

Effectiveness of Focused Obstetric Ultrasound Training to Nurses from Remote Health Posts to Improve Pregnancy Outcome and Reduce Morbidity

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ABSTRACT

Background: A rural ultrasound program was started in Nepal in order to detect complicated pregnancies early in health post where radiologists are not available to provide their services. The study aims to investigate whether focused obstetric ultrasound trained nurses were capable of detecting high risk pregnancy at an early stage in their health post and refer them to higher centre timely so that they are taken care properly.

Methods: The study site for research were health posts and hospitals where the rural ultrasound program had been conducted in districts of Sudurpashchim province. The referral centres within Sudurpashchim province were assessed for cross verification of diagnosis and pregnancy outcome of referred cases. Quantitative data was collected from health posts and hospitals ultrasound log book where women who had accessed obstetric ultrasound services during pregnancy. Qualitative data was collected from nurses who have completed training. The data was verified from log-book registered in the health post and hospitals. All the quantitative data was entered and analysed.

Results: Cross verified data revealed that focused obstetric ultrasound received nurses identified cases been verified same diagnosis in referral hospitals with 66 cases. In-depth interview with 28 nurses revealed that training received by them was effective in minimizing preventable maternal and neonatal mortality and morbidity.

Conclusions: Focused obstetric ultrasound in rural and under-resources communities like in Nepal has the potential to improve access and quality of health care services and can result in an increased uptake of antenatal care service utilisation.

Keywords: Complicated pregnancies; health post; nurses; obstetric ultrasound

INTRODUCTION

In Nepal, where radiologists are often unavailable in rural areas, rural ultrasound program was initiated to detect difficult pregnancies. This effective strategy has been implemented throughout province by Far-Western Provincial Health Directorate and ongoing contributions are made to further reduce Maternal Mortality in Nepal.¹

Originally rural focused obstetric ultrasound training to nurses started in Solukhumbu in 2006 and hence with importance of its needs it was started in Dhading, Humla, Sindhupalchowk, Mahottari, and other districts across Nepal with technical support by Solukhumbu Polytechnical Academy. With training, ultrasound devices

had been handed over to health posts for nurses receiving training for the same. Women who delayed seeking care or arrived at medical facilities later experienced over 65 percent of maternal fatalities.²

Study aims to cross-check diagnosis between focused obstetric ultrasound program and referral hospital with complicated pregnancies that were referred for higher care and to evaluate success of a complicated pregnancy.

METHODS

The study employed a mixed-method approach and was conducted in health posts and hospitals in Sudurpashchim Province where rural ultrasound program had been rolled out by Far-West Provincial Health Directorate

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with technical assistance by Solukhumbu Polytechnical Academy.

The sample size for quantitative data was calculated using sample size was calculated using formula, $n = \frac{Z^2 P(1-P)}{d^2}$ where, prevalence of cases scanned and identified as complicated and referral (P) = 4%,¹ Z is z score and confidence level at 95% = 1.96, margin of error (d) = 5%. Thus, the total sample size (n) was 60. A purposive sampling technique was used until the required sample size was reached. Data was collected from the health post log book of women who had accessed rural ultrasound in health posts and had complicated or abnormal ultrasound findings from January 2020 till October 2022. Cases without complication or abnormal pregnancy were excluded and referred cases were cross-checked with hospitals in Sudurpashchim province.

For qualitative data, 12% of total focused obstetric ultrasound training received nurses from 88 palikas of Sudurpashchim Province (225) was calculated and total 28 nurses were interviewed. A purposive sampling technique was used to select nurses who had received 21 days of focused obstetric ultrasound training from November 2019 to July 2022. Nurses without training were excluded.

The data collection tool for this study was rural ultrasound health post log book. The logbook also contains details of patients in which hospitals they have been referred to.

The study was approved by Nepal Health Research Council (Reg no. 461/2022). All training received nurses who voluntarily gave their consent with signature were enrolled in in-depth interviews. All personal identifiers were anonymized for confidentiality. After data collection data was checked for completeness and consistency. Frequencies and percentages were analysed.

For qualitative data, questionnaire was developed and tools were pretested in a sample population and further adapted as needed during the course of data collection. Interviews were conducted in Nepali, recorded with permission and later transcribed and translated into English. A thematic approach was used to analyse data, where codes were developed based on interview questions and initial reading of transcripts.

Co-author coded all interviews using codebook. Content codes were further grouped into thematic categories. NVivo was used for organizing text, coding data, grouping codes into relevant themes and presenting key themes.

RESULTS

Data was collected from Achham, Baitadi, Bajura, Dadeldhura, Doti, Kailali and Kanchanpur districts, total 457 cases were referred between January 2020 till October 2022 to higher centers by trained nurses for further treatment.

Most pregnant women 391 (85.56%) who were identified as high-risk pregnancies at health post were at ≥ 20 years of age and 53 (11.60%) women were at 20 years of age. Mostly pregnant women 282 (61.71%) were in their third trimester followed by 95 (20.79%) in their second trimester.

Cross-verification of referral cases revealed that only 66 out of 457 cases (14.44%) were verified. Highest number of verified cases were from Achham 18 (27.27%), Kanchanpur 15 (22.73%), Dadeldhura 13 (19.70%), and Kailali 8 (12.12%) districts. Most of the cases were verified in Seti Provincial hospital 22 (33.33%), Dadeldhura Hospital 18 (27.27%) and Mangalsen Hospital 11 (16.67%).

During cross verification, it was found that, 13 (19.70%) had breech presentation, 1(1.52% had twins with breech, 10 (15.15%) had IUFD where 1(1.52%) had Hydrocephalus IUFD, 1(1.52%) had IUFD with Eclampsia and ascites, 1(1.52% had twins with IUFD 1(1.52%) had pre-eclampsia with IUFD, 2 (3.03%) diagnosed as IUGR. Almost all complicated pregnancy findings during focused obstetric ultrasound by nurses were similar to diagnosis found in referral hospitals' log book of 66 women.

Among 66 women who have received care from referred hospitals, pregnancy outcome of women is shown in Table 1.

Table 1. Pregnancy outcome of women.

| Pregnancy outcome | Number of women (Percent) (n=66) |
|--|----------------------------------|
| Breech delivery: mother baby alive | 2 (3.02) |
| Caesarean section: mother baby alive | 19 (28.79) |
| Caesarean section: IUFD, mother alive | 1 (1.52) |
| CAC for missed abortion | 1 (1.52) |
| Treated and discharged for leaking PV bleeding | 1 (1.52) |
| IUFD expelled and mother alive | 5 (7.58) |
| Manual Vacuum Aspiration for blighted ovum | 1 (1.52) |

| | |
|---|------------|
| Normal delivery: Twins, mother babies alive | 1 (1.52) |
| Normal delivery: mother alive, lacerated hydrocephalus IUFD | 1 (1.52) |
| Normal delivery: mother alive, anencephaly | 1 (1.52) |
| Normal delivery: mother alive, macerated baby | 1 (1.52) |
| Normal delivery: mother baby alive | 18 (27.27) |
| Operated and recovered ectopic pregnancy | 1 (1.52) |
| Refer out | 2 (3.02) |
| Spontaneous IUFD expelled | 1 (1.52) |
| Suction retained placenta | 1 (1.52) |
| Vacuum Delivery: IUFD | 2 (3.02) |
| Vacuum delivery: mother baby alive | 2 (3.03) |
| Vacuum delivery: Twins IUFD, mother alive | 1 (1.52) |
| Missing* | 4 (6.06) |

*Outcome of pregnancy field was empty in hospital log book

Of 28 nurses interviewed, seven were from Achham, two were from Dadeldhura, two were from Dhangadi Sub-Metropolitan City, two were from Doti, four from Kailali and eleven from Kanchanpur districts of Sudurpashchim Province. Nurses who have received refresher training were 19 nurses' and nine have not yet received refresher training. On average, interviews lasted approximately 45 minutes. Each training batch was completed for 21 days and in each training an average number of participants was 15.

Trained nurses recognized the importance of ultrasound in rural health post, benefits women who resides geographically and are financially challenged, to provide service to disadvantaged rural women, to develop competence, efficient than using manual for finding position of fetus, timely diagnosing and referral of complicated cases, to reduce neonatal and maternal mortality and morbidity and save lives of women and neonatal.

"The work of Rural Ultrasound is helping to reduce MMR and neonatal mortality. That's why I am thankful to Dr. Mingmar Sherpa who is the father of Rural Ultrasound program for giving me this opportunity. My motive was also focused on reducing MMR and neonatal mortality rates which is one of the reasons and women living in this village have difficulty reaching to place to receive service due to economic issues. I received the training to ease problems of those women to receive the services."

A5

All trained nurses expressed that training was effective, training sessions were interactive and during training participants received proper guidance and objectives of learners were met because of skilled trainer in both theoretical and practical sessions. However, two nurses from Kailali and Kanchanpur, expressed that due to large number of training participants, they did practice in one.

"It was my first time to receive ultrasound training, I was nervous and uncomfortable at first. I was unsure if I could learn or not but later after doing it practically it became easier. I used to think I could learn more about abnormal cases if found in training.. I used to wonder how to do ultrasound practically but later I was able to do it easily with proper practice."- K17

All participants expressed that they learnt about normal and abnormal cases of pregnancy and timely referral of cases in case of complication findings during ultrasound.

"learned about all condition of fetus, measurement of head circumference (BPD), if there is presence of hydrocephaly, anencephaly or other abnormal findings, measuring abdominal circumference, abnormality, if there is any deformation of the fetus, if portal venal is developed or not, if there is spine or not, if urine bladder has been developed or not, how to find the AFI , Polyhydramnios, Oligohydramnios, to find the cardiac activity (FHR) of fetus, to find presentation (Breech, Cephalic, Transverse)."- A2

Regarding follow up after focused obstetric ultrasound training, almost all responded that there are no such follow up from palika level or other except in few cases but regarding clinical confusion and queries, regular group chat with trainer through is in continue which made them helpful.

"There is no follow up done but in Ministry of Population had called us for briefing and reporting regarding ultrasound services provided by nursing staff in the district level. They asked about diagnosis of abnormal cases, how is program ongoing, and if we have received incentives or not? If there is confusion about cases (abnormal) then we send the report in the group created and we receive response promptly."- K18

Most nurses expressed confidence in providing focused obstetric ultrasound services to pregnant women. The nurse shared that after receiving training and providing ultrasound services at health posts and during home visit, pregnant women visit health post and are curious

about their pregnancy.

“People had heard that I had received the training and they were happy that they didn’t have to go to district hospital to get ultrasound services. Service seekers were happier than me because most people have financial problems to go to district hospitals to receive services. I felt that there should be ultrasound services in every area of the Sudurpashchim province.”- D8

Most of the nurses expressed the challenges of covering large areas by a single nurse with one ultrasound machine. Further some even expressed that certain places require 2-3 days travel to reach their destination and have problems in charging ultrasound machines. However, some nurses shared that after other nurses from the same palika were trained for focused obstetric ultrasound, it made it easy to provide services. One of the nurses expressed the challenges of staff turnover and difficulty in reporting.

“Main concern is referred patient not going to referred places due to low economic condition. In my absence, there is no alternate service provider to give ultrasound service so they need to refer them to Mangalsen to receive the service.”- A7

“Due to challenging geographical condition, during monsoon season we have to walk for 6-7 hrs. to provide services. We need to cross river carrying a machine on neck holding each other’s hands. We fear that machine might fall in the river and get damaged.”- D8

Few nurses responded that there are no challenges in using ultrasound machine. However, nurse from Darchula expresses the difficulty in using ultrasound machines due to the unavailability of electricity and geographical challenge.

Almost all nurses provided suggestions providing focused obstetric ultrasound services at all health post. Nurses suggested for frequently follow-up of their work, cases updates, expanding training, regulation of regular refresher training, provision of machine as per number of cases and areas to be covered by nurses, standard format of recording and reporting. Some suggestions are highlighted as below:

“...Reporting and recording of cases is better for rural ultrasound program. Before there was no recording tool, I used to make a simple register of the ultrasound seeker. Now there are recording tool from GP. There is much improvement from palika level...”- K13

“Since there are 2 staff to perform ultrasound, we do in rotation. I am local here and live close to HP and whenever there is complicated cases I am always present. The machine is always available here in the HP. Only during field days, another sister takes machine. It would be better if there were two machines for both of us.”- K19

“We haven’t followed up with hospitals regarding cases which we had referred. There is no refer slip, some referred cases may not go to the referred points due to crowded environment and they may go to private clinics.”- DSM28

“It would be better if training is given to another sister as well because it isn’t sure that I will be here forever.”- Da9

Most nurses shared that; the referral system is good but not followed accordingly. Insufficiency of knowledge and due to financial constraints women do not go to referred hospitals. Ineffective hospital staff coordination, a lack of a suitable referral case flow mechanism, lack of usage of referral slips, and sisters are unaware of the status of referred women are all concerns.

“Referral system is good but rural people don’t go to referred places.”- A4

“If cases are identified and referred on time then the system is very good...This saves time of both patient and hospital. Since, Baitadi is very conservative and women are rooted in the family’s decision they can’t take self-decision. There is less support from the family for women.”- K21

“Mangalsen palika supports people for transportation but problem is when people refer for cash support for transportation people don’t get money from palika on time. Palika’s process is lengthy so, hand cash would be more effective if people received support on time.”- A4

DISCUSSION

The cross-verified data revealed that focused obstetric ultrasound received nurses identified cases been verified same diagnosis in referral hospitals with 66 cases. Findings were similar in a study conducted in Rwanda 2008 where physicians and ultrasound-trained local health care providers’ quality review physicians was 96%.³

Further, In-depth interview with 28 nurses revealed that training received by them was very useful in minimizing

preventable maternal and neonatal mortality and morbidity.

In most developing countries where resources are limited, access to ultrasound during antenatal is available to few privileged women due to an extreme shortage of radiologists and doctors with specialist training, diagnostic services, and long distances to access medical care.⁴ They suggested that ultrasound training for nurses with no prior ultrasound experience can be conducted to use portable ultrasound machines to perform focused obstetric ultrasound to improve access to ultrasound for pregnant women.⁵ They also said that it would be helpful if additional nurses were trained so that all areas are covered in remote areas without any interference in regular service provision. Also, it was found that among midwife ultrasound skills over the six-month study period was retained.^{5,6} The study conducted in Rwanda in 2008 supported that after preliminary training, an ultrasound program headed by local healthcare providers is sustainable and leads to precise diagnosis.³ Nurses who work in rural health facilities if trained properly for focused obstetric ultrasound examination, they can detect complicated cases early and can refer to higher centres where they can be treated and their lives are saved which is supported by other study conducted by Rijken et al in 2009, the study resulted that locally trained health workers can obtain accurate foetal biometry measurements for gestational age estimation and training of local health workers like midwives in developing countries is likely and could allow effective practice of obstetric ultrasound imaging.⁷

A report on maternal mortality 2022, revealed that among seven provinces, Bagmati Province had the lowest MMR at 98 per 100,000 live births followed by Sudurpashchim Province at 130 per 100,000 live births.⁸ The provincial annual health report of Sudurpashchim Province published in 2021/22 showed that institutional deliveries (82.5% to 92.8%) and first antenatal visits (81.4% to 87.7%) of pregnant mothers increased steadily, possibly due to the availability of focused obstetric ultrasound trained nurses. As a result, it helped to decrease maternal mortality and neonatal mortality.⁹

Furthermore, the staffs from referral hospitals should also be involved in cases referral with following referral mechanism flow and using referral slip so that pregnancy outcomes would be known to the nurses as well.

As informed by the trained nurses in the beginning due to the unavailability of data recording format, some information regarding ultrasound findings was not mentioned in ultrasound log book and hence are

missing. In some cases, it was found that the name or age mentioned or provided at health post been different than that was found in hospitals as the information provider (usually family member) while providing to hospital personnel would be different and because of which those cases were not included.

Due to lack of follow up from palika and other associated organization, the challenges faced by women due to financial constraints are not been addressed in some extent. Although Family Welfare Division had allocated emergency referral funds with an objective to support emergency referral transport to women from poor, Dalit, Janajati, geographically disadvantaged, and socially and economically disadvantaged communities who need further treatment to 53 hospitals of 52 districts in FY 2077/78 from across the seven provinces. A total of 6,700,000 Rupees was allocated to 53 hospitals to support women when referral needed. Additional about 60,000 rupees in each palika was allocated for the Basic Emergency Obstetric and New-born Care (BEONC) service sites to support transport fares for women who could not afford referral to high facility.¹⁰

Additionally, due to staff turnover and missed handover to recruited staff, there is a gap in recording and reporting data and information.

The study revealed that some challenges such as financial constraints, lack of knowledge, distance to health facility, unavailability of transportation prevented pregnant women reaching referral facilities and, in some districts, due to accessibility of more options at private clinics and open border in India.

As single life matters and due to this training to nurses at health posts have saved lives of maternal and neonatal and also could aid in achieving the Sustainable Development Goal (SDG) target of reducing the global MMR to less than 70 maternal deaths per 100,000 live births by 2030.¹¹

This study was conducted in specific setting. So, findings should be cautiously interpreted and before generalizing the finding, the context in which study was undertaken should be taken in account.

CONCLUSIONS

Undesirable instances of maternal and neonatal mortality and morbidity caused by preventable factors are unacceptable, particularly when effective solution is available. In Nepal, providing focused obstetric ultrasound in rural and under-resourced communities

can lead to greater utilisation of antenatal care services. With proper training and guidance, nurses can accurately determine gestational age, identify foetal anomalies in all trimester and determine the number of gestations.

To expand access to ultrasound for all pregnant women in country, we recommend training additional nurses to perform focused obstetric ultrasound. This approach has potential to improve healthcare access and quality in resource-constrained settings. Additionally, our findings suggest that ultrasound programs led by nurses at health posts are sustainable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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