

RESEARCH

Open Access



Universal coverage of the first antenatal care visit but poor continuity of care across the maternal and newborn health continuum among Nepalese women: analysis of levels and correlates

Resham B Khatri^{1,2*}, Rajendra Karkee³, Jo Durham^{1,4} and Yibeltal Assefa¹

Abstract

Background: Routine maternity care visits (MCVs) such as antenatal care (ANC), institutional delivery, and postnatal care (PNC) visits are crucial to utilisation of maternal and newborn health (MNH) interventions during pregnancy-postnatal period. In Nepal, however, not all women complete these routine MCVs. Therefore, this study examined the levels and correlates of (dis)continuity of MCVs across the antenatal-postnatal period.

Methods: We conducted further analysis of the 2016 Nepal Demographic and Health Survey. A total of 1,978 women aged 15–49 years, who had live birth two years preceding the survey, were included in the analysis. The outcome variable was (dis)continuity of routine MCVs (at least four ANC visits, institutional delivery, and PNC visit) across the pathway of antenatal through to postnatal period. Independent variables included several social determinants of health under structural, intermediary, and health system domains. Multinomial logistic regression was conducted to identify the correlates of routine MCVs. Relative risk ratios (RR) were reported with 95% confidence intervals at a significance level of $p < 0.05$.

Results: Approximately 41% of women completed all routine MCVs with a high proportion of discontinuation around childbirth. Women of disadvantaged ethnicities, from low wealth status, who were illiterate had higher RR of discontinuation of MCVs (compared to completion of all MCVs). Similarly, women who speak Bhojpuri, from remote provinces (Karnali and Sudurpaschim), who had a high birth order (≥ 4), who were involved in the agricultural sector, and who had unwanted last birth had a higher RR of discontinuation of MCVs. Women discontinued routine MCVs if they had poor awareness of health mother-groups and perceived the problem of not having female providers.

* Correspondence: rkchettri@gmail.com

¹School of Public Health, Faculty of Medicine, University of Queensland, Brisbane, Australia

²Health Social Science and Development Research Institute, Kathmandu, Nepal

Full list of author information is available at the end of the article



© The Author(s). 2021 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Conclusions: Routine monitoring using composite coverage indicators is required to track the levels of (dis)continuity of routine MCVs at the maternity care continuum. Strategies such as raising awareness on the importance of maternity care, care provision from female health workers could potentially improve the completion of MCVs. In addition, policy and programmes for continuity of maternity care are needed to focus on women with socioeconomic and ethnic disadvantages and from remote provinces.

Keywords: antenatal care, (dis)continuity of care, essential interventions, institutional delivery, postnatal care, routine maternity care visits

Introduction

The World Health Organization (WHO) recommends women should receive health interventions during routine maternity care visits (MCVs), including at least four antenatal care (4ANC) visits, institutional delivery assisted by skilled birth attendants (SBAs) [1], at least three PNC visits within the first week after childbirth [2]. These routine MCVs, from the conception to the first month of childbirth, is considered as maternal and newborn health (MNH) continuum of care (CoC) from the life cycle perspective [3]. The health of mothers and newborns is arguably a single entity except for their biological differences; interventions received by pregnant women can affect the health of newborns. Therefore, the MNH continuum is a vital period for the health of mothers and newborns; it is also a combined construct from survival and health service delivery [4]. A modelling study of 75 high-burdened countries estimated that increased coverage of essential MNH interventions could reduce up to 71% of neonatal deaths, 33% of stillbirths, and 54% of maternal deaths annually [5].

Globally, the MNH CoC has received substantial attention in research, policy, and programmes over the past two decades [4]. Sustainable Development Goal three (SDG-3) states universal coverage of quality MCVs across the CoC (target 3.8) [6, 7]. Out of nine tracer services in SDG-3, two are related to maternity and newborn care, such as childbirth assisted by SBAs and childbirth at health facilities (HFs) [8]. Thus, assessing a composite coverage of routine MCVs is important to track the utilisation status of tracer maternity health services and SDG-3 target 3.8.

However, the coverage of routine MCVs across the MNH CoC (i.e., during the antenatal through to postnatal period) is often low and characterised by high discontinuation rates at different stages of pathway. For example, the completion of all routine MCVs was low in several low- and middle-income countries (LMICs) [3, 4, 9, 10], including in Cambodia [9] and Tanzania [11]. For example, 90% dropout was reported in Tanzania from the first ANC visit to PNC visit, while the highest (55%) proportion was seen from institutional delivery to a PNC visit [11].

Nepal is one of the countries with the highest maternal mortality ratio (MMR) and neonatal mortality rate (NMR) in the South Asia region [12, 13]. Annually, 259 (per 100,000 live births) women die due to pregnancy and childbirth-related problems, and 21 (per 1,000 live births) newborns die within the first month of birth in Nepal [14]. High MMR and NMR may be contributed by low coverage of routine MCVs. For instance, the 2016 Nepal Demographic and Health Survey (NDHS) reported more than two-thirds of pregnant women received 4ANC visits, while nearly three in five women received institutional delivery and the first PNC visit within 48 h of childbirth [14]. Under the Aama and Newborn care programme in Nepal, 4ANC visits and institutional delivery are incentivized where women get some monetary incentives (e.g., women who complete at least four ANC visits in 4, 6, 8 and 9 months get 8 USD (1 USD ≈ 100 Nepali Rupees), and give birth at health facilities assisted by SBAs get an average of 20 USD) [15]. However, despite providing those maternity incentives, women with multiple forms of social disadvantages (e.g., women living in poverty, illiterate and disadvantaged ethnicities), and hard to reach-communities of remote provinces (e.g., Karnali, and Sudurpashchim) had the lowest coverage of ANC visits and institutional delivery compared to their privileged counterparts [16]. Such poor access to routine MCVs could result in a lack of utilisation of essential MNH interventions among populations with a high magnitude of MMR and NMR.

Other studies in Nepal have revealed that the utilisation of 4ANC visits contributed to the uptake of institutional delivery [17] and PNC visits [18], and women who utilised institutional delivery services were more likely to receive PNC visits [19]. In addition, a qualitative study reported that Nepalese women prioritise PNC visits if they experience any complications [20]. However, little evidence is available on the levels and social determinants associated with (dis)continuity of routine MCVs at the MNH CoC. Thus, this study aimed to examine the levels and social determinants of (dis)continuity of recommended MCVs across antenatal, delivery and postnatal period. Furthermore, findings of this study inform policymakers and programme managers to design and implement targeted policies to increase completion of all

routine MCVs in Nepal. In addition, this study provides methodological insights how DHS data can be used to create composite coverage of all MCVs and measure the (dis)continuity care across the antenatal- postnatal pathway.

Trajectory of Nepal’s health policy context for MNH

Figure 1 shows the major health policy, strategy, plans and programmes, particularly in MNH in Nepal over the last three decades[21]. National health policy 1991 increased the availability of health posts up to the village development committee (now called as wards). After the mid-2000s, Nepal has made significant policy shifts in maternal and newborn health, introducing a safe motherhood policy, safe

delivery incentive programme, SBA policy and community-based newborn and child health programs. In the mid - 2010s, integration of maternal and newborn health services was given more attention, including free newborn care services. In addition, the quality of care is emphasised in the health policies and programmes such as Nepal Health Sector Strategy (2016-2021) and Nepal Safe Motherhood and Newborn Health Program Roadmap by 2030 [22].

Methods

Data source and sampling design

The NDHS 2016 data (<https://dhsprogram.com/methodology/survey/survey-display-472.cfm>) were used

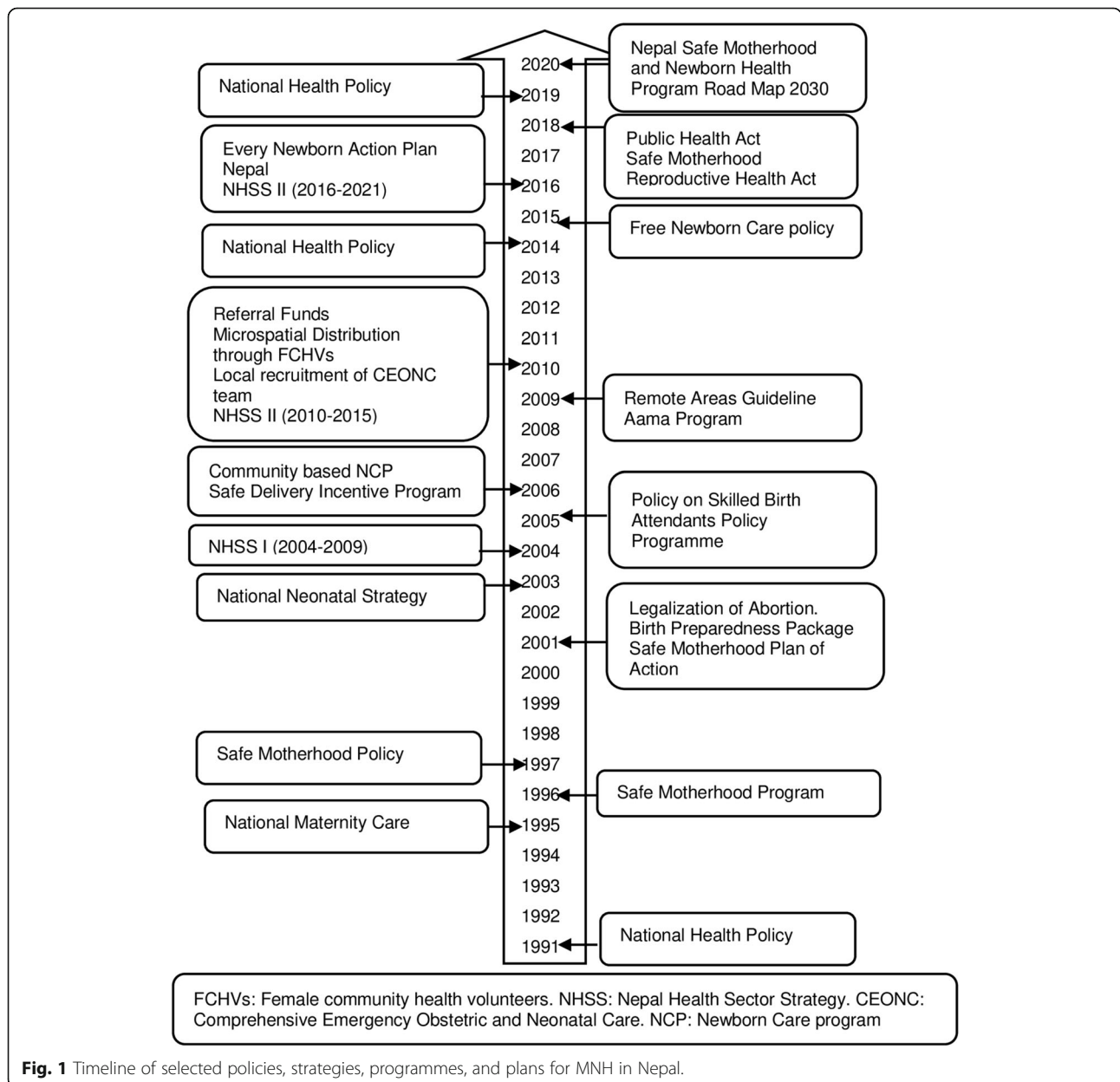


Fig. 1 Timeline of selected policies, strategies, programmes, and plans for MNH in Nepal.

in this study [14]. The NDHS is a nationally representative cross-sectional survey conducted by Nepal’s Ministry of Health and Population (MOHP) in 2016 to identify primary health care coverage and health status, especially family planning, reproductive, newborn, child health, and nutrition. A more detailed sampling design is described in the 2016 NDHS report [14]. In this study, we included 1978 women aged 15–49 years who had a live birth in the two years preceding the survey and provided information on their pregnancy, childbirth, and postnatal care [16].

Country context- Nepal

Nepal is the landlocked country between China and India, with resident of 29 millions [23]. Nepal has diversities in languages and ethnicities. Brahmin and Chhetri are the dominant ethnicities, and Nepali is the national language and is primarily spoken in the Hilly areas [24]. In 2015, passing with different political turmoils, Nepal reformed 240 years long unitary monarchial political system to a federal republic country. In line with the federal governance system, the health system is also decentralized into three layers of governments: one federal, seven provincial, and 753 local governments [25]. Municipalities are further divided into several wards (minimum 5 to maximum 35 wards) for administrative and service delivery. Nepal has a mixed care delivery system, and health services are provided through public and private providers/hospitals. Basic health services are provided from public facilities through public fundings, while people have to pay for secondary and tertiary health services. These health services in public facilities are

relatively cheaper than private facilities; however, there is still high out-of-pocket expenditure (57% of current health expenditure) [26]. Nepal has a national health insurance scheme, a voluntary health insurance scheme implemented in 2016 [27]; however, enrolment is low, and there is a high dropout rate for the renewal of the insurance programme.

Conceptual framework

Based on the previous conceptual framework [28, 29], we developed a conceptual framework [30] and adapted it for this study to guide the analysis and interpretation (Fig. 2). The conceptual framework comprises the input-output-outcome model. We grouped several social determinants as inputs into three broader domains structural, intermediary, and health system. Structural social determinants are included to identify the most disadvantaged women groups (who are left behind). Similarly, intermediary social determinants influence the conditions of health, cover non-health sector factors, and can be addressed through multisectoral actions. Finally, health system factors are concerned with health care delivery.

Study variables

The detail of independent variables, including women’s socioeconomic characteristics and health-seeking factors, are described in the Supplementary file (Table S1). Briefly, structural social determinants included women’s ethnicity, wealth status, education, religion, maternal occupation, perceived violence, decision-making for at least

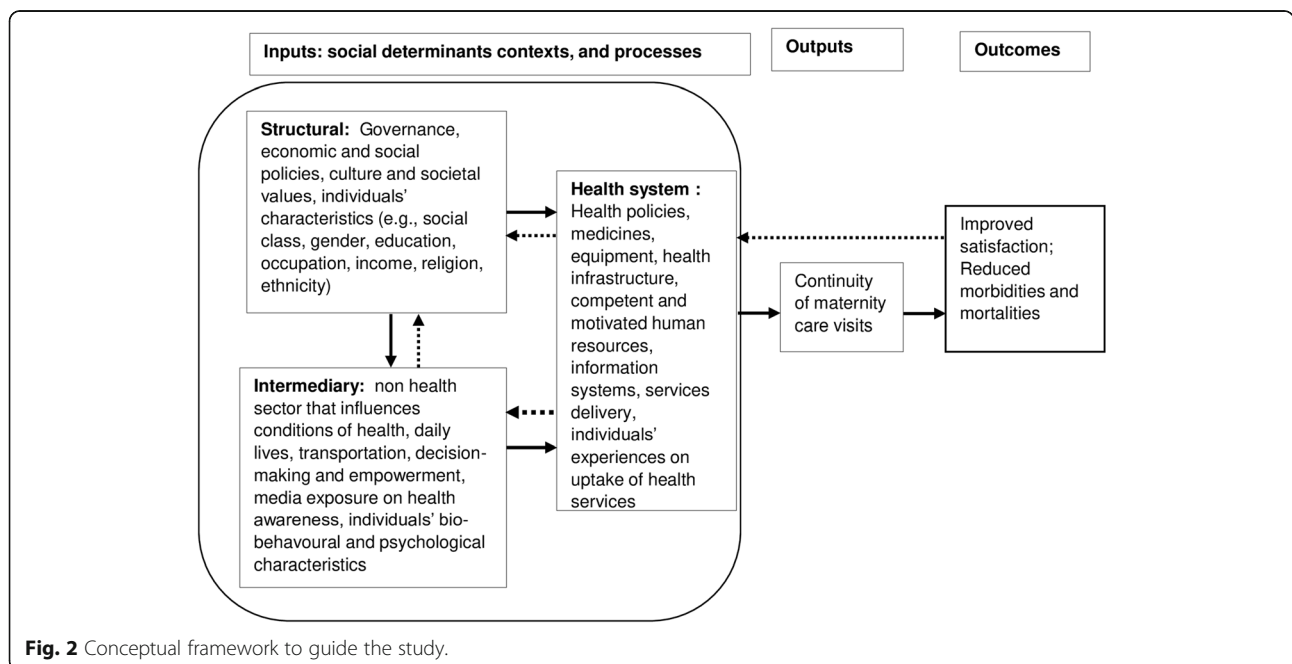


Fig. 2 Conceptual framework to guide the study.

three areas (healthcare, purchasing, and movement), and sex of the household head. Intermediary variables were women's language, maternal age, residence, provinces, region, birth order, sex of child, access to bank account, media exposure, perceived problem of distance to HFs, and intended birth of the last child. Finally, the health system variables included the women's (perceived) problem of not having female health workers, awareness on health mothers' groups in the community, and mode of delivery (normal or caesarian section). We further categorised some socioeconomic variables such as ethnicity (advantaged and disadvantaged), education (illiterate, primary, secondary and higher), wealth status (upper and lower) [16].

This study used the data from the 2016 NDHS, and where responses were self-reported based on the recall of women who had a live birth two years before the survey. Along the pathway of the antenatal-postnatal period, there were three possible points of discontinuation: before completing 4ANC visits, completion of 4ANC visits but discontinued institutional delivery, completion of 4ANC visits and institutional delivery but discontinued PNC visit. So, in this study, the outcome variable was created using the information on the utilisation of maternity service in the antenatal, delivery and postnatal period. The outcome variable had four mutually exclusive categories: had no or less than 4ANC visits=1; had 4ANC visits but no institutional delivery (ID) =2; had 4ANC visits and ID but no PNC (mother-newborn pair) visit=3; had 4ANC visits and ID and PNC visit=0 (reference category).

Data analysis

Multinomial logistic regression analysis was conducted, and the magnitude of (dis)continuity of care was reported as relative risk ratios (RR) with 95% confidence intervals (CIs). Sampling weights (available in the NDHS 2016 dataset) have been applied in the analysis, so results are representative at the national and strata levels. All analyses were weighted to adjust for the two-staged cluster sampling used in the 2016 NDHS [14]. All estimates were reported in weighted value (unless otherwise indicated) including frequency, and proportion (%). The clustering effect of complex sampling design was adjusted using survey 'svy' set command in Stata 14.0 (Stata Corp, 2015).

Before running the multivariable multinomial regression model, multicollinearity was checked and excluded independent variables having variation inflation factors ≥ 3 [31]. Backwards elimination multivariable multinomial logistic regression analyses were conducted [32]. First, the full multinomial multivariable regression model was run, estimated p-value for each independent variable. Then, the most insignificant variable (variable

with the highest p-value) was deleted, comparing p values with other independent variables. This procedure was repeated until no insignificant independent variable was left at $p < 0.20$ [33]. The statistical significance level was set $p < 0.05$ (two-tailed) to identify the independent variables associated with the outcome variable. The goodness of fit test was conducted using the Log-likelihood Ratio test [6].

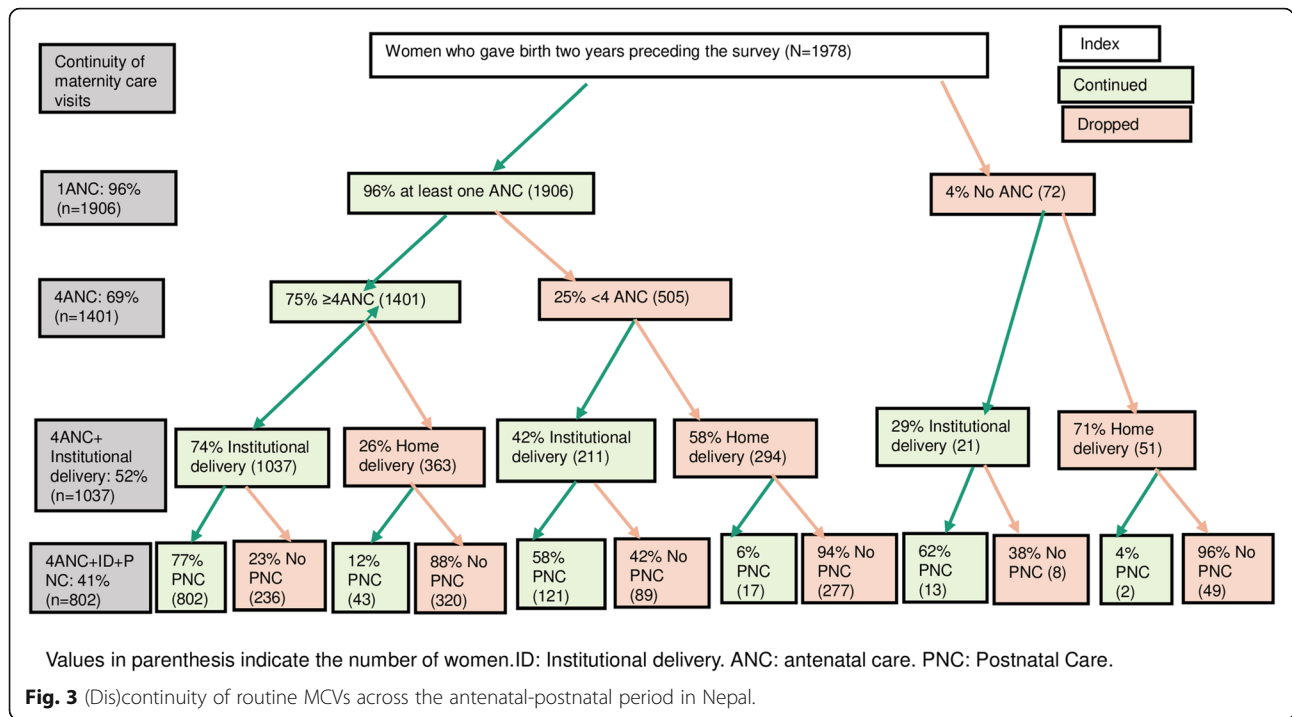
Results

Background characteristics of women

The background characteristics of women included in this study are presented in supplementary file 1, [Table S2](#). In summary, among the 1,978 women, 42% were from households in the lower wealth status, while more than two-thirds (69%) of women were from disadvantaged ethnicities. Nearly two in five women (42%) were native Nepali speakers. More than one in four women (26%) were from province two, only 6% were from Karnali province. Similarly, more than half (55%) of women were from the Terai (Plain) Region, but about half (46%) of women were from urban areas. Two-thirds (67%) of women had no decision-making authority to health-seeking, buying something and nearly one-third (29%) of women reported any kind of perceived violence (see variable detail description in Supplementary file 1, [Table S1](#)). Four in five (79.7%) women were aged 20–34 years, and approximately 69% did not have a bank account. Over two-thirds (68%) of women had no awareness of the availability of a health mothers' group in their communities. Three in five (60%) women felt distance to an HF was a challenge when accessing health services. More than two thirds (72%) of women perceived it as challenging to access care when there were no available female health workers (Supplementary file, [Table S2](#)).

(Dis)continuity of care of routine MCVs at different stages of CoC

Figure 3 shows the continuity of routine MCVs across the MNH continuum of care. Among 1,978 women included in this analysis, only two in five (41%) attended all three MCVs (4ANC visits, institutional delivery, and one PNC visit within 48 h of childbirth). Almost all (96%) received at least one ANC visit, but only 71% completed 4ANC visits. More than one in two women (52%) completed at least 4ANC visits and received institutional delivery services. Women without 4ANC visits, however, had a higher home delivery rate. For instance, among women who were unable to complete 4ANC visits, 58% of them gave birth at home, while 71% of women with no ANC visits ($n=72$) were delivered at home. Only 4% (of $N=1,978$) of women did not receive ANC visits, institutional delivery, or PNC visits (Fig. 3).

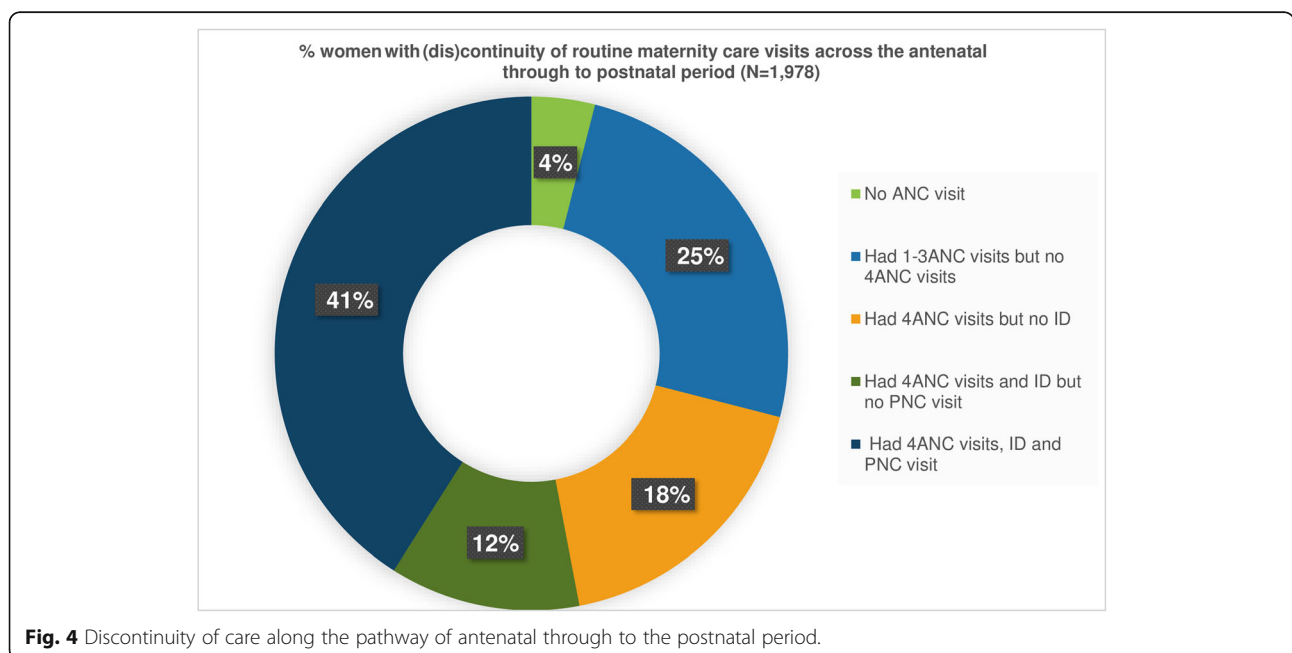


Additionally, Fig. 4 shows the proportion of women who discontinued maternity care along the antenatal-postnatal pathway. Nearly one in 20 women did not visit any forms of routine maternity care visits. About one in four (25%) women had at least one ANC visit but not completed, while one in five women had at least 4ANC visits but did not complete institutional delivery. Only

two in five women completed all recommended 4ANC visits.

Descriptive analysis of (dis)continuity of care of MCVs

Table 1 shows the women who completed/discontinued routine MCVs across the maternal and newborn health continuum. Over half of women completed all visits if



they were belonged to advantaged ethnicity (54%), had secondary or higher-level education (54%), had jobs (53%), had a bank account (54%). The completion of all MCVs was higher if women were from provinces three (51%) and four (54%). Similarly, their completion of MCVs if women had media exposure (51%), distance to HF was not a problem (53%), and who delivered via C-Sect. (71%). However, only one in four women completed all three routine care visits if they were from Karnali province (24%), a Bhojpuri speaker (21%), illiterate (25%), and higher birth order (≥ 4) (21%) (Table 1).

Correlates of the (dis)continuity of MCVs across the maternal and newborn health continuum

Findings of the bivariable regression analysis are presented in Supplementary file (Table S3). Correlates of discontinuation of MCVs in the bivariable analysis were structural (wealth status, education), intermediary (residence, province, region, birth order, media exposure on public health issues, access to a bank account, the intention of last birth, perceived problem of the long distance to the HFs, and perceived violence) and health system (perceived problem if not having female providers in HFs, awareness of health mothers' groups, and mode of delivery).

Table 2 shows the multivariate multinomial regression analysis of correlates of discontinuity of MCVs during the antenatal-postnatal period. Eight determinants were significantly associated with discontinuity of care before completing 4ANC visits. For example, there was a higher relative risk of discontinuation before completion of 4ANC visits (completing all MCVs) if women were illiterate (Relative Risk Ratio (RR)=2.65; 95% CI: 1.72, 4.08), from lower wealth status (RR=2.39; 95% CI: 1.63, 3.51), speak Bhojpuri language (RR=3.28; 95% CI: 1.26, 8.58), or live in Karnali province (RR=4.08; 95% CI: 2.30, 7.21). Similarly, if women had high birth order (≥ 4) (RR=2.15; 95% CI: 1.41, 3.30), women not having media exposure (RR=1.81; 95% CI: 1.33, 2.46), unwanted last birth (RR=2.11; 95% CI: 1.47, 3.02), who were not aware of health mothers' group in their community (RR=1.53; 95% CI: 1.13, 2.07) had a higher risk of discontinuing before completing 4ANC visits.

Similarly, nine determinants were significantly associated with continuity of care until 4ANC visits but discontinued before completing institutional delivery (Table 2). Women completed 4ANC visits but discontinued institutional delivery (compared to the completion of all three MCVs) if they had primary education (RR=1.92; 95% CI: 1.26, 2.93) and lower wealth status (RR=2.82; 95% CI: 1.88, 4.22), who were involved in agriculture (RR=1.51; 95% CI: 1.04, 2.19) or from disadvantaged ethnicity (RR=1.54; 95% CI: 1.05, 2.26) compared to women

with higher education, who belonged to upper wealth status, who were housewives, and advantaged ethnicities, respectively (Table 2). Moreover, women who lived in rural areas (RR=1.91; 95% CI: 1.36, 2.69) and women with no media exposure (e.g., radio, newspaper, television) (RR=1.56; 95% CI: 1.13, 2.14) had a higher risk of discontinuity of care before completing institutional delivery compared to women from urban areas.

Moreover, two determinants were associated with continuity of care until 4ANC visits and institutional delivery but discontinued before completing the PNC visit (Table 2). For instance, women from provinces Karnali (RR=2.24; 95% CI: 1.07, 4.71) and Sudurpaschim (RR=3.57; 95% CI: 1.87, 6.81), and women with a perceived problem of not having a female provider (RR=1.64; 95% CI: 1.12, 2.39) had a higher risk of completing all 4ANC visits and institutional delivery but discontinued before completing PNC visit.

Discussion

This study examined the composite coverage of routine MCVs. Only 41% of women received all three routine MCVs, higher discontinuation from antenatal through to postnatal period. There was a high proportion of discontinuation around later gestational weeks of pregnancy (4ANC visits) and institutional delivery. Several correlates were associated with the (dis)continuity of MCVs across the MNH continuum. For instance, women with structural disadvantages (e.g., disadvantaged ethnicity, lower wealth status, illiterate women) had a higher risk of discontinuing routine MCVs. Higher discontinuity of MCVs was reported if they were from Karnali and Sudurpaschim provinces, who speak Bhojpuri, had high birth order, and poor media exposure on health issues, who had poor awareness on the health mothers' group, and who perceived problems if not having female providers.

The reasons for low completion of routine MCVs may be due to high discontinuation at later gestational weeks of pregnancy or around childbirth. This study identified that women with home delivery were more likely to dropout the first PNC visit. Past studies in Nepal have reported poor uptake of 4ANC visits and institutional delivery due to long walking hours, and unavailability of infrastructure and equipment for childbirth services in local health facilities [34, 35]. The current study revealed lower discontinuation from institutional delivery to PNC visits than previous antenatal and intrapartum visits. The reasons for this could be due to the compulsory PNC checkup at health facilities before discharge in case of facility birth provisioned in the National Safe Motherhood Programme [36]. However, evidence revealed low PNC visit than institutional delivery [16], which suggest

Table 1 (Dis)continuity of routine MCVs during maternal and newborn health continuum of care in Nepal, 2016 (N=1,978)

social determinants	Frequency	Had less than 4ANC visits (%)	Had 4ANC visits but no ID (%)	Had 4ANC visits and ID but no PNC visit (%)	Had 4ANC visits ID and PNC visit (%)	p
Structural						
Wealth status						
Lower (40%)	832	35.1	26.2	8.6	30.0	< 0.001
Upper (60%)	1,146	24.8	12.7	14.3	48.2	
Ethnicity						
Disadvantaged	1,374	34.3	19.6	11.3	34.8	< 0.001
Advantaged	604	17.6	15.5	13.4	53.6	
Religion						
Others	306	39.1	16.2	10.1	34.5	0.056
Hindu	1672	27.3	18.8	12.2	41.7	
Maternal education						
Illiterate	570	46.5	20.2	8.8	24.6	< 0.001
Primary	391	36.5	24.9	10.0	28.6	
Secondary or more	1,016	16.6	14.8	14.4	54.1	
Maternal occupation						
Not working	928	32.9	13.7	12.9	40.5	< 0.001
Agriculture	823	27.6	25.0	10.0	37.3	
Working paid	227	19.2	13.6	14.5	52.7	
Perceived violence						
No	1,397	27.8	18.1	11.2	42.9	0.044
Yes	581	32.4	19.0	13.7	34.9	
Decision-making						
No	1,324	30.9	18.9	11.6	38.6	0.111
Yes	654	25.6	17.3	12.6	44.5	
Household head						
Male	1,438	30.4	18.9	12.2	38.6	0.073
Female	540	25.9	17.0	11.2	45.9	
Intermediary						
Language						
Nepali	839	19.8	17.8	13.2	49.2	< 0.001
Maithili	360	32.4	24.5	11.2	32.0	
Bhojpuri	267	54.4	12.1	12.2	21.3	
Others	512	29.1	18.2	10.1	42.6	
Residence						
Urban	1,062	24.5	14.0	13.5	48.0	< 0.001
Rural	916	34.6	23.4	10.0	32.0	
Provinces						
One	338	21.2	23.0	8.3	47.5	< 0.001
Two	513	42.0	19.2	12.0	26.9	

Table 1 (Dis)continuity of routine MCVs during maternal and newborn health continuum of care in Nepal, 2016 (N=1,978)
(Continued)

social determinants	Frequency	Had less than 4ANC visits (%)	Had 4ANC visits but no ID (%)	Had 4ANC visits and ID but no PNC visit (%)	Had 4ANC visits ID and PNC visit (%)	p
Bagmati	312	24.2	14.2	10.7	50.9	
Gandaki	164	24.7	11.9	9.0	54.4	
Lumbini	364	25.3	19.5	13.5	41.7	
Karnali	121	45.4	22.0	9.0	23.6	
Sudurpaschim	166	16.0	15.5	23.0	45.5	
Region						
Mountain	131	28.3	30.5	3.4	37.8	0.001
Hills	760	23.8	18.2	11.7	46.3	
Terai	1,087	33.0	17.0	13.1	36.9	
Maternal age (years)						
<19	291	25.8	15.7	16.9	41.6	0.146
20-34	1,582	29.2	18.8	11.1	40.9	
≥35	106	37.7	19.7	10.2	32.4	
Birth order						
<4	1,678	24.9	17.7	13.3	44.1	< 0.001
≥4	300	52.8	22.3	4.4	20.6	
Sex of index child						
Male	1,063	28.9	17.4	12.1	41.6	0.699
Female	915	29.5	19.5	11.7	39.4	
Access to bank account						
No	1,367	33.9	20.2	11.6	34.4	< 0.001
Yes	611	18.6	14.3	12.7	54.4	
Media exposure						
No	911	40.0	22.6	9.5	27.8	< 0.001
Yes	1,067	19.9	14.7	13.9	51.4	
Last child (index child)						
Unwanted	418	39.7	16.4	11.1	32.9	< 0.001
Wanted	1,560	26.3	18.9	12.1	42.6	
Distance to HFs as a perceived problem						
No problem	763	23.0	13.6	12.2	51.3	< 0.001
Big problem	1,215	33.0	21.4	11.8	33.8	
Health system						
Perceived problem not having female providers						
No problem	562	22.1	14.1	10.7	53.1	< 0.001
Big Problem	1,416	31.9	20.1	12.4	35.6	
Awareness of health mothers' group						
No	1,340	32.5	17.7	11.5	38.3	<

Table 1 (Dis)continuity of routine MCVs during maternal and newborn health continuum of care in Nepal, 2016 (N=1,978) (Continued)

social determinants	Frequency	Had less than 4ANC visits (%)	Had 4ANC visits but no ID (%)	Had 4ANC visits and ID but no PNC visit (%)	Had 4ANC visits ID and PNC visit (%)	p
Yes	638	22.1	19.8	12.8	45.4	0.001
Mode of delivery						
Normal	1,780	30.6	20.4	11.8	37.2	< 0.001
C-section	198	16.1	0	13.0	70.9	

ID: institutional delivery, HF: health facility, HMG: health mothers' group, p-values obtained from Fisher exact test. Other languages include (e.g., Tharu, Magar). Other religions include Buddha, Jain, Kirat, Christian.

not all women who gave birth at health facilities were not getting PNC services before they discharge from health facilities. The lower continuity of recommended MCVs was consistent with the studies in Cambodia [37] and Lao PDR [38]. In later weeks before childbirth or during childbirth, pregnant women may face difficulties reaching health facilities if physical access is poor or there is no suitable accommodation close to the health facility in Nepal [19]. Even where there was good accessibility of health facilities, knowledge of and demand for PNC was low in Nepal [39]. The upgrading and accrediting of all health posts to birthing centers and strengthening existing birthing centers could increase the availability of quality intrapartum care in rural Nepal. On the other hand, ensuring necessary arrangements at health facilities (e.g., providing medicine and equipment and training female community health workers), including transportation facilities to reach health facilities, could increase institutional delivery and PNC visit.

The current study revealed women with social disadvantages (e.g., illiterate, poor, marginalised ethnic group, involved in agricultural work) and geographical factors had higher discontinuation across the MNH continuum. In Nepal, generally, women with social disadvantages have difficulties in daily living and working conditions, usually have more focus on livelihood support than healthcare. They have inequitable distribution of livelihood opportunities and resources that contribute to poor access to and higher discontinuation of MCVs [19]. Earlier studies in Nepal also have reported women's living, and working life in the mountains [35] and women with poor wealth status also hindered the utilisation of MCVs services [40]. Such women in the maternity and postnatal period may not seek health services unless there are complications [20]. These factors are mostly non-modifiable and often require long term sociopolitical interventions [29, 41–43], and technical and biomedical focussed approaches on their own may not improve routine MCVs across the maternity continuum [42]. In the short term, Nepal's Ministry of Health and Population can focus its programmes on targeting women

living in difficult geographical areas (e.g., Karnali province) and women with social disadvantages (e.g., poor, marginalised ethnicity). A previous study found to improving health services delivery included strengthening birthing centers (e.g., health logistics, human resources and training), and establishing maternity waiting homes [44]. Childbirth services in all rural health facilities could increase the institutional delivery assisted by SBAs and first PNC visit. The PNC home visit and counselling on maternity and newborn care services through female community health volunteers (FCHVs) in hard-to-reach communities of remote provinces (e.g., Karnali) could also improve PNC services. Longer-term structural interventions to improve the uptake of routine MCVs may include improving female access to formal and informal education and employment opportunities [29].

The study found higher discontinuation of MCVs across the MNH CoC, especially women who had more than four children, or women who had last birth unintended. However, health system strategies could improve the continuity of MCVs across the CoC, such as birth spacing, awareness of health issues through mass media exposure, and having female providers at the health facilities. This suggests if women had intended pregnancy, they could prioritise routine MCVs for healthy pregnancy and childbirth. In addition, effective uptake of family planning (FP) services could help for wanted pregnancy and reduced birth spacing, resulting in women being more likely to complete recommended routine MCVs for their intended birth [45].

Health awareness on the importance of pregnancy, childbirth, and PNC services can be improved via exposure to mass media (e.g., local radios, newspaper, television) and dissemination of health information to current and future mothers. A past study in Nepal reported that mass media exposure was positively associated with maternal services [45]. Other studies in other LMICs settings showed that health awareness through digital tools such as mobile phones could play an important role in utilising health services [46] and maternity services [47]. In the current digital era, the use of these digital tools

Table 2 Correlates of (dis)continuity of routine MCVs across the antenatal through to postnatal period in Nepal, NDHS 2016 (N= 1,978)

Social determinants	Had no or less than 4ANC visits (ARR; 95% CI)	Had 4ANC visits but no ID (ARR; 95% CI)	Had 4ANC visits and ID but no PNC visit (ARR;95% CI)
Structural			
Wealth status			
Upper (60%)	1.00	1.00	1.00
Lower (40%)	2.39 (1.63, 3.51) ***	2.82 (1.88, 4.22) ***	0.93 (0.59, 1.48)
Ethnicity			
Advantaged	1.00	1.00	1.00
Disadvantaged	1.47 (0.79, 2.71)	1.54 (1.05, 2.26) *	1.28 (0.82, 1.98)
Maternal occupation			
Agriculture	0.79 (0.56, 1.11)	1.51 (1.04, 2.19) *	0.87 (0.59, 1.29)
Housewife	1.00	1.00	1.00
Working paid	0.64 (0.35, 1.15)	1.22 (0.70, 2.13)	1.08 (0.62, 1.90)
Maternal education			
Higher	1.00	1.00	1.00
Illiterate	2.65 (1.72, 4.08) ***	1.39 (0.93, 2.08)	1.21 (0.72, 2.02)
Primary	2.41 (1.62, 3.57) ***	1.92 (1.26, 2.93) **	1.20 (0.74, 1.93)
Intermediary			
Language			
Nepali	1.00	1.00	1.00
Maithili	1.31 (0.57, 3.00)	1.36 (0.6, 3.11)	0.71 (0.29, 1.77)
Bhojpuri	3.28 (1.26, 8.58) *	0.97 (0.35, 2.68)	1.06 (0.44, 2.57)
Others	1.52 (0.81, 2.84)	0.89 (0.55, 1.42)	0.66 (0.41, 1.05)
Province			
One	1.00	1.00	1.00
Two	1.73 (0.93, 3.21)	1.34 (0.67, 2.71)	2.19 (0.89, 5.42)
Bagmati	1.31 (0.68, 2.54)	0.75 (0.41, 1.35)	1.14 (0.57, 2.27)
Gandaki	1.45 (0.79, 2.68)	0.47 (0.23, 0.94) *	0.95 (0.46, 1.97)
Lumbini	1.10 (0.61, 1.96)	1.09 (0.67, 1.76)	1.93 (0.98, 3.82)
Karnali	4.08 (2.30, 7.21) ***	1.32 (0.65, 2.68)	2.24 (1.07, 4.71) *
Sudurpaschim	0.56 (0.29, 1.07)	0.51 (0.25, 1.02)	3.57 (1.87, 6.81) ***
Residence			
Urban	1.00	1.00	1.00
Rural	1.35 (0.95, 1.93)	1.91 (1.36, 2.69) ***	0.97 (0.64, 1.48)
Maternal age (in years)			
15-19	0.79 (0.52, 1.20)	0.63 (0.39, 0.99) *	1.24 (0.78, 1.95)
20-34	1.00	1.00	1.00
35 or above	0.55 (0.29, 1.04)	0.79 (0.35, 1.78)	1.66 (0.67, 4.11)
Birth order			
<4	1.00	1.00	1.00
≥4	2.15 (1.41, 3.30) ***	1.5 (0.98, 2.30)	0.52 (0.26, 1.06)
Media exposure			
Yes	1.00	1.00	1.00
No	1.81 (1.33, 2.46) ***	1.56 (1.13, 2.14) **	1.01 (0.69, 1.50)
Last birth (index child)			

Table 2 Correlates of (dis)continuity of routine MCVs across the antenatal through to postnatal period in Nepal, NDHS 2016 (N=1,978) (Continued)

Social determinants	Had no or less than 4ANC visits (ARR; 95% CI)	Had 4ANC visits but no ID (ARR; 95% CI)	Had 4ANC visits and ID but no PNC visit (ARR;95% CI)
Wanted	1.00	1.00	1.00
Unwanted	2.11 (1.47, 3.02) ***	1.15 (0.76, 1.72)	1.10 (0.67, 1.82)
Health system			
Perceived problem not having female providers			
No problem	1.00	1.00	1.00
Big problem	1.25 (0.89, 1.76)	1.46 (1.05, 2.04) *	1.64 (1.12, 2.39) *
Awareness on health mothers' group			
Yes	1.00	1.00	1.00
No	1.53 (1.13, 2.07) **	1.10 (0.79, 1.53)	1.06 (0.76, 1.46)

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. Results obtained from the multinomial logistic regression analysis. Determinants that had $p < 0.2$ included in the final model adjusting for covariates listed in the table. The likelihood ratio of the reduced model with the full model was [chi-square=19.47; $p=0.0555$], and our model was the best fit. HWS: health workers, HMG: health mothers' group, HF: health facility, ID: institutional delivery, ANC: antenatal care. The reference category of outcome variable was the completion of all three MCVs. Other languages include Tharu, Magar. ARR: Adjusted risk ratio.

and social media platforms can be helpful to raise awareness on maternity and newborn care and information on health services. In addition, context-specific strategies can be adopted to increase the uptake of needed MCVs that include outreach clinics in remote and underprivileged communities or mobilisation of local community workers for PNC home visits [48]. The health mothers' groups can raise awareness in the community; however, most of these groups are not functional regularly in Nepal [49]. Health mothers' groups are FCHVs-led community health groups where current and future mothers can gather and discuss reproductive, maternal, child health and nutrition issues [50]. Thus, properly functional health mothers' group in the community could raise awareness among pregnant women and provide necessary health information in their pregnancy and childbirth. Such health groups could address the social taboos as talking about reproductive health-related issues is culturally taboo in Nepali society, and women are usually like to share the provision of female providers [20, 51]. Thus, such awareness raising programmes need to focus to disadvantaged population groups (e.g., women of lower wealth status, who speak Maithili language, living in remote areas). The Aama programme (maternity incentive programme) has provisioned 4ANC visits and institutional delivery, resulted in the increased coverage of these visits; however, there is no provision of financial incentive for PNC visits [52]. In the current Aama programme, in addition to 4ANC visits and institutional delivery, incentivizing and integrating PNC visits could potentially increase the completion of routine visits in the maternity care continuum. The health promotion activities such as health education and advocacy, maternal newborn and child health services and context-

specific policy need to be ensured. Such programs can be targeted to marginalised women such as Dalits, Karnali province, and Bhojpuri speaking women.

The measurement of continuity of care is vital for tracking health services coverage across the MNH continuum by creating a composite coverage indicator of all three routine MCVs. Such measurement and tracking could give the actual coverage of MCVs across the CoC. Past studies reported routine monitoring systems [15] lack composite coverage of all routine MCVs across the CoC [53, 54]. Completing all routine maternity care visits is a critical window of opportunity to receive recommended MNH interventions for the survival of mothers and newborns. A modelling study estimated that increased access and quality of MNH interventions across the CoC could avert up to two-thirds of maternal deaths, more than half of maternal deaths, and nearly one-third of stillbirths annually [5]. The composite coverage measurement of maternity MCVs can have a significant implication to track the coverage in countries with high maternal and neonatal deaths. The composite indicator can be created and included in routine health management information systems (HMIS) and periodic health surveys (e.g., demographic and health surveys). In addition, the composite coverage indicator can help to track services coverage among disadvantaged populations and can be employed to assess the reach of existing policy interventions. The monitoring of routine quality maternal and newborn health services is prioritised in SDG-3 [55], the creation and integration of composite coverage indicator can be the initial step to achieve this milestone.

Implications for policies and programmes

The composite coverage indicators of the maternity care continuum can have implications in tracking services

utilisation among disadvantaged populations. The findings of this study can have potential implications in the revision of existing maternity incentive programmes. This study created and executed two composite coverage indicators across the maternity care continuum (i) combined coverage of 4ANC visits and institutional delivery indicator can be used to revise the existing Aama program (maternity incentive programme), and (ii) combined coverage of all three MCVs can be employed to extend the scope of it incorporating PNC visit. First, the current Aama program has provided the incentive for 4ANC visits and institutional delivery separately; instead, these two can be merged and targeted to those who complete 4ANC visits and institutional delivery. Second, the composite coverage of recommended MCVs can be used to extend the maternity incentive program by incorporating the PNC visit across the antenatal, institutional delivery and postnatal period. In addition, the current Aama program has provisioned maternity incentives to all women irrespective of marginalisation status. But such incentives need to be customized to women with multiple forms of marginalisation in the context of the beneficiaries from corresponding local government and wards. Nepal has implemented a decentralised health system, and local health officers can create composite coverage indicators and track the composite coverage of MCVs in their catchment areas. Municipal governments are close to communities; they can identify the most disadvantaged population groups and track the composite coverage of MCVs. Such measurement and tracking services coverage among those groups might help provide financial incentives for completing all recommended visits.

Strengths and limitations

This study has a few strengths and limitations. Strengths included; first, this study is based on a nationally representative survey with a high response rate (98%), and findings could be generalised at the national level. Second, this study considered the PNC visit for mothers and newborns rather than previous studies that examined PNC visit for newborn or PNC mothers separately. Thirdly, creating composite indicators of all three MCVs and analysis can provide a new perspective. Finally, other researchers can adopt similar analyses using multiple rounds of DHS surveys. This study has the following limitations. First, as this study used the 2016 NDHS data based on the observational and cross-sectional design, inferences drawn from this study allow the study of correlations rather than causality. Second, the NDHS 2016 collected information based on recall of women who had a live birth five years before the survey (2011-2016); however, this study included a short recall period of two years, restricting the study sample (2014–2016). Third, this study is based on secondary data analysis; we could

not include important variables, including obstetric complications that could contribute to discontinuation along the pathway. Fourth, the outcome variable was self-reported after face-to-face interviews with women, which may have social desirability bias. Finally, this study has not explored stories of why women discontinued health services utilisation across the CoC. The qualitative research could provide a deeper understanding of real stories of the underlying reasons for discontinuation across the CoC.

Conclusions

Women had high proportion of discontinuation around the late gestational week of childbirth. Disadvantaged women had high discontinuation in different stages of the maternity care continuum. Creation and execution of composite coverage of 4ANC visits, institutional delivery and PNC visit could track the uptake of health services across the CoC. Monitoring MCVs utilisation using composite coverage indicators and provision of focused strategies (e.g., home visits and outreach services, incentives who complete all routine MCVs) could increase the completion of all routine MCVs across the CoC, especially among disadvantaged women. The continuous availability of maternity and newborn services in health facilities and trained female health providers could improve the continuity of maternity care during pregnancy, intrapartum, and the postnatal period. In the decentralised health system of Nepal, the local rural municipality can be responsible for funding to design and execute these strategies for universal coverage of completion of all routine MCVs and better maternal and neonatal outcomes.

Supplementary information

The online version contains supplementary material available at <https://doi.org/10.1186/s12992-021-00791-4>.

Additional file 1 Table S1. Description of variables included in the analysis of (dis)continuity of routine MCVs in Nepal, NDHS 2016. **Table S2.** Characteristics of women who had a live birth in the two years preceding the survey in Nepal in NDHS 2016. **Table S3.** Bivariable multinomial logistic regression analysis of (dis)continuity of routine MCVs in Nepal, NDHS 2016.

Acknowledgements

This manuscript is a part of the first author's (RBK) doctoral thesis at the School of Public Health, the University of Queensland (UQ), supported by the UQ International and Research and Training Scholarships. We would like to acknowledge the UQ for providing the scholarship for the doctoral programme.

Authors' contributions

RBK conceived of the study, performed the statistical analysis. RBK drafted the manuscript. RK, JD and YA supervised the study and provided critical comments in the revision process. All authors contributed significantly during the revision and finalised the manuscript. All authors read and agreed on the final version of the manuscript. The author(s) read and approved the final manuscript.

Funding

No funding was received for the development of this manuscript.

Availability of data and materials

Data used in this study are publicly available secondary data obtained from the DHS (<https://dhsprogram.com/data/available-datasets.cfm>).

Declarations

Ethics approval and consent to participate

We used secondary data from the NDHS 2016. The NDHS 2016 was approved by an ethical review board of Nepal Health Research Council, Nepal, and ICF Marco International, Maryland, USA. The Ministry of Health and Population (MOHP) (Nepal), ICF International Maryland, and DHS (USA) approved and oversaw the overall research process of the NDHS 2016. As the NDHS data are publicly available for further analysis, and data were deidentified of the research participants, the first author (RBK) took approval for the download and use of dataset for his doctoral thesis, downloaded data of individual woman records from the Nepal data file available from the DHS (<https://dhsprogram.com/data/available-datasets.cfm>). The research proposal got an ethical exemption from the human research ethics committee of the University of Queensland (UQ), Australia.

Consent for publication

Not applicable.

Competing interests

The authors declared that they have no competing interests.

Author details

¹School of Public Health, Faculty of Medicine, University of Queensland, Brisbane, Australia. ²Health Social Science and Development Research Institute, Kathmandu, Nepal. ³School of Public Health and Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal. ⁴School of Public Health and Social Work, Queensland University of Technology, Brisbane, Australia.

Received: 12 October 2021 Accepted: 19 November 2021

Published online: 11 December 2021

References

- Darmstadt GL, Walker N, Lawn JE, Bhutta ZA, Haws RA, Cousens S. Saving newborn lives in Asia and Africa: cost and impact of phased scale-up of interventions within the continuum of care. *Health Policy Plan.* 2008;23(2):101–17.
- World Health Organization: WHO recommendations on postnatal care of the mother and newborn. In: Geneva; 2014.
- Chalise B, Chalise M, Bista B, Pandey AR, Thapa S. Correlates of continuum of maternal health services among Nepalese women: Evidence from Nepal Multiple Indicator Cluster Survey. *PLoS One.* 2019;14(4):e0215613.
- Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. *Lancet.* 2007;370(9595):1358–69.
- Bhutta ZA, Das JK, Bahl R, Lawn JE, Salam RA, Paul VK, Sankar MJ, Blencowe H, Rizvi A, Chou VB, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet.* 2014;384(9940):347–70.
- Yeji F, Shibanuma A, Odoro A, Debpuur C, Kikuchi K, Owusu-Agyei S, Gyapong M, Okawa S, Ansah E, Asare GQ, et al. Continuum of care in a maternal, newborn and child health program in Ghana: Low completion rate and multiple obstacle factors. *PLoS One.* 2015;10(12):e0142849.
- Sustainable Development Goal 3: Ensure healthy lives and promote wellbeing for all at all ages [<https://www.who.int/sgd/targets/en/>]
- Fullman N, Barber RM, Abajobir AA, Abate KH, Abbafati C, Abbas KM, Abd-Allah F, Abdulkader RS, Abdulle AM, Abera SF, et al. Measuring progress and projecting attainment on the basis of past trends of the health-related Sustainable Development Goals in 188 countries: an analysis from the Global Burden of Disease Study 2016. *Lancet.* 2017;390(10100):1423–59.
- Wang W, Hong R. The continuum of care for maternal and newborn health in Cambodia: where are the gaps and why? A population-based study. *The Lancet.* 2013;381:S145.
- Shibanuma A, Yeji F, Okawa S, Mahama E, Kikuchi K, Narh C, Enuameh Y, Nanishi K, Odoro A, Owusu-Agyei S, et al. The coverage of continuum of care in maternal, newborn and child health: a cross-sectional study of woman-child pairs in Ghana. *BMJ Glob Health.* 2018;3(4):e000786.
- Mohan D, LeFevre AE, George A, Mvembeni R, Bazant E, Rusibamayila N, Killewo J, Winch PJ, Baqui AH. Analysis of dropout across the continuum of maternal health care in Tanzania: findings from a cross-sectional household survey. *Health Policy Plan.* 2017;32(6):791–9.
- Gage AD, Carnes F, Blossom J, Aluvaala J, Amatya A, Mahat K, Malata A, Roder-DeWan S, Twum-Danso N, Yahya T et al. In Low- And Middle-Income Countries, Is Delivery In High-Quality Obstetric Facilities Geographically Feasible? *Health Aff (Millwood)* 2019, 38(9):1576–1584.
- Akseeer N, Kamali M, Arifeen SE, Malik A, Bhatti Z, Thacker N, Maksey M, D'Silva H, da Silva IC, Bhutta ZA: Progress in maternal and child health: how has South Asia fared? *BMJ* 2017, 357:j1608.
- Ministry of Health, New ERA; and, ICF: Nepal Demographic and Health Survey 2016. Kathmandu; 2017.
- Ministry of Health: Annual Report, Department of Health Services 2075/2076 (2018/2019). In: Ministry of Health, Department of Health Services. Kathmandu, Nepal; 2020.
- Khatri RB, Alemu Y, Protani MM, Karkee R, Durham J. Intersectional (in) equities in contact coverage of maternal and newborn health services in Nepal: insights from a nationwide cross-sectional household survey. *BMC Public Health.* 2021;21(1):1–12.
- Shahabuddin A, De Brouwere V, Adhikari R, Delamou A, Bardaj A, Delvaux T: Determinants of institutional delivery among young married women in Nepal: Evidence from the Nepal Demographic and Health Survey, 2011. *BMJ open* 2017, 7(4).
- Moyer CA, Mustafa A. Drivers and deterrents of facility delivery in sub-Saharan Africa: a systematic review. *Reprod Health.* 2013;10(1):40.
- Khatri RB, Karkee R. Social determinants of health affecting utilisation of routine maternity services in Nepal: a narrative review of the evidence. *Reprod Health Matters.* 2018;26(54):32–46.
- Sharma S, van Teijlingen E, Hundley V, Angell C, Simkhada P. Dirty and 40 days in the wilderness: Eliciting childbirth and postnatal local practices and beliefs in Nepal. *BMC Pregnancy Childbirth.* 2016;16(1):147.
- Family Health Division: Strategy for Skilled Health Personnel and Skilled Birth Attendants 2020-2025. Kathmandu Family Welfare Division, MOHP, Nepal; 2021.
- Khatri RB: Towards equity of maternal and newborn health services in Nepal. PhD Thesis. The University of Queensland, Australia; 2021.
- Nepal Demographics Profile [https://www.indexmundi.com/nepal/demographics_profile.html]
- Central Bureau of Statistics: National population and housing census 2011. Kathmandu, Nepal 2012.
- Constituent Assembly Secretariat. Constitution of Nepal 2015. Kathmandu: Constituent Assembly Secretariat; 2015.
- Ministry of Health: Nepal National Health Accounts 2012/13-2015/16. In: Kathmandu, Nepal; 2018.
- Ranabhat CL, Subedi R, Karn S. Status and determinants of enrollment and dropout of health insurance in Nepal: an explorative study. *Cost Eff Resour Alloc.* 2020;18(1):40.
- Khatri R, Durham J, Karkee R, Assefa Y: Patterns and determinants of effective coverage of routine maternal and newborn health visits in Nepal: Analysis of the 2016 Demographic and Health Survey. 2021.
- Hamal M, Dieleman M, De Brouwere V, de Cock Buning T. Social determinants of maternal health: a scoping review of factors influencing maternal mortality and maternal health service use in India. *Public Health Rev.* 2020;41(1):13.
- Khatri RB, Durham J, Assefa Y. Utilisation of quality antenatal, delivery and postnatal care services in Nepal: An analysis of Service Provision Assessment. *Globalization and Health.* 2021;17(1):1–16.
- Akinwande MO, Dikko HG, Samson A. Variance Inflation Factor: As a Condition for the Inclusion of Suppressor Variable(s) in Regression Analysis. *Open Journal of Statistics.* 2015;05(07):754–67.
- Heinze G, Wallisch C, Dunkler D. Variable selection - A review and recommendations for the practicing statistician. *Biom J.* 2018;60(3):431–49.
- Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. *Source Code Biol Med.* 2008;3:17.
- Khatri RB, Dangi TP, Gautam R, Shrestha KN, Homer CSE. Barriers to utilization of childbirth services of a rural birthing center in Nepal: A qualitative study. *PLoS One.* 2017;12(5):e0177602.
- Byrne A, Hodge A, Jimenez-Soto E, Morgan A. Looking beyond supply: a systematic literature review of demand-side barriers to health service utilization in the mountains of Nepal. *Asia Pac J Public Health.* 2013;25(6):438–51.

36. Family Welfare Division: Nepal Safe Motherhood and Newborn Health Road Map 2030. In: Ministry of Health, Kathmandu, Nepal; 2019
37. Wang W, Hong R. Levels and determinants of continuum of care for maternal and newborn health in Cambodia—evidence from a population-based survey. *BMC Pregnancy Childbirth*. 2015;15(1):62.
38. Sakuma S, Yasuoka J, Phongluxa K, Jimba M. Determinants of continuum of care for maternal, newborn, and child health services in rural Khammouane, Lao PDR. *PLoS One*. 2019;14(4):e0215635.
39. Xu S, Blavo C, Marahatta SB, Banjara M, Amatya R, Hardigan P, Anderson N. Assessment of Healthcare Utilization among Women Experiencing Childbirth in Suburban Nepal. *Journal of Health Promotion*. 2019;7:53–64.
40. Devkota B, Maskey J, Pandey AR, Karki D, Godwin P, Gartoulla P, Mehata S, Aryal KK. Determinants of home delivery in Nepal - A disaggregated analysis of marginalised and non-marginalised women from the 2016 Nepal Demographic and Health Survey. *PLoS One*. 2020;15(1):e0228440.
41. Mumtaz Z, Salway S, Shanner L, Bhatti A, Laing L. Maternal deaths in Pakistan: intersection of gender, caste, and social exclusion. *BMC Int Health Hum Rights*. 2011;11(Suppl 2):S4.
42. Mumtaz Z, Salway S, Bhatti A, Shanner L, Zaman S, Laing L, Ellison GT. Improving maternal health in Pakistan: toward a deeper understanding of the social determinants of poor women's access to maternal health services. *Am J Public Health*. 2014;104(Suppl 1(S1)):S17-24.
43. Ruiz-Cantero MT, Guijarro-Garvi M, Bean DR, Martinez-Riera JR, Fernandez-Saez J. Governance commitment to reduce maternal mortality. A political determinant beyond the wealth of the countries. *Health Place*. 2019;57:313–20.
44. Munabi-Babigumira S, Glenton C, Lewin S, Fretheim A, Nabudere H. Factors that influence the provision of intrapartum and postnatal care by skilled birth attendants in low-and middle-income countries: a qualitative evidence synthesis. *Cochrane Database Syst Rev* 2017(11).
45. Fatema K, Lariscy JT. Mass media exposure and maternal healthcare utilization in South Asia. *SSM Popul Health*. 2020;11:100614.
46. Willcox M, Moorthy A, Mohan D, Romano K, Hutchful D, Mehl G, Labrique A, LeFevre A. Mobile technology for community health in Ghana: is maternal messaging and provider use of technology cost-effective in improving maternal and child health outcomes at scale? *J Med Internet Res*. 2019;21(2):e11268.
47. Jain AK, Winfrey W. Contribution of Contraceptive Discontinuation to Unintended Births in 36 Developing Countries. *Stud Fam Plann*. 2017;48(3):269–78.
48. Perry HB, Sacks E, Schleiff M, Kumapley R, Gupta S, Rassekh BM, Freeman PA. Comprehensive review of the evidence regarding the effectiveness of community-based primary health care in improving maternal, neonatal and child health: 6. strategies used by effective projects. *J Glob Health*. 2017;7(1):010906.
49. Hamal M, Heiter K, Schoenmakers L, Smid M, de Cock Buning T, De Brouwere V, Bardají A, Nepal C, Dieleman M. Social Accountability in Maternal Health Services in the Far-Western Development Region in Nepal: An Exploratory Study. *International journal of health policy and management*. 2019;8(5):280–91.
50. Panday S, Bissell P, van Teijlingen E, Simkhada P. The contribution of female community health volunteers (FCHVs) to maternity care in Nepal: a qualitative study. *BMC Health Serv Res*. 2017;17(1):623.
51. Mattebo M, Bogren M, Brunner N, Dolk A, Pedersen C, Erlandsson K. Perspectives on adolescent girls' health-seeking behaviour in relation to sexual and reproductive health in Nepal. *Sexual & Reproductive Healthcare*. 2019;20:7–12.
52. Bhatt H, Tiwari S, Ensor T, Ghimire DR, Gavidia T. Contribution of Nepal's free delivery care policies in improving utilisation of maternal health services. *Int J Health Policy Manag*. 2018;7(7):645–55.
53. Shah R, Rehfuess EA, Paudel D, Maskey MK, Delius M. *Reprod Health*. 2018; 15(1):110.
54. Arsenault C, Jordan K, Lee D, Dinsa G, Manzi F, Marchant T, Kruk ME. Equity in antenatal care quality: an analysis of 91 national household surveys. *Lancet Glob Health*. 2018;6(11):e1186–95.
55. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, Adeyi O, Barker P, Daelmans B, Doubova SV, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. *Lancet Glob Health*. 2018;6(11):e1196–252.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

