BMJ Open

Who are dying and why? A case series study of maternal deaths in Nepal

Rajendra Karkee ,[1] Kirti Man Tumbahangphe,[2] Nashna Maharjan,[2] Bharat Budhathoki,[2] Dharma Manandhar[2]

To cite: Karkee R, Tumbahangphe KM, Maharjan N, *et al*. Who are dying and why? A case series study of maternal deaths in Nepal. *BMJ Open* 2021;**11**:e042840. doi:10.1136/bmjopen-2020-042840

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2020-042840).

Received 16 July 2020
Revised 26 April 2021
Accepted 29 April 2021

[1]School of Public Health and Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal
[2]Mother and Infant Research Activities, Kathmandu, Nepal

Correspondence to
Dr Rajendra Karkee; rkarkee@gmail.com

ABSTRACT

Objectives To identify delays and associated factors for maternal deaths in Nepal.

Design A cross-sectional case series study of maternal deaths. An integrated verbal and social autopsy tool was used to collect quantitative and qualitative information regarding three delays. We recorded death accounts and conducted social autopsy by means of community Focus Group Discussions for each maternal death; and analysed data by framework analysis.

Setting Sixty-two maternal deaths in six districts in three provinces of Nepal.

Results Nearly half of the deceased women (45.2%) were primiparous and one-third had no formal education. About 40% were from Terai/Madhesi and 30.6% from lower caste. The most common place of death was private hospitals (41.9%), followed by public hospitals (29.1%). Nearly three-fourth cases were referred to higher health facilities and median time (IQR) of stay at the lower health facility was 120 (60–180) hours. Nearly half of deaths (43.5%) were attributable to more than one delay while first and third delay each contributed equally (25.8%). Lack of perceived need; perceived cost and low status; traditional beliefs and practices; physically inaccessible facilities and lack of service readiness and quality care were important factors in maternal deaths.

Conclusions The first and third delays were the equal contributors of maternal deaths. Interventions related to birth preparedness, economic support and family planning need to be focused on poor and marginalised communities. Community management of quick transportation, early diagnosis of pregnancy risks, accommodation facilities near the referral hospitals and dedicated skilled manpower with adequate medicines, equipment and blood supplies in referral hospitals are needed for further reduction of maternal deaths in Nepal.

Strengths and limitations of this study

- Social autopsy of maternal death is an innovative approach that explores physical, environmental, cultural and social factors contributing to maternal death through community discussions of the event.
- This study used an integrated verbal and social autopsy tool to triangulate quantitative and qualitative information regarding three delays of maternal deaths.
- Qualitative data were analysed by standard framework analysis based on the three delays framework.
- This study relied on self-reported information only from the demand sides (relatives, neighbours and community leaders).

INTRODUCTION

Maternal health continues to be an important global concern. It was in the fourth Millennium Development Goal and, it is again included in the Sustainable Development Goal No. 3 with the target of reduction of maternal mortality to <70 per 100 000 live births.[1] Ending preventable maternal and perinatal deaths while ensuring health and well-being and enabling environments are the main priorities for the United Nations' Sustainable Development Goals and Global Strategy for Women's, Children's and Adolescent's Health (2016–2030).[2] Countries have made varied progress during the Millennium Development era. Nepal made a significant progress in reduction of maternal mortality by >50% from 901 to 258 per 100 000 live births from 1990 to 2015.[3] The progress in Nepal has been linked to efforts and promotional activities of safe motherhood programmes such as Birth Preparedness and Complication Readiness, and Maternity Incentive Schemes, with substantial international support, mainly by United States Agency for International Development and Department for International Development. However, progress after 2015 appeared stagnant as indicated by latest Nepal Demographic and Health Survey carried out in 2016.[4]

Nepal is working hard to further reduce maternal mortality. In general, four groups of factors—social, cultural, economic and health system—are important in the reduction of maternal mortality. Considering the Nepal's varied geography, ethnicity, culture and unequal health infrastructure, the role and importance of these factors varies. Factors can range from distal such as cultural and community awareness to more proximal such as quality-related health system factors.[5] Social autopsy of maternal death is an innovative approach that explores physical,

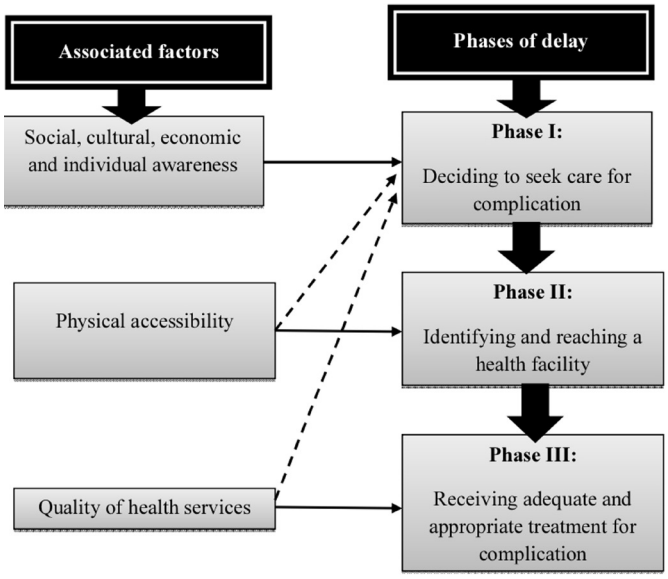

Figure 1 The 'three delays framework' for utilisation of institutional delivery services and maternal mortality. Adapted from Thaddeus and Maine.[7]

environmental, cultural and social factors contributing to maternal death through community discussions of the event. It explores the unique story behind the death from community perspectives and is well accepted in community settings.[6]

The three delays framework is widely used to analyse these factors in terms of 'delays' (figure 1). The three consecutive delays of maternal mortality are: first delay to decide to seek care (ie, associated social, cultural, economic and individual awareness); the second delay to reach a health facility (ie, the geography and distance) and the third delay to receive the care after reaching a health facility (ie, quality services).[7 8] Although the immediate or medical causes of maternal mortality are haemorrhage, infection, hypertensive disorder and obstructed labour around the time of delivery and presumably in attempted home delivery, the preceding causes can be late decision to seek obstetric care, late arrival in the health facility or late and/or inadequate treatment after arriving in the health facility.[9] Hence, it is important to understand which delay(s) is crucial in maternal death so that an appropriate intervention to that delay can be targeted. The first delays are within the control of individual women and their families but the third delays are not.

There have been several studies in Nepal on the role of delay factors in the utilisation of institutional delivery services, one of the proxy indicators of maternal mortality.[5] However, there has not been much systematic analysis of the cause of maternal deaths themselves from the community perspectives to identify social and individual errors such as community factors, individual behavioural factors and health system factors. If each maternal death is analysed for these errors or delays, important clues and missed opportunities can be identified to further reduce maternal mortality in Nepal. Hence, the aim of this study was to identify the crucial delays and associate factors for maternal deaths so as to suggest missed opportunities for maternal survival in Nepal. Findings are important to inform the health system and safe motherhood programme to concentrate on health system reforms and policy options for maternal survival in Nepal and similar countries.

METHODS

Study area and settings

This study was conducted in six districts (*Parsa, Sarlahi, Banke, Rolpa, Surkhet and Kalikot*) of three provinces of Nepal: province 2, 5 and 6. The provinces had lower proportions of institutional deliveries compared with other provinces of Nepal. Two districts from each province were selected such that one district selected from each province had overall poor health system infrastructure, human development index and utilisation of delivery services compared with corresponding district selected from the same province. The study area comprises both hills and plain with diverse ethnic inhabitants.

Study design and identification of maternal deaths

Within a broader mixed method study designed to understand the factors associated with maternal mortality, this is a cross-sectional case series study of maternal deaths (cases). We aimed to identify maternal deaths that would occur for the period of 6 months and that had occurred in previous 9 months from the start of field work in May, 2019. Maternal deaths that occurred in the last year in the selected districts were traced through several ways. First, available data and information on maternal deaths were obtained from District Health Offices; and next meetings were held in relevant lower health facilities to identify all maternal deaths. The meetings comprised local health official in-charge, members of health facility operation and management committee, female community health volunteers and local community leaders. A list of all reported maternal deaths with addresses was prepared in the meeting. The data collectors visited the reported households with maternal deaths to confirm them as maternal deaths.

A maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[10] All maternal deaths except suicide cases were included for a verbal and social autopsy. We traced 65 maternal deaths, but 3 of them were suicide cases and excluded from the analysis. Out of 62 maternal deaths included, 41 occurred before the start of field work and 21 occurred after the start of field work.

Data collection tool and procedure

We prepared an integrated verbal and social autopsy tool. The tool was synthesised from WHO verbal autopsy questionnaire,[11] the Maternal and Perinatal Death Inquiry and Response Programme in India[12] and Dead Women Talking Initiatives in India.[13] The tool sought quantitative and qualitative information regarding all delays as well as death account and obstetric complications and illness questions (see online supplemental file 1). It included modules on: (i) introductory information and an account of death; (ii) first delay of deciding whether to seek care (demographic, cultural, economic, perceived need of skilled care of the deceased woman and her household); (iii) second delay on reaching a health facility (factors pertaining to costs, distance, road condition and vehicles); (iv) third delay (health system factors and quality of care; (v) reproductive history, time period and probable medical causes of death and (vi) Focus Group Discussions (FGDs) on the crucial delays for death. The tool was pretested with five respondents, who were relatives of maternal deaths not included in this study.

We recruited six data collectors and conducted a workshop on the use of verbal and social autopsy tools together with the status, cause and delay phases of maternal mortality. The data collectors were local from the districts and had previous experiences of working on maternal health survey. A pair of data collectors was sent to each district. They approached the households of maternal deaths. First they conducted structured interview of modules (I) to (V) only with the nearest family member or decision maker (respondent) of the deceased woman.

After finishing the interview, the data collectors conducted social autopsies by facilitating focus group discussions on crucial delays attributable for the maternal deaths. A pre-information was sent to the participants who consisted of respondent, neighbours, local health worker, local female community health workers, local ward chairman, other local leaders, teachers and ambulance drivers. The facilitators first described and oriented the participants about the three delays and associated factors of a maternal death with showing a pictorial chart of connected three delays. After that, facilitator requested the participants to tell their views on the causes and most important delay for the death of the woman and what could have saved her life. Sixty-two focused group discussions were carried out with the number of participants ranging from 5 to 10. The focus group discussions were recorded and transcribed in Nepali and then in English.

Data analysis

We used qualitative and quantitative analysis to triangulate the information to identify the crucial delays for maternal deaths. Quantitative data were analysed by descriptive statistics in STATA V.13. Qualitative data were analysed using NVivo V.12 by framework analysis method.[14] The analytical framework was derived from the three delays framework. We proceeded by familiarising with the data by reading and re-reading the transcripts. Then, we assigned numerical codes of delay factors within each delay derived from our analytical framework; made a chart by arranging the codes into three delays by cases and finally interpreted the codes to answers the crucial delay factors. The coding and themes searching process were initially done by two of the authors in NVivo V.12 software, and later, verified and cross-checked by senior authors. We identified the most repeated codes within three delays and then used them to derive themes. For each case, we identified major factors related to each delay and arrived to a consensus whether one of the delays can be attributed as the major cause of death or more than one.

Patient and public involvement statement

This study did not involve any patients. The relatives of deceased women, neighbours, local health workers and community leaders were involved in social autopsies during data collection phase.

RESULTS

Demographic characteristics of respondents and deceased women

Majority of respondents were family members (90.3%), mainly husband (38.7%), followed by mother-in-law (16.1%). The rest of the respondents were from outside of family members including aunt (4.8%), neighbour (3.2%) and health worker (1.6%). More than one-third of respondents (37.1%) had no education. Table 1 shows the demographic characteristics of the deceased women. The mean age of the deceased women was 25.3 years and only 12.9% were from *Brahmin and Chhetri* caste. The majority (91.9%) of deceased women were unemployed while about 60% of husbands were semi-employed either in daily waged jobs, small business or had gone aboard to work. Nearly half of them (45.2%) were primiparous and one-third had no formal education. The main decision maker of household was father-in-law (37.1%) followed by husband (35.5%). The majority of houses of deceased women used wood (72.6%) as cooking fuel and houses made up mud and bricks/stone/bamboo in walls (58.1%) and earth or mud in floor (87.1%). Majority of maternal deaths (74.2%) were from plain districts. The most common place of death was private hospitals (41.9%), followed by public hospitals/primary healthcare centres (30.7%), at homes (14.5%) and on the way (12.9 %).

Household knowledge and preparedness

Table 2 shows the household knowledge and preparedness for pregnancy and childbirth as replied by respondents. Majority received information about pregnancy and childbirth care (80.4%) and think that pregnancy is risky (69.6%); antenatal check-up is necessary (98.2%) and delivery need to be at facility (94.6%). Around 16% could not state any danger signs of pregnancy and

Table 1 Sociodemographic characteristics of deceased women (n=62), Nepal, 2019

Characteristics	N (%)
Age in years, mean (SD)	25.3 (5.9)
Age at marriage, years, mean (SD)	18.2 (4.3)
Residence	
Plain districts	46 (74.2)
Hill districts	16 (25.8)
Province	
2	28 (45.2)
5	25 (40.3)
6	9 (14.5)
Caste	
Upper caste (Brahmin/Chhetri)	8 (12.9)
Terai/Madhesi	21 (33.9)
Lower caste (Dalits)	19 (30.6)
Janajati	9 (14.5)
Religious minority	5 (8.1)
Religion	
Hindu	57 (92.0)
Muslim	5 (8.0)
Parity	
0	28 (45.2)
1	12 (19.3)
2	9 (14.5)
3	6 (9.7)
4	4 (6.5))
5	3 (4.8)
Occupation	
Salaried job	2 (3.2)
Semi-employed	3 (4.9)
Unemployed	57 (91.9)
Occupation (husband)	
Salaried job	9 (14.5)
Semi-employed	37 (59.7)
Unemployed	15 (24.2)
Education	
No schooling	21 (33.9)
Primary	16 (25.8)
Secondary	21 (33.9)
Higher secondary and above	4 (6.5)
Education (husband)	
No schooling	10 (16.1)
Primary	20 (32.2)
Secondary	22 (35.5)
Higher secondary and above	9 (14.5)
Family structure	
Nuclear	36 (58.1)
Joint	26 (41.9)
Household main decision maker	
Husband	22 (35.5)
Woman herself	2 (3.2)
Father-in-law	23 (37.1)
Mother-in-law	7 (11.3)
Others	8 (12.9)
Walls make-up	
Cement and bricks	17 (27.4)
Mud and bricks/stone/bamboo	36 (58.1)
Planks/Brushwood	9 (15.5)
Floor	
Natural (earth/mud)	54 (87.1)
Wholly or partially cemented	8 (12.9)
Roof	
RCC	10 (16.1)
Metal sheet	8 (12.9)
Other	44 (71.0)
Source of cooking fuel	
Wood	45 (72.6)
Gas	10 (16.1)
Cow dung	7 (11.3)
Monthly income (Rs), median	16 000

delivery, while about a quarter (23.2 %) could not state any danger signs of post partum.

A majority had heard of birth preparedness programme (64.3%) and the *Aama* programme (60.7%). The commonly cited preparedness activity was 'saving money' (62.5%) followed by 'identifying transport' (39.3%). In fact, majority had saved money (80.3%) and had at least one antenatal check-up (89.3%). Nearly half (46.4%) had gone after first trimester for first time antenatal check-up mainly in health post (58.9%). Majority (78.6%) said they have planned to delivery at a health facility. About three-fourth women had some complications or signs of labour starting at homes but median time to seek treatment was about 3 days. The most cited reason for not going earlier to a health facility was 'not anticipating the severity' of the problem (62.5%).

Accessibility of health facilities and treatment-seeking status

Health post or primary healthcare centres were the nearest health facility for delivery service from majority's household (87.1%) while zonal or regional hospitals (59.6%) were the nearest Comprehensive Emergency Obstetric Care (CEmOC) sites (table 3). The median time taken

Table 2 Household knowledge and preparedness for pregnancy and childbirth (n=56), Nepal, 2019

	N (%)
Knowledge	
Information received	45 (80.4)
Knows risk of pregnancy	39 (69.6)
Necessary to have ANC	55 (98.2)
Necessary to deliver at a health facility	53 (94.6)
Knowledge of danger signs during pregnancy*	
Vaginal bleeding	24 (42.8)
Swollen hands and body	26 (46.4)
Loss of consciousness and convulsions	18 (32.1)
Blurred vision	7 (12.5)
Severe headache or dizziness	22 (39.3)
Fever	13 (23.2)
Severe abdominal pain	31 (55.4)
Problem in breathing (fast breathing)	3 (5.4)
Do not know	10 (17.9)
Knowledge of danger signs during delivery*	
Severe vaginal bleeding	36 (64.3)
Prolonged labour for >12 hours	26 (46.4)
Placenta not delivered 30 min after delivery	18 (32.1)
Loss of consciousness and convulsions	16 (28.6)
Swollen hands and body	23 (41.1)
Do not know	9 (16.1)
Knowledge of danger signs after delivery*	
Severe vaginal bleeding	30 (53.6)
High fever	19 (33.9)
Smelly water discharge from vagina	7 (12.5)
Swollen hands and body	25 (44.6)
Loss of consciousness and convulsions	15 (26.8)
Do not know	13 (23.2)
Preparedness	
Heard of birth preparedness	36 (64.3)
Knowledge of preparedness activity*	
Identification of health facility to deliver	13 (23.2)
Arrangement to have skilled birth attendant at birth	7 (12.5)
Save money	35 (62.5)
Identification of transportation	22 (39.3)
Identify people who can donate blood	16 (28.6)
Buy 'Delivery Kit'	3 (5.3)
Prepare cloth for the newborn baby	19 (33.9)
Heard of *Aama* programme	34 (60.7)
Identified transport	27 (48.2)
Saved money	45 (80.3)
Had antenatal check-up	50 (89.3)
Time of first ANC	
Within first trimester	24 (42.8)
After first trimester	26 (46.4)
Place of first ANC visit	
ORC	5 (8.9)
Health post	33 (58.9)
PHC	3 (5.4)
Private facility	9 (16.1)
Planned place of delivery	
Health facility	44 (78.6)
Home	7 (12.5)
Do not know	5 (8.9)
Start of labour or complications	
At home	43 (76.8)
After admitting to a health facility	13 (23.2)
Time taken to decide to go to health facility, median (IQR), hours	75 (60–1440)
Reasons for not going earlier*	
Not anticipating the severity	35 (62.5)
No one available to go with her	4 (7.1)
Too far to travel	5 (8.9)
No transportation available	6 (10.7)
Cost (transport, healthcare, other)	4 (7.1)
Was late at night (transportation and provider not available)	2 (3.6)
Sudden labour	10 (17.8)
Problem started before delivery time	10 (17.8)
No trust in quality	4 (7.2)

*Multiple responses.
ANC, antenatal care; ORC, outreach clinic; PHC, primary healthcare centre.

to reach the nearest Basic Emergency Obstetric Care sites was 20 min. Similarly, the median time taken to reach the nearest CEmOC sites was 120 min. About 60% replied that ambulance was available either in the community or at a health facility. Nearly three-fourth women were referred to higher facility having CEmOC functions and median time of stay at the lower health facility was 120 hours. Majority of respondents did not perceive the readiness of health facility and faced difficulty in getting bed, drugs or health workers in time. The median cost of treatment was Nepalese Rs 40 000.

Table 3 Accessibility of health facilities, treatment and travel history of deceased women by regions (n=62), Nepal, 2019

	Total, n (%)
Nearest health facility	
Health post/PHC	54 (87.1)
District hospital	3 (4.8)
Regional hospitals	5 (8.1)
Distance to nearest BEmOC sites, median (IQR) min	20 (15–45)
BEmOC sites 24 hours accessible	57 (91.9)
Nearest CEmOC sites	
District hospital	9 (15.8)
Zonal/Regional hospital	34 (59.6)
Private hospital	14 (24.6)
Distance to nearest CEmONC sites, Median (IQR), min	120 (60–180)
Ambulance available	
Yes	38 (61.3)
No	24 (38.7)
Did the woman die at the nearest CEmONC site?*	
Yes	22 (41.5)
No	31 (58.5)
Referral to CEmOC sites*	
Yes	37 (71.2)
No	15 (28.8)
Time spent before referral, median (IQR), hours	120 (30–660)
Waiting time to be treated at referral sites, Median (IQR), min	15 (5–30)
Perceived readiness of services	
Yes	15 (34.9)
No	28 (65.1)
Median cost for the treatment, Rs (IQR)	40 000 (13 000–70 000)

*n=53 (excluding deaths at homes).
BEmOC, Basic Emergency Obstetric Care; CEmOC, Comprehensive Emergency Obstetric Care.

Delay phases and factors

Table 4 shows the frequencies of codes within each delay phase obtained from death account and community focus group discussions based on the analytical framework. The most common delay factor coded was 'inadequate information/no perceived need' (37.1%), followed by 'incompetent nurses/health workers' (32.3 %), 'perceived cost/no money' (24.2%), 'multiple referral' (19.4%) and 'neglect and not immediate treatment' (19.4%). Figure 2 shows the relative share of delay phases accountable for maternal deaths. Nearly half of deaths (43.5%) were attributable to more than one delay while first and third delay each contributed equally (25.8%). We derived following reasons for delays from framework analysis.

Lack of perceived need or benefit

Family members of deceased women lacked perceived need or benefit of using the delivery services. This lack arose because women had not been given enough information on possible seriousness of pregnancy, delivery and post partum and they did not share their problems even if they had. This has resulted in inadequate birth preparedness including late antenatal check-up, long wait at homes unless life-threatening complications arise and unsafe abortions. In some cases, the pregnancy was not wanted by the woman and they did not seek abortion services earlier from right places. Some had previous bad experience or low perceived benefit of birth centres. Birth centres have not skilled doctors or nurses with life-saving procedures.

> …main thing is that she should not have concealed that problem. (FGD A-15)

> She replied that she didn't want to continue the pregnancy because she had already three daughters and one son…but she told me that her husband wanted to have another son and do not allow her to have contraceptives. (FGD D-3)

> During the delivery of first baby, she experienced a lot of pain during suturing…a small operation was done without any numbing medicine… she had a very bad experience with the hospital and that's why she refused to go hospital for the second delivery. (FGD B-14)

Perceived cost and low status

Majority of deceased women were from poor and marginalised families. The fear of cost and lack of money deterred them seeking treatment from higher-level hospitals or reaching there on time. Moreover, the women in such families had low status, could not themselves decide use of contraceptives and lacked family support.

> After getting referral from health post, we should have taken her immediately to Nepalgunja (a nearby city) …we could not do that because of money…she spent a whole night and day in pain at home before taking to hospital after managing money. (FGD A-6)

> Her husband has always been outside for work, and he used to drink too much. Neither the husband nor other family members took care of her and sought treatment. (FGD C-6)

Traditional beliefs and practices

Traditional practices such as seeking help from traditional birth attendants or local health workers or traditional healers at home are still prevalent. The tradition of home delivery and wanting more children with at least

Table 4 Frequencies of delay factors within each delay associated for maternal deaths (n=62), Nepal, 2019

First delay		Second delay		Third delay	
Delay factors	**N (%)**	**Delay factors**	**N (%)**	**Delay factors**	**N (%)**
Fear of going to hospital	1 (1.6)	Bad road	6 (9.7)	Incompetent nurses/health workers	20 (32.3)
Inadequate information/ preparedness	23 (37.1)	Far off health facility	3 (4.8)	Lack of drugs, blood and equipments	6 (9.7)
Long wait at home	6 (9.7)	No emergency transport	6 (9.7)	Late referral to higher facility	9 (14.5)
Low perceived quality	2 (3.2)			Multiple referral	12 (19.4)
Perceived cost/no money	15 (24.2)			Neglect and not immediate treatment	12 (19.4)
Bringing health workers for home delivery	4 (6.5)			Absence of health workers and ambulance driver at health facility	6 (9.7)
Previous bad experience	2 (3.2)			No respectful care	5 (8.1)
Traditional beliefs and customs	10 (16.1)				

one son has also put women in pregnancy and childbirth risk.

> We have a trend to call TBA (Traditional Birth Attendant) at first after labour pain starts. So, at first we called TBA and she advised us to take the delivering woman to health facility only if her labour pain prolongs. (FGD B-5)

> She had thought that she would deliver baby at home and everything will be fine because she had delivered four babies at home before. But this time placenta didn't come out then mother in-law sought for help. (FGD D-10)

Physically inaccessible facilities

In hills and mountains, health facilities with CEmOC sites are far off and hard to physically access. Even in the plain areas, due to unavailability of emergency transport, particularly at night time, it is difficult to get mothers to hospitals. This results in very late arrival at the referral hospitals or death on the way, either after attempted home delivery or even after first sign of labour pain.

> It is very difficult to get vehicle in time during night. It took more than two hours to arrange a vehicle. We have to walk across the river because vehicle cannot cross the river. She died in the midway to the hospital.

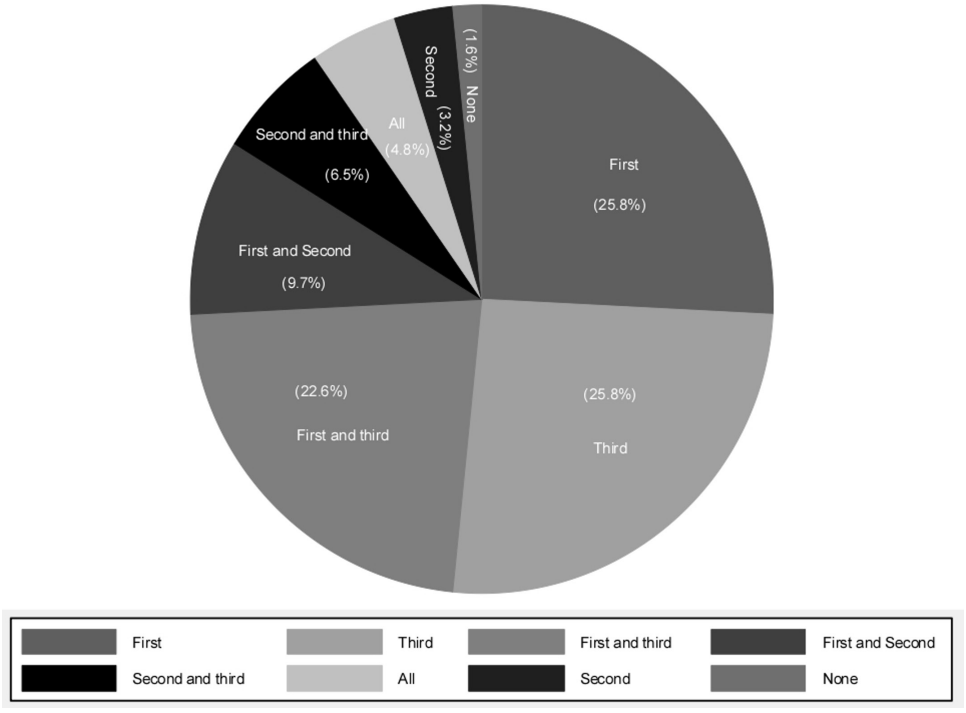

Figure 2 Role of delay phases for maternal deaths (n=62), Nepal, 2019.

The road was getting pitch dark at that time. (FGD C-3)

Lack of service readiness and quality care

Even after reaching a health facility, many participants complained that health workers did not check or refer promptly. The late referral has occurred more often in private facilities which tried to treat patients and charged them a large amount. Participants also felt that they did not get respectful care. Senior doctors and nurses were often absent, and lower level workers were not skilled. Often the lower level health workers had to handle the complications. There was lack of life-saving procedures such as blood transfusion, caesarean section and scanning procedures, especially at lower health facilities. Overall, many participants cited that they observed mismanagement and inadequate care in referral hospitals. Because of the lack of life saving procedures, or competent health workers, there have been multiple referrals. Often this referral starts from a birthing centre, but one referral hospital has also referred to another. This has resulted very late arrival at the final health facility and subsequent death.

We took her to health post which was nearby to us, but later after the birth of child, blood started to flow continuously, and they said there were no further medicines and facilities; so please take fast to another hospital. (FGD D-7)

No, no, there was no delay taking to the hospital. She died in the hospital 7 days after giving birth to her daughter. (FGD A-12)

We first took her to local Health Post, which then referred to the District Hospital, which again referred to the Zonal Hospital. Doctors at the Zonal Hospital operated only on the third day. (FGD B-8)

DISCUSSION

This study gathered quantitative as well as qualitative information on three delays that can be attributed to maternal deaths. While all the three delays can sum up for a particular maternal death, our effort in this study is to identify the substantial delay phase in each maternal death. Accordingly, we identified first and third delays as equal contributors. Other studies carried out in Malawi found third delay as the most common delay,[15] whereas another study in India attributed first delay as the most common cause.[16] In this study, nearly half of deaths were attributable to more than one delay similar to the reports by a study in Varanasi, India[17] and in Malawi.[9] Second delay was the least contributor in this study.

Lack of perceived need or benefit and economic resources are the main causes to have the first delay in this study, which is similar to other studies.[8 18] In the first instance, women and family did not seek delivery services in this study because they did not perceive its necessity. This arises out of ignorance, lack of health knowledge, no benefit of nearby birth centres or low socioeconomic status as in other comparable studies from Somalia and Malawi.[9 19] In fact, a significant proportion of maternal deaths in this study come from poor and marginalised communities: majority of deceased women were from lower or janajati castes, were uneducated without any employment and whose houses were made up with mud, stone, bamboo without cemented or metal sheet roofs and depend on wood as source of cooking fuel. This indicates that safe motherhood activities need to be focused on the poor and marginalised communities in Nepal.

Although the majority households had received information about pregnancy and delivery care, knew some danger signs, thought that antenatal check-up and delivery at a health facility were necessary, and had gone to antenatal check-up, this awareness and antenatal check-up did not translate into seeking and receiving timely and appropriate delivery care. This demonstrates awareness or knowledge is not sufficient to change behaviour of institutional deliveries as there are other enabling factors such as money, transport, decision power, distance and quality of health facility.[5] Besides, there could be a deficiency in high-quality antenatal care and counselling as has been observed in a study in Myanmar.[20] The in-depth understanding of the severity of risk and early communication, especially by the pregnant women herself is important. A study in India reported major cause in first delay was due to caregiver unawareness of severity of problem.[16] Majority in this study had labour pain or complications started at homes with attempted home delivery expecting normal delivery. The reasons behind this might be not enough in understanding or early diagnosis of the severity of the problems, perceived distance of hospital and cost as demonstrated in other study in Nepal.[20]

Besides, traditional practices and the status of women can play important roles in the first delay. The main decision makers in household are men in this study. Men are often not involved in the delivery process either they are not informed of the problems in time or they do not give enough attention towards pregnant member within family. This is because women have low status in society and daughter-in-laws face discrimination in the husband's house and do not demand obstetric services.[21] This is a general characteristic of patriarchal society, and more in poor and marginalised households in rural areas of Nepal. Maternal complications and deaths are also linked with unsafe abortion and multiple pregnancy or birth, which is apparently by-product of patriarchal society where son is necessary, women are forced to accept husbands' decisions on contraception and number of children and husbands do not use contraceptives.[22] Such connections of patriarchal society with maternal deaths as a result of unsafe abortions and high-parity deaths have been reported in India and Uganda despite the conductive legal environment.[23 24] This indicates the need of concentrated intervention on family planning and birth spacing with men's involvement in these communities.

In this study, family, at first hand, brought traditional birth attendant or local untrained health workers in their houses to help in delivery. The use of traditional birth attendant is a traditional practice prevalent more in poor and marginalised communities in Nepal. This is because traditional birth attendants are locally available and there is not need to go out to health facilities which are perceived as unfriendly by the women. But these workers cannot manage complications, leading to maternal deaths as also been observed in studies in Bangladesh and Nepal.[25 26] Similarly, traditional healers were also sought because of local availability, belief and cost in Nepal.[27]

Distance and emergency transport are important factors in the second delay for the use of delivery services in the literature.[28] Although health posts and primary healthcare centres with basic emergency obstetric service were physically accessible within an hour from the deceased women's houses, hospitals providing comprehensive emergency obstetric services are far away, especially in hill districts. The poor road condition and unavailability of ambulance or public vehicle in time makes the accessibility of hospitals difficult in Nepal.

The majority of deaths in this study occurred in health facilities, more in private hospitals than in public hospitals. This might be due to referral from public hospitals or perceived better quality and services of private hospitals than public hospitals. This indicates that the health service quality of private hospitals needs to be monitored and regulated. It is obvious that hospitals with comprehensive emergency obstetric services play crucial roles in managing near miss maternal cases rather than lower health posts and health centres with basic emergency obstetric services. This is the reason that, in this study, majority of cases were referred to public or private hospitals from lower health facilities. Furthermore, majority of deaths did not occur at the nearest hospital that offers comprehensive emergency obstetric services, with many instances of multiple referrals. Participants in this study reported late referral from lower health facilities or often attempted treatment before referring as in other studies in Ghana.[29] This is suggesting that health facilities, even the referral hospitals, were not ready for prompt treatment of maternal complications as has been found in other studies carried out in southern Nepal.[30 31] Lack of equipments, drugs and most importantly, the skilled nurse and doctors were cited as cause of maternal deaths on reaching the facility in this study as in many other studies in low-income and middle-income countries.[15 32–34] So, there is utmost necessary to increase service readiness and quality of maternity care in referral hospitals accountable to treat maternal severe complications by providing sufficient structural elements rather than establishing many birth centres. Designated CEmOC sites in health centres or hospitals should have sufficient beds, essential drugs, medical equipment, robust infrastructure, skilled care and consistent operating hours as has been demonstrated in a cluster randomised trial in India.[35]

Since the majority of cases had complications which started while at home or in lower level facilities and faced difficulty in transportation, the fact that many cases arrived very late at the final hospital is an important risk factor. The very late arrival with severe problems poses risks and challenges for the referral hospitals with limited human and logistic resources. This might be the reason on multiple referrals up to higher facilities observed in this study. To save maternal deaths by offering timely intrapartum or postpartum care, the important thing to do is to screen the high-risk pregnancies, and placing or referring them in the most appropriate facility.[36] This can be done by dedicated emergency transport such as helicopter rescue, better referral capacity or accommodation facilities near the referral hospitals. Accommodation facilities such as maternity waiting homes are relevant to consider especially in hills region of Nepal and have been successfully used in some countries.[37 38] In China, a five-strategy package concentrating on risk screening with referral and treatment strategy for critically ill women have been successful on management of high-risk pregnant women towards controlled decline of maternal mortality.[39]

The numbers of maternal deaths traced in hills districts are less than from the plain districts. The population density is higher in plain districts and easier to trace deaths than in hills districts. Although information on knowledge and awareness was sought from nearest relative, this might not reflect exactly to that of the deceased woman. The social autopsy was done by means of a focus group discussion consisting of 5–10 persons rather than a discussion of a community gathering. The analysis was guided by predetermined codes which can miss emerging new ideas. This study included views from demand sides but not of supply sides which needs to be investigated. Health workers might have different views on third delay, particularly late arrival of cases in health facilities. Furthermore, this study did not make investigation on facility-based medical record reviews on the maternal deaths.

CONCLUSIONS

This study identified first and third delays as equal contributors to maternal deaths. The majority of maternal deaths occurred on the way or in the hospitals after being admitted. Maternal deaths occurred more in poor and marginalised communities, where women have low status and family do not perceive prompt need of hospital care because of unawareness of complications and perceived cost. Family start seeking professional care when complications arise in intrapartum or post partum, and nearby lower level facilities can not manage them. Because of multiple referrals and emergency transportation problems, cases usually reach late to referral hospitals, which lack prompt quality treatment due to lack of skilled manpower and logistics. Woman dies in the quest of good quality care aggravated by quick transportation problem.

Interventions related to birth preparedness, economic support and family planning need to be focused on poor and marginalised communities. Community management of quick transportation, early diagnosis of pregnancy risks, accommodation facilities near the referral hospitals, monitoring of private hospitals and dedicated skilled manpower with adequate medicines, equipment and blood supplies in referral hospitals are needed to have timely, adequate and appropriate intrapartum or postpartum care to further reduce maternal deaths in Nepal.

Acknowledgements The authors are thankful to the study participants, data collectors and local leaders for supporting the study, particularly in conducting social autopsies. The authors are also thankful to Professor Colin Binns, Alison Morgan and Abi Merriel for their feedback in study conducting phase and refinement of this article.

Contributors RK and DM designed and set the objectives. RK prepared the research tool with feedback from DM, KMT, BB and NM. KMT, BB and NM supervised data collection and analysed the data. RK interpreted the data and wrote the first draft of the manuscript. DM contributed to data interpretation and critically edited the manuscript. All authors read and approved the final manuscript.

Funding This study was funded by the Research and Evidence Division, South Asia Research Hub of the Department for International Development (DFID) by purchase order number 40115180.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval for this study was obtained from the Nepal Health Research Council (reg. no. 87/2019). Written informed consent was obtained from all respondents, including for audio-recording and using excerpts in publications. Verbal consent and thumb print was taken in case of illiteracy. The purpose of the study and utilisation of the findings were explained to each respondent.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data are stored at the MIRA office in Kathmandu and are not publicly available. De-identified data can be made available with prior permission from MIRA.

ORCID iD

Rajendra Karkee http://orcid.org/0000-0003-1510-5457

REFERENCES

1 United Nations General Assembly. *Transforming our world: the 2030 agenda for sustainable development*. New York: United Nations General Assembly, 2015.
2 Every Woman Every Child. *The global strategy for women's, children's and adolescents health (2016-2030): Survive, Thrive, Transform*. New York: Every Woman Every Child, 2015.
3 WHO. *Trends in maternal mortality: 1990-2015: estimates from who, UNICEF, UNFPA, world bank group and the United nations population division: Executive summary*. Geneva: World Health Organization, 2015.
4 MoHP[Nepal], New ERA, ICF International Inc. *Nepal demographic and health survey 2016*. Kathmandu, Nepal and Calverton, Maryland, 2016.
5 Karkee R, Lee A, Binns C. Why women do not utilize maternity services in Nepal: a literature review. *WHO South East Asia J Public Health* 2013;2:135–41.
6 Biswas A, Rahman F, Eriksson C, *et al*. Social autopsy of maternal, neonatal deaths and stillbirths in rural Bangladesh: qualitative exploration of its effect and community acceptance. *BMJ Open* 2016;6:e010490.
7 Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med* 1994;38:1091–110.
8 Gabrysch S, Campbell OMR. Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth* 2009;9:34.
9 Mgawadere F, Unkels R, Kazembe A, *et al*. Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC Pregnancy Childbirth* 2017;17:219.
10 WHO. *The who application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM*. Geneva: World Health Organization, 2012.
11 On C, Ronsmans C. *Verbal autopsies for maternal deaths: World Health organization workshop, London, 10-13 January 1994*. Geneva: World Health Organization, Geneva; (WHO/FHE/MSM/95.15), 1995.
12 UNICEF. *Maternal and perinatal death inquiry and response: empowering communities to avert maternal deaths in India*. New Delhi, 2008.
13 Subha Sri B, Khanna R. *Dead women talking: a civil society report on maternal deaths in India*. New Delhi: CommonHealth and Jan Swasthya Abhiyan, 2014.
14 Gale NK, Heath G, Cameron E, *et al*. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117.
15 Combs Thorsen V, Sundby J, Malata A. Piecing together the maternal death puzzle through narratives: the three delays model revisited. *PLoS One* 2012;7:e52090.
16 Dikid T, Gupta M, Kaur M, *et al*. Maternal and perinatal death inquiry and response project implementation review in India. *J Obstet Gynaecol India* 2013;63:101–7.
17 Kumari K, Srivastava RK, Srivastava M. Maternal mortality in rural Varanasi: delays, causes, and contributing factors. *Indian J Community Med* 2019;44:26–30.
18 Karkee R, Lee AH, 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:e004372.
19 Aden JA, Ahmed HJ, Östergren P-O. Causes and contributing factors of maternal mortality in Bosaso district of Somalia. A retrospective study of 30 cases using a verbal autopsy approach. *Glob Health Action* 2019;12:1672314.
20 Okawa S, Win HH, Leslie HH, *et al*. Quality gap in maternal and newborn healthcare: a cross-sectional study in Myanmar. *BMJ Glob Health* 2019;4:e001078.
21 Morrison J, Thapa R, Basnet M, *et al*. Exploring the first delay: a qualitative study of home deliveries in Makwanpur district Nepal. *BMC Pregnancy Childbirth* 2014;14:89.
22 Puri M, Singh S, Sundaram A, *et al*. Abortion incidence and unintended pregnancy in Nepal. *Int Perspect Sex Reprod Health* 2016;42:197–209.
23 Morgan R, Tetui M, Muhumuza Kananura R, *et al*. Gender dynamics affecting maternal health and health care access and use in Uganda. *Health Policy Plan* 2017;32:v13–21.
24 Yokoe R, Rowe R, Choudhury SS, *et al*. Unsafe abortion and abortion-related death among 1.8 million women in India. *BMJ Glob Health* 2019;4:e001491.
25 Biswas A, Halim MA, Dalal K, *et al*. Exploration of social factors associated to maternal deaths due to haemorrhage and convulsions: analysis of 28 social autopsies in rural Bangladesh. *BMC Health Serv Res* 2016;16:659.
26 Thatte N, Mullany LC, Khatry SK, *et al*. Traditional birth attendants in rural Nepal: knowledge, attitudes and practices about maternal and newborn health. *Glob Public Health* 2009;4:600–17.
27 Regmi K, Madison J. Contemporary childbirth practices in Nepal: improving outcomes. *Br J Midwifery* 2009;17:382–7.
28 Karkee R, Binns CW, Lee AH. Determinants of facility delivery after implementation of safer mother programme in Nepal: a prospective cohort study. *BMC Pregnancy Childbirth* 2013;13:193.
29 Goodman DM, Srofenyoh EK, Olufolabi AJ, *et al*. The third delay: understanding waiting time for obstetric referrals at a large regional hospital in Ghana. *BMC Pregnancy Childbirth* 2017;17:216.

30 Lama TP, Munos MK, Katz J, *et al*. Assessment of facility and health worker readiness to provide quality antenatal, intrapartum and postpartum care in rural southern Nepal. *BMC Health Serv Res* 2020;20:16.
31 Morgan A, Jimenez Soto E, Bhandari G, *et al*. Provider perspectives on the enabling environment required for skilled birth attendance: a qualitative study in Western Nepal. *Trop Med Int Health* 2014;19:1457–65.
32 Knight HE, Self A, Kennedy SH. Why are women dying when they reach hospital on time? A systematic review of the 'third delay'. *PLoS One* 2013;8:e63846.
33 Kumar S, Dansereau E. Supply-Side barriers to maternity-care in India: a facility-based analysis. *PLoS One* 2014;9:e103927.
34 Baharuddin M, Amelia D, Suhowatsky S. Maternal death reviews: a retrospective case series of 90 hospital-based maternal deaths in 11 hospitals in Indonesia. *Int J Gynecol Obstet* 2019;144:59–64.
35 Agarwal R, Chawla D, Sharma M, *et al*. Improving quality of care during childbirth in primary health centres: a stepped-wedge cluster-randomised trial in India. *BMJ Glob Health* 2018;3:e000907.
36 Hanson C, Schellenberg J. Redesigning maternal health services: is centralisation the answer in low-resource settings? *BMJ Glob Health* 2019;4:e001488.
37 Buser JM, Munro-Kramer ML, Carney M, *et al*. Maternity waiting homes as a cost-effective intervention in rural Liberia. *Int J Gynaecol Obstet* 2019;146:74–9.
38 Singh K, Speizer I, Kim ET, *et al*. Reaching vulnerable women through maternity waiting homes in Malawi. *Int J Gynaecol Obstet* 2017;136:91–7.
39 Liu J, Song L, Qiu J, *et al*. Reducing maternal mortality in China in the era of the two-child policy. *BMJ Glob Health* 2020;5:e002157.