicated in the future considering municipality as a unit of analysis once the data on dependent and independent variables is available. This could help LLGs for formulating specific plans to address the gap.
- Predictors of service coverage may change with the impact of policy initiatives, expansion of health services and overall development of the districts. Regular analysis identifying districts lagging in terms of service coverage could be useful.
- The study revealed variations across districts based on predominant caste of the district. For example, districts with Limbu as predominant caste have lower composite coverage of maternal health services as well as mCPR compared to Brahmin. Further studies will be useful to determine if certain caste specific cultural practices are serving as facilitator or barrier to service utilisation.
- Poverty gap in the district, which is the measure of the depth or intensity of poverty was not associated with any of the coverage indicators. Further studies are indicated to assess if the intensity of poverty is still a determinant of service coverage particularly for services covered in this study which are offered free of cost, and in some cases with financial incentives. Such studies with individual as unit of analysis may also reveal if the disparities within the districts are masked at district level.

5. LIMITATIONS

Despite best efforts, the analysis has the following limitations:

- Since the estimates come from the analysis of district-level coverage indicators and district characteristics, findings cannot be generalised at the individual level. For example, if the female mean age at marriage in the district increase by one unit, the coverage of four ANC services decreases by around 19% does not mean that females who get married at later ages are less likely to have their first ANC visit.
- The analysis uses district-level data characteristics from ‘Population Atlas of Nepal 2014’²⁹, changes are likely to have occurred over the last 6 years. However, this was the latest available country data for Nepal.

6. DISSEMINATION AND UTILIZATION OF FINDINGS

6.1 Dissemination of study findings

The results were shared with wider stakeholders including DoHS, MoHP and health external development partners at national level. This report will also be uploaded to relevant publicly accessible websites and shared through social media and other relevant platforms.

6.2 Utilisation of research findings

This is a complete report summarising the findings from a secondary analysis by modelling routine data with district characteristics. This report can be useful for policy makers in designing different targeted interventions related to maternal health and FP services. However, limitations of the study need to be taken into consideration while designing the interventions and making policy changes based on the study findings.

6.3 Research open and enhanced access policy

This study strictly adhered to the DFID research open and enhanced access policy.³⁰ The raw data used in this study will be made available in a publicly accessible repository.

7. REFERENCES

1. World Health Organization, UNICEF. Trends in maternal Mortality: 1990-2015: Estimates from WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. 2015.
2. World Health Organization. Maternal mortality. <https://www.who.int/en/news-room/fact-sheets/detail/maternal-mortality>.
3. Alkema L, Chou D, Hogan D, et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *The Lancet* 2016; **387**(10017): 462-74.
4. Graham W, Woodd S, Byass P, et al. Diversity and divergence: the dynamic burden of poor maternal health. *The Lancet* 2016; **388**(10056): 2164-75.
5. Singh S, Darroch JE, Ashford LS. Adding it up: the costs and benefits of investing in sexual and reproductive health 2014: Alan Guttmacher Institute; 2014.
6. Frenk J, Bobadilla JL, Sepuúlveda J, Cervantes ML. Health transition in middle-income countries: new challenges for health care. *Health policy and planning* 1989; **4**(1): 29-39.
7. Essue BM, Laba T-L, Knaul F, et al. Economic burden of chronic ill health and injuries for households in low-and middle-income countries. *Disease control priorities* 2017; **9**.
8. Beaglehole R, Bonita R, Horton R, et al. Priority actions for the non-communicable disease crisis. *The Lancet* 2011; **377**(9775): 1438-47.
9. FMoHP and NHSSP. Budget Analysis of Ministry of Health and Population FY 2018/19.: Federal Ministry of Health and Population and Nepal Health Sector Support Programme, 2018.
10. GDB Compare/ Viz Hub. 2019. <https://vizhub.healthdata.org/gbd-compare/>.
11. Ministry of Health; New ERA; and ICF. Nepal Demographic and Health Survey 2016. Kathmandu, 2017.
12. Hug L, Alexander M, You D, Alkema L, for Child UI-aG. National, regional, and global levels and trends in neonatal mortality between 1990 and 2017, with scenario-based projections to 2030: a systematic analysis. *The Lancet Global Health* 2019; **7**(6): e710-e20.
13. Institute for Health Metrics and Evaluation (IHME). Maternal Health Atlas. 2019. <https://maternalhealthatlas.org/>.
14. Ministry of Health, New ERA, ICF. Nepal Demographic and Health Survey 2016. Kathmandu, Nepal: Ministry of Health, 2017.
15. National Planning Commission. Nepal: Sustainable development goals, status and roadmap 2016-2030. Kathmandu: Government of Nepal National Planning Commission; 2017.
16. Holmes KK, Bertozzi S, Bloom BR, et al. Major infectious diseases: key messages from disease control priorities. *Major infectious diseases* 2017.
17. Dieleman JL, Sadat N, Chang AY, et al. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016–40. *The Lancet* 2018; **391**(10132): 1783-98.
18. Ministry of Health. National Health Sector Strategy 2016 to 2021. Kathmandu, Nepal: MoH; 2015.
19. Population MoHa. Safe Motherhood Programme. <https://www.mohp.gov.np/eng/program/reproductive-maternal-health/safe-motherhood-programme>.
20. Ministry of Health and Population. National In -Service Training Strategy for Skilled Birth Attendants 2006-2012. Kathmandu: National Health Training Centre, Ministry of Health and population; 2007.
21. Ministry of Health and Population. Nepal National Newborn Health Strategy-2004. Kathmandu, Nepal: MoHP; 2004.

22. Ministry of Health. Nepal's Every Newborn Action Plan. Kathmandu, Nepal: Ministry of Health; 2016.
23. Adam T, Lim SS, Mehta S, et al. Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries. *Bmj* 2005; **331**(7525): 1107.
24. World Health Organization. Tracking universal health coverage: first global monitoring report: World Health Organization; 2015.
25. Stuart E, Woodroffe J. Leaving no-one behind: can the Sustainable Development Goals succeed where the Millennium Development Goals lacked? *Gender & Development* 2016; **24**(1): 69-81.
26. Melamed C. Leaving no one behind: How the SDGs can bring real change. *Development Progress London* 2015.
27. Ministry of Health and Population. Inequalities in maternal health service utilization in Nepal: an analysis of routine and survey data November 2018.
28. World Health Organization. World health statistics 2018: Monitoring health for the SDG: World Health Organization; 2018.
29. Central Bureau of Statistics. Population Atlas of Nepal. 2014.
30. Department for International Development. DFID Reseach Open and Enhanced Access Policy v1.1 2013.