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A scoping review of interventions to improve maternal and neonatal care in Nepal

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Abstract

Background Nepal has achieved significant progress in maternal health outcomes, and the country's health system prioritises life-saving interventions during pregnancy, delivery, neonatal, and postpartum care. This scoping review aimed to systematically identify and analyse the available on interventions to improve maternal and neonatal care in Nepal.

Methods Our scoping review was conducted using Arksey and O'Malley's five-stage framework to map existing interventions. Data searches were carried out in Medline, CINAHL, PsycINFO and Scopus, focusing on interventions to improve the maternal and neonatal care. Titles and abstracts were screened, followed by full-text reviews of potentially relevant studies. Key findings were retrieved using a data extraction sheet, and the findings were presented in a narrative synthesis.

Results Our review found 418 studies, and 20 (published between 2004 and 2023) were included for this scoping review using various interventions targeting maternal and neonatal populations. Five overarching interventions were identified. Community-based maternal health literacy was the most significant intervention, followed by health facility strengthening, including health staff training, mobilisation of female community health volunteers for birth preparedness and identifying danger signs, mobile health messaging, and involving husbands in improving the uptake of maternal and neonatal care. Most interventions were a mixture of activities with a combination of interventions rather than a single intervention.

Conclusions The findings highlight that no single intervention is sufficient on its own; indeed, a combination of approaches is needed to improve the uptake of maternal and neonatal care services. Effective interventions should be scaled up and extended to underserved and marginalised communities to ensure that maternal and neonatal care services are accessible to all.

Keywords Maternal care, Neonatal care, Intervention, Institutional delivery, Postnatal care, Scoping review, South Asia

1 Background

Improving the quality, responsiveness, accessibility, and affordability of maternal and neonatal (defined as infants up to 28 days old) health services is a global health priority [1, 2]. Most maternal and neonatal mortality is preventable or at least manageable

through timely interventions during the antenatal, delivery and postnatal periods. Preventing avoidable maternal and neonatal deaths is crucial to achieving the United Nations Sustainable Development Goals (SDGs) targets 3.1 and 3.2 respectively by 2030. SDG 3 includes reducing the maternal mortality ratio (MMR) to below 70 per 100,000 live births and the neonatal mortality ratio (NMR) to below 12 deaths per 1000 live births [1, 2].

Nepal is committed to reaching the MMR and NMR targets by 2030 [3]. Currently, Nepal has an MMR of 151 per 100,000 live births [4] and an NMR of 21 per 1000 live births [5]. Higher MMRs have been reported in Lumbini and Karnali provinces at 207 and 172 per 100,000 live births, respectively [4]. Despite the significant progress in increasing maternal health service uptake and reducing the MMR, many women and neonates in Nepal continue to die each year due to limited access to preventative care and essential health services [4–6], and uptake of services is worse in poorer/rural people and certain geographical regions [7]. Nepal's national health policy focuses on "leaving no one behind" [8, 9], and the Nepal Government has made progress in both supply and demand of these services, including financing strategies implemented by the government since the 1990s [10] as well as improving access to and quality of the health system [11].

Approximately two-thirds (70%) of Nepalese women and newborns receive postnatal care (PNC) services with inequalities in access to maternal health services, especially for ethnic minority women [4]. Postnatal check-ups in Nepal highlight serious inequalities in access to postpartum care, particularly in rural areas and the Madesh province. Only 49% of rural women and 53% of newborns in Madhesh receive postnatal services; the figures suggest inadequate coverage of essential healthcare during a critical period when both mothers and newborns are highly vulnerable. Alarmingly, 61% of maternal deaths occur after delivery, underscoring the urgent need to strengthen postpartum care services [4, 5]. Globally antenatal care (ANC) interventions have been prioritised over PNC interventions leading to the latter being neglected despite its key role in reducing mortality [12]. The government of Nepal developed and initiated many strategies and programmes to improve maternal and newborn care [3] such as increasing skilled birth attendants, free maternity care, monetary incentives for antenatal care, and birth preparedness and complication readiness programs which may have contributed to the uptake and utilisation of relevant services [3, 9, 10, 13]. Likewise, research has highlighted the importance of community-based health promotion interventions in rural communities [13] and behaviour change interventions [14]. Whilst there has been a recent systematic review of ANC interventions in Nepal [15], there has yet to be a consolidated review of the available and effective interventions in improving institutional delivery, delivery by skilled health professional, PNC, and newborn care in relation to maternal and neonatal mortality in Nepal. Hence, our scoping review aimed to systematically identify and analyse the available interventions to improve maternal and neonatal care in Nepal, with a particular focus on institutional delivery, delivery by skilled health professional, PNC and neonatal care. Neonatal care covers essential care during the first 28 days of life, including immediate post-birth care (i.e. warming, skin-to-skin contact, Kangaroo mother care, cord care, early initiation of breastfeeding), specialised support for at-risk neonates (i.e. premature or low-birth-weight babies), and parental education on newborn care practices and danger signs [8, 9].

2 Methods

A scoping review was conducted using Arksey and O'Malley's five-step scoping review approach which included the five stages below: (a) identifying the review question; (b) identifying the relevant studies; (c) selecting the relevant studies; (d) charting the data; and (e) collating, summarising and reporting the results [16]. A scoping review provides comprehensive coverage of the available literature, addresses wider research questions about the types and effective interventions for improving the uptake of maternal and neonatal care including institutional delivery, skilled health professional delivery, neonatal and postnatal care. The review also identifies any gaps in literature [17]. The findings follow the Preferred Reporting Items for Systematic and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) [18].

2.1 Stage 1: Identifying the review question

The research questions were developed following the 'PICO approach' (Table 1) to pre-specify the Population, Intervention, Comparator, and Outcome [19]:

- Population: Nepalese women in the antepartum and postpartum periods including the neonates (i.e. defined those who are in labour and caring for a neonate up to 28 days after birth [20]) and,
- Intervention: Any targeted programmes to increase antepartum and postpartum care for women and newborns care,
- Comparator: any comparison groups reported in the literature,
- Outcomes: Reported evidence of outcomes or impact on increasing the uptake of institutional delivery, delivery by skilled health professional, postnatal and neonatal care and reduced maternal and neonatal mortality.

The questions for this scoping review were:

Table 1 Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Study focus	Interventions reported to improve uptake of institutional delivery, delivery by skilled health professions, neonatal and postnatal care services and reduce the maternal and neonatal mortality	Studies reported other than institutional delivery, delivery by skilled health professions, neonatal and postnatal care services
Outcome indicators	Study reported to uptake of institutional delivery, delivery by skilled health professional, post-natal care and neonatal care. Neonatal care defined as the first 28 days of life, including immediate post-birth care (i.e. warming, skin-to-skin contact, Kangaroo mother care, cord care, early initiation of breastfeeding), specialised support for at-risk neonates (i.e. premature or low-birth-weight babies), and parental education on newborn care practices and danger signs	Studes not covered on the uptake and or utilisation of maternal and neonatal care services
Types of studies	Primary studies: interventions-based RCT, quasi-experimental, controlled before and after study, observational cohort studies, and evaluations of population-based interventions	Publications on reviews, study protocol, editorial, and non-intervention studies
Setting	Studies conducted in Nepal	No specific data to Nepal
Time	Published between 1997 when Nepal launched its Safe Motherhood Programme [3] and July 2024	Studies published before January 1997 and after July 2024
Language	Peer-reviewed publications written in the English language	Publications other than in the English language as we did not have resources for translation

- What are the key interventions associated with improved to uptake of antepartum and postpartum care for women and newborns care services, particularly institution delivery, delivery by skilled health professional, neonatal care and PNC)?
- What outcomes or impact were identified in improving uptake of maternal and neonatal care services utilisation and outcomes indicators (especially institutional delivery, delivery by skilled health professional, neonatal and PNC services) in Nepal?
- What are the gaps or areas requiring further intervention in institutional delivery, delivery by skilled health professional, neonatal and postnatal care services in Nepal?

2.2 Stage 2: Identifying the relevant studies

Four major electronic health sciences and multidisciplinary databases including Medline, CINAHL, PsycINFO and Scopus were systematically searched to identify potential studies. In addition, backward reference searching was conducted by examining the reference lists of included studies. The detailed search terms are provided in Supplemental File 1.

2.3 Stage 3: Selecting the relevant studies

Two researchers independently screened abstracts and titles for eligibility according to the inclusion criteria. Full-text articles were then screened to identify the final papers eligible for inclusion using the same inclusion and exclusion criteria (Table 1).

2.4 Stage 4: Charting the data

A data extraction Excel spreadsheet was developed, and two authors (SW and JM) independently extracted the data. Both authors thoroughly reviewed each of the final included studies and cross-checked the extracted information to ensure completeness. Any missing data were verified and completed before finalising the data extraction sheet. No discrepancies were identified in the final dataset.

2.5 Stage 5: Collating, summarising and reporting results

The data were analysed narratively, summarising the types, patterns, similarities, and effectiveness of interventions. Narrative synthesis was utilised because of the nature of the data, such as variations in content, intervention delivery mode, duration and types of interventions (especially uptake of institutional delivery, skilled health professions, neonatal, and postnatal care), which other approaches could not adequately capture [21]. The methodological quality of the included studies was not assessed, as this is generally not required in scoping reviews [16].

3 Findings

3.1 Search outcomes

A total of 418 records were identified, and after removing duplicates ($n = 95$), 323 studies remained for title screening. Of these, 219 studies were excluded for having inappropriate titles and 104 abstracts were screened. Fifty-six studies were subsequently excluded during abstract screening due to not meeting the inclusion criteria. The remaining 48 full-texts studies were assessed for eligibility, with 28 excluded due to irrelevant outcomes ($n = 18$) or inappropriate research design ($n = 10$). Finally, 20 studies were included in the scoping review (Fig. 1).

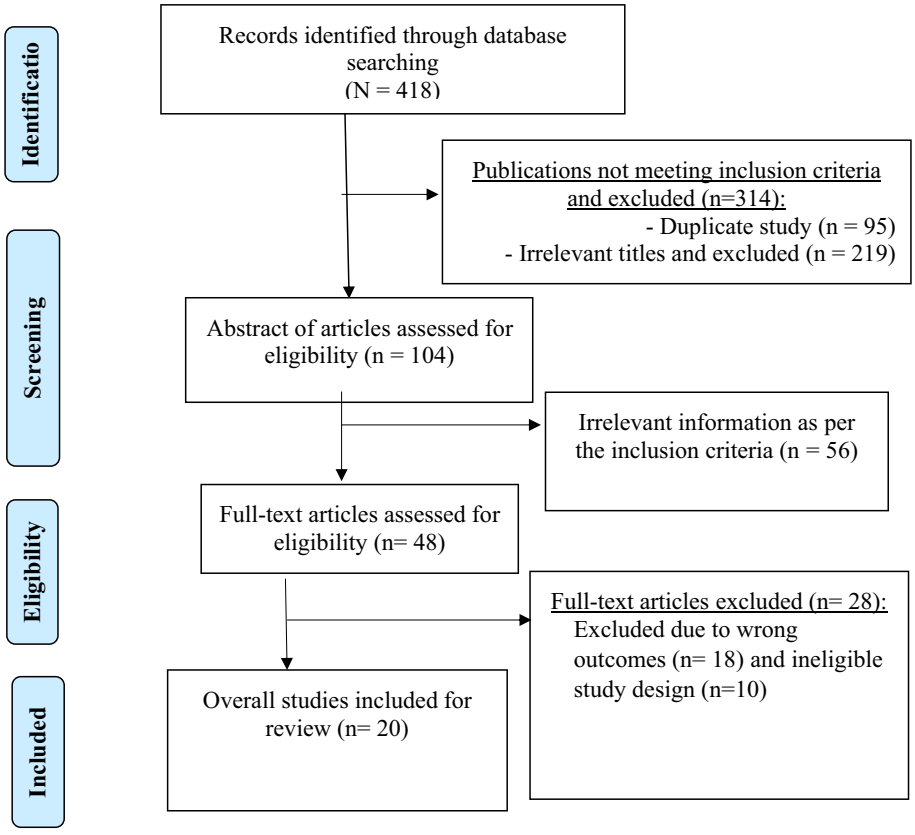

Fig. 1 PRISMA-ScR flowchart of study search and selection process

3.2 Characteristics of included studies

Table 2 provides the details of the included studies for this scoping review. All included studies were published from 2004 [22] to 2023 [23, 24], with fluctuations in the number of studies per year. A diverse range of research designs was employed and the higher number of included studies ($n = 10$) were Randomised Control Trials [22, 23, 25–32] followed by eight prospective studies (before/after) [24, 33–39] and two cohort studies [40, 41]. The interventions took place in primary care settings, where most ($n = 14$) were conducted in the community, followed by health facilities [23, 28, 30, 36, 38, 41]. Most studies were conducted across several districts ($n = 8$), followed by three in Makawanpur and two each in Acham, Kathmandu, and Morang districts (Table 2). The total sample size of all studies was 160,160 respondents, ranging from the smallest sample ($n = 43$) [29] to the largest of 89,014 [28]. A large proportion of the recruited women were illiterate with rates ranging from 4% [27] to 77.3% [36]. Similarly, the proportion of participants from ethnic minority communities ranged from 23.2% [22] to 100% [30]. The duration of interventions varied significantly, with most studies ($n = 10$) lasting 18 months or less and ranging from 28 days [41] to 48 months [24, 38].

3.3 Types of intervention and main outcome categories

The review identified five commonly used intervention strategies: (a) maternal health literacy ($n = 8$) [22, 24, 27, 32, 35, 37], literacy with food and cash support [31] and literacy with financial and transportation support [26]; followed by (b) mobilisation of Female Community Health Volunteers (FCHVs) ($n = 5$) [25, 29, 33, 34, 40]; (c) health facility

Table 2 Summary of studies selected for systematic review

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Acharya et al. (2019) [25]	*Study district (s)*: Dhanusha *Province (s)*: Madesh *Study site*: Community *Duration*: Seven months	RCT	379	Pregnant women in the second trimester Age: < 20 years 22.7% education: no education 23.5% Caste/ethnicity: ethnic minority 37.5% Parity: multipara 60.9%	*Intervention*: The MATRI-SUMAN trial focused on the capacity building of FCHVs and providing information about maternal and child health care services to pregnant women by mobile text messaging *Control*: Usual care	FCHV's led maternal and child health literacy via mobile text messaging	*Positive effect:* Received MATRI-SUMAN intervention had (a) increased initiation of breastfeeding within the first hour of birth (aOR 1.9, 95% CI 1.2–2.9), (b) exclusive breastfeeding for six months (aOR 2.0; 95% CI 1.3–3.1), and (c) initiating complementary feeding at six months (aOR 1.9, 95% CI 1.2–2.9)	PNC and Newborn care
Chaudhary et al. (2023) [23]	*Study district (s)*: Kavreplanchock *Province (s)*: Bagmati *Study site*: Health facilities *Duration*: Four months	RCT	229	Pregnant women owning smartphones with internet connectivity Age: Mean age 26 (SD – 4) year Education: primary 7.4% Caste/ethnicity: ethnic minority 23.2% Parity: multipara: 42.2%	*Intervention*: Social media-based health education where the intervention group received a 16-min YouTube video on PNC care. Participants were reminded to watch the video every week via telephone call for a month *Control*: Usual care	Social media-based including YouTube video-based education and weekly telephone call	*Positive effect:* (a) Pregnant women in the intervention group had an 8.1-point higher PNC knowledge score than the control group (95% CI 2.4–1.8). (b) Maternal care attribute knowledge improved by 4.3 points (95% CI 1.6–7.1) *No statistical difference in effect:* (a) Newborn care attribute knowledge increased by 3.4 points ($p \geq 0.05$) among pregnant women in the intervention group	PNC and Newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Chaulagain et al. (2017) [44]	*Study district (s):* Three districts -Bajhang, Dailekh and Kanchanpur *Province (s):* Sudurpaschim and Karnali *Study site:* Community *Duration:* 12 months	RCT	3844	Pregnant women Age: < 20 years-23.3% Education: illiterate 20.2% Caste/ethnicity: ethnic minority 36.1% Parity: NR	*Intervention:* Five components included: (a) family support to pregnant women for childbirth in a health facility, (b) financial assistance for women and families who seek SBA (Skilled Birth Attendance), (c) transport to health facility for birth, (d) women-friendly environment at health facilities, and (e) SBA security to increase their service utilisation *Control:* Usual care	Health literacy including financial and transportation support	*Positive effect:* (a) One-year comprehensive intervention package was effective in increasing the use of skilled birth care services (OR 1.6; 95% CI 1.2–2.1), which was almost double (30.4 vs. 56.5%) between the baseline and post-interventions	Skilled birth care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Hodgins et al. (2010) [33]	Study district (s): Two districts- Jhapa and Banke *Province (s):* Koshi and Lumbini *Study site:* Community *Duration:* 12 months	Before and after the study	3480	Pregnant women Age: Mean age 25 year Education: illiterate 54% Caste/ethnicity: NS Parity: NR	*Intervention:* Package covered birth preparedness/complication readiness, self-care in pregnancy, and essential newborn care. FCHVs led home-based counselling to pregnant women and other family members (husbands/mothers-in-law) and reinforced with a pictorial handout used for discussion with family. FCHVs visited homes within three days of birth, dispensing postnatal period (iron, vitamin A) and assessing for danger signs *Control:* Usual care	FCHVs-based health literacy including doorstep counselling services	*Positive effect:* FCHVs based advice or services improved maternal health outcomes: (a) skilled birth attendance 18.4 to 67.6% (OR 6.6, 95% CI 7.3–12.6); (b) identified delivery-related danger signs 14.6 to 63.5% (OR 10.4, 95% CI 8.1–13.4); (c) delay bathing 24 h postnatally 7.6 to 61.4% (OR 19.8, 95% CI 15.1–26.1); (d) identified newborn danger signs 13.2 to 56.5% (OR 8.8, 95% CI 6.9–11.2); (e) postnatal home visit by FCHV within 7 days of delivery 6.9 to 34.9% (OR 7.3, 95% CI 5.6–9.6), (f) health facility delivery increased 24 to 28.4% (OR 1.3, 95% CI 1.1–1.6), (g) increased taking any iron or folate 24.4 to 62.4% (OR 5.6, 95% CI 4.7–66.8), (h) increased taking vitamin A 34.7 to 66% (OR 3.9, 95% CI 3.2–44.9), (i) increased breastfeeding initiation within an hour of birth 34.1 to 54.9% (OR 2.4, 95% CI 1.7–3.3)	Institutional delivery, skilled birth care and PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Hodgins et al. (2020) [27]	*Study district (s):* Sarlahi *Province (s):* Madesh *Study site:* Community *Duration:* Seven-months	RCT	4454	Women in late pregnancy, aged 16 years and older Age: < 20 years 25.2%, Education: illiterate 63.4% Caste/ethnicity: NR Parity: NR	*Intervention:* Women were given a 6.9 cm card to assess whether the baby's foot was small; if so, to call a number for advice. Follow-up visits assessed skin-to-skin thermal care and care-seeking outside the home; assessed restricting to low birthweight (using 2 cutoffs: 2500 g and 2000 g) *Control:* Usual care	Health literacy includes empowering households to identify and provide appropriate maternity care services	*Positive effect:* (a) higher proportion of those in the intervention arm reported judged the baby's foot smaller than the card (OR 1.7, 95% CI 1.0–2.3), (b) increased skin-to-skin thermal care than among controls; for those < 2500 g RR 2.50 (95% CI 2.01–3.1)	PNC and Newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Kc et al. (2019) [28]	*Study district (s):* NC *Province (s):* NC *Study site:* 12 hospitals *Duration:* 18 months	RCT	89,014	Health workers Age: mean age 24 (SD 4.3) years Education: illiterate 4%, Caste/ethnicity: ethnic minority 54.9% Parity: multipara 19.4%	*Intervention:* The quality improvement (QI) package was implemented in a stepped-wedge manner with a delay of three months for each step. QI included improving hospital leadership on intrapartum care, building health workers' competency in neonatal resuscitation, and continuously facilitating QI processes in clinical units *Control:* Usual care	Health facility on scaling-up neonatal resuscitation quality improvement package	*Positive effect:* (a) incidence of intrapartum-related mortality was 11.0 per 1000 births during the control period and 8.0 per 1000 births after intervention (aOR 0.79, 95% CI, 0.7–0.9, (b) use of bag and mask ventilation improved Apgar scores (< 7 at one minute) for babies (from 3.2 to 4.0%) in intervention period (aOR, 1.5, 95% CI 1.3–1.8) *No statistical difference in effect:* (a) incidence of early neonatal mortality was 12.7 per 1000 live births during control period and 10.1 per 1000 live births after intervention (aOR, 0.9, 95% CI 0.8–1.0)	PNC and Newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Khanal et al. (2009) [34]	*Study district (s):* Morang *Province (s):* Koshi *Study site:* Community *Duration:* 30 months	Before and after study	1857	Married women of reproductive age Age: mean age 25 (SD 5) years Education: illiterate 48.8% Caste/ethnicity Parity: NR	*Intervention:* Trained and mobilised the FCHV to provide ANC, essential newborn care and basic management of sick neonates *Control:* Usual care	FCHVs training and mobilisation in fostering institutional delivery and PNC	*Positive effect:* (a) lower home birth rate after interventions (64.8%) than baseline (69.6%) and control (70.1%) groups ($p=0.001$), (b) increased the presence of skilled and trained attendants rate between baseline and endline groups (50.4 vs. 60.6%, $p=0.001$), (c) reduced total newborn illness rate between baseline and endline groups (41.2 vs. 38.2%—($p=001$), (d) significant improvement in ENC practices of early breastfeeding (29 vs. 43.5%—$p=0.001$), (e) cord care (28.4 vs. 60.5%—$p=0.001$), (f) baby wiped (58.8 vs. 63.5%), (g) baby wrapped (69.3 vs. 71.9%—p = 0.002), h) delay in bathing (17.5 vs. 42%) practices at the intervention group ($p=0.001$), (i) reduced the case fatality rate (3.2%) than the baseline (14.1%) and control (15.6%), and (j) lower death of ill babies 2.1 in follow-up than baseline 5.4%, $p=0.001$	Institutional delivery, skilled birth care, PNC and newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Mahato et al. (2020) [35]	*Study district (s):* Nawalparasi *Province (s):* Lumbini *Study site:* Community *Duration:* 24 months	Before and after study	1119	Women of reproductive age with a child below 24 months of age Age: < 20 years 7.5% Education: illiterate 47.8% Caste/ethnicity: ethnic minority 91.7% Parity: NR	*Intervention:* Supported the birthing centres facilities and conducted community health promotion programmes with local women *Control:* Usual care	Health facility/birthing centre expansion with maternal health literacy in improving institutional delivery	*Positive effect:* (a) women more likely to give birth at health facilities (OR 5.6, 95% CI 3.3–9.4), (b) increased health facility delivery as per the joint decision made by women and family for primary care facilities (OR 1.8, 95% CI 1.1–2.9) and (c) hospitals/tertiary care facilities (OR 1.8, 95% CI 1.1–2.9)	Institutional delivery

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Manandhar et al. (2004) [22]	*Study district (s):* Makwanpur *Province (s):* Bagmati *Study site:* Community *Duration:* 24 months	RCT	28,931	Pregnant and postpartum mothers Age: < 20 years 31% Education: illiterate 70.5% Caste/ethnicity: NS Parity: NR	*Intervention:* Trained female facilitators from the local community supported groups through an action-learning cycle using participatory learning. They identified local perinatal problems and developed prevention strategies using picture card games, stretcher schemes, and interactive learning during home visits *Control:* Usual care	Community-based participatory learning in women's group monthly meeting-based interventions	*Positive effect:* (a) NMR reduced 26.2 vs. 36.9 per 1000 in control group (aOR 0.7, 95% CI 0.5–0.9), (b) maternal mortality ratio was 69 in intervention clusters compared with 341 per 100,000 in control clusters (aOR 0.2, 95% CI 0.1–0.9), (c) women in intervention were more likely to have institutional birth (7 vs. 2%, aOR 3.6, 95% CI 1.6–8.1), (d) trained birth attendance by a government health provider (9 vs. 3%, aOR 3.1, 95% 1.6–6.0), (e) used a clean home delivery kit (19 vs. 5%, aOR 4.6, 95% CI 2.8–7.5), (f) used a boiled blade to cut cord (54 vs. 26%, aOR 3.5, 95% CI 1.4–8.7), (g) attendant washed her hands (68 vs. 33%, aOR 5.5, 95% CI 2.4–12.6), (h) baby taken to health facility when ill (24 vs. 10%, aOR 2.5, 95% CI 1.7–4.9) *No statistical difference in effect:* (a) breastfeeding within one hour of birth increased (54 vs. 62%) and (b) discarded colostrum (29 vs. 42%)	Institutional delivery, PNC and newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Maru et al. (2017) [36]	*Study district (s):* Achham *Province (s):* Sudurpaschim *Study site:* Hospitals *Duration:* 24 months	Before and after the study	210	Postpartum women Age: median age 23.5 years Education: NR Caste/ethnicity: ethnic minority 56.5% Parity: multipara 68%	*Intervention:* Comprehensive emergency obstetric care services improvement *Control:* Usual care	Health facility in rolling out of comprehensive emergency obstetric care services in increasing institutional delivery	*Positive effect:* (a) institutional birth rates increased after comprehensive emergency obstetric care from 30% (95% CI 21–41%) to 77% (95% CI 69–83%) at both hospital (27 to 59%) and village clinics (3 to 17%), (b) women believed hospital was the safest place for delivery and increased service utilisation (OR 44.8, 95% CI 4.8–13.0) and (c) safety prioritization in decision-making (OR 7.7, 95% CI 3.2–21.0), (d) qualitative findings revealed comprehensive emergency obstetric care awareness, increased social expectation for institutional birth, and birth planning as important factors	Institutional delivery

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
McPherson et al. (2006) [37]	*Study district (s):* Siraha *Province (s):* Madesh *Study site:* Community *Duration:* 24 months	Before and after study	162	Pregnant and postpartum women Age: mean age 24.5 years Education: illiterate 77.3% Caste/ethnicity: ethnic minority 99.5% Parity: NR	*Intervention:* The birth preparedness package (BPP) is implemented through the government health system and the package includes interpersonal communications with clients using a flip chart for use by community health workers, and key chains with key messages for pregnant women *Control:* Usual care	Health literacy with birth-preparedness programmes to improve delivery and PNC services by	*Positive effect:* (a) birth preparedness index (BPI) increased from 33% at baseline to 54% at the endpoint, (b) use of postnatal care services within a week of delivery increased from 11 to 25% ($p=0.01$), whereas the use within 6 weeks of delivery doubled from 17 to 34% ($p=0.02$), (c) preparation for emergencies increased from 33% at baseline to 54% at endline ($p=0.001$) and the BPP found to positively influence knowledge and intermediate health outcomes *No statistical difference in effect:* (a) use of skilled birth attendance unchanged from baseline at 17%	Institutional delivery, Skilled birth care and PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Morrison et al. (2005) [32]	*Study district (s):* Makwanpur *Province (s):* Bagmati *Study site:* Community *Duration:* NR	RCT	111	Pregnant women Age: NR Education: NR Caste/ethnicity: NR Parity: NR	*Intervention:* Problem identification and community planning using participatory iterative methods. Introduced concept of 'learning together' and encouraged to discuss perinatal problems in group and with neighbours/friends *Control:* Usual care	Health literacy including participatory community lead activities in improving PNC care	(a) Community-women groups identified the need for local transportation support and strategies to address post-partum haemorrhage and vaginal discharge during pregnancy	PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Morrison et al. (2020) [29]	*Study district (s):* Makwanpur *Province (s):* Bagmati *Study site:* Community *Duration:* 24 month	RCT	43	Pregnant women Age: NR Education: illiterate 42% Caste/ethnicity: ethnic minority 88% Parity: NR	*Intervention:* Conducted three-day workshops with the health management committee (HMC) to improve their capacity for planning and action and supported FCHVs to run monthly women's group meetings. Groups mobilised communities to address barriers to institutional delivery through participatory learning and action cycles *Control:* Usual care	Health literacy including mobilisation of community groups (HMC, FCHVs) to improve maternal care	*No statistical difference in effect:* (a) increased institutional delivery (38.5 vs. 40.5%), trained health worker attendance (38.5 vs. 40%) and PNC visits (45.3 vs. 52.4%), (b) reduced home delivery (61.5 vs. 59.5%) in the intervention group but not statistically significant between trial arms	Institutional delivery, skilled birth care and PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Mullany (2007) [30]	*Study district (s):* Kathmandu *Province (s):* Bagmati *Study site:* Health facilities *Duration:* Eight-months	RCT	442	Pregnant women Age: mean age 22.2 (SD 3.3) Education: illiterate 23.7% Caste/ethnicity: ethnic minority 23.5% Parity: primiparous 72.2%	*Intervention:* Group A—husband and wife received health education together, Group B—wife received health education alone *Control:* Usual care	Health literacy with male partner involvement	*Positive effect:* (a) women receiving education with their husbands were twice as likely to make more birth preparations (RR 1.99, 95% CI 1.10–3.59), (b) to attend PNC(RR 1.25, 95% CI 1.01–1.54), (c) postpartum visit was higher in the husband maternal health literacy group (61 vs. 47%, RR, 1.29, 95% CI, 1.04–1.60), (d) institutional delivery (93.6 vs. 90.6%) and attendance by a trained provider at birth (60.7 vs. 47%) slightly higher in interventions group	Institutional delivery, skilled birth care and PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Neupane et al. (2017) [40]	*Study district (s):* Morang *Province (s):* Koshi *Study site:* Community *Duration:* 12 months	Cohort study	2229	Newborns/neonates Age: NR Education: NR Caste/ethnicity: ethnic, minority 86% Parity: NR	*Intervention:* Community-based management and treatment of illnesses of newborn children. FCHVs were trained to measure birth weight on their initial visit and follow-up visits to assess, counsel and advise on the care of LBW babies and essential newborn care *Control:* Usual care	FCHV lead home visits and doorstep services	*Positive effect:* (a) the proportion of LBW child deaths among those who received FCHV follow-up visits and those who did not receive them was 2% (95% CI 1–2%) and 11% (95% CI 6–18%), (b) FCHV follow-up visits had an 84% lower risk of LBW children mortality than those who did not (RR 0·16, 95% CI 0·09–0·29) *No statistical difference in effect:* (a) no differences in FCHVs follow-up and uptake of institutional delivery ($p \geq 0.05$)	Institutional deliveryand neonate care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Rana et al. (2007) [38]	*Study district (s):* Four = Dang, Kapilvastu, Panchthar, and Saptari *Province (s):* Bagmati, Lumbini, Koshi and Madesh *Study site:* Health facilities *Duration:* 48 months	Before and after study	8 public health facilities	Health workers Age: NR Education: NR Caste/ethnicity: NR Parity: NR	*Intervention:* Health workers training for EmOC and delivery care, the National Safe Motherhood Program used a training strategy. Comprehensive EmOC, specifically for caesarean sections and other surgical procedures, was provided to junior doctors. The training varied from 5 days to 6 months *Control:* Usual care	Health staff training and strengthening facilities in improving delivery services	*Positive effect:* (a) EmOC improved from 1.9 to 16.9%, (b) the proportion of births in EmOC facilities increased from 3.8 to 8.3%; and (c) the case fatality rate declined from 2.7 to 0.3%	Institutional delivery

Table 2 (continued)

Author/ year	Study district/province/site/ duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Saville et al. (2018) [31]	*Study district (s):* Dhanusha and Mahottari *Province (s):* Madesh *Study site:* Community *Duration:* 24 months	RCT	10,936	Pregnant women Age: NR Education: illiterate 64% Caste/ethnicity: ethnic minority 100% Parity: multipara 40%	*Intervention:* Multi-arms interventions: Arm 1: PLA only, Arm 2: PLA + food supplement, Arm 3: PLA + cash transfer *Control:* current gov't program	Community-based health literacy with food and cash supports	*Positive effect:* (a) community-based participatory learning and action (PLA) women's groups plus food support improved institutional deliveries (OR 1.46 95% CI 1.03–2.06), (b) reduced colostrum discarding (OR 0.71, 95% CI 0.54–0.93), (c) increased breastfeeding within 1 h 35.1 vs. 52.5% (OR 1.53, 95% CI 1.10–2.14) *No statistical difference in effect:* (a) PLA alone and with cash support did not improve institutional delivery, breastfeeding initiation within an hour and reducing colostrum discharge	Institutional deliveryand PNC

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Thapa et al. (2018) [41]	*Study district (s):* Morang and Jhapa *Province (s):* Koshi *Study site:* Hospitals *Duration:* 28 days	Cohort study	96	Health workers Age: median age 20.5 years Education: NR Caste/ethnicity: ethnic minority 89.5% Parity: multipara 27%	*Intervention:* Trained health workers and HW identified mothers and followed up telephonically to ascertain the practice of kangaroo mother care. Traditional wrap for the first six hours and the new wrap for the next six, and vice versa *Control:* Usual care	Health workers lead telephone follow-up and Kangaroo mother care	*Positive effect:* (a) A new wrap users (429.1 h), 95% CI 351.7–470.3) performed skin-to-skin contact for an extra 77.4 h overall than traditional wrap (351.7 h, 95% CI 259.3–444) users from first day to 28 days postpartum found significant, (b) health workers and mothers reported positive experiences with the new wrap [easy to wear without assistance, secure and flexible to move in kangaroo mother care position *No statistical difference in effect:* (a) proportion choosing the different wraps did not differ significantly (81.3 vs. 89.6%)	Newborn care

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Thapa et al. (2019) [39]	*Study district (s):* Achham *Province (s):* Sudurpaschim *Study site:* Community *Duration:* 12 months	Before and after study	1208	Pregnant women Age: median age 24 years Education: NR Caste/ethnicity: ethnic minority 39.5% Parity: NR	*Intervention:* Home visits with group care. The implementation approach allowed for iterative design improvement by making changes to improve the intervention's quality *Control:* Usual care	Doorsteps maternal health literacy	*Positive effect:* (a) institutional birth rate increased between baseline and endline (81.2 to 91.5%), (b) qualitative findings revealed that women found groups to be a source of learning and discussion as well as social support and empowerment. They also mentioned increased maternal health service availability at the local clinic	Institutional delivery

Table 2 (continued)

Author/year	Study district/province/site/duration	Study design	Sample size	Study participants and key characteristics	Intervention description	Intervention delivered by	Reported findings	Primary outcome
Tiwari et al. (2023) [24]	*Study districts:* Achham and Dolakha *Province (s):* Sudurpaschim and Bagmati *Study site:* Community *Duration:* 48 months	Before and after study	11,416	Married women of reproductive age (15–49 years) Age: NR Education: NR Caste/ethnicity: NR Parity: NR	*Intervention:* CHW's monthly home-based screening for complications, counselling on pregnancy care, nutrition, birth preparedness, PNC, and newborn care, and made appropriate referrals; early childhood care of under-two children using the GoN's CB-IMNCI *Control:* Usual care	Doorsteps CHW counselling	*Positive effect:* (a) institutional birth rate increased by 30% after CHWs-based intervention ($p < 0.001$), (b) 78–89% of postpartum women received at least one CHW-counselled home visit within 60 days of childbirth, and (c) 23–60% received postnatal counselling within a week of birth, (d) CHWs' intervention increased knowledge, reached at marginalised communities, enabled early detection of high-risk pregnancies, and facilitated timely referral of pregnancy complications, i.e., heavy vaginal bleeding, concerns for infection in the uterus, and blood pressure, reduced maternal and neonatal morbidity and mortality	Institutional delivery, PNC and newborn care

*B*baseline,*C*control,*CI*confident interval,*E*endline,*I*intervention,*N*number,*NR*not reported,*O*ratio

strengthening, including staff training ($n = 5$) [35, 36, 38, 41, 42]; (d) mobile health messaging including YouTube videos [23, 25]; and (e) husband involvement [30]. Several themes overlapped involving multiple interventions (Table 2).

Intervention strategies primarily focused on improving institutional delivery ($n = 14$), including delivery by skill health professionals, and enhancing health staff skills. The second recurring theme was PNC and neonatal care ($n = 12$), which involved increasing knowledge, and uptake of PNC services, promoting breastfeeding practices (initiating breastfeeding within an hour and exclusive breastfeeding), providing education on screening for underweight newborns, raising awareness of danger signs, delaying

bathing, and improving overall newborn care. The final one was interventions related to reduce the MMR [22, 28], and NMR [22, 28, 34].

3.4 Interventions reported outcomes, effectiveness, or impact

This review identified a wide range of interventions to improve maternal and neonatal care in Nepal, as stated below:

3.4.1 Interventions for reducing maternal and neonatal mortality

Five studies reported effective interventions in reducing maternal and neonatal mortality, including: (a) community-based maternal health literacy programmes led by FCHVs [40]; and (b) strengthening health facilities including health workers training [28, 38]. (Table 2). Two studies provided effective interventions for reducing MMR with community and health facility-based interventions [22, 28]. Community-based participatory learning in monthly women's group meetings significantly reduced the maternal mortality ratio to 69 per intervention compared to 341 per 100,000 in control groups; with reductions in NMR from 26.2 interventions vs. 36.9 control groups per 1000 live births [22]. Training and mobilising FCHVs in community-based care and treatment of illness was found to be effective in early identification of danger signs. The proportion of neonatal deaths among those who received FCHV follow-up visits was significantly reduced 2% (95% CI: 1–2%) compared to 11% (95% CI: 6–18%) in the control groups [39]. FCHVs provided basic care to sick neonates, resulted to a lower neonate case fatality rate (i.e. 3.2 vs. 15.6%) and reduced death rates (i.e. 2.1 vs. 5.4%, $p = 0.001$) after the intervention [34]. Strengthening Emergency Obstetric Care (EmOC) services resulted in a decrease in the NMR from 2.7 to 0.3% [38].

KC et al. reported that the quality improvement package for neonatal resuscitation significantly reduced the incidence of intrapartum-related mortality from 11.0 in control to 8.0 per 1000 births (aOR 0.79; 95% CI, 0.69–0.92). The incidence of early neonatal death fell from 12.7 to 10.1 per 1000 live births in the intervention community. Implementing health workers training in helping Babies Breathe the Quality Improvement Cycle (HBB-QIC) reduced the NMR in intervention groups by 10.1 per 1000 live births. Moreover, implementing the bag-and-mask ventilation for neonate resuscitation quality improvement package also reduced the intrapartum mortality of neonates with low Apgar scores (<7 at 1 min) from 3.2 to 4% during intervention periods (aOR, 1.5, 95% CI, 1.3–1.8) [28] (Table 2).

3.4.2 Interventions for improving uptake of delivery by skilled health professionals and institutional delivery

A total of 14 studies examined improving the institutional delivery and uptake of skilled birth care services, with varying degrees of effectiveness. Ten studies were community-based maternal health literacy along with health workers training [22, 25, 29, 34–36, 38, 39, 43, 44], two FCHVs mobilisation [24, 29], mobile messaging [25] and husband involvement [30] were identified as effective interventions for improving delivery by skilled health professionals and institutional delivery rates (Table 2). Community-based health literacy interventions found almost a double (OR 1.6, 95% 1.2–2.1) impact in increasing the use of skilled birth care services [26] and almost six times (OR 5.6, 95% CI 3.3–9.4) increased the uptake of institutional delivery [25]. The overall proportion

of home births reduced by almost double in post-interventions (58.8 vs. 29.3%, OR 5.6, 95% CI 3.3–9.4) and increased in visiting skilled healthcare providers (53.7 vs. 70.5%) for delivery [35]. Institutional delivery among women who received community health support rose by 10% (81.2–91.5%) and also improved the overall service availability at the local clinic [39]. Participatory learning during monthly women's group meetings significantly increased institutional delivery (OR 3.6, 95% CI 1.6–8.1), attendance at trained birth providers for delivery (OR 3.1, 95% CI 1.6–6.0), visits to a doctor, nurse, or midwife (OR 3.5, 95% CI 1.5–8.1), use of a clean home delivery kit (OR 4.6, 95% CI 2.8–7.5), and use of a clean boiled blade to cut the cord (OR 3.5, 95% CI 1.4–8.7) [22].

FCHVs-based interventions were found to significantly increase the decision-making for institutional delivery (OR 1.8, 95% CI 1.1–2.9), talking at tertiary care facilities (OR 1.8, 95% CI 1.1–2.9), and the use of skilled birth care services (OR 1.6, 95% CI 1.2–2.1) [25]. The mobilisation of CHW increased institutional delivery by an average of 30% after the implementation of the targeted interventions [24].

A total of seven studies reported that infrastructure improvement was found effective in improving institutional delivery and trained birth attendance [22, 24, 26, 28, 33, 35, 36]. Strengthening comprehensive emergency obstetric care increased institutional birth rates from 30 to 77% at both hospital (27–59%) and clinic levels (3–17%) [36]. Likewise, mobile health interventions increased the use of institutional service delivery among expecting mothers. Pregnant women who received mobile text messages identified that this was an effective approach in deciding to give birth at a health facility (aOR 1.9, 95% CI 1.0–2.7) compared to those who did not get the intervention [25]. Moreover, women who received maternal health literacy with husbands or husband engagement increased institution delivery (90.6 vs. 93.6%) and skilled providers at birth (47 vs. 60.7%) [30] Mahato et al. [35] found that women whose husbands or family members were the decision makers had almost twice the odds of delivering in a primary care facility (OR 1.8, 95% CI 1.1–2.9) and in a hospitals/tertiary care facility (OR1.8, 95% CI 1.1–2.9) based delivery (Table 2).

3.4.3 Interventions to improve the uptake of neonatal care services

A total of two interventions (a) community maternal health literacy and (b) health workers training found effective interventions in improving newborn care services [22, 27, 43]. Participatory community health promotion increased almost three times (OR 2.8, 95% CI 1.7–4.9) the use of neonatal care services than the control community [22]. Strengthening maternity care services, particularly health worker training in newborn resuscitation, improved foetal heart rate monitoring (aOR 2.1, 95% CI 1.96–2.23) and increased abnormal heart rate monitoring (aOR 1.53, 95% CI 1.3–1.7) [43]. This indicated that healthcare providers training to improve their knowledge and skills in managing newborn care. Hodgins et al. (2020) showed that increased health literacy by the screening of the baby's foot at home enhanced the mother's health knowledge of low birth weight and seeking early healthcare (OR 1.7, 95% CI 1.0–2.3). Study further reported that increased skin-to-skin thermal care than among controls; for those <2500 g RR 2.50 (95% CI 2.01–3.1). FCHV follow-up visits resulted in an 84% reduction in the risk of low birth weight compared to those who did not receive such follow-ups [40] (Table 2).

3.4.4 Interventions to improve the uptake of PNC services

A total of eight studies helped improved PNC [22, 25, 26, 29, 30, 33, 34, 37]. Increasing education levels in the intervention significantly improved the uptake of PNC services. Birth preparedness plans were shown to be effective in increasing postnatal visits from 11 to 25% ($p = 0.01$), whereas utilisation within 6 weeks after delivery doubled from 17 to 34% ($p = 0.02$) [37]. Participatory community health literacy led to an improvement of almost three times (OR 2.8, 95% CI 1.7–4.9) in mothers utilising newborn care services and also babies taken to health facilities during illness (10–24%), promotion of breastfeeding practice within one hour of birth (54–62%) and reduced the discarding of colostrum (42–29%) [22]. Community women's group meetings were also shown to be successful in identifying the need for local transportation support and strategies for managing pregnancy-related vaginal discharge and postpartum haemorrhage [32]. Hodgins et al. reported that FCHV's doorstep services significantly improved in delaying bathing 24 h from 7.6 to 61.4% (OR 19.8, 95% CI 15.1–26.1) [32]. Community-based FCHV mobilisation and counselling services resulted in a positive outcome for breastfeeding initiation within an hour of birth, which rose significantly from baseline to endline (34.1 to 54.9%, OR 2.39, 95% CI 1.7–3.0) [33, 34]. Moreover, husband involvement in PNC visits was higher among women who received antenatal health education along with their husbands (RR 1.3, 95% CI 1.0—1.5) than among those who received education alone [30]. Intervention aimed at improving women's health literacy by mobile text messaging improved PNC visits (aOR1.6, 95% CI 1.0–5.1), and early breastfeeding initiation (aOR 1.9, 95% CI 1.0–3.4) [25]. Social media-based health literacy (using YouTube video) on PNC care knowledge score increased (OR 8.1, 95% CI 2.4–13.8) significantly [23] (Table 2).

3.4.5 Interventions without effect

Despite several significant outcomes in improving maternal and neonatal health indicators, four community-based interventions [29, 31, 39, 40], health facility strengthening including staff training [28] and baby wraps [41] did not find significant differences between groups. Women's empowerment and mobilisation were shown to increase institutional delivery by 10%, but there was no significant difference [39]. Participatory learning and action with financial support did not improve institutional delivery, and breastfeeding initiation [31]. Women's group discussion increased the uptake of institutional delivery, delivery by skilled health professionals and PNC visits but was not statistically significant [29]. There were no significant differences between community-based care, including FCHV support in improving institutional delivery and treatment centre selection [40]. Health facility strengthening, including quality improvement care packages, reduced death rates; however, the change was not statistically significant [28]. There was no significant difference in the proportion of Kangaroo mother care using different wrap methods [41] between groups (Table 2).

4 Discussion

To the best of our knowledge, this is the first scoping review that synthesised the up-to-date available intervention studies on improving maternal and neonatal services in Nepal. Multi-component interventions implemented across multiple settings were more successful in improving the maternal and neonatal care services in Nepal. Our findings

revealed that community-based participatory learning in monthly women's group meetings significantly reduced the NMR and had substantial impact on improving maternal and neonatal care [22]. Our findings are consistent with previous studies showing that women's group meetings are an effective approach to reducing maternal and neonatal mortality rates [45, 46]. Community-based interventions, such as safe motherhood action groups, and other community health volunteers initiatives foster early identification of danger signs and raise awareness in Zambia [47]. They also promote institutional deliveries, the use of clean delivery kits, and early initiation of breastfeeding in LMICs (Low-and-Middle Income Countries) [48]. Furthermore, the literature indicates that increased knowledge of skilled birth attendants and implementing PNC awareness programmes contribute to safer childbirth [49].

The expansion of birthing centres and emergency obstetric care sites with skilled health professionals proved to be an effective intervention for improving maternal and neonatal health care in our study. Due to Nepal's difficult geographical landscape, women still must travel for hours to get to maternal health services [50]. In remote areas, smaller facilities often operate with limited health workers, and the lowest health facilities at the community is health posts which has lack of birthing facilities [3, 51, 52]. The Safe Delivery Incentive Programme has not been incorporated in all local-level health facilities, as many health posts do not have birthing services [3]. Although, Nepal has seen improvements in maternal health services through the Government Safe Motherhood Programme initiatives in upgrading health infrastructure [3] including the establishing birthing centres in remote and underserved areas with necessary obstetric care facilities, trained health staff, and supplies. Well-equipped health facilities have been identified as an effective intervention for increasing access to and utilisation of maternal and newborn health care services in Sub-Saharan Africa [53]. Expanding and strengthening health facilities is critical to ensure services are available at all times. In Nepal's current federalised health system, all 753 local-level governments should take the lead in ensuring the availability of quality maternal and neonatal care services in every health facility [54]. Evidence from other LMICs also indicates that strengthening facilities with trained healthcare providers is associated with improved maternal health outcomes and significant reductions in MMR [55].

Our review identified that mobilising women's groups, including FCHV support appeared to be successful in improving in demand generation of institutional delivery and neonatal care services and also lowering the neonatal death rates. The FCHV programme was initiated in Nepal and had a significant impact on maternal and neonatal mortality between 1996 and 2022 [5, 56]. FCHVs have been instrumental in facilitating timely referrals, providing doorsteps services and overcoming sociocultural barriers to maternal care-seeking [56, 57]. Therefore, FCHVs collaboration with healthcare providers should continue to improve the uptake of maternal and neonatal care.

Implementing safe motherhood interventions and their uptake needs regular communication between skilled health workers and family members, especially husbands for effective service delivery. Our findings on husband involvement found effective interventions in improving institutional delivery. Similar findings also found that husband engagement had a substantial influence [49, 58]. This intervention has some implementation challenges in Nepal, where male involvement is minimal partly due to the high number of male migrant workers [59, 60]. This necessitates multiple interventions to

expand the currently implemented programmes. Although Nepal has implemented several policy initiatives for improving maternal health services (e.g., the President Women Upliftment and Safe Delivery Incentive Programme), there is a lack of evaluation of which interventions should be instrumental in targeting left-behind wives in a highly fragmented geography with diverse health-seeking behaviours [3, 61].

Our findings also show that SMS-based health messaging interventions improved institutional delivery, which is consistent with previous research in LMICs on improving health facility delivery [62, 63], using skilled birth attendance during delivery [64] and improving pregnant mothers' knowledge of danger signs and birth preparedness [65]. This indicates that mobile phone messaging would be effective in reaching many women at once to inform and promote maternity services. Although this review contains only limited SMS-based intervention studies, these programmes could be expanded to reach to the marginalised communities, allowing them to access health information and influence their behaviour to improve maternity care services. Further research should be conducted to delve deeper into the effectiveness of the above-mentioned interventions by sub-group analyses particularly looking to the vulnerable groups to improve the uptake of maternal health care services.

Overall, interventions show that effective linkage between ANC, delivery care, and PNC are critical for maternal and newborn care and the continuity of care from the home to the hospital for complications or illness management. Nepal's Safe Motherhood and Newborn Health Road Map 2030 [9] emphasises the need for a continuum of care to improve maternity care. Therefore, it is imperative to implement integrated interventions at different levels to improve maternal healthcare in Nepal's geographically and culturally varied communities.

4.1 Implications for practice and research in Nepal

This scoping review may be beneficial for healthcare practitioners, policymakers, and researchers when assessing which interventions are most suitable for various settings. Community-based health promotion strategies, including home visits and community health workers mobilisation, are well-established and trusted interpersonal communication efforts both globally and in Nepal. Some interventions, however, faced implementation issues in contexts with patriarchal gender norms, i.e., husband engagement in improving maternal care in these situations where male involvement is minimal due to employment or migrant workers [59, 60]. Marginalised communities, rural dwellers and those experiencing high levels of poverty are at great risk. Targeted interventions are crucial to address their continuity of care needs and to improve the uptake of maternal and neonatal health services. This analysis included only 20 interventions-based studies with few focusing on marginalised and ethnic minority communities. Mixed-methods research has the potential to provide a comprehensive understanding of situations and contextual acceptability [66] which facilitates the ability to translate interventions across Nepal. Nepal is well-known as a highly fragmented cultural society, with over 100 caste and ethnic communities living there, each community having its own unique health-seeking behaviours [61]. Hence, there is a need for targeted intervention packages that provide accessible services delivered by trained healthcare providers, promote community mobilisation and education, offer doorstep services through FCHVs, and strengthen referral systems for sick mothers and neonates to prevent premature deaths.

4.2 Limitations of this review

Our review has a number of limitations for consideration when interpreting the data. This review excluded grey literature from related fields, as a result, some intervention studies not published in academic publications were potentially excluded from this review. Almost all of the included studies were designed to evaluate vertical interventions using small-scale, short-term implementations and piloting, making it difficult to offer a full picture of the intervention's effectiveness in improving the uptake and reducing maternal and neonatal deaths in Nepal. Our search was linguistically constrained where we used only English publications where we may have missed important studies published in the native language (i.e. Nepali). It should also be noted that some of the studies included in this review had small sample sizes, that might influence the outcomes of the study. Furthermore, our review included studies only conducted in Nepal, and the findings may not be generalisable to high-income countries. Finally, our review procedure was neither registered nor published protocol before conducting this scoping review, which may raise concerns regarding its quality assurance. However, our review rigorously followed the PRISMA_ScR guidelines and Arksey and O'Malley's five-stage scoping review framework to ensure quality and maintain credibility.

5 Conclusion

Upgrading health facilities including health worker training to improve their knowledge and skills, promoting community-based maternal health literacy, mobilising FCHVs for birth preparedness, identifying danger signs, promoting mobile health messaging, and involving husbands in maternal health literacy were found an effective intervention for improving the uptake of institutional delivery, delivery by skilled health professionals and neonatal care. Findings also showed that training healthcare providers to improve their knowledge and skills in managing newborn care was successful in reducing the rates of morbidity and death. Despite Nepal's highly fragmented geographical landscape, more technologically driven efforts might be instrumental in promoting maternal and neonatal health services. The findings suggest that effective interventions such as strengthening maternal care facilities, mobilising women's groups, and deploying FCHVs to provide doorstep services either alone or together should be expanded and scaled up in reaching the maternal and neonatal care services up to the rural communities. Interventions to prevent newborn deaths, such as women's groups mobilisation and FCHVs doorstep visits should be initiated early in pregnancy to enhance birth preparedness, encourage institutional deliveries, ensure the presence of skilled birth attendants, and improve access to neonatal care services. Therefore, FCHVs collaboration with healthcare providers should continue to improve the uptake of maternal and neonatal care. Further research is needed to assess the impact of several government initiatives, such as the Safe Delivery Incentive, the Free Newborn Care Programme, and Emergency Referral Funds to ensure that no one is left behind.

Supplementary Information

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Additional file1 (DOCX 14 KB)

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The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Declarations

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