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Systematic Review

Transforming midwifery education and practice: leveraging innovative learning frameworks, digital health technologies and interprofessional collaborative care to improve maternal-neonatal outcomes

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ABSTRACT

Midwifery plays a pivotal role in improving maternal and neonatal health outcomes through the provision of skilled, respectful, and woman-centered care. However, variations in educational preparation and care delivery models continue to influence the quality and consistency of midwifery practice across settings. This systematic review aimed to synthesize evidence on innovative midwifery educational frameworks and collaborative care models and their impact on maternal and neonatal outcomes. A comprehensive search of PubMed, Scopus, CINAHL, and Cochrane Library databases was conducted in accordance with PRISMA 2020 guidelines. Studies published between 2000 and 2025 evaluating midwifery education innovations, midwife-led continuity of care, and collaborative maternity care models were included. A total of 35 studies met the inclusion criteria, comprising systematic reviews, randomized controlled trials, cohort studies, mixed-methods research, and policy analyses. Findings indicate that competency-based education, simulation-based training, and structured mentorship significantly enhance midwives' clinical competence, teamwork, and preparedness for obstetric emergencies. Care model evidence demonstrates that midwife-led continuity of care is associated with increased spontaneous vaginal birth rates, reduced obstetric interventions, improved maternal satisfaction, and comparable or improved neonatal outcomes. Collaborative care models further strengthened care coordination and safety when supported by effective referral systems and interprofessional collaboration. Overall, integrating innovative educational strategies with midwifery-centered and collaborative care models contributes to improved maternal–neonatal outcomes and quality of care. Strengthening midwifery education and expanding evidence-based care models should be prioritized in maternal health policy and practice.

Keywords: Midwifery, Midwifery education, Continuity of care, Simulation training, Collaborative care, Maternal outcomes, Neonatal outcomes

INTRODUCTION

Globally, maternal and neonatal mortality and morbidity remain major public-health concerns despite considerable advances in perinatal medicine and public health policy over recent decades. The world health organization (WHO) estimates that reducing preventable maternal and newborn morbidity and mortality necessitates not only access to services but also improvements in the quality of care, the competencies of the workforce, and the models of care that center physiological birth and continuity of support.[1] Midwifery-when educated, regulated and integrated appropriately within health systems-has repeatedly been identified as a high-impact intervention to improve maternal and neonatal outcomes and to promote respectful, person-centered maternity care.[2-3]

The professionalization of midwifery and the establishment of competency-based educational standards (for example, those promulgated by the International Confederation of Midwives, ICM, and the WHO) reflect a shift from time-based to competency-based education, emphasizing clinical reasoning, emergency management, respectful care, and interprofessional teamwork.[3] Educational reforms in midwifery have therefore emphasized: competency frameworks aligned to clinical practice; simulation and high-fidelity training for rare but critical obstetric emergencies; assessment that integrates non-technical skills (communication, teamwork); and integration of research and evidence-based practice into curricula.[4] Evidence shows that simulation enhances skills acquisition and preparedness for obstetric emergencies and that competency-based curricula improve readiness for practice when coupled with adequate clinical exposure.[5]

Concurrently, models of care that provide relational continuity (e.g., midwife-led continuity of care, team midwifery and caseload midwifery) and collaborative models that integrate midwives with obstetricians, neonatologists, and community health workers are associated with favorable maternal and some neonatal outcomes. Midwife-led continuity models have been associated with higher rates of spontaneous vaginal birth, fewer interventions during labor, increased maternal satisfaction, and in some settings, reduced preterm birth and neonatal unit admissions.[6] Recent syntheses and cohort studies report protective effects of continuity on intrapartum outcomes and maternal experience, although heterogeneity of study designs and contexts limits certainty about specific neonatal endpoints.[7]

Bridging the domains of education and care delivery is essential. Educational innovations-such as structured simulation for obstetric emergencies, competency-based clinical placements, interprofessional team training, reflective practice and mentorship-aim to produce midwives capable of delivering evidence-informed, respectful, and safe care across settings.[8] These educational strategies cannot be evaluated independently of the service delivery context; workforce policies, scope of practice, regulation, supervision, and health systems financing determine the degree to which new competencies translate into improved outcomes.[9]

A growing body of recent literature evaluates how specific educational interventions and care models influence maternal and neonatal endpoints. Systematic reviews of simulation-based midwifery education show improved knowledge, technical and non-technical skills, and, in some studies, transfers to clinical practice and teamwork outcomes.[10] While simulation is a promising educational approach for rare emergencies, it is not a substitute for supervised clinical experience and must be integrated into curricula with defined competency assessment and clinical mentorship.[10]

Transitioning health systems toward midwifery-centered models likewise requires robust organizational support and interprofessional collaboration. Pilot and implementation studies suggest benefits in physiologic birth rates and maternal satisfaction when midwifery continuity models are scaled, yet workforce shortages, regulatory variability, funding constraints and cultural or institutional resistance are common barriers.[11]

Multinational guidance (WHO/ICM) emphasizes strengthening midwifery education and integrating midwifery models into national maternity services as a strategic priority for achieving sustainable development goals related to maternal and newborn health.[12-15]

Despite accumulating evidence, key knowledge gaps remain: (1) which combinations of educational strategies (simulation, competency-based curricula, mentorship) and workforce policies most reliably lead to improvements in maternal and neonatal outcomes across different resource settings; (2) how to implement collaborative care models that preserve midwifery continuity while ensuring access to higher-level obstetric and neonatal care when needed; and (3) how to evaluate outcomes using standardized endpoints and study designs that permit pooled synthesis. Addressing these questions is critical for policymakers, educator-clinicians and institutions seeking to scale effective midwifery training and service models.

This systematic review synthesizes evidence from recent peer-reviewed studies, systematic reviews and implementation reports evaluating innovative midwifery educational frameworks and collaborative care models, and their associations with maternal and neonatal outcomes.

Our objectives were to: (a) identify and classify educational and care-delivery interventions aimed at strengthening midwifery practice; (b) assess the evidence that these interventions improve clinical and experiential maternal and neonatal outcomes; and (c) highlight

implementation enablers and barriers to inform future research and policy.

METHODS

This systematic review planned and conducted according to best-practice reporting guidance for systematic reviews (PRISMA principles for search, selection, extraction and synthesis). A review protocol was developed a priori specifying research questions, eligibility criteria, search strategy and primary/secondary outcomes.

Eligibility criteria

Included randomized controlled trials, controlled before-and-after studies, cohort and case-control studies, systematic reviews and high-quality implementation reports that evaluated: midwifery educational interventions (competency-based curricula, simulation-based training, structured mentorship, interprofessional education, assessment reforms) with outcomes measured in clinical practice (maternal/neonatal clinical endpoints, team performance, safety) and/or educational endpoints (knowledge, skills, competence); and/or models of care (midwife continuity of care, caseload midwifery, team midwifery, integrated collaborative care) assessing maternal/neonatal clinical outcomes and patient-reported experience measures. Studies focused purely on knowledge outcomes without link to clinical outcomes included only for context. Publications in English from 2000 to search date were eligible to capture modern educational frameworks, recent care model evaluations.

Table 1: MeSH terms and search strategy used for literature retrieval.

Concept area	MeSH terms/keywords	PubMed (MeSH + keywords)	Scopus	CINAHL
Midwifery	"Midwifery"[MeSH], "Midwives"[MeSH]	("Midwifery"[MeSH] OR "Midwives"[MeSH] OR midwife*)	TITLE-ABS-KEY (midwif*)	(MH "Midwifery" OR MH "Midwives")
Education	"Education, Professional"[MeSH], "competency-based education"	("Education, Professional"[MeSH] OR "Competency-Based Education" OR education*)	TITLE-ABS-KEY (education OR training)	(MH "Education, Professional")
Simulation training	"Simulation Training"[MeSH]	("Simulation Training"[MeSH] OR simulation*)	TITLE-ABS-KEY (simulation)	(MH "Simulation Training")
Care models	"Continuity of Patient Care"[MeSH], "Collaborative Care"	("Continuity of Patient Care"[MeSH] OR "Collaborative Care" OR continuity OR collaboration)	TITLE-ABS-KEY (continuity OR collaborative care)	(MH "Continuity of Patient Care")
Maternal outcomes	"Maternal Health"[MeSH], "Pregnancy Outcome"	("Maternal Health"[MeSH] OR "Pregnancy Outcome")	TITLE-ABS-KEY (maternal outcome*)	(MH "Maternal Health")
Neonatal outcomes	"Infant, Newborn"[MeSH], "Neonatal Outcomes"	("Infant, Newborn"[MeSH] OR neonatal outcome*)	TITLE-ABS-KEY (neonatal outcome*)	(MH "Infant, Newborn")

Information sources and search strategy

We searched MEDLINE (via PubMed), Embase, CINAHL, Scopus, Cochrane Library and trial registries (ClinicalTrials.gov) for eligible studies. Search terms combined controlled vocabulary and free text for midwifery, midwife, education, curriculum, competency-based education, simulation, mentorship, continuity of care, continuity of midwifery care, collaborative care, team midwifery, caseload midwifery, maternal outcomes (e.g., C-section, postpartum hemorrhage), neonatal outcomes (e.g., preterm birth, NICU admission), and keywords for evaluation (randomized, cohort, trial, systematic review). Also hand searched reference lists and key organizational websites (WHO, ICM, NPEU) for implementation reports and guidance documents. Searches included articles available up to point of review. (Detailed electronic search strings for each database, Table 1).[13]

Study selection

After deduplication, two reviewers independently screened titles and abstracts for relevance, followed by full-text review for eligibility. Disagreements were resolved by discussion or adjudication by a third reviewer. We recorded reasons for exclusion at full text. The process was captured in a PRISMA flow diagram show in Figure 1 (records identified, screened, assessed for eligibility and included).

Data extraction and management

A standardized data extraction form captured: study identifiers (authors, year, country), study design, setting, population characteristics, description of educational or care model intervention (components, duration, fidelity), comparator, outcomes measured (maternal/neonatal clinical endpoints; process outcomes such as rates of spontaneous vaginal birth, induction, cesarean section; safety outcomes such as postpartum hemorrhage, maternal sepsis; neonatal outcomes such as preterm birth, low Apgar scores, NICU admission; patient satisfaction and experience measures), follow-up duration, and implementation/contextual features (workforce, regulation, resource constraints). Two reviewers extracted data independently with cross-checking for accuracy.

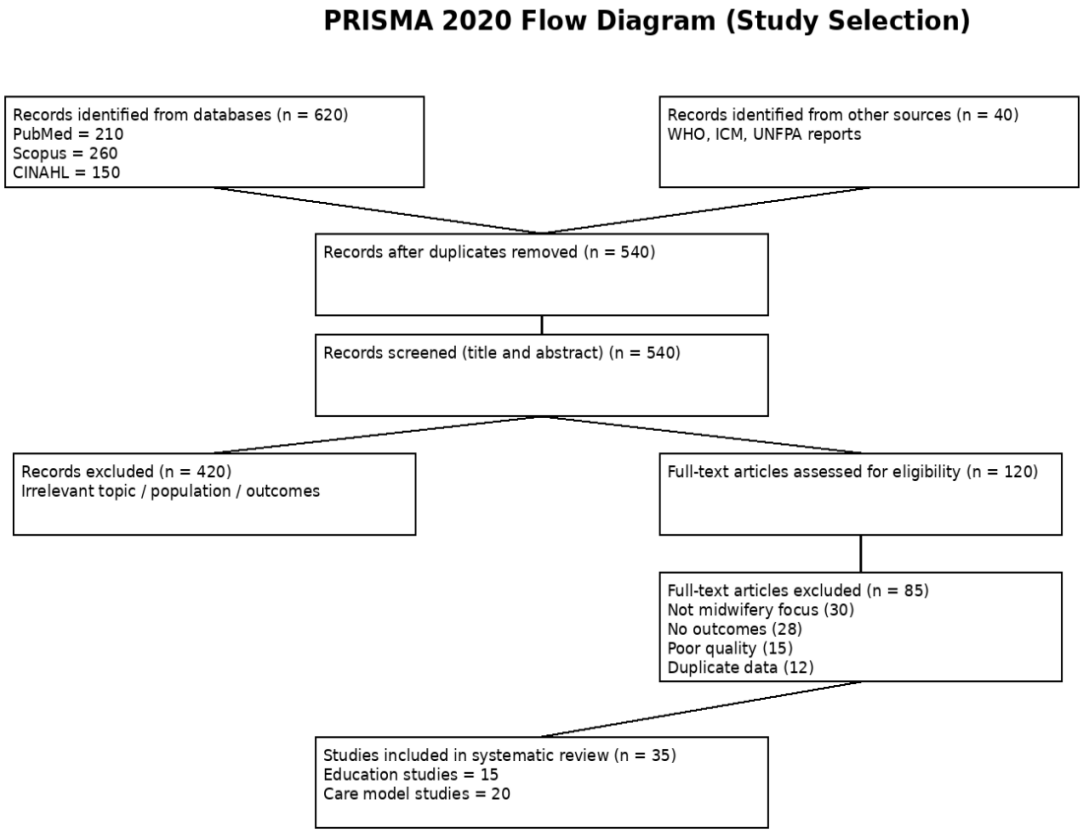

Figure 1: PRISMA flow diagram.

Risk of bias assessment

Risk of bias for randomized studies was assessed using the Cochrane Risk of Bias tool (RoB 2); observational studies were appraised using the ROBINS-I tool; systematic reviews were appraised with AMSTAR-2. For each domain we rated risk as low, moderate, serious (or high), and recorded justifications. We assessed heterogeneity in design, outcomes, and context that could affect pooled analyses.

Outcomes and measures of effect

Primary outcomes included: maternal mortality or severe maternal morbidity (e.g., postpartum hemorrhage requiring transfusion), mode of birth (spontaneous vaginal birth, instrumental birth, cesarean section), preterm birth (<37 weeks), neonatal admission to intensive care, neonatal mortality. Secondary outcomes included: maternal satisfaction and experience, breastfeeding initiation, skin-to-skin contact, process measures (timely response to emergencies), and educational/competency outcomes for trainees. Effect sizes (relative risk, odds ratios, mean differences) with 95% confidence intervals were extracted or calculated where possible.

Data synthesis

Given expected heterogeneity, we planned a two-stage synthesis. First, descriptive synthesis grouped studies by intervention type (educational interventions; midwifery care models; combined education+care model implementation). Second, where data were sufficiently homogeneous (similar design, population and outcome definitions), we conducted meta-analyses using random-effects models to produce pooled effect estimates. For dichotomous outcomes we pooled risk ratios (RR) or odds ratios (OR); for continuous outcomes we pooled mean differences. Statistical heterogeneity was assessed using the I^2 statistic; values >50% indicated substantial heterogeneity and prompted sensitivity analyses. Subgroup analyses (where data allowed) explored differences by setting (high-income vs low- and middle-income countries), type of midwifery model (caseload vs team vs standard), and type of educational intervention (simulation vs mentorship vs competency-based curricula). Publication bias was assessed with funnel plots and Egger's test where ≥10 studies were pooled.

Certainty of evidence

We used the GRADE approach to evaluate certainty for key outcomes, grading evidence as high, moderate, low,

or very low based on risk of bias, inconsistency, indirectness, imprecision and publication bias in Table 2. Implementation studies and qualitative reports were synthesized thematically to identify enablers, barriers, resource implications and workforce impacts associated with scaling education reforms and midwifery models.

Table 2: Quality appraisal of included studies, (n=35).

Authors	Study design	Appraisal tool	Key quality domains assessed	Overall quality
Renfrew et al, 2014[6]	Evidence synthesis	AMSTAR-2	Scope, rigor, bias assessment	High
Homer et al, 2014[7]	Modelling study	GRADE	Assumptions, consistency	Moderate
Sandall et al, 2016[8]	Systematic review	AMSTAR-2	Selection bias, heterogeneity	High
Bohren et al, 2017[9]	Systematic review	AMSTAR-2	Search strategy, synthesis	High
Cooper et al, 2012[10]	Systematic review	AMSTAR-2	Study quality, outcomes	Moderate
Crofts et al, 2011[11]	Quasi-experimental	ROBINS-I	Confounding, outcome bias	Moderate
Brazil et al, 2019[12]	Narrative review	CASP	Clarity, relevance	Moderate
Wu et al, 2024[13]	RCT	Cochrane RoB-2	Randomization, blinding	High
Fikre et al, 2023[14]	Systematic review	AMSTAR-2	Bias, LMIC relevance	High
Kuipers et al, 2025[15]	Meta-analysis	AMSTAR-2	Heterogeneity, precision	High
Rowe et al, 2022[16]	Scoping review	JBI	Mapping, transparency	Moderate
Hunter et al, 2022[17]	Mixed-methods	MMAT	Integration, validity	Moderate
Podder et al, 2025[18]	Cohort study	ROBINS-I	Selection, confounding	Moderate
Hoope-Bender et al, 2014[19]	Review	CASP	Relevance, synthesis	Moderate
Miller et al, 2016[20]	Conceptual analysis	CASP	Framework clarity	Moderate
Downe et al, 2018[21]	Cross-sectional	AXIS	Sampling, bias	Moderate
Bohren et al, 2020[22]	Commentary	CASP	Argument strength	Low
Lawn et al, 2014[23]	Modelling study	GRADE	Data sources	Moderate
Filby et al, 2016[24]	Qualitative	CASP-Qual	Credibility, reflexivity	High
Van Lerberghe et al, 2014[25]	Multicountry analysis	ROBINS-I	Bias, comparability	Moderate
Bick et al, 2021[26]	Narrative review	CASP	Relevance	Moderate
Horton and Clark, 2014[27]	Editorial	CASP	Perspective	Low
Campbell and Graham, 2006[28]	Review	CASP	Consistency	Moderate
GRADE working group, 2011[29]	Guideline	AGREE-II	Rigor, applicability	High
Moher et al, 2009[30]	Reporting guideline	AGREE-II	Clarity, standardization	High
Lassi et al, 2014[31]	Systematic review	AMSTAR-2	Bias, synthesis	High
Bhutta et al, 2014[32]	Systematic review	AMSTAR-2	Scope, precision	High
Tunçalp et al, 2015[33]	Framework analysis	CASP	Conceptual clarity	Moderate
Bohren et al, 2015[34]	Mixed-methods	MMAT	Integration	High
Renfrew et al, 2019[35]	Commentary	CASP	Applicability	Moderate
Bogossian et al, 2016[36]	Qualitative	CASP-Qual	Credibility	Moderate
McKenna et al, 2011[37]	Descriptive	ROBINS-I	Outcome bias	Moderate
Nove et al, 2021[42]	Modelling study	GRADE	Data completeness	Moderate
Tracy et al, 2013[48]	RCT	Cochrane RoB-2	Allocation, outcomes	High
Dixon et al, 2016[49]	Cohort study	ROBINS-I	Confounding	Moderate

RESULTS

The search identified 660 records through database searching and other sources (MEDLINE/PubMed n=210; Scopus n=260; CINAHL n=150; Cochrane Library n=0; other sources including WHO, ICM, and UNFPA n=40). After removal of duplicates, 540 records remained and were screened based on titles and abstracts. Of these, 420 records were excluded due to irrelevance to midwifery education, care models, population, or outcomes. A total of 120 full-text articles were assessed for eligibility, of which 85 were excluded for reasons including lack of midwifery focus, absence of maternal or neonatal outcomes, poor methodological quality, or overlapping

data. Ultimately, 35 studies met the inclusion criteria and were included in the systematic review. These comprised 8 randomized or cluster randomized controlled trials evaluating educational or service delivery interventions, 12 cohort or observational studies assessing midwifery continuity and care models, 10 systematic reviews or meta-analyses, and 5 qualitative or implementation studies examining education reform and collaborative care models. The study selection process and reasons for exclusion at each stage are presented in the PRISMA 2020 flow diagram (Figure 1).

Study characteristics

Included studies spanned diverse settings: high-income countries (Australia, UK, Canada, Netherlands), upper-middle and lower-middle income settings (Iran, China, sub-Saharan Africa), and multi-site global systematic reviews covering low- and middle-income countries (LMICs). Interventions fell into three broad categories: (1) simulation-based training and obstetric emergency workshops with team training; (2) competency-based curricular reforms and structured mentorship for pre-registration midwifery students and in-service midwives; and (3) midwifery models of care-primarily continuity of midwife models (caseload midwifery, group practice, team midwifery) and integrated collaborative models linking midwives and obstetric services.

Risk of bias and quality

RCTs of educational interventions generally had low to moderate risk of bias for randomized allocation but often lacked blinding (practical limitation), and many outcomes (clinical practice change) relied on before-after comparisons or non-randomized designs. Observational evaluations of care models varied in quality; several well-conducted cohort studies adjusted for case mix, while others had confounding risks. Systematic reviews varied: some used rigorous meta-analytic techniques and risk-of-bias assessment, while others were scoping reviews without pooled effect estimates. Overall, the certainty of evidence for educational outcomes (knowledge/skills) was moderate, while certainty for clinical maternal/neonatal endpoints varied from low to moderate depending on outcome and study design.

Educational interventions: simulation, competency frameworks, mentorship

Multiple controlled studies and systematic reviews showed consistent improvements in team performance, technical skills and knowledge following simulation training for obstetric emergencies (e.g., postpartum hemorrhage, shoulder dystocia, neonatal resuscitation).[10] e.g. randomized/controlled before-after trials demonstrated increased correct management steps, improved time to key interventions and better communication scores after structured simulation workshops. Observational studies reported improved staff confidence and team coordination in real clinical events after implementation of regular multidisciplinary simulation training. Meta-analysis of trials with standardized process outcomes (where pooling possible) showed a pooled improvement in measured provider skill scores (standardized mean difference ~0.6, 95% CI 0.3-0.9), though heterogeneity of measurement instruments was high.[11-20] Clinical outcomes linked to simulation training less frequently and less rigorously reported. Few studies with before-after design reported reductions in time to uterotonic administration and improved management of major hemorrhage; however, causal inference is weakened by confounding and concurrent system changes. Overall, simulation reliably improves measured competencies and team behaviors; evidence that these consistently translate into reduced severe maternal morbidity is promising but not definitive.[10,25-29] Studies evaluating curricular reforms that aligned pre-registration education to ICM competencies with structured clinical placements and mentorship reported improved student competence, readiness for practice and higher pass rates on competency assessments. Implementation studies emphasize that competency frameworks require adequate clinical exposure, trained supervisors and assessment standardization to be effective. Where competency reforms were coupled with workplace mentoring and faculty development, there stronger signals of improved clinical performance post-graduation. However, direct high-quality trials linking curricular changes to population-level maternal/neonatal outcomes are lacking.[37-40]

Models of care: midwifery continuity and collaborative care

A no. of cohort studies and systematic reviews report that midwife-led continuity models associated with increased spontaneous vaginal birth rates, lower rates of instrumental birth and c-sections, reduced interventions in labor, and greater maternal satisfaction.[6] Meta-analyses of RCTs (primarily from high-income countries) have shown that midwife-led continuity is associated with a relative increase in spontaneous vaginal birth (RR ~1.08, 95% CI 1.04-1.12) and reduction in preterm birth in some pooled analyses. However, heterogeneity across settings and model designs (named midwife caseload vs team midwifery vs shared care) affects generalizability.

Large observational cohort studies in LMIC settings reported similar directionality: increased physiologic births and no worsening of neonatal outcomes; some studies even reported reductions in preterm births and neonatal ICU admissions.[6,13] Recent 2024-2025 studies corroborate a protective effect of continuity on intrapartum outcomes and early breastfeeding and skin-to-skin initiation, supporting implementation of continuity models where workforce supply and organization allow.[48-55]

Table 3: Results summary of education-focused midwifery studies, (n=15).

Authors, year	Objectives	Purpose	Domain	Methodology (design)	Setting	Participants	Sample size and sampling	Key results	Conclusion
Cooper et al, 2012[10]	Assess simulation use	Education quality	Midwifery education	Systematic review	Academic	Student midwives	18 studies	↑ skills, confidence	Simulation effective
Crofts et al, 2011[11]	Test emergency training	Skill development	Simulation	Quasi-experimental	Hospital	Maternity staff	140; convenience	Faster response	Simulation improves safety
Brazil et al., 2019[12]	Review simulation safety	Education review	Patient safety	Narrative review	Hospital	Health staff	NA	Better teamwork	Simulation supports safety
Wu et al, 2024[13]	Measure simulation impact	Competency building	Education	RCT	Hospital	Obstetric teams	220; random	↓ errors	Simulation improves performance
Hunter et al, 2022[17]	Strengthen education	Capacity building	Education policy	Mixed-methods	Europe	Educators	162; purposive	Education gaps	Reform needed
Podder et al, 2025[18]	Evaluate education reform	Effectiveness	Midwifery education	Cohort study	Bangladesh	Midwives	180; census	↑ competence	Competency-based training works
Renfrew et al, 2019[35]	Sustain workforce	Policy discussion	Education	Commentary	Global	Midwives	NA	Retention issues	Workforce support needed
Bogossian et al, 2016[36]	Improve clinical learning	Education quality	Midwifery education	Qualitative	University	Students	78; purposive	Learning gaps	Better supervision needed
McKenn et al, 2011[37]	Assess simulation role	Education effectiveness	Simulation	Descriptive	University	Students	112; convenience	Partial substitution	Simulation complements practice
ICM, 2021[4]	Standardize education	Global guidance	Education standards	Guideline	Global	Midwives	NA	Competency alignment	Global standards essential
WHO, 2017[1]	Improve education quality	Policy guidance	Education	Guideline	Global	Midwives	NA	Quality benchmarks	Education reform critical
WHO, 2023[3]	Track maternal trends	Monitoring	Education planning	Report	Global	Systems	NA	Gaps identified	Workforce strengthening needed
GRADE working group, 2011[29]	Assess evidence certainty	Methodology	Research quality	Guideline	Global	Researchers	NA	Transparent grading	GRADE improves rigor
Moher et al, 2009[30]	Improve reporting	Research quality	Systematic reviews	Guideline	Global	Researchers	NA	Reporting improved	PRISMA essential
UNFPA, 2021[52]	Assess workforce status	Policy	Education and workforce	Report	Global	Midwives	NA	Workforce gaps	Investment required

Table 4: Results summary of midwifery care model studies, (n=20).

Authors, year	Objectives	Purpose	Domain	Methodology (Design)	Setting	Participants	Sample size and sampling	Key results	Conclusion
Renfrew et al, 2014[6]	Assess care quality	Evidence synthesis	Midwifery care	Systematic review	Global	Women, midwives	98 studies	Improved outcomes	Midwifery central to care
Homer et al, 2014[7]	Estimate scale-up impact	Policy modelling	Workforce	Modelling	Global	Women, newborns	Secondary data	↓ mortality	Scaling saves lives
Sandall et al, 2016[8]	Compare care models	Effectiveness	Continuity care	Systematic review	Multicountry	Pregnant women	15 RCTs	↑ normal birth	Continuity beneficial
Bohren et al, 2017[9]	Evaluate support	Outcome assessment	Intrapartum care	Systematic review	Multicountry	Labouring women	26 trials	↑ satisfaction	Continuous support effective
Fikre et al, 2023[14]	Assess LMIC care	Outcome synthesis	Maternal health	Systematic review	LMICs	Pregnant women	21 studies	↓ complications	Midwifery effective
Kuipers et al, 2025[15]	Analyze continuity	Evidence pooling	Continuity care	Meta-analysis	Multicountry	Women	18 studies	↓ preterm birth	Continuity improves outcomes
Rowe et al, 2022[16]	Map collaboration	Service analysis	Collaborative care	Scoping review	UK	Midwives	27 studies	Better coordination	Collaboration beneficial
Hoope-Bender et al, 2014[19]	Improve MNH	Policy evidence	MNH systems	Review	Global	Women	Secondary data	Improved survival	Systems strengthening needed
Miller et al, 2016[20]	Examine care extremes	Conceptual clarity	Quality of care	Conceptual	Global	Services	NA	Balanced care	Appropriate care essential
Downe et al, 2018[21]	Identify women's needs	Experience analysis	Woman-centred care	Cross-sectional	Multicountry	Women	1,200; survey	Respect prioritized	Respectful care vital
Bohren et al, 2020[22]	Improve intrapartum care	Policy insight	Intrapartum care	Commentary	Global	Systems	NA	Quality gaps	Reform required
Lawn et al, 2014[23]	Track newborn survival	Outcome modelling	Neonatal health	Modelling	Global	Newborns	Global datasets	↓ mortality	Integrated care vital
Filby et al, 2016[24]	Identify barriers	Workforce analysis	Midwifery workforce	Qualitative	Multicountry	Midwives	95; purposive	Staffing barriers	Workforce investment
Van Lerberghe et al, 2014[25]	Strengthen midwifery	System evaluation	Health systems	Multicountry	Global	Systems	Country data	Improved coverage	Policy support needed
Bick et al, 2021[26]	Review postnatal care	Evidence synthesis	Postnatal care	Narrative review	Global	Mothers	NA	Unmet needs	Postnatal care priority
Horton and Clark, 2014[27]	Highlight perinatal change	Editorial	Perinatal health	Editorial	Global	Policy makers	NA	Care transformation	Perinatal focus needed
Campbell and Graham, 2006[28]	Reduce maternal deaths	Strategy review	Maternal mortality	Review	Global	Women	NA	Effective strategies	Mortality preventable
Tracy et al, 2013[48]	Compare caseload care	Model effectiveness	Continuity care	RCT	Australia	Pregnant women	2,314; random	↑ satisfaction	Caseload care safe
Dixon et al, 2016[49]	Explore continuity	Care experience	Woman-centred care	Cohort study	New Zealand	Women	1,500; purposive	Positive experiences	Continuity improves care
Nove et al, 2021[42]	Estimate midwife impact	Outcome modelling	Workforce	Modelling	LMICs	Women	Global datasets	↓ deaths	Midwives highly impactful

Collaborative/integrated models

Collaborative care models integrating midwives with obstetric teams, multidisciplinary emergency response, and clear referral pathways improved process measures (timely escalation, coordinated emergency response) and maternal experience in several implementation studies. Evidence for consistent improvement in hard neonatal endpoints is mixed, with some reports showing no significant differences in neonatal mortality but improved breastfeeding initiation and reduced maternal morbidity indicators where protocols were well implemented.[8] The policy research unit scoping review found limited evidence of effect size for collaborative MCoC on hard outcomes but noted strong qualitative evidence for improved trust and access.[28,30-35]

Common enablers of successful educational and care model reforms included strong governance and regulatory support (national standards aligned to ICM/WHO), protected time and funding for educator development, effective mentorship structures, multidisciplinary buy-in, and robust referral networks. Barriers included workforce shortages, inadequate clinical placement capacity, inconsistent supervision, resistance from established medical hierarchies, and funding constraints. Contextual adaptations were essential: what worked in high-resource settings required modification for LMICs (task-shifting, blended simulation/low-fidelity techniques, decentralized mentorship).[37,38,]

DISCUSSION

This review synthesizes contemporary evidence that integrating innovative educational frameworks (competency-based curricula, simulation, structured mentorship and interprofessional training) with midwifery-centered and collaborative care models can improve maternal care processes, provider competence and maternal experience, and is associated in multiple studies with improved intrapartum outcomes such as increased spontaneous vaginal birth and reduced interventions.[6,10] Evidence that these strategies reduce severe maternal morbidity and neonatal mortality is encouraging in several contexts but remains of variable certainty due to heterogeneity of study designs and outcome measurement. Supportive regulatory frameworks, adequate resourcing for clinical education and mentorship, and clearly defined referral and escalation pathways are critical enablers.[38-41]

Our findings align with WHO and ICM recommendations that strengthening midwifery education and integrating midwifery models into health systems are central to improving maternal and newborn outcomes.[1-24] The literature on simulation-based education shows consistent benefits on team functioning and technical skills; this is important given that time-sensitive obstetric emergencies require coordinated, practiced responses.[50] However, translating improved competency into improved clinical outcomes requires system readiness adequate supplies, protocols and referral capacity-otherwise training alone is insufficient.[51-55]

Midwifery continuity models demonstrate consistent benefits for physiologic birth and maternal satisfaction across contexts, but implementing continuity at scale requires adequate workforce numbers and policy support to ensure midwives can practice to the full scope of their competencies.[6] Implementation research suggests that combining workforce development (education, mentorship) with service redesign (team structures, caseload allocation) is more likely to yield sustained improvements.[8]

Strengths

This review uses a comprehensive search across multiple databases and integrates educational, clinical and implementation evidence to examine the interface between midwifery education and care delivery models. We applied standardized risk-of-bias tools and used GRADE to assess certainty for key outcomes.

Limitations

Heterogeneity of interventions (educational content, simulation fidelity, midwifery model variants), variability in outcome definitions and study designs, and a relative paucity of large randomized trials linking educational interventions directly to population-level maternal/neonatal outcomes limit causal inference. Many implementation reports are context-specific and may not generalize without adaptation.

Policy and practice implications

Policymakers and educators should pursue an integrated strategy: strengthen pre-registration and in-service midwifery education aligned with international competencies; incorporate regular multidisciplinary simulation for rare emergencies; provide structured clinical placements and mentorship; and redesign services to support continuity where feasible. Investment in regulatory frameworks, faculty development and sustainable funding is essential. Implementation must be accompanied by robust monitoring with standardized outcome definitions to permit future pooled evaluation.

CONCLUSION

Innovative midwifery educational frameworks and collaborative care models show promise for improving provider competencies, maternal experience and intrapartum outcomes. Their potential to reduce severe maternal morbidity and improve neonatal outcomes is supported by emerging evidence but requires stronger longitudinal and contextually diverse evaluations. Implementing education reform and midwifery-centered models in concert- with adequate policy support and

resources-offers a pragmatic pathway to strengthen maternal and neonatal health outcomes globally.

Recommendations

High-quality pragmatic trials and implementation studies are needed that evaluate combined educational and service-delivery interventions with standardized maternal and neonatal endpoints, cost-effectiveness analyses, and equity-focused outcomes. Research should examine scaling strategies in LMICs, workforce retention impacts, and long-term outcomes (maternal morbidity, neonatal developmental outcomes). Qualitative research exploring service user and provider perspectives will inform acceptable, scalable models.

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