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Research article

Socioeconomic and physical distance to the maternity hospital as predictors for place of delivery: an observation study from Nepal

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Abstract

Background: Although the debate on the safety and women's right of choice to a home delivery vs. hospital delivery continues in the developed countries, an undesirable outcome of home delivery, such as high maternal and perinatal mortality, is documented in developing countries. The objective was to study whether socio-economic factors, distance to maternity hospital, ethnicity, type and size of family, obstetric history and antenatal care received in present pregnancy affected the choice between home and hospital delivery in a developing country.

Methods: This cross-sectional study was done during June, 2001 to January 2002 in an administratively and geographically well-defined territory with a population of 88,547, stretching from urban to adjacent rural part of Kathmandu and Dhading Districts of Nepal with maximum of 5 hrs of distance from Maternity hospital. There were no intermediate level of private or government hospital or maternity homes in the study area. Interviews were carried out on 308 women who delivered within 45 days of the date of the interview with a pre-tested structured questionnaire.

Results: A distance of more than one hour to the maternity hospital (OR = 7.9), low amenity score status (OR = 4.4), low education (OR = 2.9), multi-parity (OR = 2.4), and not seeking antenatal care in the present pregnancy (OR = 4.6) were statistically significantly associated with an increased risk of home delivery. Ethnicity, obstetric history, age of mother, ritual observance of menarche, type and size of family and who is head of household were not statistically significantly associated with the place of delivery.

Conclusions: The socio-economic standing of the household was a stronger predictor of place of delivery compared to ethnicity, the internal family structure such as type and size of family, head of household, or observation of ritual days by the mother of an important event like menarche. The results suggested that mothers, who were in the low-socio-economic scale, delivered at home more frequently in a developing country like Nepal.

Background

The high level of maternal mortality in developing countries has been attributed partly to the non-availability of services, and partly to the poor utilisation of these services when they are available. The immediate medical causes of maternal deaths are similar for women all over the world: postpartum haemorrhage, infection, toxaemia, obstructed labour and septic abortions. However, these diagnostic categories conceal the underlying mechanisms and reasons for the deaths: the unavailability and inaccessibility of qualified health care; and the logistic problems of providing emergency obstetric care where and when it is needed [1]. Access to quality care during pregnancy and especially at delivery seems to be the crucial factor in explaining the disparity in maternal mortality and morbidity between the developing and the industrialised world. An estimated 90% of maternal deaths could be avoided, if adequate care was provided [2]. Childbirth is a risk-producing event, and timely and adequate medical care for women who experience obstetric complications is an option for mitigating the risk. This has been well illustrated in a historical case of a religious sect in the U.S., whose female members refuse to utilise modern obstetric care. Although socioeconomically privileged compared to the women in developing countries, this group experiences a maternal mortality rate similar to that of developing countries, 872/100,000 live births [3].

In Nepal, maternal mortality is high with quoted figures ranging from 515–1500/100,000 live births, and the need for treatment of women with obstetric complications is inadequately met [4]. In rural districts, the proportion of institutional deliveries is as low as 4% [5]. Even in urban Kathmandu, a significant proportion of women, approximately 19 %, still deliver at home despite supposedly accessible institutional maternity services [6,7]. The mode of organisation of obstetric services, where a woman is to give birth and who should attend a normal delivery is still debated, and the lessons to be learned by developing countries from the history of industrialised west is being scrutinised and explored [8]. Regarding the official national health policy in respect to place of delivery in Nepal is outlined in His Majesty's Government of Nepal, Safe Motherhood Policy, 1998 [9]. It is stated in the document that Ministry of Health will expand and improve maternity care services through the existing Primary Health Care networks and will emphasize the role of female health care providers with midwifery training, and ensuring that emergency obstetric services are available where and when needed, ensuring the provision of maternity care at the community level as close to the peoples homes as possible. Targets were set so that it could be ensured at least 50% of all deliveries are attended by trained health workers by the year 2000.

Although the debate on the safety and women's right of choice to a home delivery vs. hospital delivery continues in the developed countries, an undesirable outcome of home delivery, such as high maternal and perinatal mortality, is documented in developing countries [10,11]. A study in Tanzania showed that in home births conducted without a trained attendant, the perinatal mortality was three times higher than that for hospital or dispensary births with trained attendants [12]. In Papua New Guinea, a high rate of obstetric complications was found amongst seemingly normal pregnancies delivering at home [13]. The Dutch system is an exception to the rule in the developed countries, as it is still based on the idea that women with low-risk pregnancies are free to choose where to give birth to their children. And in 1991, 35% of all Dutch babies were born at home [14]. Dutch perinatal mortality statistics are comparable with that in the Scandinavian countries, and are uninfluenced by the relatively high proportion of home deliveries [15]. In a Norwegian study, it was reported that the safety of low-risk women while delivering in small maternity clinics run by midwives with a general practitioner as the formal leader, was unquestionable and that a decentralised birth organisation should be offered to a low-risk population is more a question of politics, than a medical problem [16]. At the same time, in the U.S., where automobiles and highways are plentiful, it has been shown that geographical inaccessibility to obstetric care is associated with more frequent negative pregnancy outcomes. Women who live in communities with poor access to antenatal and obstetric services are likely to bear infants who are premature and have prolonged hospitalisations with higher costs or both [17].

A review on concepts, operational definitions and measurement of place of residence as an exposure measure for general health effects conclude that conflicting evidence about the extent and magnitude of place effects on general health may be due to differing conceptualisations and operationalisations [18]. In relation to maternity care, place of delivery can be conceived as an exposure measure of maternal morbidity and mortality, or as an outcome measure itself also determined by different socio-economic variables. The place of delivery and its determinants have been on the research agenda for a long time [19,20]. Elo in 1992 found quantitatively important and statistically reliable estimates of the positive effect of maternal schooling on the use of prenatal care and delivery assistance. In addition, large discrepancies were found in the utilisation of maternal health-care services by place of residence [21]. Bolam et al. (1998) have reported that multiparity and lower maternal education are associated with home delivery [6]. In rural Nigeria, maternal education and occupation, religion, and occupation of the husband are found to be most consistently associated with the use of health institutions for delivery – at the same

time maternal age, parity, and marital status and place of the residence are not significantly associated [22]. In a Ugandan study, it was shown that access to maternity services is one of the influencing factors in choice of delivery site [23]. In most of these studies, low socio-economic status of the women measured by different variables individually, or by combining information from several variables is implicated as being a predictor for home delivery. A review of the literature reminds us that there is no consensus on the definition of socio-economic status and there are longstanding debates on its measurement [24-26]. Composite measure of education, income and occupation is classically used in Great Britain as a constructed variable of social class for studying general health issues. A household social class measure is proposed to serve as a better predictor of reproductive outcomes and economic level, than does individual social class standing [27]. The distance to the maternity hospital has been reported to be more important in maternity care than other general curative health services [20].

Part of maternal mortality and morbidity in developing countries caused by different socio-economic factors is mediated through the place of delivery. It is important to identify the risk factors, which lead either to home or hospital delivery. Hence we are reporting the effect of socio-economic factors, ethnicity, distance from maternity hospital, family structure, obstetric history, and antenatal care received during the present pregnancy in a developing country like Nepal on the choice between home and hospital deliveries.

Methods
A cross-sectional study was done from June 2001 to January 2002 in an administratively and geographically defined territory with total population of 88,547 [28]. This area included Kathmandu municipality Ward no 14 and adjacent 8 Village Development Committees (VDCs), Seuchatar, Sitapaila, Ramkot and Dahachok in Kathmandu District and Chatredeurali, Jivanpur, Kebalpur and Goganpani in Dhading District. The farthest border of Dhading VDCs was 5 hours distance from maternity hospital in Kathmandu. The territory was purposefully chosen so that the well-defined study area stretched continuously from inside to outside, but nearby of Kathmandu valley and both home and hospital delivery could be expected in the area.

Study population and inclusion criteria
The targeted municipal and village territories were visited by the researchers before data collection and cooperation from Female Community Health Volunteers (FCHVs) and community leaders were solicited. A house-to-house visit was done to locate all eligible women. Formal mapping was not done, as locating eligible women and data collec-

tion was done at the same time. We moved from one part of study area to another until data collection was completed from the whole area. During the six months period the principal researcher was absent from the research area only during some weekends and major festivals. The target population for this study was women who resided in the study area and had delivered within 45 days on the date of contact. Delivery was defined as giving birth after 28 weeks of pregnancy from last menstrual period, so women having stillbirths, perinatal and neonatal deaths were included. Regarding maternal deaths no recent maternal deaths (among eligible women) was either encountered by researchers or reported by community members. With a population of 88,547, and a national average of 45% of female population in the reproductive age group between 15–45 years, and a total fertility rate per woman of 5.2, we expected pregnancies in the study area in 45 days to be approximately 419. Based on the national crude birth rate of 41.4/1000 one would expect 453 live births in the study area per 45 days recall period. The actual identified population who met inclusion criteria totalled 311. Among these women, 2 eligible mothers refused to participate in the study and one eligible mother had left the area. Thus the study population constituted 308 mothers.

Data collection instruments
A questionnaire was developed to collect information about socio-economic status, distance from maternity hospital, family structure, obstetric history, and use of antenatal care and place of delivery. The questionnaire was pre-tested on 10 non-participating mothers outside the study area with similarities on ethnic and language background and was modified accordingly. Both translation to Nepali and back translation to English were done and supervised by people with research and medical backgrounds. Amenity score status as a proxy for socio-economic status was constructed using 6 variables: type of latrine, fuel used for cooking and having a radio, television, video-deck or telephone in the household. Antenatal care was defined as the women having attended either government (including both sub-healthpost/ healthpost or hospitals) or private institutions during the pregnancy, and having received at least two doses of tetanus injections.

Information about the last and previous pregnancies was documented by asking if the women had any miscarriage, still-birth in the last pregnancy or whether live-born child had died within 5 yrs of birth from all previous pregnancies. Based on this information a composite measure of obstetric history was developed and classified dichotomously if the women had experience of any of the above-mentioned events.

Ethnicity was recorded by an open-ended question and was classified after data were available. It was classified in 3 categories Brahmin, Chetri and Newar; Tamang and Magar; and professional caste groups with remaining minorities. In Nepal, there is a tradition of ritual observance of the days of menarche, which entails not being in contact with common household water in this time period. This practice varies between the different ethnic groups, and urban and rural populations and may serve as a risk indicator for different cultural and social factors. Practice of the ritual by the mother was recorded for the main component as not being in contact with common household water for days. The duration of the marriage was recorded as the length of the marriage. The type of family was recorded as joint if two related families lived together, and extended if more than two related families lived in the one household. The head of household as defined by the woman could be any person i.e. husband, father-in-law, mother-in-law, mother herself or others in the family. The distance to the maternity hospitals with facilities for caesarean section was calculated, by the time taken to reach these facilities from the mother's residence, and not in kilometres. In the study area, there were no intermediate level of maternity clinics or maternity homes where the women could go and give birth. All the VDCs had either a health post or a sub-health post and one VDC had a primary health care centre which officially has a provision for staffing of a doctor. However, during our data collection period, the position was not filled. The municipal ward also had a municipality-run health facility led by health assistant. All these facilities ran antenatal care for pregnant women though of different quality and women in urban and periurban area also visited private doctors for antenatal care. All institutional deliveries were defined as hospital delivery and all deliveries at home, even if referred to hospital after deliveries including those deliveries on the way to hospital were defined as home delivery.

Interviews

The principal researcher conducted most of the interviews in the house-to-house survey. A trained female research assistant with health professional background interviewed 11 mothers. If the eligible woman was not at home, or if the time was not convenient for her to be interviewed, the interviewer came back later. The purpose of the study was explained and verbal consent was obtained. All questionnaires were reviewed daily and forms with missing information and visible inconsistencies were completed as soon as possible by revisiting the mother for clarification.

Statistical analysis

Bivariate and multivariate analysis was done using SPSS 10.0 statistical software. Categorical variables with three or more levels were converted into two dummy variables. The results are presented in terms of prevalence proportion ratios (PPR) for home delivery in a bivariate analysis, and crude and adjusted odds ratio in multivariate analyses. All factors with significant odds ratio ($p < 0.05$) of home delivery in the bivariate analysis were included in the multivariate analysis in a logistic regression. Both forward selection and backward elimination were used to exclude non-significant risk factors. In order to study interrelation among the determinants, a correlation matrix was formed.

Results

The number of mothers giving birth either at home or in hospital were almost equal. 91% of women delivering at home were attended only by relatives and 7% by assistant nurse midwifes of one year nursing training after school education or other paramedics of same or higher educational level. Information about attendants was missing for 2%. Our study population comprised of mothers of different ethnic background: Chetri 23%, Brahmin 21.4%, Tamang 21.1%, Newar 13%, professional castes 6%, Magar 5.5% and others 10%. Cultural characteristics and prevalence proportion ratios of home delivery are displayed in Table 1. Young age at marriage, late age at menarche, multi-parity, having no antenatal care were all statistically significantly associated with high prevalence proportion of home delivery. Ethnicity was grouped in 3 categories of a) Brahmin, Chetri Newar; b)Tamang, Magar; c) professional castes and others. The groups Tamang/Magar and professional castes had 2.5 (CI 1.5–4.4) and 1.9 (CI 1.0–3.6) times higher risk of delivering at home when compared with Brahmin, Chetri, Newar. Risk of home deliveries in Kathmandu VDC was 2.6 (CI 1.4–4.9) and in Dhading VDC 35 times higher (CI 16.6–76.3) than in Kathmandu municipality. Having an obstetric history of still-birth, or a miscarriage in the last pregnancy or whether a child died within 5 years of birth in previous pregnancies, family structure like type and size of family or who is head of the household or the observation of ritual days by mother under menarche were not statistically significantly associated with the place of delivery.

The proportion of socio-economic, husband and household characteristics and prevalence proportion ratios of home delivery is displayed in Table 2. The lower level of mother's education, mother's occupation other than office work, lower yearly income, lower amenity score status and the long distance to maternity hospital with facilities for caesarean section, are all statistically significantly associated with a higher prevalence proportion of home delivery. The lower the economic status of the mother, the more likely that she would not go into hospital for delivery. The secondary and lower level of the husband's education and occupation other than office work were also

Table 1: Proportion of mother's characteristics, family background and prevalence proportion ratios (PPR) according to home delivery.

Determinants		Place of Delivery		PPR	95%CI
		Home % (N = 152)	Hospital % (N = 156)		
Age of mother					
	>29	21.8	15.5	1.1	0.6–1.4
	19–28	67.8	77.4	1.0	0.5–1.1
	<18	11.2	7.1	1.0	
Age at menarche					
	>15	61.3	45.3	1.4	1.0–1.7
	<14	38.7	54.7	1.0	
Observe days of menarche as ritual					
Observing		81.9	78.6	1.1	0.8–1.5
Not observe		18.1	21.4	1.0	
Age at marriage					
	9–15	22.8	8.1	2.1	1.6–2.9
	16–18	51.0	40.0	1.6	1.2–2.2
	>19	26.2	51.0	1.0	
Type of family					
Nuclear		45.4	37.2	1.3	0.9–1.6
Joint		31.6	33.3	1.1	0.8–1.5
Extended		23.0	29.5	1.0	
Size of family					
	2–5	26.3	30.1	0.9	0.7–1.2
	>6	73.7	69.9	1.0	
Head of household					
Others		41.4	44.8	0.9	0.7–1.2
Husband		58.6	55.2	1.0	
Parity					
	> 5	24.3	7.1	2.3	1.7–2.3
	2–4	48.0	39.1	1.6	1.2–2.1
Primiparous		27.6	58.8	1.0	
Antenatal care					
No		38.9	5.1	2.3	1.9–2.8
Yes		61.1	94.9	1.0	
Obstetric history*					
Yes		23.0	11.5	0.6	0.3–1.2
No		77.0	88.5	1.0	

* Primigravidae (N = 117) had been excluded as they had no stillbirth or dead child.

Table 2: Proportion of socio-economic factors and husband and household characteristics and PPR according to home delivery.

Determinants	Place of delivery		PPR	95%CI
	Home % (N = 152)	Hospital % (N = 156)		
Distance to maternity Hospital				
>3 hrs	21.1	1.9	4.5	3.2–6.3
2–3 hrs	27.0	3.2	4.4	3.1–6.2
61–120 mins	22.4	6.4	3.8	2.7–5.4
31–60 mins	9.2	10.3	2.3	1.4–3.7
Upto 30 mins	20.4	78.2	1.0	
Education of mother				
Illiterate	53.3	22.4	6.6	2.6–16.8
Literate only	13.2	7.7	5.9	2.3–15.6
Primary (up to 5th grade)	21.7	14.7	5.6	2.2–14.5
Secondary(10th grad)	9.2	33.3	2.0	0.7–5.7
College/university	2.6	21.8	1.0	
Occupation of mother				
Agriculture	74.3	14.8	5.1	2.3–11.5
Housewife	22.2	67.8	1.5	0.6–3.5
Officework	3.5	17.4	1.0	

Table 2: Proportion of socio-economic factors and husband and household characteristics and PPR according to home delivery.

Yearly income				
<Rs.24,000	25.0	4.5	5.0	2.3–11.0
Rs.25–48,000	28.9	22.4	3.3	1.5–7.6
Rs.49–100,000	28.3	26.9	3.0	1.3–6.9
Rs.101–200,000	14.5	30.1	1.9	0.8–4.6
>200,000	3.3	16.0	1.0	
Husband's education				
Illiterate	18.5	5.3	6.9	3.4–14.1
Literate only	10.6	4.6	6.2	2.9–13.0
Primary (up to 5th gr)	33.1	14.6	6.2	3.0–12.7
Secondary	33.1	39.1	4.0	2.0–8.4
College/university	4.6	36.4	1.0	
Husband's occupation				
Agriculture	54.6	8.3	4.0	2.8–5.8
Wage earner (urban area)	12.8	7.6	2.9	1.8–4.6
Machine handling (driver)	15.6	22.9	1.9	1.2–3.0
Office work	17.0	61.1	1.0	
Amenity score status				
Low	52.0	5.1	9.6	5.3–17.4
Medium	41.4	33.3	5.8	3.1–10.7
High	6.6	61.5	1.0	

found to be statistically significantly associated with home delivery.

The results of multivariate analysis, namely the risk of home delivery estimated as adjusted odds ratio from logistic regression analysis is displayed in Table 3. Living farther than one hour away is 8 times and low amenity score status was 4 times more likely to lead to home delivery. The mother's education lower than primary, not having antenatal care and multiparity were also associated with a high prevalence proportion of home delivery. The mother's age at marriage, her age at menarche, obstetric history, the husband's education, occupation and yearly income were all excluded from the model as non-significant. Despite high odds ratio in the bivariate analysis, the occupation of the mother was not found to be associated with the place of delivery, when adjusted with the distance from the maternity hospital. It could be due to its high correlation with the distance from the maternity hospital. A correlation matrix was formed to study interrelation among variables. This showed that the amenity score status was highly correlated with the distance to the maternity hospital, the mother's education, and whether antenatal care was received.

Ethnicity (classified in 3 groups) was not statistically significant associated with place of delivery when adjusted with amenity score status. This separate model was constructed to look for effect of ethnicity. Another separate model was constructed to see the association of Kathmandu municipality, Kathmandu VDCs and Dhading VDCs with adjustment on ethnicity and amenity score sta-

tus. After adjustment on ethnicity and amenity score status risk of home delivery in Kathmandu VDCs was twice (CI 1.0–4.3) and in Dhading VDCs 10 times higher than in the Kathmandu municipality.

Discussion

Social factors such as low amenity score, primary and lower education, physical factors, as for example a long distance to the maternity hospital, and obstetric factors as not having antenatal care and multiparity, were all statistically significant associated with an increased risk of home delivery.

A cross-sectional study may have both selection and information bias, which can threaten internal validity. There are 308 mothers in the study population, which is less than the expected 419, but it could be assumed that the number of pregnancies would be lower in the urban and periurban study area than was estimated from the national average. Though we do not have data on total fertility or crude birth-rate specifically for our study area, this mostly urban/periurban area probably have a higher than national average contraceptive prevalence rate. Almost all eligible mothers were at home as they were still on maternity leave (period), and very few mothers refused to participate in the study, so we do not think the results are biased because of selection. With our strivings to locate eligible women by the house to house survey conducted with the cooperation of FCHVs and community leaders, there must be only few, if any, women not included in study population. The proportions of home delivery were higher the farther we went into the rural area: 20% in

Table 3: Risk of home delivery estimated in multivariate analysis: adjusted odds ratio from logistic regression analysis.

Explanatory Variables	Crude OR	95% CI	Final model Adjusted OR*	95% CI
Amenity score				
Low status(+)	22.7	11.0–46.5	4.4	1.8–10.6
Mother's education				
Up to primary (5th grade)(+)	9.1	5.1–16.4	2.9	1.3–6.5
Distance to ma-ternity hospital				
>1 hr(+)	18.2	9.9–33.2	7.9	3.7–16.6
Antenatal care				
No(+)	11.7	5.3–25.7	4.6	1.8–11.4
Parity				
Multiparous(+)	3.0	1.9–4.9	2.4	1.2–4.9

* Adjusted for all the other variables in the final model

Kathmandu Metropolitan, 39% in Kathmandu VDCs and 90% in Dhading VDCs. These proportions were similar to another study from Nepal [6].

In this multiethnic, multilingual population the study was conducted by a male researcher using the native Nepali language. This could compromise the interviews, but all respondents spoke Nepali and if any problems were encountered, information given by the women were always validated by presence and support of family members.

In the study, the outcome measure home or hospital delivery could not be influenced by recall bias. Exposure measures like yearly income could be influenced by selective memory or courtesy, or lack of sharing full information. Special efforts were taken to validate the income measures by introducing visual linear analogue scales and probing for the identification of different circumstances and sources of income. Interviews were conducted at the mother's place of residence and confidentiality was assured. If any misclassification had occurred, it would have been in both groups and of a non-differential nature.

External validity and representativeness of our study may mainly be applied to similar urban/periurban area and population having maternity hospital within the distance of median two hours and maximum range of five hours and having health posts and primary health care facilities for providing antenatal care.

Low socio-economic status has been found as a predictor for place of delivery. Other studies also have implicated different socio-economic factors as determinants of place of delivery. In a Nigerian study, 41% of the mothers who did not deliver in hospital explained that they could not afford the hospital bill, and 31% said they had inadequate transportation possibilities [29]. In an economic study from the Philippines, it was reported that the elasticity

coefficient suggests that a 1 percent decrease in the mean travel time to modern public facilities will increase the probability of choosing that option for infant delivery by 1.2 percent [30]. These studies are in agreement with our study. Even then while interpreting the meaning and implication of these findings, we face arguments that advise cautiousness [31,32].

We have studied the distance to the maternity hospital as having a causal role for place of delivery. Long distance from the maternity hospital was found to be significantly associated with home delivery and a linear trend could be seen. As we had, somehow, three distinct population from Kathmandu municipality, Kathmandu VDCs and Dhading VDCs; effect of this classification as an effect modifier would be worth analysing. But a common classification of distance, at whatever level either 15 minutes, half an hour or 1 hour done, resulted in absence or low number of either home deliveries in Kathmandu municipality or hospital deliveries in Dhading VDCs. These results were seen though the extreme point of Dhading VDCs were only 5 hrs far, with median 2 hrs distance for whole study population. If we had chosen a study population which included persons from farther area, we expect that distance would have even greater effect on place of delivery. In Kenya, the most significant predictors of choosing home delivery (an informal delivery setting) are the distance from the household to the nearest maternity bed [20]. Le Bacq, & Rietsema reported that hospital delivery in Kasama, Zambia seemed generally to be possible only for mothers living within walking distance of that institution, and that a dose-response relationship between distance and maternal mortality existed [33]. By inquiring about resources and stress, Yantzi, Rosenberg, Burke, & Harrison studied the impacts of the distance to the hospital on families with a child suffering from a chronic medical condition [34]. They reported that the families who had to travel more than 80 km to the hospital were 194% more likely to be negatively impacted by the hospitalisa-

tion compared to families who lived less than 80 km from the hospital. Noorali, Luby, & Rahbar, chose the distance in kilometres rather than travel time as an indicator of physical accessibility [35]. The reason given was the subjectivity involved in measuring travel time, particularly in a rural area where the mothers are not accustomed to using watches. In our study, we chose travel time instead of distance in kilometres to define the physical distance as we think this as a more relevant way of measuring distance. We enquired about both the transport time on foot and when using various forms of transportation, and summed up later to define the physical distance. In cases of infant delivery, the actual time needed to travel is more crucial than the distance in kilometres.

Mothers who did not seek antenatal care during pregnancy were 4.5 times more likely to choose delivery at home. Antenatal care attendance in our study was higher than national average (Table 1). How the women not attending antenatal care in other than our study area would behave in relation to choice of place of delivery is only matter of speculation. But not seeking antenatal care during pregnancy may be conceived as a marker of social distance of the mother from modern maternity care [36,37]. In relation to influence on representativeness due to high antenatal care attendance, we can only say positively that our results could not be influenced in any way by presence of women not attending antenatal care in our study population. Multiparity was associated with a double risk of home delivery. Similar finding has also been reported in another study from Nepal [6]. Unfortunate experiences in hospital, quicker childbirth in the multiparous or having had an uncomplicated first delivery might explain why some of the multiparous deliver at home. Bad obstetric history was not associated with a risk of home delivery, it could be explained in a way that as a typical example of confounding by indication that mothers with bad obstetric history would choose hospital delivery so that risk of home delivery is low but not sufficient to produce higher risk of hospital delivery.

The risk for home delivery among the poorly educated was lower than for other identified risk factors except parity. This suggests education of mother is not the sole predictor of the place of delivery, and hence other mechanisms or causal pathways for predicting the place of delivery have also to be entertained. Low education was not associated with a high risk of home delivery within low amenity score stratum. Education was 8 times more influential only within the high amenity score stratum. The prevalence proportion ratio of home delivery among the illiterate and 'literate only' in the lower amenity score stratum were 2.5 (CI = 1.3–4.6) times higher than the illiterate and 'literate only' group in the higher amenity score stratum, when each group was compared to a primary and higher education group among the higher amenity score stratum as a reference group (Table 4). Overall, this suggested that socio-economic status (measured by the amenity score status) is a more important causal factor than low education. Elo demonstrated the importance of the region of residence as a proxy for socio-economic status combined with maternal education, when determining the use of maternal health service [21]. In the multivariate analysis, the occupation of mother was not found to be significantly associated with the place of delivery. This could be due to the correlation of the mother's occupation with the distance from the maternity hospital. The mother's age at marriage, her age at menarche, and observance of the menarche ritual, type and size of family, and who is head of household are not significantly associated with the place of delivery. These cultural characteristics may not serve as risk indicators for the place of delivery, although we had hypothesised that they could serve as risk indicators for low social status. The lack of any role of these factors may be explained by the organisation of maternity care rather than these cultural characteristics having a decisive influential role in predicting the place of delivery.

Table 4: Stratification of amenity score status by education, and PPR according to home delivery.

Risk factors		Place of delivery		PPR	95%CI
		Home (N = 152)	Hospital (N = 156)		
Amenity score	**Education**				
Low status	Illiterate+literate	94	31	20.8	6.8–63.5
	Primary+higher	48	29	17.2	5.6–53.1
High status	Illiterate+literate	7	16	8.4	2.4–30.0
	Primary+higher	3	80	1.0	

X^2 – trend 108.3, p < 0.01

The findings are similar in many developing countries although we can see the opposite in developed countries like The Netherlands [38]. The Dutch researchers reported that compared to the higher socio-economic status group, there was an increased risk of hospital delivery in the lower socio-economic group in the Netherlands. This is just opposite to our findings, though it can be easily appreciated that home deliveries in Nepal are in no way comparable to Dutch home deliveries with a trained midwife and immediate access to emergency transport. But the point is; given the alternative organisation of maternity health care, socio-economic status of women determinants leading to home deliveries can be opposite than that of Nepalese women. In our opinion, to comprehend delivery care organisation and the determinants for place of delivery, the Dutch experience can be a point of reference and not a contradiction, although it may seem so in light of our results at its face value. In developed countries, women may prefer to give birth at home for dimensions of experience unavailable in hospital. Indeed, it was reported from New Zealand, that mothers who choose a home delivery do so for reasons of control, continuity and the familiarity of home [39].

Conclusions

Relevance of our findings to overall maternity health care policy context is not straightforward and the extensive literature review regarding place of delivery and its determinants we did in the background was intended for the purpose of showing dichotomy of hospital and home delivery as an important research issue. Our intention was to elevate the status of home delivery as a phenomenon on equal footing to hospital delivery, because there is every possibility that home delivery will continue in Nepal for a long time to come. Though it is agreed, skilled delivery attendance is of crucial importance rather than hospital delivery per se. When home delivery will have its rightful place in regard to where a mother should give birth to a child, expanding skilled delivery attendance outside hospitals will be the crucial question and challenge. In our study, we found that 91% home deliveries were attended by relatives at best having only own experience of childbirth, and only 7% by intermediate level health professionals. The literature on process indicators will be of special and high importance in this context and can guide us when we specifically look for answers how barriers to attaining maternal health during childbirth could be removed. This could possibly be done by incorporating a qualitative approach in our research endeavours.

In a developing country like Nepal, parity and the education level of mothers play a small, but significant role in determining the place of delivery. Economic variables like amenity score status and the distance from the maternity hospital are major causal components for choosing the place of delivery, while cultural characteristics like ethnicity, the observance of the menarche ritual-days and the type and size of the family, or who is head of household or obstetric history have little influence or are not risk indicators for the place of delivery. We therefore conclude that the mothers and families, in order to arrive at 'reasoned decision-making' as postulated by Donovan & Blake (1992), may constantly be thinking of the burden of their decision on the family of whether to attend hospital for delivery [40]. Thus low socio-economic status and the long physical distance of more than one hour to the maternity hospital acted as barriers to hospital delivery. The physical distance from the maternity hospital along with the education of the mother and the amenity score status of the family might serve as indicators of socio-economic status in a developing country like Nepal, at least while looking for socio-economic status and maternity care.

Competing interests

None declared.

Authors' contributions

All authors took part in study design and questionnaire development.

RRW carried out data collection and data entry.

BBN supervised data collection.

SS supervised data entry.

All authors took part in data analysis and manuscript writing and read and approved the final manuscript.

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