

Maternal Near Miss Analysis in Three Hospitals of Nepal: An Assessment Using Three Delays Model

Nashna Maharjan,¹ Heera Tuladhar,² Kasturi Malla,³ Kirtiman Tumbahangphe,¹ Bharat Budhathoki,¹ Rajendra Karkee,⁴ Jyoti Raj Shrestha,¹ Abi Merriel,⁵ Dharma Sharna Manandhar¹

ABSTRACT

Background: Maternal Near Miss cases have similarities with those dying from such complications and so present an important opportunity to improve practice. This study was conducted to assess the prevalence of Maternal Near Miss events and identify the delays experienced.

Methods: This was a facility-based cross-sectional study conducted in three tertiary referral hospitals from three provinces of Nepal. All the women surviving a near miss event during six months data collection period were included in the study.

Results: There were 67 near miss cases, 7 maternal deaths, and 9158 live births in the study hospitals during the data collection period. This resulted in Maternal Near Miss ratio of 7.31/1000 live births and facility-based Maternal Mortality Ratio of 76/100,000 live births. Severe obstetric haemorrhage (54%) was the most frequent clinical cause of near miss, followed by hypertensive disorders (43%). At least one type of delay was experienced by 85% women. First delay occurred in 63% (42 of 67) cases, second delay occurred in 52% (33 of 62) cases and third delay occurred in 55% (37 of 67) cases.

Conclusions: This study found out that all three delays were common among women experiencing maternal near miss event. Raising awareness regarding dangers signs, improving referral system and strengthening ability of health workers can help in reducing these delays.

Keywords: Maternal near miss; MNM; Nepal; three delays

INTRODUCTION

Most of the maternal deaths in Nepal are due to direct obstetric causes,¹⁻³ most of which can be prevented with timely diagnosis and management. Since maternal death is preceded by severe maternal morbidity, the systematic identification and study of such cases provide further understanding of the determinants of maternal mortality.⁴ A Maternal Near Miss (MNM) case is defined as “a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy”.⁵

MNM analysis also provides realistic and significant first-hand information surrounding the three delays as these women have similar specific characteristics to women who die of maternal complications.^{4,6,7} Most of the MNM analysis studies conducted in Nepal had studied only the clinical characteristics.⁸⁻¹¹ However, in this study, we have assessed the prevalence of MNM events and also identified the delays incurred.

METHODS

This was a facility-based prospective cross-sectional study conducted in three of the largest government referral hospitals from the three provinces of Nepal, i.e. Narayani Hospital from Province 2, Bheri Hospital from Province 5, and Province Hospital from Karnali Province. The presence of an Intensive Care Unit (ICU), maternity ward, blood transfusion services, facilities for Caesarean Section (CS), and number of births were considered during selection of these hospitals.

All women admitted in the study hospitals during six months data collection time period (1st May 2019 to 31st October 2019) for the treatment of pregnancy-related complications, having delivered or within 42 days of termination of pregnancy, and who fulfilled at least one potentially life-threatening condition as stated by World Health Organization (WHO)⁵ were purposively enrolled as participants for this study after taking informed consents.

Correspondence: Nashna Maharjan, Mother and Infant Research Activities (MIRA), Kathmandu, Nepal. Email: nashnamaharjan@gmail.com, Phone: +9779841153801.

Data collection was done in two stages. First, medical records of the participants were reviewed and information on clinical characteristics were collected using WHO's near miss identification tool.⁵ After this, further information on factors contributing to near miss event and delays were obtained by interviewing the participants using a semi structured questionnaire. The three delays model was used to identify the delays leading to near miss events.¹²

Family members/ relatives of the participants were also interviewed to gather relevant information. All the participants were interviewed after they were medically stable. Three trained field researchers with bachelor's in nursing and public health background were allocated to each study hospital for data collection and they worked in close coordination with the obstetrics and gynaecology department in each study hospital. They visited the hospitals every day and collected data after the Head of Department confirmed the near miss event. After field-based data collection, all the near miss cases were discussed by the study team. The quantitative data were entered in EpiData version 3.1 and analysed using SPSS version 22. The interviews were audio recorded and the qualitative information were coded, themes were developed, patterns and concepts in the themes were identified and narratives in each themes and sub themes were summarized. Both quantitative and qualitative information were discussed among the team members and it was considered appropriate that more than one delay can occur in some cases. An analytical framework was developed based on the three delays model to identify and categorize the delays.¹²⁻¹⁴

This study was a part of major study, "understanding the factors contributing to maternal mortality in selected provinces of Nepal". The ethical approval for this study was obtained from Nepal Health Research Council (NHRC) on 25 March 2019 (Registration number 87/2019). Similarly, written consents were sought from all the study hospitals and clear written informed consents were also obtained from all the study participants.

RESULTS

During the six month study period, there were 67 maternal near miss cases, 7 maternal deaths and 9158 live births in the selected three study hospitals. This resulted in a maternal near miss ratio of 7.31 per 1000 live births and facility based maternal mortality ratio of 76 per 100,000 live births. The mean age of the MNM cases was 23± 5 years. Most of the women (73%) were

above 20 years, were Dalits (34.3%), were not involved in income generating works (79.1%) and had monthly household income of less than NRs. 30,000 (92.5%) (Table 1).

Table 1. Socio-demographic characteristics (n=67).

Characteristics	n(%)
Age	
< 20 years	18 (26.9)
≥ 20 years	49 (73.1)
Mean age± SD	22.9±4.6
Geographical location	
Plain/ Terai districts	33 (49.3)
Hill districts	34 (50.7)
Residency	
Urban	44 (65.7)
Rural	23 (34.3)
Caste	
Brahmin/ Chhetri/ Thakuri	20 (29.9)
Janajatis	11 (16.4)
Dalits	23 (34.3)
Terai/ Madhesi other castes	2 (3)
Muslim	10 (14.9)
Others	1 (1.5)
Women's education	
No schooling	14 (20.9)
Primary level (grade 1 to 8)	27 (40.3)
Secondary level (grade 9 to 12) and above	26 (38.8)
Occupation	
Involved in income generating works	14 (20.7)
Not involved in income generating works	53 (79.1)
Monthly household income	
≤ Rs. 30,000	62 (92.5)
> Rs 30,000	5 (7.5)
Monthly Income (NRs), median	15000

Similarly, 59 cases were above 28 weeks of gestation, whereas 8 cases had pregnancy below 28 weeks and they had complications due to abortion. Most of the near miss occurred in post-partum period in most cases (40.3%) and developed complications at home (58.2%). Similarly, more than half of the women, i.e. 57% were primigravida and about half of the women (52.2%) were referred from other health facilities. Majority (89.6%) had at least one antenatal check-up and only 43.3% knew about antenatal and post-natal danger signs. (Table 2).

Table 2. Obstetric and reproductive characteristics (n=67).

Characteristics	n (%)
Stage of near miss	
Ante-Partum (before birth)	22 (32.8)
Intra-Partum (during labour)	13 (19.4)
Post-Partum (after birth)	27 (40.3)
Post-abortion	5 (7.5)
Gravida	
Primi	38 (56.7)
Multi	29 (43.3)
Place of development of complications	
Home	39 (58.2)
Health facility	28 (41.8)
Study hospital/ Tertiary hospital (for MNM)	17 (25.4)
Another health facility (for MNM)	11 (16.4)
Birth preparedness*	
Had arranged money	55 (82.1)
Had arranged transportation	30 (44.8)
Had identified blood donors	13 (19.4)
Had identified health facilities	48 (71.6)
Arranged all four	2 (3)
Had at antenatal check-ups at least once	60 (89.6)
Knowledge of danger signs	29 (43.3)
Arranged none	5 (7.5)
Referred from another health facility	
Yes	35 (52.2)
No	32 (47.8)
If yes, immediate place of referral#	
Health post	13 (37.1)
Primary hospital	16 (45.7)
Private hospital	6 (17.1)

*multiple responses, #n=35

Severe haemorrhage was the cause of near miss condition in more than half of the women (54%) followed by hypertensive disorders (43%) (Table 3).

Table 3. Underlying medical causes of MNM (n=67).

Underlying medical causes	n (%)
Severe haemorrhage	36 (53.7)
Early pregnancy haemorrhage	7 (10.4)
Late pregnancy haemorrhage	3 (4.5)
Post-partum haemorrhage	26 (38.8)
Primary PPH	23

Secondary PPH	3
Hypertensive disorders	29 (43.3)
Pre eclampsia	5 (7.5)
Eclampsia	24 (35.8)
Sepsis	3 (4.5)
Ruptured uterus	3 (4.5)
Severe complications of abortion	5 (7.5)
Other obstetric complications	0
Non obstetric medical complications	3 (4.5)

*Percentage may exceed 100% due to multiple disorders

Out of the total 67 MNM cases, 57 (85%) cases faced at least one delay while no delays were found in remaining 10 (15%) cases. The percentage of delays in maternal near miss cases are shown in Figure 1.

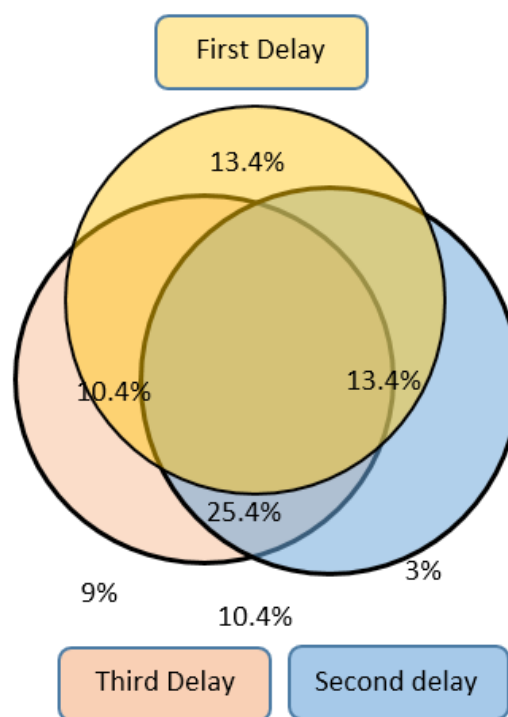


Figure 1. Delays accountable for maternal near misses (n=67).

Seventeen (25%) women had all three delays. Overall, 60% of near miss cases were attributable to more than one delay. The delays are sub-categorised in Table 4. The median time taken to reach lower/ referring health facility was 30 minutes, and it ranged from 1 minute to 120 minutes. Similarly, the median time taken to reach the final health facility from the lower health facility was 60 minutes and ranged from 15 minutes to 15 hours. The median time taken to receive care after reaching appropriate health facility was 10 minutes (Range: 1 minute to 60 minutes).

Table 4. Sub-categorisation of delays experienced by MNM cases (n=67).

Sub-categorisation		n (%)
First delay	Delay in seeking care after development of complications at home (Time interval between recognition of complication and decision to seek care is more than one hour)	19 (28.4)
	Lack of perceived need or benefit (danger signs/ minor symptoms experienced during pregnancy or post-partum period but did not seek appropriate care or ignored the symptoms or were unaware about the possibility of complications)	39 (58.2)
	Traditional practices (Sought care from traditional healers instead of going to health facility after recognition of complications at home)	3 (4.5)
Second delay	Delay in reaching to lower/ first health facility from home (More than one hour taken to reach health facility)	14 (20.9)
	Delay in reaching final health facility from home (more than one hour)	17 (25.4)
	Delay in reaching final health facility from lower/ referring health facility (more than one hour)	15 (22.4)
Third delay	Delay in referral from lower health facility (more than 30 minutes taken by lower health facility to transfer/ refer the cases to another health facility)	20 (29.9)
	Late/ no treatment at final health facility (more than 30 minutes taken to provide appropriate care by obstetric facilities or do not provide any treatment)	8 (12)
	Multiple referral (referral from more than 2 health facilities)	5 (7.5)

*percentage may exceed 100% due to multiple delays

The reasons for first delay were lack of understanding of the perceived need; not anticipating the severity during initial stages; self-medicated abortion; lack of family support; traditional beliefs and practices; perceived long distance to health facilities and fear of cost and insufficient money for treatment. Some quotes depicting first delay are below:

“My hands and legs were swollen since the 7th month of my pregnancy. The staff of the health post told me to immediately go to the hospital (tertiary level) for check-up as it could be dangerous. But I thought that my limbs were swollen due to cold. I stayed protected from cold at home. When I came here, I came to know that my blood pressure was very high and I also developed fits. I don’t know how that happened.” (MNM case 38)

“I had video x-ray (USG of abdomen) done and at that time I came to know that I was pregnant. So, I myself

went to medical shop to buy medicine for abortion. Four days after consuming that medicine, I bled continuously for 8 days. We (including family) decided to seek treatment and came in this hospital only after 8 days.” (MNM case 46)

“When she first convulsed sticking out her tongue, we thought it was due to wrath of god at first. So, we took her to a Jhankri to do jharphuk (exorcism). But later when she still was not cured, we took her to local medical shop. From there we were suggested to take her to bigger hospital.” (Family member, MNM case 58)

“I tried to have home delivery. Placenta was not delivered immediately after baby’s delivery. When placenta was not delivered for 5 hours, the local government gave NRs. 1 lakh to reserve the helicopter. Then only I was brought here.” (MNM case 49)

The reasons for second delay were lack of road or poor road condition, long distance to health facilities and lack of transportation.

The reasons for third delay were unavailability of skilled health workers in referring health facilities; unavailability of caesarean section, Intensive care unit, lifesaving drugs and blood transfusion services in referring health facilities; delayed referral and poor communication during referral. Some instances showing third delay are:

“I went to the district hospital for delivery. When I was there, I suddenly had fits. But the medicine to treat the fits (Magnesium sulphate) was not available in that hospital. So, I was brought to this hospital by a helicopter.” (MNM case 12)

“We took her to the hospital (tertiary level) on time. It was night time and there were no doctors.” (MNM case 6)

“She (MNM case) had fluid leakage before having labour pain. So, we took her to a Health Post. The sister there asked us to go to another health facility. We asked her where to go? We asked her whether to go to a private hospital or government hospital. That sister told us to go wherever we want to go. We took her to a private facility. But there was no operation (caesarean section) facility. So, that private hospital asked us to take her to government hospital or another private hospital.” (Family member of MNM case 1)

DISCUSSION

This study showed an overall Maternal Near Miss (MNM) ratio of 7.31 per 1000 live births, which is similar to the ratio shown by Shrestha et al. in a tertiary level hospital of Nepal (7.7/1000 live births).¹⁵ However, other studies

conducted in Nepal like Rana et al. 2013 and Gurung et al. in 2015 showed slightly lower MNM ratio, i.e. 3.8/1000 live births and 6.06/ 1000 live births respectively.^{9,11} Khadka et al. on the other hand, showed a higher MNM ratio (16.6/1000 live births).¹⁶ This disparity may be due to geographical differences, differences in the number of cases and differences in diagnostic criteria used to define near miss cases.

Severe postpartum haemorrhage accounted for the majority of near miss events in this study followed by hypertensive disorders like Eclampsia and pre-eclampsia. The Nepal Maternal Mortality and Morbidity study (2008-2009) also obtained similar results.³ Other studies conducted in Nepal also identified severe postpartum haemorrhage as the major underlying cause of Maternal Near Miss (MNM) followed by hypertensive disorders.^{8,9,11,16} Overall, 85.1% of near miss cases in this study had at least one type of delay in accessing maternal health care. More than half of the near miss cases (59.7%) in our study were attributable to more than one type of delay. A maternal mortality study conducted by Shrestha et al. in Western Nepal also identified multiple delays in accessing maternal health care.²

In our study, the major reason for the delay in seeking care was ignorance of dangerous signs or unawareness of the severity of complications by women and her family members. However, the majority of the women in our study had at least one antenatal visits and only 10.4% did not visit a health facility for antenatal check-up. This does raise the question regarding the quality of antenatal visits attended by the women in this study. It is mandatory that danger signs are well communicated to women during antenatal check-ups. But, more than half of the women in this study (56.7%) had insufficient knowledge about the danger signs during pregnancy and the postpartum period. Our data also showed delay in reaching lower health facilities and delay in reaching the referral hospital from lower health facilities. In our study, more than half (52.2%) were referred from lower health facilities. Some women also experienced multiple referrals before arriving at the study hospital. The reasons for referral in our study were variously ascribed to being unable to manage complications (57.1%) and more specifically due to essential drugs shortages; no capacity to provide a blood transfusion; unavailability of doctors and a facility not being able to provide with caesarean section services or ICU level care. This resulted in the majority of second and third delays in this study.

It is recommended to save money for emergencies, arrange transportation beforehand, identify potential blood donors and identify health facilities for giving birth.

These actions are collectively called birth preparedness and the main aim of this is to reduce delays in accessing delivery care services.¹ Though most of the women had financial saving and identified health facility for birth beforehand (82.1% and 71.6% respectively), only 44.8% had arranged transportation beforehand and 19.4% had identified potential blood donors. Overall, only 3% women had arranged all four as per recommendation and 7.5% had not arranged anything. This percentage is higher than the national data which showed that only 62% women in Nepal had financial savings and 15% had transportation arrangements.¹ Similarly, more than half (63%) women were referred from Comprehensive Emergency Obstetric Centres, i.e. Primary Hospitals and Private hospitals. These hospitals should have all the facilities and human resources for managing complicated cases.

Since complications started at homes or in lower facilities in most cases and there was difficulty in transporting the women to the appropriate obstetric facility, many cases arrived very late at the final hospital. The very late arrival with severe problems posed risks and challenges for the referral hospitals with limited human and logistic resources, leading to multiple referrals to higher facilities costing time and in many cases. The referral mechanism is very important in the provision of timely care because the lower health facilities need to be connected to higher tertiary comprehensive obstetric care hospitals. A dedicated emergency transport at every local level, helicopter rescue in remote areas, better referral capacity and accommodation facilities near the referral hospitals is needed.

In this study, we collected information from the audit of women's records at study hospitals, and interviews were only conducted with women and her family members. We could not get much information about the type of care received by women in referring/ lower health facilities and the reason for referral could not be accurately identified as the women lacked referral slips and records from referring health facilities. Moreover, the quality of care received by women in health facilities (both referring and referral) was not identified in this study. A pure qualitative approach in the future may help to understand in-depth about the individual, social and health system factors related to the delays. Similarly, time calculation for three delays were collected through recall of the women and their family members, as a result, recall bias could not be avoided.

CONCLUSIONS

The prevalence of MNM ratio in this study was 7.31 per

1000 live births. Severe haemorrhage and eclampsia were the major causes of near miss in this study. Although all three delays occurred in both maternal death and near miss cases in this study, the delay in deciding to seek care was found to be more significant as the complications that started at home was aggravated by taking long time to reach appropriate health facility and lack of timely treatment after reaching the health facility. Therefore, a comprehensive approach is required to solve these delays. This study identified gaps in referral of women from lower-level health facilities to tertiary level hospitals. Improved referral system, along with an emphasis on awareness, availability of quality services and skilled human resources at all designated sites is needed if further delays are to be prevented. The near miss cases in this study identified similar pathways as maternal deaths. Nepal already has a Maternal and Perinatal Death Surveillance and Response (MPDSR) system. In addition to this, a comprehensive system to assess the Maternal Near Miss (MNM) could help to further identify ways to reduce maternal deaths in Nepal.

Author Affiliations

¹Mother and Infant Research Activities (MIRA), Kathmandu, Nepal

²Kist Medical College Teaching Hospital, Lalitpur, Nepal

³Himal Nursing Home, Kathmandu, Nepal

⁴BP Koirala, Institute of Health Sciences, Dharan, Nepal

⁵Population Health Sciences, University of Bristol, UK.

Competing interests: None declared

REFERENCES

1. Ministry of Health and Population (MoHP), Nepal New ERA and ICF International Inc. Nepal Demographic and Health Survey 2016. Kathmandu: Ministry of Health and Population; 2017. Available from: <https://dhsprogram.com/publications/publication-fr336-dhs-final-reports.cfm>
2. Shrestha J, Gurung S, Shrestha A, Subedi A. Maternal Mortality and Associated Factors in a Tertiary Care Center of Western Nepal. *Journal of Lumbini Medical College*. 2017;5(2):58-63. [\[Article\]](#)
3. Pradhan A SB, Barnett S, Sharma SK, Puri M, Poudel P, Chitrakar SR, Hulton L. Nepal Maternal Mortality and Morbidity Study 2008/ 2009. In: Family Health Division DoHS, ed. Kathmandu, Nepal: Ministry of Health and Population, Government of Nepal; May 2010. Available from: <http://nmfsp.gov.np/PublicationFiles/aaef7977-9196-44d5-b173-14bb1cce4683.pdf>
4. Pattinson R, Buchmann E, Mantel G, Schoon M, Rees H. Can enquiries into severe acute maternal morbidity act as a surrogate for maternal death enquiries? *BJOG: An International Journal of Obstetrics & Gynaecology*. 2003;110(10):889-893. [\[Article\]](#)
5. Souza JP, Cecatti JG, Haddad SM, Parpinelli MA, Costa ML, Katz L, Say L. The WHO maternal near-miss approach and the maternal severity index model (MSI): tools for assessing the management of severe maternal morbidity. [\[Article\]](#)
6. Pattinson R, Say L, Souza JP, Broek NV, Rooney C. WHO maternal death and near-miss classifications. *Bulletin of the World Health Organization*. 2009;87:734-A. Available from: <https://www.who.int/bulletin/volumes/87/10/09-071001/en/>
7. Cecatti JG, Souza JP, Neto AF, Parpinelli MA, Sousa MH, Say L, Pattinson RC. Pre-validation of the WHO organ dysfunction based criteria for identification of maternal near miss. *Reproductive Health*. 2011 Dec;8(1):1-7. [\[Article\]](#)
8. Shrestha NS, Saha R, Karki C. Near miss maternal morbidity and maternal mortality at Kathmandu Medical College Teaching Hospital. *Kathmandu University medical journal*. Apr-Jun 2010;8(30):222-226. [\[Article\]](#)
9. Rana A, Baral G, Dangal G. Maternal near-miss: a multicenter surveillance in Kathmandu Valley. *Journal of the Nepal Medical Association*. 2013;52(190). [\[Article\]](#)
10. Rana HB, Banjara MR, Joshi MP, Kurth AE, Castillo TP. Assessing maternal and neonatal near-miss reviews in rural Nepal: an implementation research study to inform scale-up. *Acta Paediatrica*. 2018;107:17-23. [\[Download PDF\]](#)
11. Gurung B, Koirala R, Dongol Y. Near-miss obstetric events in a tertiary care teaching hospital in Nepal: an audit. *Nepal Journal of Obstetrics and Gynaecology*. 2015;10(1):30-32. [\[Article\]](#)
12. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Social science & medicine*. 1994;38(8):1091-1110. [\[Article\]](#)
13. Papali A, McCurdy MT, Calvello EJ. A "three delays" model for severe sepsis in resource-limited countries. *Journal of critical care*. Aug 2015;30(4):861 e869-814. [\[Article\]](#)
14. Oliveira FC, Surita FG, E Silva JL, Cecatti JG, Parpinelli MA, Haddad SM, et al. Severe maternal morbidity and maternal near miss in the extremes of reproductive age: results from a national cross-sectional multicenter study. *BMC pregnancy and childbirth*. 2014 Dec;14(1):1-9. [\[Download PDF\]](#)
15. Shrestha J, Shrestha R, Tuladhar R, Gurung S, Shrestha A. Maternal near miss in a tertiary care teaching hospital. *American Journal of Public Health Research*. 2015;3(5A):17-22. [\[Article\]](#)
16. Khadka M, Uprety DK, Rai R. Evaluation of associated risk factors of near miss obstetrics cases at BP Koirala Institute of Health Sciences, Dharan, Nepal. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 7(2):2. [\[Download PDF\]](#)