Two thirds of the most disadvantaged Dalit population of Nepal still do not deliver in health facilities despite impressive success in maternal health

Surendra Prasad Chaurasiya1*, Nilesh Kumar Pravana1, Vishnu Khanal2, Dhiraj Giri3

1 Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan University, Kathmandu, Nepal, 2 Nepal Development Society, Bharatpur, Nepal, 3 Department of Natural Science, Kathmandu University, Kathmandu, Nepal

* spchaurasiya@gmail.com

Abstract

Introduction
The gains in maternal and child health in Nepal was impressive in the last two decade but success was unevenly distributed. The Dalits of Nepal are the most disadvantaged caste group and have benefitted least from the advances in maternal health service. This study investigated the rate of and factors associated with the institutional delivery among the Dalit women of the Mahottari, Nepal.

Materials and methods
A cross-sectional study was conducted during July-December 2014 using a structured questionnaire. A total of 328 mothers who had their childbirth within one year were interviewed. Descriptive statistics followed by binary and multivariable logistic regression analyses were computed to find the association of key variables with institutional delivery.

Results
In this study, only 30% of the mother had institutional delivery. Fifty eight percent mothers had no any birth preparedness and complication readiness. Four or more antenatal visits (Adjusted Odds Ratio (AOR): 3.54, CI: 1.82–6.90), birth preparedness (AOR: 3.15, CI: 1.61–6.18), planned pregnancy (AOR: 2.63, CI: 1.37–5.06) and receiving advice from health staffs (AOR: 3.96, CI: 2.00–7.86) and mother's autonomy (AOR: 2.25, CI: 1.03–4.49) were associated with child birth at the health facility.

Conclusion
This study indicated that birth preparedness, ANC visit frequency, planning of pregnancy, advice for institutional delivery and mother’s autonomy were significantly associated with health facility delivery. Less than one-third mothers had institutional delivery and reasons
were feeling of un-necessary, far distance, lack of transportation and associated cost; and birth preparedness is also low. Hence, promotion of birth preparedness, uptake of ANC service, proper counselling for institutional delivery, promoting women autonomy and strengthening women to have planned pregnancy were some recommendation to promote institutional delivery for such disadvantage community.

Introduction

Institutional delivery and access to referral level facility are essential intervention in saving the lives of mothers and children in many developing countries [1]. Over the last decades, the maternal mortality ratio (MMR) was observed more than ten time higher in developing countries than in developed and almost all of the global maternal death (99%) occurred in developing countries, followed by sub-Saharan Africa region alone accounting for (179,000) and South Asia (69,000) [2]. Millennium Development Goals (MDG) has targeted to reduce MMR by three quarters between 1990 and 2015. Accordingly, the government of Nepal has committed to reducing MMR to 134 deaths per 100,000 live births; increase institutional delivery to 40% and increase delivery assisted by skilled birth attendants (SBA) to 60%, increase at least four Antenatal Care (ANC) visit to 80% [3, 4]. A recent report of the World Health Organization (WHO) shows that globally since 1990, MMR has been dropped by 44% but the world failed to meet the 75% reduction target [5].

As a result of Nepal’s committed efforts, the country has made a significant improvement in maternal health services in the past decade [4, 6, 7]. The overall MMR has been decreased (850 live birth per 100,000 in 1990 to 229 live birth per 100,000 in 2010) [3, 8]; delivery assisted by SBA has been increased by seven folds (7% in 1990 to 36% in 2011) [3]; health facility delivery has been increased (8% in 1996 to 35% in 2011); and four or more ANC visits has been increased (9% in 1996 to 50% in 2011) [6, 7]. With such gains, the recently adopted ‘Sustainable Development Goals’ has globally summoned to reduce MMR to less than 70 per 100,000 live births by 2030 [5].

While the gains in maternal and child health in the country seem impressive, there is no uniformity. Nepal has a socially constructed caste-based hierarchical system in which the Brahmins/Chhetris are considered at the top (advantaged caste) and Dalits are at the lowest (disadvantaged caste) [9]. This system had an impact on the access of and utilization of health services by Dalit caste. Therefore, it is unsurprising that the gains in maternal health are also lowest for this group [3, 9]. For instance, MMR (national 229 versus Dalit 273), four or more ANC visit (Brahmin/Chhetri 64% versus Dalits 40%), institutional delivery (Brahmin/Chhetri 49% versus Dalit 26%) [9]. Further, a study showed increment in the difference between Brahmins/Chhetri and Dalits in ANC utilization from 10 to 19%; and institutional delivery from 5.7% in 1996 to 15.4% in 2006 [10]. These stats suggest that the gains were trickled more through much improvement in the upper caste groups, and the gains remain slower the in the Dalit caste.

Ecologically, Nepal has three regions, the northern Himalayan belt, middle hilly belt and the Southern plain (Terai). The central southern region of Nepal has a unique situation. This region is considered the food bank of the country where rice is grown as a major staple food. The plain terrain has an open border to India. Its plain terrain has more opportunity for development and also increased the likelihood of the use of health services in the areas. However, the national service utilization report shows that the statistics in this region is not as good as
the hilly region. For instance, institutional delivery was 22% in Mahottari district while 45% at the national level in 2012/013 according to district health report and annual report respectively [11, 12].

Similarly, regional and geographical differences in health are well documented in Nepal, the situation of the Dalit caste group remain under-reported. To plan and implement public health programs focused to reduce maternal deaths, obstetric morbidities, and increase maternal health service utilization, well-designed studies are needed. Therefore, the objective of this study was to identify the rate of and factors associated with health facility-based childbirth among Dalit women who delivered their babies within one year in Mahottari district.

Methods and materials

Study setting
The study was conducted in the Mahottari district of central Nepal, which lies about 253 kilometres to the South-East to the capital of Nepal, Kathmandu. The southern part of district borders to the Bihar state of India. The district is divided into six electoral areas and each area consists of 11 to 14 village development committees (VDC—the smallest administrative unit in rural areas of Nepal) with a total VDC seventy seven including one municipality. Each VDC then is divided into nine wards which can be as small as a village. According to the National Population and Housing Census 2011, the total population of the district was 627,580 (male 311,016 and female 316,564) [13]. There are two district hospitals, three primary health care centres, 20 health posts, and 52 sub-health posts that provide primary health care services to its population [11]. The maternal health services provided through these public health facilities are free of cost according to the government of Nepal’s maternal health program guidelines. All the services related to maternal health services are collectively known as ‘Aama Program’ (means “Mother Program”). This program has four components: (a) the Safe Delivery Incentive Program, a cash incentive scheme initiated in July 2005, (b) free institutional delivery care, which was launched in mid-January 2009,(c) incentive to health worker for home delivery and (d) incentive to women for 4 ANC visits at the 4, 6, 8 and 9 months pregnancy following institutional delivery [12]. The district was chosen purposively as this has unique representativeness of the Southern areas in the plain (Terai) region of Nepal.

Study design and participants
This was a cross-sectional study conducted in Mahottari district during July-December, 2014. The mothers were included in the study if: (i) they had childbirth during the last one year, (ii) were local residents of the districts, (iii) were not migrated to the district after childbirth, and [14] belonged to Dalit ethnic group. A multistage simple random sampling technique was used. This district has six electoral areas and each area constitutes 11 to 14 VDCs (Fig 1). To ensure the representativeness, two VDCs were selected randomly selected from each electoral area. A list of all Dalit eligible mothers of 6’2 VDC = 12VDCs was prepared with the help of local public health facilities’ community-based newborn program records, and female community health volunteers. More than 95% of all births were covered in their records and thus, our lists have included to a higher level of inclusiveness from the selected communities. Of the 348 eligible mothers, 15 women had migrated out of the district; therefore, 328 participants were interviewed.

Instrument and data collection
The questionnaire was adapted from the Nepal Demographic and Health Survey (NDHS) 2011 [6]. Observation checklist was prepared to observe assets and animals in the house based
on the NDHS 2011. A few minor words were changed in the original questionnaire to adapt the local context and increase readability of the questions. The face-to-face interview was conducted in the local language at respondent’s house to collect information by two trained female interviewers who were trained by the first author and also involved in pretesting of questionnaires.

**Ethics**

Ethics approval was obtained from the Institutional Ethical Review Board, Institute of Medicine, Tribhuvan University Nepal (Approval Number 79(6-11-E)071/072. Informed written consent was also obtained from the district health office Mahottari and participants of the study. Personal identifiers were removed before the analysis of data and data were only presented as aggregate.

**Variables**

The outcome variable was ‘place of delivery’ and delivery in health facility coded as ‘1’ and delivery in the home as ‘0’. Delivery in health facility includes delivery in either public (birthing centre, primary health care centre, district hospital, zonal hospital) or private sector (private hospital, NGO run hospital) [15]. The independent variables were selected based on comprehensive literature review and grouped into four major groups: socio-cultural,
economic accessibility, physical accessibility and perceived need. Socio-cultural factors included ethnicity, mother’s education, husband’s education, mother’s autonomy, and mother’s current age, traditional healers, family type and family size. Economic accessibility factors were wealth status, mother’s occupation, husband’s occupation. The physical accessibility factors were the distance (home to the nearest health facility that provides delivery service), availability of motorized transport and means of transport. The perceived need factors were antenatal care, perceived quality of ANC service, parity of mother, planning of last pregnancy, advice for health facility delivery, birth preparedness and complication readiness, exposure to maternal health message, affiliation in mother’s group/network, absence of health workers in health facility, perception of health worker’s behavior, visit with female community health volunteer [16, 17].

The age of respondent as reported by the individual was recorded. It was categorized into four groups: 15–19, 20–24, 25–29 and 30 years or above for analysis purpose [18]. Educational status was recorded as no formal education, primary, secondary, and certificate and above [6]. However, for bivariate analysis, it was re-coded to educated and uneducated. Occupation of the mother was broadly categorized into a housewife, daily wage, agriculture and job; and for a husband, it was categorized into the daily wage, agriculture, business and job[19]. Wealth status is a composite measure of socioeconomic status and adapted from NDHS 2011. It was derived using household assets and expenditures. Then the household wealth index was categorized into three groups poor to least poor corresponding from lowest to the highest status [6]. Woman’s autonomy included three components: control over finance, decision making power and extent to which she has the freedom to movement using 12 variables adapted from NDHS 2011. The women were categorized into three groups from low autonomy to high autonomy from the lowest to the highest. Ethnicity was adapted from further analysis of the 2011 NDHS. Mothers were asked whether they had heard about the birth preparedness; if yes, they were then prompted by reading the list of birth preparedness: saving money, arrangement of transport, finding blood donor, contacted with health worker to help in delivery, buy a safe delivery kit, arranged food & cloth[6]. The Dalit caste that was part of the study populations were ‘Terai Dalit’-Chamar, Mushahar, Dusadh/Paswan, Tatma, Khatabe, Banter, Dom, Chidimar, Dhobi, Halkhor and the ‘Hill Dalit’-Kami, Damai, Sarki, Gaine, Badi [9].

Statistical analysis
Descriptive analysis was performed to report the rate of health facility delivery and characteristics of participants. The association of health facility delivery and other independent variables were first tested using Chi-square tests and the significant factors (p-value < 0.05) were further entered for multi-variable analysis to ascertain the association of these factors with health facility delivery using backward LR methods [20]. Data analyses were performed using Statistical Package for Social Sciences Version 20.

Results

Characteristics of participants
Table 1 provides a description of the independent variables. The mean age of mother was 22.52 years (standard deviation 3.72). More than three-quarters of mothers (78%) and half of the husbands (58%) had no formal education. The majority of mothers (79%) were a housewife and 80% of husbands were engaged in daily wage work. Among the mothers who delivered in a health facility, half of them used an ambulance, followed by bull cart/tanga (24%) to reach a health facility. More than two third (71%) mothers did not found motorized transport easily at their residence village. The distance of health facility (that provide delivery service) from
Table 1. Description of socio-culture, economic, physical accessibility and perceived need factors.

| Characteristics          | Frequency (n = 328) | Percent |
|--------------------------|---------------------|---------|
| **Caste**                |                     |         |
| Terai Dalit              | 296                 | 90.2    |
| Hill Dalit               | 32                  | 9.8     |
| **Mother age (Year)**    |                     |         |
| 15–19                    | 68                  | 20.7    |
| 20–24                    | 159                 | 48.5    |
| 25–29                    | 79                  | 24.1    |
| ≥30                      | 22                  | 6.7     |
| **Family size**          |                     |         |
| 9 or more members        | 104                 | 31.7    |
| 5–8 members              | 178                 | 54.3    |
| 3–4 family members       | 46                  | 14      |
| **Type of Family**       |                     |         |
| Joint or extended        | 226                 | 68.9    |
| Nuclear                  | 102                 | 31.1    |
| **Mother’s education**   |                     |         |
| No formal education      | 257                 | 78.4    |
| Secondary                | 34                  | 10.4    |
| Primary                  | 31                  | 9.5     |
| Certificate or above     | 6                   | 1.8     |
| **Husband’s education**  |                     |         |
| No formal education      | 192                 | 58.5    |
| Secondary                | 68                  | 20.7    |
| Primary                  | 55                  | 16.8    |
| Certificate or above     | 13                  | 4       |
| **Practice of traditional healers** |       |         |
| No                       | 59                  | 18.0    |
| Yes                      | 269                 | 82.0    |
| **Women Autonomy**       |                     |         |
| Lowest                   | 89                  | 27.1    |
| Middle                   | 131                 | 39.9    |
| Highest                  | 108                 | 32.9    |
| **Women’s occupation**   |                     |         |
| Housewife                | 259                 | 79.3    |
| Daily wage               | 62                  | 18.9    |
| Agriculture              | 3                   | 0.9     |
| Job                      | 3                   | 0.9     |
| **Husband’s occupation** |                     |         |
| Daily wage               | 263                 | 80.2    |
| Agriculture              | 21                  | 6.4     |
| Business                 | 21                  | 6.4     |
| Mechanics                | 14                  | 4.3     |
| Job                      | 9                   | 2.7     |
| **Wealth status**        |                     |         |
| Lowest                   | 109                 | 33.2    |
| Middle                   | 109                 | 33.2    |
| Highest                  | 110                 | 33.5    |

(Continued)
| Characteristics                          | Frequency (n = 328) | Percent |
|-----------------------------------------|---------------------|---------|
| Means of transport during delivery (n = 98) |                     |         |
| Ambulance                               | 49                  | 50      |
| Bull cart/Tanga                         | 23                  | 23.5    |
| Bus                                     | 14                  | 14.3    |
| Foot                                    | 9                   | 9.2     |
| Motorcycle                              | 3                   | 3.1     |
| Availability of motorized transport     |                     |         |
| No                                      | 233                 | 71      |
| Yes                                     | 95                  | 29      |
| Distance (home to a health facility)    |                     |         |
| >2 Km                                   | 187                 | 57      |
| ≤2 Km                                   | 141                 | 43      |
| ANC visit frequency                     |                     |         |
| <4 ANC                                  | 191                 | 58.2    |
| ≥4 ANC                                  | 137                 | 41.8    |
| Perceived good quality of ANC           |                     |         |
| No                                      | 264                 | 80.5    |
| Yes                                     | 64                  | 19.5    |
| Parity of mother                        |                     |         |
| 3+                                      | 155                 | 47.3    |
| Second                                  | 93                  | 28.4    |
| First                                   | 80                  | 24.4    |
| Planning of last pregnancy              |                     |         |
| No                                      | 185                 | 56.4    |
| Yes                                     | 143                 | 43.6    |
| Advised for health facility delivery (n = 252) |         |         |
| No                                      | 113                 | 44.8    |
| Yes                                     | 139                 | 52.2    |
| Birth preparedness and complication readiness |               |         |
| No                                      | 190                 | 57.9    |
| Yes                                     | 138                 | 42.1    |
| Get transport incentive (n = 98)        |                     |         |
| No                                      | 31                  | 31.6    |
| Yes                                     | 67                  | 68.4    |
| Association in women group/network      |                     |         |
| No                                      | 231                 | 70.4    |
| Yes                                     | 97                  | 29.6    |
| Heard about the Safe Delivery Incentive Program |               |         |
| No                                      | 153                 | 46.6    |
| Yes                                     | 175                 | 53.4    |
| Exposed to the maternal health message  |                     |         |
| No                                      | 236                 | 72      |
| Yes                                     | 92                  | 28      |
| Absence of health workers in the health facility |  |         |
| No                                      | 227                 | 69.2    |
| Yes                                     | 101                 | 30.8    |

Perceived discriminatory behaviour of health worker

(Continued)
mother’s house was more than 2 KM for 57% mother. The mean distance was 3.19 KM with SD 1.65.

Health care related information about participants

The above Table 1 also shows that two in five mothers (42%) had visited four or more ANC visit while 58% of mothers had less than four. About one-fifth of mothers perceived ANC as good quality. Likewise about half (47%) of mothers were multiparous and more than half (56%) mothers had not planned their last pregnancy. As per the mother’s statement, mothers who visited any ANC, only 50% of them were suggested for health facility delivery. Similarly, more than half of the mothers (53%) mothers had heard about Save Delivery Incentive Program; however, only 68% mother had got transport incentive among who delivered in a health facility. In the same way, less than one third (28%) mothers had heard about the maternal health message through one or more media and 21% mothers were not visited by female community health volunteers during their last pregnancy. Similarly, 31% of mothers reported that they observed staff absence when they had visited health facility and 27% mother perceived staff’s behaviour as discriminatory in general while providing health services.

Table 2 presents birth preparedness and complication readiness and shows 58% of mothers had not done any preparation for birth at all. Among those mothers who had any preparation, 96% mother had saved money and 51% mother had arranged transport.

Rates and factors associated with health facility delivery

Out of 328 interviewed mother, 70% mother had home delivery and only 30% (95% CI: 24.99, 34.81) mother had their childbirth in health facilities. It was found that the common reasons for not having a childbirth in a health facility were: not feeling necessary to go to health facility (63%), too far or lack of transportation (40%), cost related to service (40%), child born before reaching facility (8%), poor quality (1%), and husband did not allow (0.4%) to go health facility while giving birth to their baby.
Table 3 provides an association between health facility delivery and different factors at 95% CI in bivariate and multivariate analysis. Among socio-cultural, economic and physical accessibility factors, caste, mother’s age, family size, mother’s education, father’s education, women autonomy, mother’s occupation, husband’s occupation, wealth status, distance and availability of motorized transport were significant in bivariate analysis. Similarly, health-related significant factor in binary analysis were ANC visit frequency, perceived good quality of ANC, parity of mother, planning of last pregnancy, advice for health facility delivery, birth preparedness and complication readiness, association in women group/network, hearing about safe delivery incentive program, exposure to maternal health message, absence of health workers in health facility, perceived discriminatory behavior of health workers and visit with female community health volunteer. After adjusting for potential confounder, the regression analysis showed that ANC visits frequency (AOR: 3.54, CI: 1.82–6.90), birth preparedness and complication readiness (AOR: 3.15, CI: 1.60–6.17), planning of last pregnancy (AOR: 2.63, CI: 1.37–5.05), receiving advice from health workers during pregnancy (AOR: 3.96, CI: 1.99–7.86), and women autonomy (AOR: 2.24, CI: 1.03–4.89) were significantly associated with health facility delivery.

Discussion

This is the first study that explores the rates of health facility delivery and their associated factors in the most disadvantaged Dalit community of Nepal. We found that the health facility delivery among Dalit was very low (30%), despite our setting being plain areas of Nepal where easier access to roads and transport is possible. The reasons for low health facility delivery were: mothers did not feel necessary, far distance, unavailability of transport and associated cost of institutional delivery. In the same way, few previous studies from Nepal and other countries have found similar reasons for not going for facility deliveries [6, 8, 14, 21]. Two important findings of this study were the association of the birth preparedness and attending four or more antenatal care visit to facilities delivery. Birth preparedness counselling and services are parts of antenatal care services in Nepal [14]. Such preparation gives mothers an opportunity to speak to health workers or health volunteers, be more prepared to take themselves to health facilities when necessary, and also a sense of connection with health facilities over the period of four or more visits and birth preparedness counselling. Studies from the Kaski district of Nepal, further analysis from NDHS 2011 and a study in South East Ethiopia showed that birth preparedness was a major determinant of institutional delivery [22–24]. Our findings, association of ANC visits with health facility are consistent with previous studies from rural Nepal, Ethiopia, Kenya and Bangladesh [17–19, 24–28]. It has also been hypothesized that attending ANC visits enables mothers to recognize their needs to deliver in health facility critically looking at the dangers that are posed in home deliveries.

Advice from health workers and health volunteers has always been crucial in health promotion and maternal health. Indeed it is closely related to having frequent antenatal visits and birth preparedness. We also found that when a mother got advice for obtaining help from skilled birth attendants on delivering in health facilities, she was more likely to deliver in a health facility [17]. As mentioned earlier, ANC is one of the platforms to provide such education. The female community health workers and community outreach clinics are other sources where mothers get advice in their own community. Our findings indeed provide the evidence that these community-level services are still crucial in Nepal’s setting [12].

Mother middle autonomy was significantly associated with health facility delivery whereas highest autonomy was not associated. The reason may be that almost all of the mothers of the highest autonomy were belonging to nuclear family and their husbands had moved to a foreign country or depended on daily wage for their livelihood. This situation makes the mother...
Table 3. Association of socio-cultural, economic, physical accessibility and perceived need factors with health facility delivery.

| Characteristics                        | Crude OR (95% CI) | p-value | Adjusted OR (95% CI) | p-value |
|----------------------------------------|-------------------|---------|----------------------|---------|
| **Caste**                              |                   |         |                      |         |
| Terai Dalit                            | 1                 |         |                      |         |
| Hill Dalit                             | 7.53 (3.33–16.99) | <0.001  | 1.66 (0.33–8.16)     | 0.533   |
| **Mother’s age (Year)**                |                   |         |                      |         |
| ≥ 20                                   | 1                 |         |                      |         |
| < 20                                   | 1.9 (1.09–3.31)   | 0.023   | 1.13 (0.41–3.11)     | 0.813   |
| **Family size**                        |                   |         |                      |         |
| ≥6 member                              | 1                 |         |                      |         |
| <6 members                             | 1.88 (1.13–3.10)  | 0.014   | 2.36 (1.01–5.49)     | 0.047   |
| **Family type**                        |                   |         |                      |         |
| Joint or extended                      | 1                 |         |                      |         |
| Nuclear                                | 0.97 (0.58–1.61)  | 0.901   |                      |         |
| **Mother’s education**                 |                   |         |                      |         |
| No                                     |                   |         |                      |         |
| Yes                                    | 4.43 (2.54–7.69)  | <0.001  | 1.13 (0.48–2.63)     | 0.776   |
| **Husband’s education**                |                   |         |                      |         |
| No                                     |                   |         |                      |         |
| Yes                                    | 3.87 (2.35–6.36)  | <0.001  | 1.82 (0.95–3.47)     | 0.068   |
| **Women autonomy**                     |                   |         |                      |         |
| 1 (Lowest)                             | 1                 |         |                      |         |
| 2 (Middle)                             | 2.77 (1.48–5.15)  | 0.001   | 2.25 (1.03–4.49)     | 0.042   |
| 3 (Highest)                            | 1.25 (0.63–2.46)  | 0.519   | 1.20 (0.43–3.33)     | 0.722   |
| **Health service from traditional healers** |             |         |                      |         |
| Yes                                    |                   |         |                      |         |
| No                                     | 1.38 (0.76–2.49)  | 0.291   |                      |         |
| **Mother’s occupation**                |                   |         |                      |         |
| Daily wage                             | 1                 |         |                      |         |
| Non-daily wage                         | 10.93 (3.33–35.80)| <0.001  | 1.45 (0.32–6.57)     | 0.628   |
| **Husband’s occupation**               |                   |         |                      |         |
| Daily wage                             | 1                 |         |                      |         |
| Non-daily wage                         | 2.89 (1.65–5.07)  | <0.001  | 1.19 (0.51–2.81)     | 0.677   |
| **Wealth status**                      |                   |         |                      |         |
| 1 (Lowest)                             | 1                 |         |                      |         |
| 2 (Middle)                             | 1.82 (0.91–3.62)  | 0.088   | 1.92 (0.78–4.71)     | 0.152   |
| 3 (Highest)                            | 6.02 (3.15–11.53) | <0.001  | 1.91 (0.78–4.67)     | 0.155   |
| **Distance (home to health faculty that prove delivery service)** |             |         |                      |         |
| ≥2 Km                                  | 1                 |         |                      |         |
| < 2 Km                                 | 4.87 (1.88–12.62) | 0.001   | 1.88 (0.52–6.69)     | 0.329   |
| **Availability of motorized transport** |             |         |                      |         |
| No                                     | 1                 |         |                      |         |
| Yes                                    | 2.50 (1.51–4.14)  | <0.001  | 0.63 (0.26–1.55)     | 0.323   |
| **ANC visit frequency**                |                   |         |                      |         |
| <4                                     | 1                 |         |                      |         |
| ≥4                                     | 9.57 (3.48–16.71) | <0.001  | 3.54 (1.82–6.90)     | <0.001  |
| **Perceived good quality of ANC**      |                   |         |                      |         |
| No                                     | 1                 |         |                      |         |

(Continued)
hard to get their companion to go to a health facility when they are in labour pain. In such a scenario, probably a newer construct of autonomy is needed when mothers are all left alone at home but are burdened with the double responsibility of herself and her partner. A finding of rural Nepal showed that women’s highest autonomy was the significant factors for health facility delivery in bivariate analysis but not in multivariate analysis [18]. A study from Ethiopia showed that health facility delivery was increased when the mother could decide on health care spending along with her husband [29]. However, further research might need to explore more reasons for such association.

The mother who has planned their last pregnancy was about three times more likely to have institutional delivery. The study found that wantedness at time of birth increases the odds of having a doctor at delivery by 30% in South Africa while there was no such association in Brazil [30]. In Kenya, the rates of home delivery are increased by 40% when pregnancy is either unwanted or not wanted at that time [31].

### Table 3. (Continued)

| Characteristics                                  | Crude OR (95% CI) | p-value | Adjusted OR (95% CI) | p-value |
|--------------------------------------------------|-------------------|---------|----------------------|---------|
| Yes                                              | 4.56 (2.57–8.08)  | <0.001  | 1.18 (0.53–2.65)     | 0.676   |
| Primiparous                                      | 2.84 (1.67–4.79)  | <0.001  | 1.69 (0.72–4.00)     | 0.226   |
| Advised for health facility delivery             |                   |         |                      |         |
| Yes                                              | 5.97 (3.29–10.83) | <0.001  | 3.96 (2.00–7.86)     | <0.001  |
| Birth preparedness and complication readiness    |                   |         |                      |         |
| Yes                                              | 2.09 (1.27–3.45)  | 0.004   | 0.70 (0.32–1.50)     | 0.367   |
| Association in women group/network               |                   |         |                      |         |
| Yes                                              | 3.31 (1.98–5.50)  | <0.001  | 0.60 (0.28–1.28)     | 0.191   |
| Exposure to maternal health message              |                   |         |                      |         |
| Yes                                              | 3.94 (2.32–6.68)  | <0.001  | 1.60 (0.81–3.18)     | 0.172   |
| Absence of health workers in health facility     |                   |         |                      |         |
| Yes                                              | 2.74 (1.52–4.93)  | 0.001   | 1.21 (0.53–2.72)     | 0.641   |
| Perceived discriminatory behaviour of health workers |                 |         |                      |         |
| Yes                                              | 3 (1.72–5.23)     | <0.001  | 1.46 (0.71–3.01)     | 0.295   |
| Visit with female community health volunteer     |                   |         |                      |         |
| Yes                                              | 4.15 (1.90–9.05)  | <0.001  | 0.77 (0.25–2.33)     | 0.652   |

https://doi.org/10.1371/journal.pone.0217337.t003
This study is one of the few studies which report from the plain terrain of southern Nepal and covering the entire district. To best of authors’ knowledge, this is the first study on the most vulnerable and disadvantaged ethnic groups of Nepal (Dalit). The findings from this study could be useful in designing focused programs for such disadvantaged community. Increasing incentive to transportation and providing all the costs of maternal health services, including medicines may help families to overcome financially associated under utilization. The current findings also indicate the need for a maternal health program that is more precisely directed to vulnerable communities instead of current blanket approach intervention. However, many limitations have to be considered while interpreting the findings from this study. This study included only one district; therefore, its generality to the entire country is limited. While the study setting and the population is unique, the cross-sectional nature of the study lacks a temporal relationship. Mothers may have been more likely to report socially desirable behaviours instead of actual practices related to maternal health due to the use of local enumerators. Further, we did not explore the roles of husbands and other family members, which may influence the mother to have delivery in a health facility.

Conclusion

Despite having free delivery services and financial incentive for transportation, less than one third (30%) Dalit mothers had institutional delivery in Mahottari. The common reasons for non-institutional delivery were that mother did not feel necessary of institutional delivery, too far distance, lack of transportation and the associated cost to delivery service. Further, more than fifty percentages mother (58%) had no birth preparation and complication readiness at all. This study identified that birth preparedness, ANC visit frequency and planning of pregnancy were the most important factors associated with health facility delivery. Proper counseling to mother about institutional delivery is instrumental and can be provided during ANC visit or when mother visits a health facility. Public health programs should also include such components which improve the mother’s autonomy within and around family and empower the mother to negotiate with husband and/or family to have planned pregnancy. Future studies should focus on exploring the innovative approach to increase such service uptake in highly disadvantaged groups.

Supporting information

S1 File. S1 File is the supporting data of findings.
(SAV)

Acknowledgments

We would like to acknowledge professor Rajendra Raj Wagle, Professor Ritu Prasad Gartoulla, lecture Ramesh Sigdel, Assistant professor Bishnu Chaulagai of Department of Community Medicine and Public Health, Maharajgunj Medical Campus for their support and expert suggestion throughout the research. We also thank all the study participants for their cooperation in providing the necessary information and data collectors for their devotion and quality work.

Author Contributions

Conceptualization: Surendra Prasad Chaurasiya, Nilesh Kumar Pravana, Dhiraj Giri.

Data curation: Surendra Prasad Chaurasiya.
Formal analysis: Surendra Prasad Chaurasiya, Nilesh Kumar Pravana, Dhiraj Giri.

Investigation: Surendra Prasad Chaurasiya.

Methodology: Surendra Prasad Chaurasiya, Nilesh Kumar Pravana, Vishnu Khanal, Dhiraj Giri.

Resources: Surendra Prasad Chaurasiya.

Software: Surendra Prasad Chaurasiya, Dhiraj Giri.

Supervision: Surendra Prasad Chaurasiya.

Validation: Surendra Prasad Chaurasiya.

Visualization: Surendra Prasad Chaurasiya, Vishnu Khanal.

Writing – original draft: Surendra Prasad Chaurasiya.

Writing – review & editing: Surendra Prasad Chaurasiya, Nilesh Kumar Pravana, Vishnu Khanal, Dhiraj Giri.

References

1. Campbell O.M. and Graham W.J., Strategies for reducing maternal mortality: getting on with what works. The Lancet, 2006: 368(9543): p. 1284–1299.

2. World Health Organization, Trends in Maternal Mortality: 1990 to 2013. 2014, Geneva: WHO, UNICEF, UNFPA, World Bank and UN.

3. Government of Nepal, N.P.C., Nepal Millennium Development Goals Progress Report, 2013, GoN, National Planning Commission, United Nations Country Team Nepal: Kathmandu Nepal.

4. Ministry of Health and Population Government of Nepal, Nepal health sector programme-implementation Plan-II 2010–2015. 2010, Ministry of Health and Population Nepal: Kathmandu Nepal.

5. Ties Boerma C.M., Carla AbouZahr, Somnath Chatterji, Daniel Hogan and Gretchen Stevens, Health in 2015: from MDGs Millennium Development Goals to SDGs, Sustainable Development Goals. 2015: Geneva.

6. Ministry of Health and Population, Nepal Demographic and Health Survey 2011, Ministry of Health and Population, New ERA, and ICF International Calverton, Maryland, USA: Kathmandu, Nepal.

7. Anjushree Pradhan and P.G. Prakash Dev Pant, Trends in Demographic and Reproductive Health Indicators in Nepal. 2007, New ERA, Macro International Inc.: Calverton, Maryland.

8. Pradhan Ajit, et al., Nepal Maternal Mortality and Morbidity Study 2008/2009. 2010, Ministry of Health and Population Department of Health Services Family Health Division: Kathmandu, Nepal.

9. Jhabindra Prasad Pandey M.R.D., Sujan Karki, Pradeep Poudel and Meeta Sainju Pradhan, Maternal and Child Health in Nepal: The Effects of Caste, Ethnicity, and Regional Identity: Further analysis of the 2011 Nepal Demographic and Health Survey. 2013, Nepal Ministry of Health and Population, New ERA, and ICF International Calverton, Maryland, USA: Kathmandu Nepal.

10. RTI International, Equity Analysis of Health Care Utilization and Outcomes. 2008, Ministry of Health and Population Government of Nepal, RTI International.

11. Government of Nepal, et al., District Health Office Mahottari District Annual Report. 2011/2012: Jaleshwor Mahottari.

12. Ministry of Health and Population, Annual Report of Department of Health Services (DoHS). 2011/2012, Ministry of Health and Population: Kathmandu Nepal.

13. http://cbs.gov.np/image/data/Population/National%20Report/National%20Report.pdf.

14. Government of Nepal Ministry of Health and Population, D.o.H.S., Family Health Division, National Safe Motherhood and Newborn Health Long Term Plan (NSMNH-LTP) 2006–2017. 2006: Kathmandu Nepal.

15. Khanal V., et al., Factors associated with non-utilisation of health service for childbirth in Timor-Leste: evidence from the 2009–2010 Demographic and Health Survey. BMC International Health and Human Rights, 2014. 14(1): p. 14.

16. Karkee R., Lee A.H., and Binns C.W., Why women do not utilize maternity services in Nepal: a literature review. 2013.
17. Gabrysch S.C., Oona M. R., *Still too far to walk: Literature review of the determinants of delivery service use*. BMC Pregnancy and Childbirth, 2009. 9(1): p. 34.

18. Sudesh Raj Sharma A.K.P., Bharat Mani Devkota and Sarswoti Singh, *Factors associated with place of delivery in rural Nepal*. 2014.

19. Choulagai B., et al., *Barriers to using skilled birth attendants’ services in mid-and far-western Nepal: a cross-sectional study*. BMC International Health and Human Rights, 2013. 13(1): p. 49.

20. Daniel W.W., *Biostatistic A foundation for Analysis in the Health Science*. 2005.

21. Dahal R.K., *Factors Influencing the Choice of Place of Delivery among Women in Eastern Rural Nepal*. International Journal of Maternal and Child Health, 2013. 1(2): p. 30.

22. Karkee R., Lee A.H., and Binns C.W., *Birth preparedness and skilled attendance at birth in Nepal: implications for achieving millennium development goal 5*. Midwifery, 2013. 29(10): p. 1206–1210. https://doi.org/10.1016/j.midw.2013.06.002 PMID: 23751594

23. Karkee R., Lee A.H., and Khanal V., *Need factors for utilisation of institutional delivery services in Nepal: an analysis from Nepal Demographic and Health Survey, 2011*. BMJ Open, 2014. 4(3): p. e004372. https://doi.org/10.1136/bmjopen-2013-004372 PMID: 24650803

24. Belda S.S. and Gebremariam M.B., *Birth preparedness, complication readiness and other determinants of place of delivery among mothers in Goba District, Bale Zone, South East Ethiopia*. BMC Pregnancy and Childbirth, 2016. 16(1): p. 1.

25. Dhakal Sulochana, E.v.T., Edwin Amairaj Raja, and Keshar Bahadur Dhakal, *Skilled Care at Birth among Rural Women in Nepal: Practice and Challenges*. 2011.

26. Anwar I., *Inequity in maternal health-care services: evidence from home-based skilled-birth-attendant programmes in Bangladesh*. Bulletin of the World Health Organization, 2008. 86(4): p. 252–259. https://doi.org/10.2471/BLT.07.042754 PMID: 18438513

27. Feyissa T.R. and Genemo G.A., *Determinants of Institutional Delivery among Childbearing Age Women in Western Ethiopia, 2013: Unmatched Case Control Study*. PLoS One, 2014. 9(5): p. e97194. https://doi.org/10.1371/journal.pone.0097194 PMID: 24810609

28. Kitui J., Lewis S., and Davey G., *Factors influencing place of delivery for women in Kenya: an analysis of the Kenya demographic and health survey, 2008/2009*. BMC Pregnancy Childbirth, 2013. 13: p. 40.

29. Tarekegn S., Lieberman L., and Giedraitis V., *Determinants of maternal health service utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey*. BMC Pregnancy and Childbirth, 2014. 14(1): p. 161.

30. Burgard S., *Race and pregnancy-related care in Brazil and South Africa*. Soc Sci Med, 2004. 59(6): p. 1127–46. https://doi.org/10.1016/j.socscimed.2004.01.006 PMID: 15210086

31. Magadi M., Diamond I., and Rodrigues R.N., *The determinants of delivery care in Kenya*. Soc Biol, 2000. 47(3–4): p. 164–88. PMID: 12055693