Assessing maternal and neonatal near-miss reviews in rural Nepal: an implementation research study to inform scale-up

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INTRODUCTION

Globally, research indicates coverage of effective maternal and child health interventions remain limited and scaling-up strategies for improving the quality of maternal and newborn care (MNC) are of high priority. The burden of maternal and neonatal deaths has drawn global public health attention (1,2). Audits and reviews of adverse events, such as maternal deaths, have been proposed and tested as a strategy to improve maternal and newborn health (MNH) (3). Severe maternal morbidity, or ‘near misses’, occurs in larger numbers than deaths, and so may provide stronger evidence and more robust conclusions about causes as maternal deaths and near-misses are in the same disease pathway (4). Concerns about punitive responses to death reviews have made maternal and perinatal death surveillance and response (MPDSR) difficult to implement (5). Maternal near-miss reviews (MNR) have been proposed as a higher yield approach for evaluating quality of care (QoC) and for improving provider performance (6,7).

In 1990, the maternal death review process was introduced in Nepal. The Family Health Division (FHD), under the Nepal Ministry of Health and Population, began using maternal and perinatal death review (MPDR) systems in selected district hospitals with limited progress (8). In 2014, to refine its efforts, FHD launched the MPDSR strategy in

ABSTRACT

Aim: To understand how maternal and neonatal near-miss reviews could be implemented and scaled-up in rural communities through the existing district health system in Nepal.

Methods: Mixed methods with a modified time series evaluation design were used. The World Health Organization maternal and neonatal near-miss criteria used in multicountry surveys were adapted and used to define maternal and neonatal near-miss cases.

Results: The World Health Organization near-miss criteria were mainly applicable at the district hospital setting, but further adaptations were needed for community-level birthing centres, as organ dysfunction and critical intervention criteria were not found appropriate. In birthing centres, disease-based criteria were applicable for maternal near-miss review, and danger and clinical sign-based and condition at birth criteria were applicable for neonatal near-miss review. Primary barriers to implementation were attrition of trained staff due to the frequent transfer of healthcare providers, and time constraints of district hospital medical doctors for case-by-case reviews as they were often busy in hospital and in their private clinics.

Conclusion: Adapted maternal and neonatal near-miss review process implementation in Nepal is feasible through the existing government health system.

Key notes
- In rural areas, disease-based criteria were appropriate for maternal near-miss reviews; while for neonatal near-miss reviews, the most relevant set of criteria were the danger/clinical signs and conditions at birth criteria.
- Attrition of trained staff due to the frequent transfers was a primary barrier.
- Key recommendations include exploring integration with the existing maternal and perinatal death surveillance and response system.
five districts (9). Yet, additional evidence-based strategies along with current efforts are needed to achieve the desired health outcomes (1,10–12).

In Nepal, the common challenges for MNC services include insufficiently equipped birthing centres, unreliable supply of commodities, limited skilled human resources, low utilisation of health services and inconsistent quality of services. To better address these challenges, the Government of Nepal has implemented different programme strategies, including birth preparedness and complication readiness, and expansion of 24-hour institutional birth facilities. These programmes enable increased service access and utilisation. However, many problems remain in providing quality MNC, especially in the rural areas (13).

Maternal near-miss review is a proven strategy to improve MNC quality, but it has been implemented in only a few medical colleges and health facilities in Nepal (14,15). MNR reveals vital information about causes of near-misses, including contributing social factors, as well as care structures, processes and outcomes which are all essential components of QoC (7,16,17). MNR presents a low-cost, high-impact opportunity for improving health worker performance and reducing maternal and neonatal mortality (18).

As for maternal health, the application of the near-miss concept to the neonatal context could be useful to identify QoC issues and to strengthen health systems. There are neither standard definitions nor internationally agreed identification criteria for neonatal near-miss cases. Similarly to the maternal near-miss concept, a neonatal near-miss case refers to a neonate who presented a severe complication during the first day of life, nearly died, but then survived the neonatal period (19).

HealthRight International, in collaboration with FHD, conducted a two-year maternal and neonatal near-miss review (MNNR) implementation research project covering one district hospital and 14 community-level birthing centres in Arghakhanchi District. The aim of the study was to understand how district-wide MNNR could be implemented and scaled-up through the existing health system in Nepal.

Arghakhanchi is a rural hill district. In 2014, the estimated population was 197,632 with 22% defined as women of reproductive age. The infant mortality rate was 108 per 1000 live births, two and half times the national rate. Early marriage occurred among 18% of the population, and the average age of marriage was 19. Female literacy was 47%, and 46% of the district was classified as ‘disadvantaged’. The expected number of pregnancies was 6652, with only 30% of women choosing to give birth in a health facility. In fiscal year 2012/13, the District Health Office (DHO) reported one maternal and 23 neonatal deaths (20,21).

PARTICIPANTS AND METHODS

The study population was healthcare service providers, pregnant women and women after birth and newborns. This mixed methods research project utilised a modified time series evaluation design, incorporating assessment and dissemination before, throughout and after the intervention (22). The criteria for MNR were adapted from the World Health Organization (WHO) near-miss approach for maternal health manual (19,23). In the absence of standard global criteria for neonatal near-miss case identification, the neonatal near-miss criteria were adapted from the WHO multicountry survey on MNH protocol (19,23). The study received ethical approval from the Nepal Health Research Council and WHO Ethical Review Committee. Informed consent was obtained from each study participant.

With the support of this project, MNNR operational guidelines were developed by FHD. An MNNR-Technical Advisory Group (TAG), which consisted of central-level managers and experts, provided technical and managerial guidance to the study. MNNR committees were formed at the district hospital and each birthing centre at community level (24). The guideline manual was used to implement the MNNR process (Fig. 1) in the rural health facilities.

This research was implemented from January to December 2015 in one district hospital and 14 birthing centres at community level in Arghakhanchi. The study used primary and secondary data from the baseline, mid-term, final assessments and records of process implementation. Quantitative data were collected through questionnaires, case-record forms and a health facility assessment tool. An analysis of project costs was completed. The qualitative data were collected through in-depth interviews (IDIs), focus group discussions (FGDs) and observation checklists at baseline and endline with central-level policymakers, district-level managers, health workers and mothers. In total, 14 IDIs and six FGDs were conducted at baseline and 21 IDIs and five FGDs at endline (Table 1).

Maternal and neonatal near-miss review monthly records maintained by health facilities and the DHO and data from programme monitoring and supervision checklists were compiled and analysed. The near-miss cases reviewed by health facilities were verified by consultants, gynaecologist/obstetrician and a paediatrician from KIST medical college, Nepal.

Data from IDIs and FGDs were translated and transcribed into English. A codebook was developed, and transcripts were coded in NVivo 10.0 and then analysed using thematic analysis. Descriptive analysis of near-miss cases and associated factors performed using SPSS software version 21.0.

RESULTS

Adapting the MNNR process for Nepal

A MNNR-TAG was formed under the chairmanship of the FHD Director. The members were directors from health divisions under the Ministry of Health, MNC experts from relevant professional organisations and partner agencies. The MNNR-TAG supported the development of national MNNR operational and trainer’s guidelines. In consultation with experts, the MNNR-TAG reviewed and adapted the MNNR criteria and process for the Nepal context.
All health workers of the study health facilities were trained on the MNNR process (see Fig. 1), and MNNR committees were formed at health facilities (DHO, district hospital and birthing centres). The Statistical Assistant at the DHO, Medical Recorder at the district hospital and senior skilled birth attendants (SBAs) at birthing centres were assigned as focal persons of the health facility committees.

Each of the 15 health facilities implemented the near-miss review process according to the adapted MNNR operational guidelines. Severe acute maternal and neonatal morbidity cases at birthing centres were identified.
Information and factors associated with severe acute maternal and neonatal morbidity cases were collected through interviews with the patient and/or caregiver. Interviews were usually conducted by the attending staff, mainly SBAs. For case-by-case reviews, MNNR committee meetings at health facilities were conducted within seven days of the patient’s discharge. After each review, the individual health facilities developed action plans to prevent the avoidable factors and/or to better manage such cases successfully in the future. The DHO has organised district-level trimester (aggregate) review meetings within a year of implementation. Sharing and discussions over compiled MNNR records and reports took place in the trimester meetings. All health facilities prepared action plans for the next four months, and the DHO prepared a district action plan for the same time period to improve the quality of MNC.

The maternal near-miss case identification criteria used in the study were adapted from the WHO near-miss approach for maternal health guideline (17), while the neonatal near-miss criteria were adapted from the WHO multicountry survey on MNH (19). The categories were made inclusive to fit the local context (Fig. 2). The criteria adapted for detection of maternal near-miss at community-level health facility were clinical sign-based criteria – acute cyanosis – central and peripheral, gasping respiration, respiratory rate > 40 or <6/minutes, shock, oliguria nonresponsive to fluids or diuretics, failure to form clots, loss of consciousness lasting > 60 minutes, cardiac arrest, stroke/paralysis, uncontrollable fit, jaundice in pregnancy with/without pre-eclampsia; severe maternal complications/disease-based criteria – severe pre-eclampsia/eclampsia, severe PPH ≥ 1000 mL of blood loss (or four fully soaked pads in 30 minutes), APH (placenta praevia) requiring blood transfusion, obstructed/prolonged labour > 18 hours.

Similarly, the criteria adapted for neonatal near-miss at community-level health facility were clinical sign-based criteria – loss of consciousness > five minutes, persistent bradycardia (heart rate < 80 beats/minute), persistent tachycardia (heart rate > 200 beats/minute), poor capillary refill (>three seconds), acute central cyanosis in room air, gasping respiration, anuria lasting > six hours, visible haematuria, failure to form clots (bedside clotting time > seven minutes, clots that break easily, the absence of cloting from iv sites or suture lines after 7-10 minutes), use of therapeutic iv antibiotics, visible jaundice in first 24 hours, uncontrollable fit/status epilepticus; danger signs-based criteria – not breathing even after stimulation and suction, fast breathing/pneumonia, severe chest in-drawing, lethargy/unconsciousness, poor sucking/unable to suck mother’s milk in term baby, hypothermia (temperature < 36.5°C), fever (>100.4°F/38°C), reddish umbilicus extending to the surrounding skin/single boil/≥ 10 pustules on the skin, convulsion, nasal flaring, bulging anterior fontanelle, grunting, jaundice within 24 hours of birth (visible on palms and soles), diarrhoea with severe dehydration, persistent vomiting; conditions at birth-based criteria – very low birthweight (<1500 g), preterm (<30 weeks).

**Challenges and solutions to MNNR implementation**

During IDIs, policy-level respondents mentioned that the poor healthcare financing system of government is a key barrier for sustainability and scale-up of the MNNR programme. The MNNR implementation study in Arghakhanchi also faced some manageable barriers. Three of 12 health facilities had low adherence to the proper use of MNNR guidelines and protocols, two of 12 had irregular recording of meeting minutes and three of 12 stated that they faced resource problems to implement actions...
recommended in the MNNR process. In addition, the frequent transfer of advanced SBA doctors and anaesthesia assistants hampered the efficient implementation of comprehensive emergency obstetric and neonatal care (CEONC) at district hospital. This regularly resulted in high referrals of severe maternal and neonatal cases outside of the district. In the course of MNNR implementation at the later stage of the project period, we adapted to ensure CEONC was made functional throughout the year.

Another challenge was in setting the near-miss criteria for different level of health facilities. The MNNR-TAG and the experts debated and suggested to select and set the criteria based on the level of health facility and the availability of special services.

WHO-recommended maternal near-miss criteria were found applicable for the district hospital but for the birthing centres, the organ dysfunction and critical intervention criteria were not applicable due to unavailability of specialised and laboratory services. In birthing centres, severe complication/disease-based criteria were more applicable for maternal near-miss review, and clinical sign-/condition at birth/danger sign-based criteria were applicable for neonatal near-miss review (Fig. 2). According to the IDI findings of community-level health workers, the adapted criteria for community-level birthing centres were found practical and user-friendly.

In the FGD with district hospital nurses, all six participants said that case-by-case maternal and neonatal near-miss review within seven days of case discharge was a challenge due to the busy schedules of review committee members, especially doctors who were busy in the hospital as well as in their private clinics.

MNNR and health systems strengthening
All 12 health workers who participated in the endline survey mentioned that the MNNR process was found less threatening to health workers than the previous approach because it is based on a successful outcome and not a death. Respondents considered MNNR as a useful platform to share and discuss clinical and managerial aspects of maternal and neonatal near-miss case management. The total respondents stated that they did not experience an increased work burden while implementing the MNNR process.

Among the IDIs conducted, all participants agreed that it was useful to incorporate the MNNR programme into existing relevant district health programmes. According to a MNNR-TAG member and senior paediatrician, *Implementation and expansion of the MNNR programme should be incorporated into national reproductive health strategies.* Recommendations included expanding to select districts (terai, mountain and far west regions) through the government health system under the FHD.

In the assessment, health workers reported that they were confident in managing near-miss cases after lessons learned from the near-miss review process implementation. Some respondents considered the MNNR process as a way of reviewing the MCH survival success stories. The qualitative research found that health workers and clients were interested in the MNNR process and participated without hesitation and fear. One of the MNH experts commented on the impact, *MNNR is encouraging to the health worker, and it is a source of motivation and pride by saving a serious case.* Among the FGDs with nurses at the district hospital, the focus was on skills capacity building: *Maternal and child health services at the district hospital have been improved after implementation of the MNNR programme.* We received near-miss review training, and our skills and confidence level have been improved. Nowadays we are maintaining availability and readiness of medicines/equipment all the time in the hospital.

In addition, one local health worker remarked on the strengthened links to the community: *After MNNR implementation at the health facility, we engaged ourselves to increase awareness in the community to reduce risk factors, including home births and early age pregnancy, to address such problems. We started using mobile phones to follow-up and counsel mothers to take antenatal care, institutional delivery and postnatal services as per health facility action plans.*

MNNR case records analysis
Study health facilities reported a total of 1386 institutional births, 15 stillbirths, 11 neonatal deaths and one maternal death. In total, there were 55 near-miss cases identified and reviewed by the health facilities in one year. The maternal and neonatal near-miss cases were revalidated by consultant gynaecologist and paediatrician from KIST medical college. Of the 23 maternal near-miss cases reported by health facilities, two were rejected as they did not meet the criteria of a near-miss case. Of the 32 neonatal near-miss cases reported by birthing centres, 30 were accepted after revalidation.

Twelve of 15 health facilities were able to diagnose, manage and review at least one near-miss case. Three of 15 health facilities did not have any near-miss cases for review, because few births took place, and they did not handle any severe acute morbidity cases during the study period. The causes of maternal near-misses were haemorrhage (62%) followed by septicaemia (19%) and hypertensive disorders (19%). Neonatal near-miss cases were due to birth asphyxia (70%) followed by very low birthweight (17%), neonatal sepsis (10%) and prematurity (5%). The severe maternal near-miss rate was found to be 15 per 1000 live births, and the neonatal near-miss rate was 22 per 1000 live births.

DISCUSSION
The study findings indicate that MNNR implementation is feasible at the district hospital and birthing centres in rural communities. During 2014/2015, the Arghakhanchi District reported one maternal and 11 neonatal deaths compared to 21 maternal and 30 neonatal near-miss cases among 12 selected health facilities. The higher volume of near-miss cases compared to deaths in the facilities provides an opportunity to collect substantive information to
improve the quality of MNC. However, there might have some more referred out maternal and neonatal near-miss cases to compare with the number of maternal and neonatal death cases reported.

The present study focused on introducing the systematic process of MNNR in 2014. As most maternal and neonatal deaths occur at the district hospital and local birthing centres (13), these facilities generated evidence and resources to address QoC issues at the most critical level for immediate impact. For example, the study found that WHO organ dysfunction criteria could not be used in the birthing centres. One recent study carried out in low-resource setting health facilities in Thyolo District in Malawi revealed that there is difficulty in following the WHO criteria of maternal near-miss, specifically organ dysfunction (24). Similarly, our findings suggest that inclusion criteria, especially those disease-based, were found useful for birthing centres. Use of the near-miss review process improved health workers’ knowledge and clinical skills, encouraged management committees to generate resources for QoC and supported the availability of life-saving medicines and equipment at health facilities. While this study was limited to MNNR integration within one rural district at 15 health facilities, the findings suggest that MNNR process implementation is feasible through the existing peripheral health system in Nepal.

In addition, the study found that the perceived high workload of health workers was not a barrier for programme implementation as the monthly number of near-miss cases was low, and required minimal time. In contrast, a review of these success stories from severe, acute morbid maternal and neonatal cases documented the potential to increase the confidence of the health workers for management of near-miss cases (25).

Overall, the study demonstrated that MNNR can be implemented at the peripheral-level facilities through the existing health system. Due to government’s active involvement from the inception of the project, the implementation was well-supported. MNNR operational guidelines were developed to fit the Nepali context and the needs of lower level health facilities. The findings supported scaling-up the near-miss review process across Nepal. In addition, the study found that the MNNR process created a useful platform to share and discuss clinical and managerial aspects of acute severe maternal and neonatal morbidity case management among health workers and strengthens health worker performance, especially in delivering quality MNC services.

Maternal near-miss case reviews permitted a complete examination of the incidence, risk factors, clinical care and outcomes of severe complications in pregnancy, and enabled the lessons learned to improve future care to be identified more quickly with the potential of better health for both women and newborns (26).

An analysis of the MNNR programme costs showed that implementation, including initial training to health workers and trimester reviews, per birthing centre in Arghakhanchi was US$ 800. The cost would be reduced in succeeding years as it would not be necessary to conduct training each year and the guidelines and MNNR-TAG have already been established.

One study limitation was the inability to account for the outcome of all the identified near-miss cases. As the Arghakhanchi District is close to other referral hospitals, there is a practice of self-referral to tertiary care centres. Therefore, some near-miss cases might have been missed in the study. If the programme is expanded and scaled-up to other districts, we anticipate that those cases would be more likely to be captured by the neighbouring district reporting. Other barriers included the attrition of trained staff due to the frequent transfers and the limited time constraints of district hospital doctors. However, these staffing issues should be addressed prior, if MNNR is to be scaled-up at the national level.

To improve MNH status in Nepal, the MNNR approach is a promising strategy for future health investment. Implementing the near-miss review process through the existing health system and structure is a low-cost intervention. This strategy allows for peripheral-level facilities to troubleshoot, build their skill capacity and identify opportunities to improve MNH health outcomes in rural communities. Recommendations to ensure successful implementation and scale-up include the following: introducing the MNNR process in the health system as part of the MNH continuum of care; conducting continuous monitoring of the MNNR process to ensure proper implementation by health workers; ensure the regular functioning of CEONC at district hospital and simplifying committee structures to ensure their functionality. Other considerations include expanding the MNNR model to select areas (terai, mountain and hill regions) through the government health system before launching a national programme.

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CONFLICT OF INTEREST

The authors do not have any conflict of interest in this publication.

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