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Pre-service and in-service education and training for maternal and newborn care providers in low- and middle-income countries

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Title

Pre-service and in-service education and training for maternal and newborn care providers in Low- and Middle-Income Countries: An evidence review and gap analysis

Abstract

Background

Good quality midwifery care has the potential to reduce both maternal and newborn mortality and morbidity in high, low, and lower-middle income countries (LMIC) and needs to be underpinned by effective education. There is considerable variation in the quality of midwifery education provided globally.

Objective

To determine what are the most efficient and effective ways for LMICs to conduct pre-service and in-service education and training in order to adequately equip care providers to provide quality maternal and newborn care.

Design

Rapid Systematic Evidence Review

Methods

A systematic search of the following databases was conducted: Medline, CINAHL, LILACs, PsycInfo, ERIC, and MIDIRs. Studies that evaluated the effects of pre-service and in-service education that were specifically designed to train, educate or upskill care providers in order to provide quality maternal and newborn care were included. Data was extracted and presented narratively.

Findings

Nineteen studies were included in the review. Of these seven were evaluations of pre-service education programmes and 12 were evaluations of in-service education programmes. Whilst studies demonstrated

positive effects on knowledge and skills, there was a lack of information on whether this translated into behaviour change and positive effects for women and babies. Moreover, the level of the evidence was low and studies often lacked an educational framework and theoretical basis. Mapping the skills taught in each of the programmes to the Quality Maternal and Newborn Care framework (Renfrew et al., 2014) identified that interventions focused on very specific or individual clinical skills and not on the broader scope of midwifery.

Key Conclusions

There is a very limited quantity and quality of peer reviewed published studies of the effectiveness of pre service and in service midwifery education in LMICs; this is at odds with the importance of the topic to survival, health and well-being. There is a preponderance of studies which focus on training for specific emergencies during labour and birth. None of the in-service programmes considered the education of midwives to international standards with the full scope of competencies needed.

There is an urgent need for the development of theoretically informed pre-service and in-service midwifery education programmes, and well-conducted evaluations of such programmes.

Upscaling quality midwifery care for all women and newborn infants is of critical importance to accelerate progress towards Sustainable Development Goal 3. Quality midwifery education is an essential pre-requisite for quality care. To deliver SDG 3, the startling underinvestment in midwifery education identified in this review must be reversed.

Keywords

Midwifery, education, low- and middle- income countries, efficient evidence review, maternal and newborn mortality, Sustainable Development Goal 3

Highlights

- Quality midwifery care requires quality midwifery education. This review is the first to examine all forms of midwifery education in LMICs and identified nineteen studies of pre- and in-service midwifery education in low- and middle-income countries.
- There is a notable dearth of studies on the education of midwives educated to international standards who are able to provide the full scope of midwifery competencies in low- and middle-income countries and instead studies tended to focus on in-service education for emergency intrapartum care.
- Evaluations of midwifery education programmes in low and middle income countries were consistently of a low quality and programmes lacked an educational framework and a theoretical basis for their pedagogical approach, thereby limiting generalisability to other contexts.
- There is a lack of evidence on whether changes in knowledge and skills translate into care providers' behaviour change or positive outcomes for women and newborn infants
- There is inconsistent implementation and understanding of the terms 'midwife' and 'midwifery' internationally and this causes confusion and renders measuring the most effective way of providing pre and in-service education difficult.
- This startling lack of evidence on midwifery education is at odds with the fundamental contribution that good quality midwifery could make to survival, health, and well-being and could explain at least in part the underinvestment in midwifery globally

Abbreviations

CE = Continuing Education

CME = Community Midwifery Education

CSP = clinical skills practice

EMOC = Emergency Obstetric Care

ICM = International Confederation of Midwives

IPCC = Interpersonal Communication and Counselling

JBI = Joanna Briggs Institute

LMICs = Low and Middle Income Countries

MCHW = Maternal and Child Health Workers

OSCE = Objective Structured Clinical Examination

PPH = post-partum haemorrhage

QMNC = Quality Maternal and Newborn Care Framework

TBA = Traditional Birth Attendant

TVET = Technical and Vocational Education Training Programme

WHO = World Health Organization

Introduction

Good quality midwifery care has the potential to reduce both maternal and newborn mortality and morbidity in high, low, and lower and middle income countries (LMICs) (Renfrew et al., 2014). The Lancet Series on Midwifery demonstrated that 83% of all maternal deaths, stillbirths and newborn deaths could be averted, and 56 sexual, reproductive, maternal, newborn and adolescent health outcomes could be improved through the provision of midwifery care which provides all the skills and competencies needed. This would require personnel to be educated to the international standards of the midwife, and to be fully integrated into the health system (Homer et al., 2014, Renfrew et al., 2014, Van Lerberghe et al., 2014).

The pressing need for quality midwifery care is highlighted by the failure over the past two decades to meet Millennium Development Goals (MDG) 4 and 5 (defined as a reduction in under 5 mortality by two thirds and reduction in the maternal mortality by two thirds respectively). More specifically, if we consider MDG indicator 5.2 (proportion of deliveries attended by a skilled health professional, defined as health professionals educated and trained to proficiency in the skills needed to manage uncomplicated pregnancies, childbirth, and the immediate postnatal period, and in the identification, management, and referral of complications in women and newborn infant) we can see that whilst there was an increase in the proportion of births attended by 'skilled health personnel' from 59% in 1990 to 71% in 2014, maternal mortality has only fallen by 46% to 230 maternal deaths per 100,000 live births in LMICs (United Nations, 2015). Moreover only half of pregnant women in LMICs receive the recommended minimum of four antenatal care visits (MDG indicator 5.5; United Nations, 2015). Further improvements in the quality of the care for women and newborn infants is therefore necessary to respond to the Sustainable Development Goals (SDGs) 3.1 and 3.2 (defined as a reduction in global maternal mortality ratio to less than 70 per 100,000 births and a reduction in neonatal mortality to at

least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births respectively).

Effective midwifery education is essential to the provision of the good quality maternal and newborn care that will save lives and improve health and well-being (Fullerton et al., 2003). There is, however, considerable variation in the provision of midwifery care and the content, duration and quality of midwifery education globally. Only 15% of 'skilled birth attendants' in LMICs describe themselves as midwives (Hobbs et al., 2019). Some LMICs have started working towards strengthening education, regulation and association of midwives to the standards set by the International Confederation of Midwives (ICM), the global professional organisation for midwives (Castro Lopes et al., 2016). Despite these attempts there are serious challenges to the implementation of good quality midwifery education. For instance, a review of pre-service programme curricula for four cadres of health-care providers of maternity care in Northern Nigeria identified that no programme met all of the criteria for minimum entry requirement for students (i.e. completion of secondary education), the length of the programme, the theory: practice ratio, the curriculum model, the minimum number of births conducted during training, clinical experience, competencies, the maximum number of students allowable or the proportion of Maternal, Newborn and Child Health components (MNCH) as part of the total curriculum (Adegoke et al., 2013). In addition, a political commitment in Bangladesh to produce 1,500 midwives is going forward without the development of educational institutions that have the skills and capacity needed (UNFPA Evaluation Office, 2016). It is therefore important that attempts of governments, professional organizations and multilateral organizations to develop midwifery education are assessed and amended before scaling up.

A previous systematic review examining the development of midwifery educator capacity in teaching in LMICs identified a lack research studies specific to midwifery education (West et al., 2016). However, since the search was last performed a number of new studies have been published. In addition, there is an urgent need for a broader review which considers all forms of pre- and in-service training to provide guidance about the most effective means to delivery midwifery skills education.

Review Aims and Questions

The aim of this rapid systematic review was to determine what are the most efficient and effective ways for LMICs to conduct pre-service and in-service education and training in order to adequately equip care providers to provide quality maternal and newborn care.

There were two main review questions:

1. What is the evidence for the effectiveness of interventions aimed at the education, training and preparation of *pre-service care providers* in LMICs to provide high quality maternal and newborn care (e.g. student midwives, skilled birth attendants*)?
2. What is the evidence for the effectiveness of interventions aimed at continuing education and training of *in-service care providers* (e.g. midwives, nurses, doctors, other health workers)?

‘Midwife’ was defined as professional midwives who are educated and trained to the full scope of ICM essential competencies for basic midwifery practice. Skilled birth attendants (SBAs) were defined using the WHO definition ‘an accredited health professional - such as a midwife, doctor or nurse - who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborn babies’ (WHO, 2004).

Methods

A rapid systematic review of the literature was conducted and took a collaborative, targeted and efficient approach which was developed in conjunction with policymakers (Gavine et al., 2018). The protocol for the review was developed in conjunction with a Technical Advisory Group and is available upon request. This review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidance (Moher et al., 2009).

Search Methods

Relevant published literature was identified by searching six key electronic databases: Medical literature analysis and retrieval system online (Medline+); PsycINFO; Cumulative Index to Nursing and Health Literature (CinAHL+); Education Resources Information Center (ERIC); Midwives Information and Resource Service (MIDRS) and Latin American and Caribbean Health Sciences Literature (LILACS). The search was first performed in October and November 2017 and updated in February 2019. See Supplementary File 1 for search strategy.

As this was a rapid evidence review searches were limited to those published in the last ten years (2007 onwards) and in the English language.

In addition, the reference lists of all full-text studies that potentially met the inclusion were examined for any additional records not identified by the search.

Selection of Studies

All study records were de-duplicated and imported into Endnote. Two members of the review team independently screened the titles and abstracts of all studies identified in the database search against the following inclusion criteria:

- Includes only care providers who are involved in the delivery of maternal and newborn care. These include: Midwives, nurse-midwives, nurses, public health nurses, public health workers, GPs, obstetricians, community health workers, maternal and child health workers, skilled birth attendants, traditional birth attendants.
- Focuses on interventions specifically designed to train, educate or upskill care providers in order to provide quality maternal and newborn care
- Assesses the effect of an intervention on knowledge and/or skills
- Reports empirical data from quantitative studies (e.g. randomised controlled trials, survey, cohort, interrupted time series, systematic review and meta-analysis)
- Is set in one or more LMICs.

As the focus of this review was on effectiveness and due to the rapid timeframe in which the work had to be completed, papers that did not report quantitative data evaluating interventions (e.g. commentaries) and papers that reported primarily qualitative data were excluded.

The full texts of all papers potentially meeting the inclusion were retrieved and were independently screened by two review team members. Any disagreements were resolved through discussion with the rest of the review team.

Data Extraction

Data were extracted from included publications regarding: research methods used; the primary aims of the study being reported and key findings related to the research questions. Data extraction forms were developed and included information on the following domains: study country, study context, study design, study participants, the specific action or educational measure employed to increase knowledge and skills and details of the knowledge and skills being taught, course award (where applicable), intervention duration, theoretical basis of intervention in terms of content and pedagogical approach, facilitators, resources, and intervention outcomes. Intervention outcomes were categorised according to a version of Kirkpatrick's hierarchy which was adapted for medical education and is outlined in Table 1 (Tochel et al., 2009). Study designs were mapped to the Joanna Briggs Institute (JBI) Levels of Evidence to help make a judgement about the methodological rigour of each study (JBI, 2013).

Table 1. Adapted Kirkpatrick's hierarchy (Tochel et al., 2009)

Level	Outcomes
1. Participation	Learners' views on the learning experience (e.g. quality of materials and instruction, organisation, teaching methods) measured through questionnaires or interviews.
2a. Modification of attitudes/perceptions	Attitudes and perceptions towards the intervention measured through questionnaires or interviews.
2b. Modification of knowledge/skills	For knowledge this includes concepts, procedures and principles measured through a written or oral examination (e.g. multiple choice questions). For skills this includes clinical skills and interpersonal skills measured through a practical exam (e.g. objective structured clinical examination).

3. Behavioural Change	Transfer of learning to the workplace (e.g. application of a skill) measured through self-report data, observations or medical records.
4a. Change in organisational practice	Change in organisational practice attributable to the programme (e.g. changes/increases in procedures and care provided) measured through medical records.
4b. Benefits to patients/clients	Improvements in the health and wellbeing of patients/clients attributable to the programme (e.g. changes in morbidity) measured through patient reported data or medical records.

Synthesis

We correctly anticipated that there would be a diversity of evidence and thus that it would not be possible to synthesise results quantitatively through a meta-analysis. The extracted findings were therefore synthesised narratively based on the domains listed above. In addition the knowledge and skills being taught were mapped to the Quality Maternal and Newborn Care (QMNC) Framework (Renfrew et al., 2014) to identify any gaps in education provision. This is an evidence-based framework which identifies the characteristics of care that women, infants and families need from pre-pregnancy, through pregnancy, to birth, postpartum and the early weeks of life.

Results

The original search yielded a total of 2648 titles and the updated search yielded an additional 164 records. Thus a total of 2812 records were screened against the inclusion criteria. At this stage 2686 were excluded on the basis of title and abstract as they did not meet the inclusion criteria. The full-texts of the remaining 125 articles were retrieved and examined for eligibility. A further 106 articles were excluded for the following reasons: did not evaluate an educational intervention (n=39); not an empirical study(n=46); published before 2007 (n =5); did not evaluate a maternal child health specific

educational intervention (n=4); qualitative data only (n=2); long term follow-up study (n=1); descriptive article (n=1); not conducted in a LMIC (n=3); focused on capacity building (n=1); study protocol (n=1); full-text unavailable (n=1). Of note are two studies that were evaluations of training for care providers and data were collected at a community level and not at the level of care provider (Matendo et al., 2011, Goudar et al., 2012). Within each community, not all care providers as received training and a significant proportion of births were not attended, and as data is not available at the level of the care provider, these two studies were excluded. A total of 19 reports of 19 unique studies were thus included in the review. Figure 2 illustrates the study selection process.

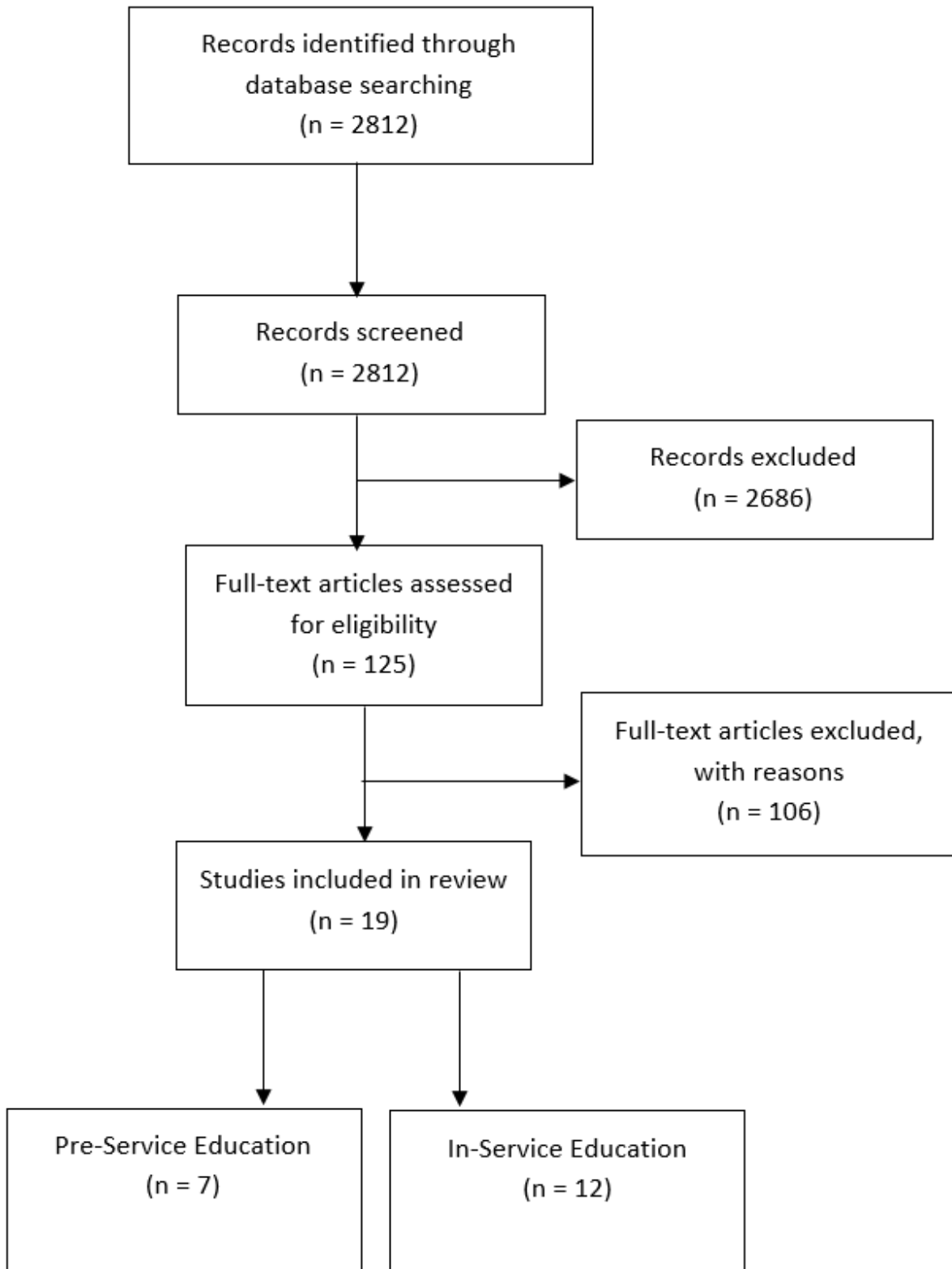


Figure 2. Flow Diagram of Study Selection Process

Study Characteristics

Seven studies that focused on pre-service education were identified (Agrawal et al., 2016, Balasubramaniam et al., 2018, Moores et al., 2016, Sharma et al., 2015, Tyer-Viola et al., 2012, Yigzaw et al., 2015, Zainullah et al., 2014). Twelve studies were identified that focused on in-service education (Ameh et al., 2012, Ameh et al., 2016, Akin-Otiko and Bhengu, 2013, Andreatta et al., 2011, Bookman et al., 2010, Cavicchiolo et al., 2017, Faucher et al., 2016, Mirkuzie et al., 2014, Ojemeni et al., 2017, Shrestha et al., 2013, Woods et al., 2015, Satishchandra et al., 2009).

Study Designs

No randomised controlled trials (RCTs) were identified. Only one pre-service study (Tyer-Viola et al., 2012) and one in-service study (Woods et al., 2015) used a non-randomised controlled experimental design and were considered to be level 2c on the JBI Levels of Evidence. The majority of studies used a one group pre- and post-intervention test and were considered to be level 2d on the JBI Levels of Evidence (Akin-Otiko and Bhengu, 2013, Ameh et al., 2012, Ameh et al., 2016, Andreatta et al., 2011, Bookman et al., 2010, Cavicchiolo et al., 2017, Faucher et al., 2016, Mirkuzie, et al., 2014, Satishchandra et al., 2009, Shrestha et al., 2013). A number of studies employed a considerably weaker cross-sectional design (Agrawal et al., 2016, Balasubramaniam et al., 2018, Moores et al., 2016, Sharma et al., 2015, Yigzaw et al., 2015, Zainullah et al., 2014) which is considered to be level 4b on the JBI Levels of Evidence. One study used a case study approach which at level 4d is considered to be the lowest JBI level of evidence with the exception of expert opinion and bench research (Ojemeni et al., 2017).

Study Settings

The majority of studies were conducted in single LMICs including six in India (Agrawal et al., 2016, Balasubramaniam et al., 2018, Faucher et al., 2016, Satishchandra et al., 2009, Sharma et al., 2015), two

in Ghana (Andreatta et al., 2011, Bookman et al., 2010) and two in Ethiopia (Mirkuzie et al., 2014, Yigzaw et al., 2015), and one each from Nigeria (Akin-Otiko and Bhengu, 2013), Papua New Guinea (Moores et al., 2016), Nepal (Shrestha et al., 2013), Somalia (Ameh et al., 2012), Mozambique (Cavichiolo et al., 2017), Tanzania (Ojemeni et al., 2017), Zambia (Tyer-Viola et al., 2012), Afghanistan (Zainullah et al., 2014) and Cambodia (Woods et al., 2015). One study was conducted in multiple countries including: Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Tanzania, Zimbabwe, Bangladesh and Pakistan (Ameh et al., 2016). Sample sizes ranged from 15 (Akin-Otiko and Bhengu, 2013) to 5939 (Ameh et al., 2016). A number of programmes took place in rural settings (Agrawal et al., 2016, Balasubramaniam et al., 2018, Moores et al., 2016, Zainullah et al., 2014)

Pre-Service Education Interventions

There was considerable variation in the interventions evaluated and they can be broadly divided into the following two categories: whole midwifery programmes (Moores et al., 2016, Sharma et al., 2015, Yigzaw et al., 2015, Zainullah et al., 2014); and a specific component of a pre-service curriculum (Agrawal, 2016, Balasubramanian, et al., 2018, Tyer-Viola et al., 2012). It should be noted that that Agrawal et al. (2016) and Balasubramanian et al. (2018) are separate evaluations of the same programme undertaken by two different cohorts of students. See Supplementary Table 1 for further details.

Within the studies examining degree programmes as a whole there was heterogeneity in terms of participants, course duration, level of course award and curriculum. For instance Moores et al. (2016) and Yigzaw et al. (2015) both reported on Technical and Vocational Education Training (TVET) accelerated one year programmes for nurses, however, Yigzaw et al. also reported on 3 year TVET (diploma) and 4 year University (degree) midwifery programmes for non-nurses. The programmes

reported by Zainullah et al. (2014) were also for non-nurses but were delivered at an accelerated rate of 24 months. Students were either 12th grade graduates undertaking a University programme or had completed between 9 and 12 grades of schooling and were undertaking a community midwifery education programme based in rural clinics. Finally, the participants in the study by Sharma et al. (2015) were training to be nurse-midwives and were undertaking a 3.5 year Diploma or a 4 year Bachelor's Degree, of which midwifery constituted 11-19%. In terms of the theoretical basis of the curriculum design, the programmes described by Moores et al. (2016) and the two diploma programmes reported by Yigzaw et al. were described as competency based curricula. Whereas the University based programme reported by Yigzaw et al. was described as a subject-based curriculum. Only Zainullah et al. reported that the curriculum adhered to international standards by requiring that graduates must achieve the ICM core competencies. No detail on the curriculum was provided by Sharma et al.

The specific component of a pre-service programme evaluated by Agrawal et al. (2016) and Balasubramaniam et al. (2018) did not describe any theoretical basis and consisted of a 72 hour virtual training package for pre-service trainee midwives and utilised live streaming as well as case discussions and clinical simulation. The other pre-service programme was underpinned by what the authors described as the theoretical model of novice to expert (Tyer-Viola et al., 2012). This intervention utilised simulation around the management of pregnancy and labour.

Two pre-service programmes evaluated in three studies were delivered in conjunction with external organisations and involved the participation of international facilitators (Agrawal et al., 2016, Balasubramaniam et al., 2018, Moores et al., 2015). With the exception of Tyer-Viola et al. (2012) these programmes were the only pre-registration programmes that described using clinical simulation. These

two programmes also had a focus on providing care in remote and rural settings. In addition, one of the programmes described by Zainullah et al. (2014) was also focused on rural settings.

In-Service Education Interventions

The majority of the in-service education programmes were less than one week in duration (Ameh 2012; Ameh 2016; Akin-Otiko and Bhengu, 2013, Andreatta et al., 2011, Bookman et al., 2010, Cavicchiolo et al., 2017, Faucher 2016 et al., Ojemeni et al., 2017, Shrestha et al., 2013). With only Mirkuzie et al. (2014) implementing a longer period of three weeks of teaching. Both Woods et al. (2015) and Satischandra et al. (2009) delivered several days of teaching which were followed-up by on-site visits. See Supplementary Table 2 for details.

The majority of the in-service programmes focused exclusively on intrapartum care, in particular the management of emergencies (Ameh et al., 2012, Ameh et al., 2016, Andreatta, 2012, Bookman et al., 2010, Cavicchiolo et al., 2017, Faucher et al., 2016, Mirkuzie et al., 2014, Woods et al., 2015). Of the remaining programmes, two focused on care of the newborn including breastfeeding (Satischandra et al., 2009, Shresta et al., 2013), one focused on interpersonal communication and counselling (IPCC; Akin-Otiko and Bhengu, 2013) and one focused on using mentoring and preceptorship (Ojemeni et al., 2017). There was striking paucity of education on antenatal and postnatal care of the woman, and on important aspects of care including family planning and post-abortion care. .

A range of different theoretical approaches to the intervention were used including: behaviour change frameworks (Akin-Otiko and Bhengu, 2013, Shresta et al., 2013); competency based approaches (Ameh et al., 2016, Woods et al., 2014); culture specific pedagogy (Andreatta et al., 2011); knowledge into action (Faucher et al., 2016); mastery learning approach (Mirkuzie et al., 2014), didactic approach

(Bookman et al., 2010) and needs assessments (Ojemeni et al., 2017). The majority of programmes involved the use of simulation, role play and sample scenarios (Ameh et al., 2012, Ameh et al., 2016, Andreatta et al., 2011, Cavicchiolo et al., 2017, Faucher et al., 2016, Mirkuzie et al., 2014, Ojemeni et al., 2017, Satishchandra et al., 2009, Woods et al., 2015) and did not include clinical experience and reflective activities.

Half of the studies described resources that were utilised including: videos (Ameh et al., 2012, Satishchandra et al., 2009); medical equipment (Ameh et al., 2012); posters in the local language (Ameh et al., 2012); dance and image only materials for TBAs (Andreatta, et al., 2011); and simulators (Mirkuzie et al., 2014, Ojemeni et al., 2017, Satishchandra et al., 2009, Woods et al., 2015) and additional reading materials (Shresta et al., 2013). Lack of detail on facilitators was a common theme with only two studies describing using international facilitators (Ojemeni et al., 2017, Woods et al., 2015) and one reporting a train the trainer approach (Ameh et al., 2012).

Study Results: Pre-service

All seven of the pre-service education studies measured level two outcomes (ie modification of attitudes, perceptions, knowledge, skills: Kirkpatrick, 2007). Three studies also measured level one outcomes (ie participation: Moores et al., 2026, Tyer-Viola et al., 2016, Yigzaw et al., 2015). No studies measured level 3 (ie behavioural change) or 4 (ie change in organisational practice, benefits to patients' clients) outcomes. See Table 1 for a description of outcomes and Supplementary Table 3 for full details of results.

Level 1 Outcomes

Participants reported a range in experiences with Moores and Tyler-Viola et al. (2012) describing a generally favourable course experience, whilst, Yigzaw et al. (2015) reported more negative experiences, particularly amongst the University students.

Level 2 Outcomes

These outcomes included self-assessment of skills (Moores et al., 2016, Sharma et al., 2015) and performance of skills (Agrawal et al., 2016, Balasubramaniam et al., 2018, Yigzaw et al., 2015, Zainullah et al., 2014) and knowledge (Tyler-Viola et al., 2012). Both Moores et al. (2016) and Sharma et al. (2015) measured confidence to perform skills amongst midwifery graduates. The findings from the studies conflict with each other, with Moores et al. reporting that the majority of participants in Papua New Guinea were confident in EMoNC and advanced skills relating to ICM competencies. Conversely, Sharma et al. reported that almost half of participants on a nursing and midwifery programme in India had low confidence in antenatal, intrapartum, postnatal and newborn care.

Skills assessment was also performed through practical clinical skills examinations. Agrawal et al. (2016) and Balasubramaniam et al. (2018) reported on the evaluation of a specific component of a course, and compared a historic cohort of students' scores with students' undertaking the new course. Pre-intervention cohort had very low scores and a significant and large improvement was reported in all of the skills evaluated (Agrawal et al., 2016, Balasubramaniam et al., 2018). Both Yigzaw et al. (2015) and Zainullah et al. (2014) compared skills in students undertaking different awards. There was no evidence that any specific approach was superior. Yigzaw et al. measured clinical skills based on ICM core competencies and reported that for some clinical skills TVET students scored higher than University

students. Conversely, for other clinical skills University students scored higher and for some there was no significant difference. Of note is that only 31.6% of students achieved the 60% grade needed to pass the national exam, which indicates that the standard upon completion of both University and TVET courses was generally low. Zainullah et al. compared community midwifery graduates with graduates from Institutes of Health Sciences who were now working as midwives (mean 2.6 years qualified, range 1-7 years) to see if they retained the 100% competency. There was no significant difference between the two groups in overall performance, with the data suggesting that skills were generally not well retained, in particular shock management with mean scores of below 40% in both groups (although CME students did score significantly higher for this specific skill).

Only Tyer-Viola et al. (2012) included the other level 2 outcome (i.e. knowledge) and reported that there was no significant difference between the control and intervention group.

Study Results: In-Service

Again for in-service education studies primarily focused on level two outcomes including: self-assessment of skills (Cavicchiolo et al., 2017); knowledge (Ameh et al., 2012, Ameh et al., 2016, Bookman et al., 2010, Cavicchiolo et al., 2017, Faucher et al., 2017, Mirkuzie et al., 2014, Ojemeni et al., 2017, Satishchandra et al., 2009, Shresta et al., 2013); skills (Akin-Otiko and Bhengu, 2013, Ameh et al., 2012, Ameh et al., 2016, Andreatta et al., 2011, Bookman et al., 2010, Cavicchiolo et al., 2017, Shresta et al., 2013). In addition three studies measured level one outcomes (Ameh et al., 2012, Andreatta et al., 2011, Mirkuzie et al., 2014), three studies also measured level 3 outcomes (i.e. changes in behaviour; Andreatta et al., 2011, Faucher et al., 2016, Satishchandra et al., 2009) and three studies measured a level 4 outcome (i.e. beneficial effects; Andreatta et al., 2011; Ameh et al., 2012, Satishchandra et al., 2009). See Supplementary Table 4 for full details.

Level 1 Outcomes

Like the majority of pre-service education programmes, the three in-service studies that measured the level 1 outcome of participants' reactions and experiences with the programme reported positive findings (Ameh et al., 2012, Andreatta et al., 2011, Mirkuzie et al., 2014).

Level 2 Outcomes

The five studies that measured the level 2 outcome of change in knowledge from pre-test to post-test, all reported a significant increase (Ameh et al., 2012, Ameh et al., 2016, Bookman et al., 2010, Faucher et al., 2016, Shresta et al., 2013). Participants were followed in three of these studies and suggested that knowledge as measured by these scales was maintained over time (Faucher et al., 2016, Shresta et al., 2013). Satishchandra et al. (2009) analysed results by dividing TBAs who had previous training and TBAs with no previous training into separate groups. Whilst both groups demonstrated improvements in knowledge, these increases were greater in the previously untrained TBAs. The majority of items assessed in these studies related to EmOC and newborn care. Cavicchilolo et al. (2017), Mirkuzie et al. (2014) and Ojemeni et al. (2017) also measured knowledge at follow-up but there is no pre-test data or control group data to examine intervention effectiveness.

The six studies that measured change in skills through practical clinical examinations all reported significant increases (Akin-Otiko and Bhengu, 2013, Ameh et al., 2012, Ameh 2016, Andreatta 2011, Bookman et al., 2010, Shresta et al., 2013). Only Shresta et al. (2013) and Bookman et al. (2010) followed up participants and reported that scores remained higher than at pre-test. It should be noted that the scores in the study by Shresta et al. were particularly low at all time points. Again, studies generally focused on the assessment of skills related to EmOC. The one study that utilised a non-

randomised controlled group design reported that intervention participants had significantly higher scores than the control group in the three emergency skills assessed (Woods et al., 2015). Interestingly, the colleagues of participants receiving the educational intervention also had higher scores than the control participants, which Woods suggests might indicate a spill over in knowledge and skills.

Level 3 and 4 outcomes

Level 3 and 4 outcomes were only measured in four of the 12 in-service studies. Moreover, generally only a sub-set of participants were followed-up and therefore only very limited conclusions can be drawn. However, some positive effects in EMOc, newborn care and delayed cord clamping were identified. More specifically, increase in provision of EMOc, a level four outcome, was identified by Ameh et al. (2012) and Andreatta et al. (2011). First, Ameh et al. (2012) reported that both basic and comprehensive healthcare facilities provided 100% of expected Emergency Obstetric Care signal functions after the intervention, compared to 43% and 56% at baseline. Secondly, Andreatta et al. (2011) followed up a sub-set of 10 participants to assess management of PPH and reported that all 13 instances of PPH were managed by uterine compression. This was associated with no maternal mortality in these cases, a level four outcome. In addition, Satishchandra et al. (2009) reported a significant increase in the number of newborn care practices being performed and improvements in breastfeeding advice. A level 4 outcome was also measured in this study with Satishchandra et al. reporting a decrease in the number of stillbirths, perinatal deaths and neonatal deaths. Finally, Faucher et al. (2016) followed a sub-set of 15 patients and self-report data indicated that delayed cord clamping (3 minutes) increased from 0% to 80% (level 3 outcome). Additionally, data were available for 98/107 births in the follow-up period and identified that delayed cord clamping for 3 minutes was performed in 53% of case and for 2 minutes in 27.6% of cases (level 3 outcome).

Mapping Empirical Studies to the QMNC Framework

Each of the studies was mapped to components of the QMNC framework (see Table 2). The table indicates which studies provided data relevant to each of the components in the framework (studies highlighted in blue are pre-service studies and studies highlighted in red are in-service studies). It can be seen that the great majority of data pertain to the three components at the top right of the table in the Practice Categories (Promoting normal processes, preventing complications; First-line management of complications; Management of serious complications). Further, only two studies provide data pertinent to “Values” and no studies are represented in the areas of: Organisation of care; Philosophy; or Care providers.

Table 2. Studies mapped to the QMNC Framework

Practice categories	Education Information Health Promotion	Assessment Screening Care planning	Promoting normal processes, preventing complications	First-line management of complications	Management of serious complications
	Agrawal	Agrawal	Agrawal	Agrawal	Zainullah
	Balasubramaniam	Balasubramaniam	Balasubramaniam	Balasubramaniam	Ameh,
	Satishchandra	Mansoor	Mansoor	Mansoor	(2012)
		Tyer-Viola	Moores,	Sharma,	Ameh
		Satishchandra	Sharma,	Yigsaw,	(2016)
			Yigsaw,	Shrestha	Andreatta
			Faucher,	Woods	Cavicchiolo
			Shrestha		Kim
			Woods		

			Shrestha		Ojemeni, Shrestha Woods Mirkuzie Bookman
Organisation of care					
Values	Moores Akin-Otiko				
Philosophy					
Care Providers					

Discussion

This review found limited quantity and quality of evidence for establishing the effectiveness of interventions aimed at the education, training and preparation of pre-service and in-service care providers in LMICs. In total 18 studies met the inclusion criteria with seven focusing on pre-service education and 11 focusing on in-service education. This is in contrast to a systematic review which examined the effectiveness of post-registration nursing and midwifery on practice and identified 61 studies from high income countries and no studies in LMICs, where arguably there is a greater need for effective education (Gijbels et al., 2010).

The small number of pre-service education programmes identified in this review generally identified low levels of self-assessed confidence (Sharma et al., 2015) and low scores for skills (Yigzaw et al., 2015, Zainullah et al., 2014). The nature of the programme award (i.e. diploma, degree) or setting (i.e. community, University) did not appear to make any difference on skills examined in these studies. The one pre-registration programme that did appear to confer some benefit on skills was a 72 hour virtual classroom package which aimed to build on midwifery knowledge and clinical skills and incorporated case-based learning, clinical simulations, demonstrations, practice, and feedback (Agrawal et al., 2016). This is of note as there is often some resistance to virtual learning, however, a meta-analysis of over 200 studies comparing distance learning and traditional classroom based approaches identified that overall there were no significant differences between the two approaches, and positive effects were a result of the quality of the programme (Bernard et al., 2004).

The in-service training programmes were evaluations of short courses and did also show some positive effects on knowledge (Ameh et al., 2012, Ameh et al., 2016, Cavicchiolo et al., 2017, Faucher et al., 2016, Ojemeni et al., 2017, Shresta, 2013), skills (Akin-Otiko and Bhengu, 2013, 2013, Ameh et al., 2012, Ameh et al., 2016, Andreatta et al., 2011, Cavicchiolo et al., 2017, Shresta, 2013, Woods et al., 2015), behaviours (Ameh et al., 2012, Andreatta et al., 2011, Faucher et al., 2016) and clinical outcomes for post-partum haemorrhage (Andreatta et al., 2011). However, the findings of these studies should be interpreted with caution as the nature of the research methods employed across the included studies in this review is generally weak in terms of establishing effectiveness of an intervention. More specifically, there were no studies that corresponded to level one on the JBI Levels of Evidence and most studies simply employed a within subjects pre- and post-test design and often recruited participants via convenience sampling. There was also a number of cross-sectional studies which are even less robust.

Thus, in terms of establishing effectiveness, the literature included in this review should be regarded as very limited.

Another serious limitation of many of the identified programmes was a lack of an educational framework for the course content (i.e. set of standards or learning outcomes). Whilst a number of the pre-service programmes did report implementing a competency based curriculum (Moores et al., 2016, Yigzaw et al., 2015, Zainullah et al., 2014), the pre-service programmes examining a specific component of a programme and the in-service programmes did not report any educational framework. This is consistent with findings of another systematic review (West, 2016). Similarly, none of the pre-service programmes identified in this review reported a theoretical basis for their pedagogical approach, however, several of the in-service ones did report using the following recognised approaches: behaviour change theoretical framework (Akin-Otiko and Bhengu, 2013, Shresta et al., 2013); adult learning (Ameh et al., 2016), knowledge to action translational framework (Faucher et al., 2016) and a mastery approach to learning (Mirkuzie et al., 2014). However, very limited detail was provided on how the interventions utilised these approaches and this combined with the lack of an educational framework makes replicating any of these approaches difficult and thus limits generalisability of the research. Similarly, there was a lack of evidence on the training and backgrounds of facilitators, which again limits generalisability.

Despite the limited evidence for effectiveness identified, this review did identify a number of salient points that are important in considering how pre- and in-service education for care providers providing maternal and newborn care can be developed.

First, there was a strong focus from many of the programmes on EmOC, in particular the in service programmes (Ameh et al., 2012, Ameh et al., 2016, Andreatta, 2012, Cavicchiolo 2017; Faucher 2016; Woods et al., 2015). By mapping the skills taught in each of the programmes to the QMNC framework, it is evident that almost all focused on very specific or individual clinical skills, mostly emergency, and not on the broader scope of midwifery. The great majority of the studies examined the teaching of specific clinical interventions to address complications during the intrapartum period, such as managing haemorrhage and resuscitation skills. Whilst there was some evidence this was effective in improving clinical skills, and good quality EmOC is in no doubt essential in reducing maternal and infant morbidity and mortality, it is not sufficient alone to make significant progress towards the Sustainable Development Goals (ten Hoop-Bender et al., 2014). Instead, education needs to be broadened and care providers also need to be taught essential preventive and supportive skills, respectful care, avoiding unnecessary interventions, and developing women's own capabilities across the whole continuum of care (Renfrew, et al., 2014). The current literature identified in this review therefore cannot answer key questions about how best to educate midwives to international standards, or which skills are most needed by which cadres in which contexts.

This is further complicated by the inconsistent implementation and understanding of the terms 'midwife' and 'midwifery'. In some countries and contexts the term 'midwife' is used only to describe professional midwives who meet in full the ICM international competencies. These countries are those with strong, established professional midwifery. In other contexts, and especially in LMICs, the term is commonly used to describe other health workers who have a more limited range of knowledge and skills. The term 'midwifery skills' is similarly used inconsistently, and can describe the full scope of practice, or specific clinical skills. However, the majority of studies provided little explanation of the operationalisation of midwifery in their context. This confusion was evident in the studies included in

this review. For instance, Sharma et al. (2015) describe participants as ‘registered midwives’ despite midwifery only constituting 11-19% of an integrated nursing and midwifery curriculum. This lack of understanding of the role of a midwife is arguably leading to a focus on in-service training on specific intrapartum emergencies, rather than investment in midwifery to international standards.

Future programme development should employ the use of the Guideline for Reporting Evidence-based practice Educational Interventions and Teaching (GREET) checklist (Phillips et al., 2016). GREET is based upon the findings of a systematic review a Delphi survey and is a validated 17 item checklist which outlines what needs to be considered in an educational intervention (e.g. learning objectives, theory, delivery). Whilst GREET was developed within the field of Health Sciences, it is not specific to midwifery and there is a need for further development and validation of topic specific items. This may include items such as the definition of midwifery being used for both the course content and the background of participants and instructors.

Additionally, future evaluations need to consider whether programmes have a demonstrable effect on behaviours and outcomes as changes in knowledge and skills do not necessarily equate to changes in outcomes. For instance a systematic review of 609 studies on simulation training for healthcare professionals (in any speciality), identified large increases in knowledge for simulation training, but only moderate improvements in patient effects (Cook et al., 2011). They reported that patient outcomes were only measured in 32 out of 609 studies. In our review, outcomes from each included study were considered at each level of Kirkpatrick’s hierarchy for evaluation which has been adapted for medical education and is outlined in Table 1 (Tochel et al., 2009). Only Ameh et al. (2012) made an attempt to consider every level of the hierarchy. This is a finding replicated by other systematic reviews which suggests lack of consideration of level four outcomes is an issue in healthcare professional education

generally (Curran and Fleet, 2005, Tochel et al., 2009, Yardley and Dornan, 2012). However, Kirkpatrick's hierarchy is not without criticism as its focus on quantitative outcome data may fail to address the complexity inherent in educational interventions (Yardley and Dornan, 2011). Studies may therefore also benefit from a process evaluation to help understand why an intervention may succeed or fail (Craig et al., 2008). Such an approach considers the implementation of the intervention, participants' and practitioners' views, and understanding of the context, and can help in interpretation of study results (Oakley et al., 2006).

Lack of well-designed educational interventions and evaluations in maternity care is arguably related to wider gender inequality, both of which have a negative impact on health and social outcomes (Sen et al., 2007). Indeed, lack of investment in good quality midwifery education has been identified as a major barrier to the provision of quality maternity care and whilst this is not unique to midwifery, it is compounded by the fact that midwifery is a profession predominantly of women that is focused on women and infants (Filby et al., 2016). Both within healthcare generally and within maternity care specifically, there is a clear feminisation of the workforce with women constituting the majority of the global health workforce (Shannon et al., 2019). However, the majority of women hold roles considered to be lower cadres of health workers and are under-represented in leadership and governance roles both at a local level and international level (e.g. World Health Organization) (Dhatt et al., 2017). Gender equality in the health workforce is therefore necessary to empower women and help address inequities in health care and underpins the SDGs (Shannon et al., 2019, Gender Equity Hub, 2018).

Limitations

Given the rapid time period this review needed to be conducted in, we were only able to include English language articles and studies published from 2007. In addition, due to time constraints we were unable to search the Grey literature. Both of these limitations may mean that studies potentially meeting the inclusion criteria were not identified and included. In addition, qualitative studies were not eligible for inclusion in this review. Such studies may provide an understanding of the barriers and facilitators of midwifery education in LMICs and a review of such studies is an area warranting further research.

Conclusions

There is a very limited quantity and quality of peer reviewed published studies of the effectiveness of pre service and in service midwifery education in LMICs. Whilst there is some evidence that suggests that EMOC is effective in improving care providers' skills, there is a dearth of evidence on transfer of learning to the workplace, changes in organisational practice attributable to the training, or in outcomes for women and their newborns. Given the state of the evidence, it is not currently possible therefore to ascertain whether there are any sustainable benefits for women and children from midwifery education programmes as currently provided. There is a preponderance of studies which focus on EmOC and on the intrapartum period and studies consistently do not consider the other aspects of the QMNC framework. Indeed, none of the in-service programmes consider the education of international-standard midwives to the full scope of midwifery. Similarly, for the pre-service programmes insufficient detail was provided to ascertain whether students were educated to the full scope of midwifery.

It is unclear as to why there is such a focus on EmOC. It is potentially easier both logistically and financially to teach skills in short blocks, whereas, educating midwives to international standards would require significantly more investment. Given the proven potential for saving lives and enhancing health

and well-being for women and newborn infants, this lack of investment in good quality research on the effectiveness and efficiency of midwifery skills education is striking.

Upscaling quality midwifery for all women and newborn infants is of critical importance to inform progress towards SDG3, the implementation of Human Resources for Health, and implementation of the Global Strategy for Women's, Children's, and Adolescent's Health. Quality midwifery education is an essential pre-requisite for quality care. To ensure all of this work is built on strong foundations, there is an urgent need for development and well conducted evaluations of education programmes for midwives and for others practising related skills, both at pre-service and in-service levels. The startling underinvestment in midwifery education identified in this review must be reversed.

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