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Retrospective Multifacility Evaluation of the Rural Obstetric Ultrasound Program's Impact on Antenatal Care

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ABSTRACT

Background: Rural women in Nepal continue to face challenges accessing antenatal care (ANC). To address these challenges, the rural obstetric ultrasound program (ROUSG) was introduced to bring basic ultrasound services to rural health facilities, enabling earlier detection of complications and timely referral. This study assessed whether ROUSG improved ANC attendance, complication detection, and perinatal outcomes.

Methods: This retrospective comparative study was conducted at seven health facilities in Kailari Rural Municipality, Kailali District. ANC records of women aged 20-49 were compared across two 12-month periods: before and after ROUSG implementation. Data were analysed using descriptive and inferential statistical tests, with significance set at $p \leq 0.05$.

Results: After implementation of ROUSG, the distribution of delivery methods differed significantly ($p = 0.032$), with fewer vaginal deliveries and more assisted deliveries. A higher proportion of complications was identified, including malpresentation (1.1% vs. 1.9%), hypertension (1.1% vs. 2.3%), and abortion-related complications (1.6% vs. 2.1%). In contrast, early ANC attendance (first and second visits) and facility-based deliveries remained largely unchanged. Maternal mortality was zero in both periods, and neonatal mortality remained low at 0.3% (2 cases) in the pre-ROUSG group and 0.2% (1 case) in the post-ROUSG group.

Conclusions: The ROUSG program was associated with greater identification of pregnancy-related complications and changes in delivery management, but no increase in ANC attendance or facility deliveries. These findings suggest that while ultrasound strengthens diagnostic capacity, persistent barriers such as cultural norms, transportation challenges, and limited counselling must also be addressed to improve maternal care-seeking behaviours in rural Nepal.

Keywords: Infant mortality; maternal mortality; prenatal care; rural health services; ultrasonography.

INTRODUCTION

Antenatal care (ANC) reduces maternal and perinatal morbidity and mortality directly by detecting and treating complications, and indirectly by identifying women at risk and ensuring referral to appropriate services.[1,2] Rural women face barriers such as distance, transportation, and limited service availability.[3] Nepal has made progress in maternal health, with the maternal mortality ratio declining from 539 per 100,000 live births in 1998 to 151 in 2022.[4-7] Still, preventable deaths persist and are often associated with incomplete ANC attendance and regional disparities[8] To address diagnostic gaps, the Government of Nepal introduced the rural obstetric ultrasound program (ROUSG) in 2019 to support earlier complication detection, timely referral, and improved institutional delivery, thereby strengthening maternal health services.[9-12] The program deploys portable ultrasound devices to rural health facilities and trains nurses and auxiliary nurse midwives to perform focused basic obstetric scans before 24 weeks of gestation. This study evaluates the effectiveness of ROUSG in improving ANC attendance, detecting complications, and reducing maternal and perinatal mortality.

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METHODS

This retrospective comparative study was conducted in seven health facilities of Kailari Rural Municipality, Kailali District, Sudurpashchim Province, Nepal. ROUSG services were introduced in 2019. This district was selected because it had one of the highest institutional delivery rates in the province. Records were reviewed for two 12-month periods: before implementation (pre-ROUSG, July 16, 2020, to July 15, 2021) and after implementation (post-ROUSG, July 16, 2021–July 15, 2022).

Ethical approval was obtained from the Institutional Review Board of Juntendo University, Japan (Reg. no. 2024-60) and the Institutional Review Board of the Nepal Health Research Council (Reg. no. 657-2024). Administrative approval was also secured from the local municipality to access facility records. All complete antenatal care records during the study periods were included. Records with missing or incomplete information (e.g., ANC visits, delivery outcomes, or complication status) were excluded. All eligible records from the seven health facilities were included; no sampling was performed.

Data were analysed using IBM SPSS Statistics version 29.0. Descriptive statistics (frequencies and percentages) summarized maternal characteristics, ANC visits, delivery outcomes, and complications. For inferential statistics, normality was assessed prior to analysis. Independent sample t-tests, Chi-square tests, and Fisher's exact tests were applied as appropriate to compare outcomes between pre-ROUSG and post-ROUSG groups. Statistical significance was set at $p \leq 0.05$.

RESULTS

A total of 1,189 records were included in the analysis: 619 from the pre-ROUSG period and 570 from the post-ROUSG period. Most women were aged 20–29 years in both groups (83.0% vs. 78.1%). Educational attainment differed significantly between groups ($p = 0.001$), with more women in the post-ROUSG group having secondary (29.6% vs. 14.2%) and higher education (6.0% vs. 2.9%), while basic education was more common pre-ROUSG (81.9% vs. 63.7%). Employment was slightly higher post-ROUSG (5.4% vs. 3.2%). No notable differences were observed for gravida or parity distributions (Table 1).

Table 1. Socio-demographic characteristics of study participants between pre-ROUSG and post-ROUSG.

	Pre-ROUSG (n=619)		Post-ROUSG (n=570)		p-value
	Number	Percentage	Number	Percentage	
Age (Years)					
20-29	519	83.00	445	78.1	0.56
30-39	101	16.3	123	21.6	
40-49	4	0.6	2	0.4	
Education					
No education	6	1.0	4	0.7	0.001
Basic education (1-8 years)	507	81.9	363	63.7	
Secondary education (9-12 years)	88	14.2	169	29.6	
Higher education (≥ 13 years)	18	2.9	34	6.0	
Occupation					
Employment	20	3.2	31	5.4	0.061
Unemployment	599	96.8	539	94.6	
Gravida					
Primigravida	348	56.2	302	53.0	0.473
Multi gravida	252	40.7	252	44.2	
Grand multi-gravida	19	3.1	16	2.8	
Para					

Nulliparity	364	58.8	324	56.8	0.768
Low multiparity	249	40.2	241	42.3	
Grand multi parity	6	1.0	5	0.9	

Patterns of ANC utilization were similar across both periods. The proportion of women attending the first ANC visit was 7.7% post-ROUSG compared with 8.7% pre-ROUSG. Attendance at the second, third, and fourth visits also showed little change, with fourth-visit completion at 75.8% post-ROUSG and 77.9% pre-ROUSG. Facility-based deliveries remained stable (50.7% vs. 51.2%) (Table 2).

Table 2. Antenatal care visits and place of delivery between pre-ROUSG and post-ROUSG.

	Pre-ROUSG			Post-ROUSG			p- value
Visits	**N (%)**	**Mean**	**SD**	**N (%)**	**Mean**	**SD**	
1st ANC visit	54 (8.7)	1.0	0.2	44 (7.7)	0.95	0.2	0.756
2nd ANC visit	39 (6.3)	0.9	0.3	38 (6.7)	0.92	0.3	0.100
3rd ANC visit	44 (7.1)	0.9	0.3	56 (9.8)	0.87	0.6	0.822
4th ANC visits	482 (77.9)	0.8	0.4	432 (75.8)	0.79	0.4	0.132
Inside health facility	317 (51.2)	1.5	0.5	289 (50.7)	0.49	0.5	0.817
Outside health facility	302 (48.8)	1.5	0.5	281 (49.3)	0.51	0.5	0.774

Abbreviations: SD, standard deviation; ANC, antenatal care

A higher proportion of complications was identified post-ROUSG (8.9% vs. 5.0%). Malpresentation (1.9% vs. 1.1%), hypertension (2.3% vs. 1.1%), and abortion-related complications (2.1% vs. 1.6%) were slightly more frequent after implementation. Placenta previa was reported at 0.5% in both groups. Intrauterine fetal demise (IUFD) was observed in both periods but more frequent post-ROUSG (0.7% vs. 0.2%). Rare conditions such as anencephaly and oligohydramnios were reported only after implementation. Maternal mortality was zero in both groups, and neonatal mortality remained low at 0.3% (2 cases) in the pre-ROUSG group and 0.2% (1 case) in the post-ROUSG group (Table 3).

Table 3. Pregnancy complications and mortality outcomes between pre-ROUSG and post-ROUSG.

Variable	**pre-ROUSG (n=28)**		**post-ROUSG (n=48)**		**p- value**
Complication identified	Number	Percentage	Number	Percentage	
No complication	588	95.0	519	91.1	0.304
Malpresentation	7	1.1	11	1.9	
Abortion	10	1.6	12	2.1	
Hypertension	7	1.1	13	2.3	
Placenta previa	3	0.5	3	0.5	
Macrosomia (>4000gm)	2	0.3	3	0.5	
IUFD	1	0.2	4	0.7	
Twins	1	0.2	2	0.4	
Anencephaly	0	0.0	2	0.4	
Oligohydramnios	0	0.0	1	0.2	
Mortality					
Maternal	0	0.0	0	0.0	-
Neonatal	2	0.3	1	0.2	0.531

Abbreviations: IUFD, intrauterine fetal demise.

The distribution of delivery methods differed significantly between groups (p = 0.032). Vaginal deliveries were less common post-ROUSG (73.3% vs. 83.4%), while assisted deliveries were more common (12.1% vs. 5.6%). Caesarean sections were slightly more frequent (10.3% vs. 7.9%), as were dilation and evacuation procedures (4.3% vs. 3.0%) (Table 4).

Table 4. Distribution of delivery methods between pre-ROUSG and post-ROUSG.

Variables	pre-ROUSG (n=302)		post-ROUSG (n=281)		p-value
Change in management	Number	Percentage	Number	Percentage	
Vaginal Delivery	252	83.4	206	73.3	
Assisted Delivery	17	5.6	34	12.1	0.032
Cesarean Delivery	24	7.9	29	10.3	
Dilation and Evacuation	9	3.0	12	4.3	

DISCUSSION

This study examined ANC and delivery outcomes before and after the ROUSG in a rural municipality of Nepal. Two findings were statistically significant. Educational attainment differed between groups, with a greater proportion of women in the post-ROUSG period having secondary or higher education. The distribution of delivery methods also differed, with assisted deliveries more common after implementation. These results indicate both population-level differences between the groups and shifts in obstetric management practices, reflecting how ultrasound findings may influence decision-making during pregnancy.

Ultrasound has become an important component of ANC in low-resource settings, enabling earlier identification of high-risk pregnancies and complications.[13-14] Training nurses and midwives to conduct focused obstetric scans has been shown to improve detection and referral in rural contexts where radiologists are unavailable.[15] In Nepal, the government has prioritized expanding access to ultrasound in primary facilities, integrating it into broader maternal health strategies. These initiatives reflect global recommendations that at least one ultrasound be provided before 24 weeks of gestation to assess fetal growth, detect anomalies, and support a positive pregnancy experience.[16,17]

Despite these efforts, ANC attendance in this study remained stable across both groups, with low rates of early visits. Facility-based deliveries also showed little change. These findings align with evidence from a large cluster-randomized trial across five countries, which demonstrated that routine ultrasound did not independently increase ANC utilization, facility deliveries, or mortality outcomes.[18] Similar observations have been reported in Nepal, where national initiatives such as the Safe Motherhood and Aama programs have provided financial incentives for institutional delivery since 2005, yet persistent disparities remain.[4] Barriers including geographic distance, transport challenges, financial limitations, and sociocultural preferences for home births continue to restrict maternal health service use.[19,20] In this study, these factors likely contributed to the unchanged ANC and delivery utilization despite greater access to ultrasound technology.

By contrast, the identification of complications was higher post-ROUSG, including malpresentation, hypertension, and abortion-related complications. Rare anomalies such as anencephaly and oligohydramnios were also recorded. Similar patterns have been reported in Ghana, Uganda, Nigeria, and Nepal, where frontline providers equipped with ultrasound were able to detect conditions not identifiable by clinical examination alone.[21-24] Improved detection has important clinical implications even if service utilization remains stable, as earlier identification allows for timely referral, preparation for obstetric intervention, and more informed counselling of families. In this study, the significant shift in delivery methods, particularly the increase in assisted deliveries, likely reflects how ultrasound findings prompted changes in delivery planning.

Findings from other contexts are mixed. In northern Nigeria, ultrasound access improved ANC compliance and supervised delivery,[25] and experiences in rural Australia have linked point-of-care ultrasound with increased maternal engagement.[26] However, randomized and pragmatic trials consistently suggest that ultrasound alone is insufficient to improve outcomes without complementary investments in health system infrastructure, referral pathways, and staff training.[27,28] These contrasts highlight the importance of

context. Where strong referral systems and community trust exist, ultrasound can act as a catalyst for care-seeking; in settings where barriers remain, its impact may be limited to diagnostic improvements rather than behavioral change.

The programmatic implications for Nepal are clear. ROUSG strengthens the diagnostic capacity of rural health workers, supports earlier referral, and enhances clinical decision-making, but it must be paired with interventions that address the social and structural barriers to maternal care. Strengthening community engagement and health worker counselling, ensuring affordable transport for referrals, and improving the availability of emergency obstetric services are essential steps.[29,30] Building on national initiatives such as Safe Motherhood and Aama, ultrasound can be embedded more effectively into a broader system of support. Without these complementary measures, the potential of ultrasound to reduce maternal and neonatal mortality will remain underutilized.

This study has several limitations. First, it relied on facility records, which may contain incomplete or inaccurate information. Second, the analysis did not capture cultural or logistical factors such as transportation, family influence, or personal preferences that influence ANC attendance and delivery choices. Third, the study was conducted in a single district over two years, limiting generalizability. Finally, the quality and consistency of ultrasound services across facilities were not assessed, which may have influenced complication detection and management.

CONCLUSIONS

The ROUSG program was associated with greater identification of pregnancy-related complications, including malpresentation, hypertension, and IUFD, but no increase in early ANC attendance or facility-based deliveries. These findings suggest that diagnostic capacity alone is insufficient to shift care-seeking behaviour in rural Nepal. Nevertheless, the identification of complications influenced delivery management, underscoring the program's critical value. Strengthening community engagement, health worker counselling, and referral systems will be essential to maximize the benefits of ultrasound and improve maternal and neonatal outcomes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Sitaula S, Basnet T, Agrawal A, Manandhar T, Das D, Shrestha P. Prevalence and risk factors for maternal mortality at a tertiary care centre in Eastern Nepal: retrospective cross-sectional study. BMC Pregnancy Childbirth. 2021;21(1):471. doi: https://doi.org/10.1186/s12884-021-03920-4

2. Carroli. G, Rooney. C, Villa. J. How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence. Paediatr perinat Epidemiol. 2001;15:1-42.doi: https://doi.org/10.1046/j.1365-3016.2001.0150s1001.x

3. Bidner A, Bezak E, Parange N. Antenatal ultrasound needs-analysis survey of Australian rural/remote healthcare clinicians: recommendations for improved service quality and access. BMC Public Health. 2023;23(1):2268. doi: https://doi.org/10.1186/s12889-023-17106-4

4. Aryal KK, Sharma SK, Khanal MN, Bista B, Sharma SL, Kafle S, et al. Maternal Health Care in Nepal: Trends and Determinants. Rockville: ICF; 2019. Report No. 118.

5. Department of Health Services. Nepal Safe Motherhood and Newborn Health Road Map 2030. Kathmandu (Nepal): Family Welfare Division; 2019.

6. Family Welfare Division. ANC to PNc continuum of care guideline. Kathmandu (Nepal): Family Welfare Division; 2022.

7. Ministry of Health and Population, New Era, ICF. Nepal Demographic Health Survey 2022. Kathmandu (Nepal): Ministry of Health and Population; 2023.

8. Ministry of Health and Population, National Statistics Office. A report on maternal mortality. Kathmandu

(Nepal): Ministry of Health and Population; 2021.

9. Ministry of Health and Population. Rural Obstetric Ultrasound Programme for Nurses, Final Reference Manual. Kathmandu: Ministry of Health and Population;2022a.

10. Ministry of Health and Population. Rural Obstetric Ultrasound Training (ROUSG) For Nurses, Teku, Kathmandu: National Health Training Center; 2022b.

11. Kozuki N, Mullany LC, Khatry SK, Ghimire RK, Paudel S, Blakemore K, et al. Accuracy of Home-Based Ultrasonographic Diagnosis of Obstetric Risk Factors by Primary-Level Health Care Workers in Rural Nepal. Obstet Gynecol. 2016;128(3):604-12. doi: https://doi.org/10.1097/AOG.0000000000001558

12. Kim C, Wagle K, Shrestha B, Bhatta S, Maharjan S, Dhakal L, et al. Perceptions of service providers, service recipients, and female community health volunteers on a rural obstetric ultrasound program in rural Nepal: a qualitative study. BMC Pregnancy Childbirth. 2023;23(1):574. doi: https://doi.org/10.1186/s12884-023-05876-z

13. Franklin HL, Mirza W, Swanson DL, Newman JE, Goldenberg RL, Muyodi D, et al. Factors influencing referrals for ultrasound-diagnosed complications during prenatal care in five low and middle-income countries. Reprod Health. 2018;15(1):204. doi: https://doi.org/10.1186/s12978-018-0647-8

14. Jagadish J, Sherpa. MG, Sherpa. LY, Lama N, Maharjan M, Lama LD, et al. Effectiveness of Focused Obstetric Ultrasound Training to Nurses from Remote Health Posts to Improve Pregnancy Outcome and Reduce Morbidity. J Nepal Health Research Council 2023;21(59):303-08.doi: https://doi.org/10.33314/jnhrc.v21i02.4739

15. Holmlund S, Ntaganira J, Edvardsson K, Lan PT, Semasaka Sengoma JP, Ahman A, et al. Improved maternity care if midwives learn to perform ultrasound: a qualitative study of 8 Rwandan midwives' experiences and views of obstetric ultrasound. Glob Health Action. 2017;10(1):1350451. doi: https://doi.org/10.1080/16549716.2017.1350451

16. World Health Organization. World Health Organization recommendations on antenatal care for a positive pregnancy experience. Geneva: World Health Organization;2016a

17. World Health Organization. Standards for improving the quality of maternal and newborn care in health facilities. Geneva: World Health Organization; 2016b.

18. McClure EM, Saleem S, Esamai F, Garces A, Chomba E, Tshefu A, et al. First Look: a cluster randomised trial of ultrasound to improve pregnancy outcomes. BMC Pregnancy Childbirth. 2014;14:73.doi: https://doi.org/10.1186/1471-2393-14-73

19. Kozuki N, Katz J, Khatry SK, Tielsch JM, LeClerq SC, Mullany LC. Community survey on awareness and use of obstetric ultrasonography in rural Sarlahi District, Nepal. Int J Gynaecol Obstet. 2016;134(2):126-30. doi: https://doi.org/10.1016/j.ijgo.2016.01.015

20. Sondaal AEC, Tumbahangphe KM, Neupane R, Smith J, Lee H, Sharma P, et al. Sustainability of community-based women's groups: reflections from a participatory intervention for newborn and maternal health in Nepal. Community Dev J. 2019;54(4):731-49. doi: https://doi.org/10.1093/cdj/bsy017

21. Mensah YB, Nkyekyer K, Mensah K. The Ghanaian woman's experience and perception of ultrasound use in antenatal care. Ghana Med J. 2014;48(1):31-8. doi: https://doi.org/10.4314/gmj.v48i1.5

22. Shah S, Santos N, Kisa R, Tumusiime J, Nabirye RC, Ayebare F, et al. Efficacy of an ultrasound training program for nurse midwives to assess high-risk conditions at labor triage in rural Uganda. PLoS One 2020;15(6):e0235269. doi: https://doi.org/10.1371/journal.pone.0235269

23. Ali S, Kabajaasi O, Kawooya MG, Byamugisha J, Zakus D, Papageorghiou AT, et al. Antenatal Doppler ultrasound implementation in a rural sub-Saharan African setting: exploring the perspectives of women and healthcare providers. Reprod Health. 2021;18(1):199. doi: https://doi.org/10.1186/s12978-021-01233-5

24. Karkee R, Tumbahanghe KM, Morgan A, Maharjan N, Budhathoki B, Manandhar DS. Policies and actions to reduce maternal mortality in Nepal: perspectives of key informants. Sex Reprod Health Matters. 2021;29(2):1907026. doi: https://doi.org/

10.1080/26410397.2021.1907026

25. Luntsi G, Ugwu AC, Ohagwu CC, Kalu O, Sidi M, Akpan E. Impact of ultrasound scanning on pregnant Women's compliance with attendance at antenatal care visits and supervised delivery at primary healthcare centres in northern Nigeria: Initial experiences. Radiography (Lond). 2022;28(2):480-86. doi: https://doi.org/10.1016/j.radi.2022.01.003

26. Doing M, Bidner A, Dizon J, Smith R, Lee H, Patel K, et al. Availability and use of antenatal point-of-care ultrasound services within rural South Australia health care. Aust J Rural Health. 2022;30(2):281-285. doi: https://doi.org/10.1111/ajr.12811

27. Devkota B, Maskey J, Pandey AR, Shrestha N, Koirala S, Adhikari S, et al. Determinants of home delivery in Nepal: a disaggregated analysis of marginalised and non-marginalised 9 women from the 2016 Nepal Demographic and Health Survey. PLoS One. 2020;15(1):e0228440. doi: https://doi.org/10.1371/journal.pone.0228440

28. Thasineku OC, Pandit S, Acharya D, Shrestha R, Lama P, Gurung A, et al. Associated factors for the utilization of institutional delivery services in Nepal: findings from the Nepal Demographic Health Survey, doi:10.1371/journal.pone.03223.

29. Witworth M, Bricker L, Mullan C. Ultrasound for fetal assessment in early pregnancy. Cochrane Database Syst Rev 7. 2015; CD007058. doi: https://doi.org/10.1002/14651858.pub3

30. Department of Health Services. Annual Health Report 2080/81. Kathmandu: Ministry of Health and Population; 2025.