Midwifery and quality care: findings from a new evidence-informed framework for maternal and newborn care

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In this first paper in a series of four papers on midwifery, we aimed to examine, comprehensively and systematically, the contribution midwifery can make to the quality of care of women and infants globally, and the role of midwives and others in providing midwifery care. Drawing on international definitions and current practice, we mapped the scope of midwifery. We then developed a framework for quality maternal and newborn care using a mixed-methods approach including synthesis of findings from systematic reviews of women’s views and experiences, effective practices, and maternal and newborn care providers. The framework differentiates between what care is provided and how and by whom it is provided, and describes the care and services that childbearing women and newborn infants need in all settings. We identified more than 50 short-term, medium-term, and long-term outcomes that could be improved by care within the scope of midwifery; reduced maternal and neonatal mortality and morbidity, reduced stillbirth and preterm birth, decreased number of unnecessary interventions, and improved psychosocial and public health outcomes. Midwifery was associated with more efficient use of resources and improved outcomes when provided by midwives who were educated, trained, licensed, and regulated. Our findings support a system-level shift from maternal and newborn care focused on identification and treatment of pathology for the minority to skilled care for all. This change includes preventive and supportive care that works to strengthen women’s capabilities in the context of respectful relationships, is tailored to their needs, focuses on promotion of normal reproductive processes, and in which first-line management of complications and accessible emergency treatment are provided when needed. Midwifery is pivotal to this approach, which requires effective interdisciplinary teamwork and integration across facility and community settings. Future planning for maternal and newborn care systems can benefit from using the quality framework in planning workforce development and resource allocation.

Introduction

Every year there are an estimated 139 million births.1 An estimated 289 000 women will die during pregnancy, childbirth, or soon after;2 2·6 million will have stillbirths,3 and 2·9 million infants will die in the first month of life.4 Poor quality maternal and newborn care is a major factor for these deaths, and continued reductions in maternal mortality needs overall improvements in quality throughout the continuum of care and improved emergency services.5–7 Poor quality care does not just result in mortality; it contributes to acute and chronic clinical and psychological morbidity for the estimated 20 million women who survive,8 with a lasting effect on mothers’ and infants’ physical and psychosocial health and wellbeing, on their need to pay for ongoing healthcare costs,9 and on the ability of their families to escape poverty.1 Poor maternal and newborn care have an economic effect on communities and countries10 and hamper efforts to tackle inter-generational inequalities in health.11 Poor quality care is not just about the available resources in a health system; some high-income countries (eg, the USA) rank lower on the health components of the 2013 Mothers Index12 than some far less wealthy ones (eg, Poland, Estonia). Neither is poor quality care just about the absence of services. There is global concern about the overuse of interventions that were designed to manage complications.13 Unnecessary interventions during pregnancy, birth, and the early weeks of life are escalating in high-income, middle-income, and some low-income settings,14–16 risking iatrogenic harm to women and newborn infants,17–18 and the economic costs of this overuse are substantial.19 Although the degree and type of risk related to pregnancy, birth, post partum, and the early weeks of life differ between countries and settings, the need to implement effective, sustainable, and affordable improvements in the quality of care is common to all. New knowledge is needed to eliminate avoidable maternal and newborn mortality and morbidity, and to inform decision making for universal health care and the UN post-2015 development agenda,20 the most effective actions for the Global Strategy for Women’s and Children’s Health21, and the Every Newborn Action Plan.22 There is growing consensus among public health professionals that midwifery care has an essential contribution to make to high-quality maternal and newborn services.2,12,13–20 This consensus stems from evidence derived from randomised controlled trials in high-income settings,21 and from practical experience in low-income, middle-income, and high-income countries.22,23,26–37 Although other forms of care have been shown to reduce maternal and newborn mortality24, these country-level experiences show that the
introduction of educated, trained, motivated, and respected licensed midwives, working effectively with medical and public health colleagues, has been associated both with a rapid and sustained decrease in maternal and newborn mortality, and with an improvement in quality of care.

In these country examples and in common parlance the term midwifery is used either to describe a collaborative activity involving a range of care providers or to describe the work of midwives, resulting in ambiguity. In this first paper in a Series of four papers about midwifery, we define the terms midwifery and midwife, specifying which term the evidence presented relates to. We aimed to test, comprehensively and systematically, the contribution that midwifery—practised by midwives and others—can make to the quality of care of women and infants globally. Randomised trials can only be used to examine some components of quality, so we have used a multimethod approach to assess the key concepts of quality in maternal and newborn care including safe, effective, accessible, appropriate, affordable, equitable, efficient, and woman-centred care.

We devised and tested a framework for quality maternal and newborn care in all settings, using the best available evidence for effective care practices and for what women and newborn infants need, and we used this evidence to assess the potential effect of midwifery and the workforce groups best able to provide midwifery care.

**What is a midwife, and what is midwifery?**

The definition of the midwife has been established by the International Confederation of Midwives, as have the competencies of the midwife (panel 1).

In some countries, the full scope of care that could be provided by qualified midwives is limited by health-system and cultural barriers and some overlap inevitably exists in roles and responsibilities between different health professionals. In many countries, some aspects of midwifery care are provided by obstetricians, family doctors, nurses, auxiliary midwives, community health workers, or traditional birth attendants, or by unsupported or inadequately trained midwives, as well as by competent midwives educated to international standards (and by nurse-midwives who are trained both as nurses and midwives). A definition of midwifery as a package of care is needed to identify the important aspects of this care and to provide a structure for our examination of the quality of midwifery care.

In this Series, we define the practice of midwifery as the “skilled, knowledgeable, and compassionate care for childbearing women, newborn infants, and families across the continuum throughout pre-pregnancy, pregnancy, birth, post partum, and the early weeks of life; timely prevention and management of complications; consultation with and referral to other services; respect for women’s individual circumstances and views; and working in partnership with women to strengthen women’s own capabilities to care for themselves and their families”.

**Panel 1: International definition of the midwife**

The International Labour Organisation (ILO) describes midwives as the primary professional group to provide midwifery. The International Confederation of Midwives defines the work of midwives and core competencies and standards for their education and practice.

“A midwife is a person who has successfully completed a midwifery education programme that is duly recognised in the country where it is located and that is based on the International Confederation of Midwives’ (ICM) Essential Competencies for Basic Midwifery Practice and the framework of the ICM Global Standards for Midwifery Education; who has acquired the requisite qualifications to be registered and/or legally licensed to practice midwifery and use the title ‘midwife’; and who demonstrates competency in the practice of midwifery.”
A framework for high-quality maternal and newborn care: development and testing

We developed a framework for quality maternal and newborn care to describe the characteristics of care that women, newborn infants, and families need from pre-pregnancy, during pregnancy and birth, and beyond. The framework identified both what a health system needs to provide high-quality care and how it delivers its functions and meets its goals within any particular context. Essential components considered were effective functions and meets its goals within any particular context. Essential components considered were effective functions and meets its goals within any particular context.

Our multimethod approach (figure 1) used some of the processes of conventional systematic review methods and drew on advances in methods for interpretive synthesis, allowing us to incorporate a range of relevant sources of evidence and synthesise the findings. The framework used the expert opinion of the 35 Series co-authors from low-income, middle-income, and high-income settings, with interdisciplinary teamwork and collaboration. The framework can be used to assess the quality of care; plan workforce development, resource allocation, or an education curriculum; or identify evidence gaps for future research. The framework can be used to assess the quality of care; plan workforce development, resource allocation, or an education curriculum; or identify evidence gaps for future research. The framework can be used to assess the quality of care; plan workforce development, resource allocation, or an education curriculum; or identify evidence gaps for future research.

In this paper, we use the framework to structure analyses of the evidence and to identify the scope of midwifery practice. The second paper in the Series used the framework to define the range of interventions included in the scope of midwifery care. The third paper used the framework to identify components of quality care that need to be strengthened in country-level examples. The framework can be used to assess the quality of care; plan workforce development, resource allocation, or an education curriculum; or identify evidence gaps for future research.

Assessment of components of quality maternal and newborn care: review methods and findings

Review 1: women’s views and experiences of maternal and newborn care

To assess evidence on what women and newborn infants need from maternal and newborn services, we did a review of meta-syntheses of qualitative studies of women’s views and experiences (review 1). The appendix for quality maternal and newborn care. The framework is intended to be relevant to any setting, and to all who need, or provide, maternal and newborn care and services. Interdisciplinary teamwork and collaboration are inherent in implementation of the framework.

Figure 1: Diagram of the multimethod approach used in this study

See Online for appendix
shows detailed methods and results from the 13 meta-syntheses identified and the included studies and quality assessment. Although data were predominantly from high-income countries, 20 of the 229 studies were done in low-income and middle-income countries.

In summary, women’s views and experiences reported in these meta-syntheses showed the inter-relationship between the different components of quality care identified in figure 2. Women reported that information and education were essential to allow them to learn for themselves, that they needed to know and understand the organisation of services so they could access them in a timely way, that services needed to be provided in a respectful way by staff who engendered trust and who were not abusive or cruel, and that care should be personalised to their individual needs, and offered by care providers who were empathic and kind. Particularly, women wanted health professionals who combined clinical knowledge and skills with interpersonal and cultural competence. These findings were of crucial importance in identification of components of quality maternal and newborn care.

**Review 2: effectiveness of maternal and newborn care practices**

**Identification of practices**

To identify high-quality, up-to-date evidence on effectiveness of specific practices in maternal and newborn care, we used two sources: the 453 systematic reviews contributed by the Cochrane Pregnancy and Childbirth Group to the Cochrane Library and the Partnership for Maternal, Newborn and Child Health Review, which contributed an additional eight reviews where evidence was derived from other Cochrane reviews. The rigorous methods used in Cochrane reviews are recognised internationally as the highest standard in evidence-based health care, hence further quality assessment was not performed.

Figure 3 shows the process of identification and classification of the included reviews. We scrutinised the 461 reviews to identify the effect on outcomes related to the primary aim of each review. All the reviews related to the practice categories (the top line of the framework); some also related to some of the cross-cutting components of organisation of care, values, philosophy, and care providers. Appendix 1 summarises their distribution across framework components.

![Diagram of the framework for quality maternal and newborn care](image-url)
Step 1 analysis: mapping the reviews to the framework for quality maternal and newborn care

We classified the practice examined in each review as effective or likely to be effective, likely to be ineffective or harmful, or inconclusive regarding its effect (including an absence of studies). We then mapped the 173 reviews that had adequate evidence to assess effectiveness (ie, excluding those when findings were inconclusive; figure 3) to the relevant practice categories on the top line of the framework. All figures and percentages refer to the number of practices rather than the number of reviews.

Effective practices related to categories of the framework for quality maternal and newborn care

The appendix shows the distribution across the practice categories and panel 2 shows details of the specific practices. 46 (38%) of the 122 effective practices were relevant for all childbearing women and infants, with 26 (21%) being first-line management for women and infants with complications. 50 (41%) practices required the input of a medical practitioner with advanced skills in obstetrics, neonatology, or medicine, for serious complications.

Step 2 analysis: examination of the effect of midwifery

We focused next on how midwifery fits within the framework for quality maternal and newborn care and what the evidence base tells us about its effect and its contribution. We identified the first four practice categories (education, information, health promotion; assessment, screening care planning; promoting normal processes and preventing complications; and first-line management of complications) within the scope of midwifery using our definition of midwifery. 72 (59%) of the 122 effective practices identified in Step 1 were within this scope (figure 3, and table for details of practices).

Outcomes shown to be improved by effective practices in the scope of midwifery

These reviews of 72 effective practices in the scope of midwifery were analysed further to identify the outcomes improved. Caveats such as concern about the quality or number of trials, or outcomes only shown to be beneficial for subgroups of participants were noted. Two of these reviews examined practices shown to be effective in regard to their primary outcome, but when there was a trade-off between benefits and harms, these have been shown separately in table.

56 outcomes were improved by the combination of practices that fall within the scope of midwifery (table). These outcomes include reduced maternal and neonatal mortality and fetal loss, reduced maternal and neonatal morbidity including preterm birth, reduced use of interventions, improved psychosocial outcomes, improved public health outcomes, and improved organisational outcomes. The scale of the effect of these outcomes varies across settings and depends on the organisation of services and the skills and competencies of the workforce.

Effective practices related to cross-cutting components of the organisation of care and philosophy

We examined these 72 effective practices within the scope of midwifery to assess whether they portrayed the cross-cutting components of the framework. We were
Panel 2: Effective and ineffective practices presented by category of practice in the framework for quality maternal and newborn care: in the scope of midwifery as defined in this paper

### Effective practices for childbearing women and infants

**Organisation of care (n=7)**
- Alternative vs conventional institutional settings for birth
- Labour assessment programmes to delay admission to the labour ward until labour is in the active phase
- Exclusive breastfeeding for at least 6 months for optimal health benefits
- Community-based intervention packages for reducing maternal and neonatal mortality and morbidity and improving neonatal outcomes
- Midwife-led continuity models vs other models of care for childbearing women
- Not reducing the schedule of antenatal visits in settings where the number of visits is already low (eg, <5)
- Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases

**Education, information, health promotion, and public health (n=11)**
- Insecticide-treated nets for prevention of malaria in pregnancy
- Specific advice to increase dietary energy and protein intakes or energy and protein supplementation in pregnancy
- Interventions to promote smoking cessation in pregnancy
- Health education and peer support to promote breastfeeding initiation
- Supplementation with folic acid for women ≤12 weeks pregnant or pre-pregnant, for prevention of neural tube defects
- Routine zinc supplementation for improving pregnancy and infant outcomes
- Daily universal oral supplementation with iron or iron and folic acid during pregnancy for improvement of maternal health and pregnancy outcomes
- Intermittent oral supplementation with iron or iron and folic acid or iron and vitamins and minerals during pregnancy for improvement of maternal health and pregnancy outcomes
- Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems
- Multiple micronutrient supplementation during pregnancy
- Education for contraceptive use by women after childbirth

**Assessment, screening, and care planning (n=1)**
- Screening for and treatment of antenatal lower genital tract infection for prevention of preterm delivery

**Promotion of normal processes and prevention of complications (n=26)**
- Antiretroviral drugs for reducing the risk of mother-to-child transmission of HIV infection
- Drugs for prevention of malaria in pregnant women
- Antiretroviral therapy for treatment of HIV infection in antiretroviral therapy-eligible pregnant women
- Antenatal digital perineal massage to prevent perineal trauma
- Breast stimulation for cervical ripening or labour induction
- Continuous labour support
- Upright positions in the first stage of labour
- Relaxation techniques for pain relief in labour
- Inhaled analgesia for pain relief in labour
- Immersion in water in first and second stage labour
- Perineal techniques in second stage labour
- Restrictive episiotomy
- Unclamping previously clamped and divided umbilical cord and allowing blood from placenta to drain freely
- Active management of third stage labour
- Prophylactic ergometrine or oxytocin in third stage labour
- Carbetocin to prevent post partum haemorrhage
- Prophylactic oxytocin to prevent post partum haemorrhage
- Prostaglandin (misoprostol) to prevent post partum haemorrhage
- Skin-to-skin mother-baby contact within 24 h of birth
- Paracetamol (one dose) for early post-partum pain
- Any type of approved analgesia for pains after vaginal birth
- Analgesic rectal suppositories for the relief of pain from perineal suturing
- Support for breastfeeding mothers
- Tetanus toxoid for pregnant women to prevent neonatal tetanus
- Interventions to relieve constipation in pregnancy
- Topical treatments for vaginal candidiasis in pregnancy

**First-line management of complications (n=25 interventions, in 26 reviews)**
- Antibiotics for gonorrhoea in pregnancy
- Interventions for treating genital Chlamydia trachomatis infection in pregnancy
- Interventions for trichomoniasis in pregnancy
- Antibiotics for treating bacterial vaginosis in pregnancy
- Antibiotics for asymptomatic bacteriuria in pregnancy
- Treatments for symptomatic urinary tract infections during pregnancy
- Anti-D administration in pregnancy for preventing rhesus alloimmunisation
- Interventions for preventing and treating pelvic and back pain in pregnancy
- Oral maternal hydration for increasing amniotic fluid volume in oligohydramnios
- External cephalic version for breech presentation at term
- Antiplatelet agents (low-dose aspirin) for preventing pre-eclampsia and its complications
- Planned early birth vs expectant management for pre-labour rupture of membranes at term
- Pharmacological and mechanical interventions to induce labour in outpatient settings
- Massage, reflexology, and other manual methods for pain management in labour
- Acupuncture or acupressure for pain management in labour
- Rapid vs stepwise negative pressure application for vacuum extraction assisted vaginal delivery

(Continues on next page)
able to assess three aspects of two components of the framework; whether they offered continuity of care (organisation), whether they strengthened women’s own capabilities (philosophy), and whether they supported the normal processes of reproduction, birth, post partum, breastfeeding and early life, and avoidance of unnecessary interventions (philosophy). Panel 2 and the appendix show findings from this stage of the analyses. When the effective service supported normal processes of reproduction and early life, the intervention is shown in italics in panel 2 (44 [61%] of 72 effective practices) (Continued from previous page)

• Continuous vs interrupted sutures for repair of episiotomy or second degree tears (64%)
• Anti-D administration after childbirth for preventing rhesus allo-immunisation (64%)
• Treatment for women with post-partum iron deficiency anaemia (64%)
• Antibiotic regimens for endometritis after delivery (64%)
• Kangaroo mother care to reduce morbidity and mortality in low birthweight infants (64%)
• Preventive, non-pharmaceutical psychosocial or psychological interventions for the prevention of post-partum depression (64%)
• Fibreoptic phototherapy for neonatal jaundice (64%)
• Emergency interventions:
  - Magnesium sulphate for women with pre-eclampsia (64%)
  - Magnesium sulphate for eclampsia (64%)

Effective practice for childbearing women and infants with a trade-off between benefits and harms

Promotion of normal processes and prevention of complications (n=26) *

• Prophylactic use of ergot alkaloids in third stage labour (significant decrease in mean blood loss, post-partum haemorrhage of at least 500 mL and use of therapeutic uterotonic but adverse effects include elevated blood pressure) (64%)

First-line management of complications (n=25 interventions, in 26 reviews)†

• Membrane sweeping (digital separation of the membranes from the lower uterine segment during vaginal examination) for induction of labour (effective in reducing length of pregnancy and number of pregnancies beyond 41 and 42 weeks but with adverse effects [pain, bleeding, irregular contractions]) (64%)

Ineffective practices for childbearing women and infants

Education, information, health promotion, and public health (n=11) *

• Vitamin A supplementation for post-partum women
• Calcium supplementation (other than for prevention or treatment of hypertension)

Assessment, screening, and care planning (n=1)

• Continuous cardiotocography as a form of electronic fetal monitoring for fetal assessment during labour (associated with a reduction in neonatal seizures, but no significant differences in cerebral palsy, infant mortality or other standard measures of neonatal wellbeing. However, cardiotocography was associated with an increase in caesarean sections and instrumental vaginal births).

Promotion of normal processes and prevention of complications (n=26) *

• Routine perineal shaving on admission in labour
• Hands and knees posture in late pregnancy or labour for fetal malposition (lateral or posterior)
• Restricted pacifier use in breastfeeding term infants for increasing duration of breastfeeding
• Umbilical vein injection for the routine management of third stage of labour
• Enemas during labour
• Amniotomy for shortening spontaneous labour
• Timing of administration of prophylactic uterotonicus (before or after delivery of the placenta following vaginal birth)

First-line management of complications (n=25 interventions, in 26 reviews)†

• Hospitalisation and bed rest for multiple pregnancy
• Support during pregnancy for women at increased risk of low birthweight babies
• Umbilical vein injection for management of retained placenta
• Vitamin supplementation for prevention of miscarriage

(Continued from previous page)

- Continuous vs interrupted sutures for repair of episiotomy or second degree tears
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- Treatment for women with post-partum iron deficiency anaemia
- Antibiotic regimens for endometritis after delivery
- Kangaroo mother care to reduce morbidity and mortality in low birthweight infants
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Review 3: characteristics and effect of midwives and other workforce groups providing some or all components of midwifery care

To examine the characteristics and relative contribution of midwives and other workforce groups providing some or all components of midwifery care, we searched the Database of Abstracts of Reviews of Effectiveness (DARE) in 2012, updated in June, 2013, and checked again before publication in January, 2014, using the terms: “midwife” or “midwifery” or “midwives” or “skilled attendant*” or “birth attendant*” or “skilled delivery attendant*” or “community health worker*”.

We identified seven high-quality reviews of randomised controlled trials that examined the effectiveness of interventions delivered by specific workforce cadres on maternal or infant outcomes, or both. The pre-publication search identified one updated review that is of central importance to this question, and it has been included here. The appendix shows details of included and excluded studies.

Midwifery care delivered by midwives and other professionals

We included two reviews with a total of 15 studies, all done in high-income countries. Sandall and colleagues included 13 trials of 16,242 women. This Review compared midwife-led continuity models of care, in which the midwife is the woman’s lead professional during pregnancy, labour, and birth (one or more consultations with medical staff were often part of routine practice), with obstetrician or family doctor-led care (midwives or nurses,

<table>
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<tr>
<th>First author and year (caveats)</th>
<th>Maternal mortality reduced</th>
<th>Duley 2010128</th>
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<tr>
<td>Serious morbidity reduced</td>
<td></td>
<td>Hofmeyr 201017</td>
</tr>
<tr>
<td>Less pain</td>
<td></td>
<td>Smith 2011,121 Beckmann 2006122 (in women who had previously given birth vaginally); Chou 2013,123 Deussen 2011,124 Hedayati 2003125 (in first 24 h after birth); Klomp 2012126 (in labour, side-effects noted); Kettle 2012,127 Pennick 2007128 (potential for bias in all but one study); Smith 2011129 (caution about study quality); Smith 2012130 (caution about study quality)</td>
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<tr>
<td>Reduced incidence of RhD alloimmunisation</td>
<td></td>
<td>Crowther 2012131; Crowther 1999132</td>
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<tr>
<td>Reduced risk of pre-eclampsia</td>
<td></td>
<td>Duley 2007133 (for women at high risk); Hofmeyr 2010134 (effect was greatest for women with low baseline calcium intake and women at high risk of pre-eclampsia)</td>
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<tr>
<td>Reduced risk of eclampsia</td>
<td></td>
<td>Duley 2010135</td>
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<tr>
<td>After eclampsia treatment: reduction in recurrence of seizures; reduction in risk of pneumonia</td>
<td>Duley 2010,136 Duley 2010,137 Duley 2010138</td>
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<tr>
<td>Reduced postpartum haemorrhage</td>
<td></td>
<td>Begley 2011,139 Kavanagh 2005,140 Tunçalp 2012,141 Cotter 2001,142 Liabsuetrakul 2002143; McDonald 2004144</td>
</tr>
<tr>
<td>Reduced perineal trauma</td>
<td></td>
<td>Aasheim 2011,145 Carroll 2009,146 Beckmann 2006147 (statistically significant for women without previous vaginal birth only)</td>
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<tr>
<td>Increased likelihood of spontaneous vaginal birth</td>
<td></td>
<td>Hodnett 2012,148 Hodnett 2012,149 Sandall 2013150</td>
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<tr>
<td>Less augmentation of labour</td>
<td></td>
<td>Hodnett 2012151; Hodnett 2012152</td>
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<tr>
<td>Reduced pharmacological analgesic use (excluding regional analgesia or epidural) during pregnancy, childbirth, and in the postnatal period</td>
<td>Lauzon 2001,153 Hodnett 2012,154 Sandall 2013,155; Chou 2013,156 Hedayati 2003157 (first 24 h after birth); Kettle 2012,158 Smith 2011159 (in one or possibly three trials, not well reported)</td>
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<tr>
<td>Reduced use of regional analgesia or epidural</td>
<td></td>
<td>Lawrence 2009,160 Cluett 2009,161 Hodnett 2012,162 Hodnett 2012,163 Sandall 2013164</td>
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<tr>
<td>Fewer caesarean sections</td>
<td></td>
<td>Hodnett 2012,170; Hofmeyr 2012171</td>
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<tr>
<td>Less perineal suturing</td>
<td></td>
<td>Caroli 2009177</td>
</tr>
<tr>
<td>Less use of therapeutic uterotonic</td>
<td></td>
<td>Liabsuetrakul 2002178 (trade-off: effects of the intervention [intramuscular or intravenous ergot alkaloids] include increased blood pressure and pain after birth requiring analgesia)</td>
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<tr>
<td>Fewer blood transfusions</td>
<td></td>
<td>Tunçalp 2012179</td>
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<tr>
<td>Less use of uterine massage</td>
<td></td>
<td>Sr 2012180</td>
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<tr>
<td>Fewer pregnancies beyond 41 weeks</td>
<td></td>
<td>Bouvain 2005181 (trade-off: adverse effects reported—pain, bleeding, irregular contractions. Number needed to treat to avoid one normal induction, n=8)</td>
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<tr>
<td>Improved satisfaction with pain relief</td>
<td></td>
<td>Smith 2011182 (caution about study quality); Smith 2011183</td>
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<tr>
<td>Reduced anxiety during first stage of labour</td>
<td></td>
<td>Smith 2012184 (reported in one study, concerns about quality)</td>
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<tr>
<td>Improved feeling of control during childbirth</td>
<td></td>
<td>Lauzon 2001185</td>
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<tr>
<td>Improved satisfaction with childbirth experience</td>
<td></td>
<td>Cluett 2009186 (reported in one study); Smith 2011,187 Hodnett 2012,188 Hodnett 2012189</td>
</tr>
<tr>
<td>Less likely to develop post-partum depression</td>
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<td>Dennis 2013190</td>
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(Table continues on next page)
or both, provided intrapartum care and in-hospital post-partum care under medical supervision), or shared models of care. Khan-Neelofur and colleagues\textsuperscript{146} included three randomised trials of 3075 women, one of which was also included by Sandall and colleagues.\textsuperscript{29} This trial compared shared midwife or general practitioner-managed care with routine visits to obstetricians in one trial and backup from obstetricians as needed in the other two trials with standard shared care between obstetricians and midwives in two trials and unspecified care in one trial.

Sandall and colleagues\textsuperscript{29} reported that women who had midwife-led continuity models of care were less likely to have regional analgesia, episiotomy, and instrumental birth and were more likely to have no intrapartum analgesia or anaesthesia, spontaneous vaginal birth, attendance at birth by a known midwife, and a longer mean length of labour. No differences were noted between groups for caesarean births. Women who were randomly assigned to receive midwife-led continuity models of care were less likely to have a preterm birth and fetal loss before 24 weeks' gestation, although no differences between groups were noted in fetal loss or neonatal death of at least 24 weeks nor in overall fetal or neonatal death. Most included studies reported a higher rate of maternal satisfaction in the midwifery-led continuity care model. Khan-Neelofur and colleagues\textsuperscript{146} reported no difference in clinical outcomes measured. However, women in the shared midwife-general practitioner-managed clinics were more satisfied with continuity of care than those in the control group. Sandall and colleagues\textsuperscript{29} noted a trend

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<tr>
<th>First author and year (caveats)</th>
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<tr>
<td>Increased attendance by a known midwife during birth</td>
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<td>Increased referrals for pregnancy complications</td>
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<td>Shorter stays on labour ward</td>
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<td>Increased breastfeeding rates—initiation</td>
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<td>Increased breastfeeding rates—duration</td>
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<td>Reduction in smoking in late pregnancy</td>
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<td>Increased maternal post-partum weight loss</td>
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<td>Reduced small for gestational age babies</td>
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<td>Fewer neural tube defects</td>
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<td>Fewer babies with low 5 min Apgar scores</td>
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<td>Increased average birthweight</td>
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<td>Decreased number of admissions to neonatal intensive care units</td>
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<td>Reduced mother-to-child transmission of HIV</td>
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<td>Breastfeeding initiation and duration improved</td>
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<td>Increased immunisation uptake</td>
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<td>Shorter hospital stay for babies</td>
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<tr>
<td>Fewer babies in SCBU more than 7 days</td>
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Based on analysis of included reviews (see methods) contributed to the Cochrane Library by the Cochrane Pregnancy and Childbirth Group and interventions in The Partnership for Maternal, Newborn and Child Health Review 2012.\textsuperscript{58} RhD=rhesus antigen. SCBU=special care baby unit. *Denotes review of care provided by lay or community health workers.

Table: Outcomes shown to be improved by midwifery, as defined in this paper
towards a cost-saving effect of midwife-led continuity models of care compared with other models of care.

Components of midwifery care delivered by community and traditional health workers
We identified five reviews with a total of 109 included studies. Four reviews included studies in low-income and middle-income countries, and one included studies from low-income, middle-income, and high-income countries. The focus of two reviews was training for traditional birth attendants, whereas three reviews focused on interventions delivered by other community health workers with varying levels of training and support: paid village or auxiliary health workers and unpaid volunteers; lady health workers or visitors, community or village health workers and facilitators; and lay health workers without professional or paraprofessional training. Training and support generally included practices and resources such as clean delivery kits and resuscitation equipment, referral support, and links with other health workers.

The findings of these reviews of community and traditional health workers are very restricted in regard to the contribution of midwifery to the quality of care. Not only were the interventions heterogeneous but also most studies were set in very low-income settings in which women in the control group might have received no care, or very basic care from less trained community workers. None of the reviews compared one trained cadre with another, or compared care offered by community and traditional health workers with professional groups.

In all of the reviews and studies of workforce, the mechanisms underpinning the effectiveness of the care provided were briefly and inconsistently defined.

Scope of practice of midwives
We used the framework to map the scope of practice of trained, licensed, and regulated midwives using competencies of midwives as defined by the International Confederation of Midwives (appendix). All the competencies mapped to one or more components of the framework, and all fell within the first four practice categories, defined by us as the scope of midwifery, showing that midwives meeting these standards practice the full scope of midwifery. One competency, incorporating collaborative working with colleagues, also mapped to management of serious complications and workforce.

Case studies: health system development without midwives
As a final step in our multimethod approach, we examined three case studies from countries where care by midwives has been absent from the health system. These are described in panel 3.

India, China, and Brazil are ranked first, second, and eighth worldwide in annual numbers of births, and combined they account for 35% of all births globally. We purposefully selected them to illustrate countries in transition—they are the three countries with the most rapid economic development since the late 20th century—and where the contribution of midwives was either absent or eliminated in the past.

Despite the diversity of these countries, and recognition of the heterogeneity of circumstances within them, they have common threads that illuminate the consequences of economic development in settings in which midwives have been marginalised or excluded from the health system. The case studies suggest that a focus on facility based and emergency care can result in a reduction in maternal and perinatal mortality. However, without the balancing effect of the full spectrum of midwifery care, this strategy has also resulted in rapidly growing numbers of unnecessary, expensive, and potentially iatrogenic interventions and inequalities in the provision of care and in outcomes. As the case studies show, the prevalence of caesarean sections in Brazil and China is among the highest in the world. India, despite its recent economic development, has a high maternal mortality rate with high inequalities related to poverty. High rates of elective caesarean sections without medical indication are associated with various poor perinatal outcomes, and draw scarce resources from community based primary care and prevention. A WHO study identified 3·2 million additional caesarean sections annually were needed in low-income countries, whereas at the same time, about 6·2 million unnecessary caesarean sections were being done in middle-income and high-income countries.

As the case studies show, both China and Brazil have taken steps to reintroduce midwives in recent years, as a strategy to reduce mortality, morbidity, and unnecessary interventions.

Discussion
We used the analyses presented in this paper to develop a new evidence-based framework that describes a system for high-quality maternal and newborn care as a basis for improvements in maternal and neonatal outcomes. Our analyses began, not with the needs of professionals or the health system, but with those described by pregnant and postnatal women. Women’s perceptions of their experiences are important in and of themselves, but if systems do not meet their needs, women are less likely to access services and might even reject them altogether. For women, good quality clinical care and improved communication, education, information, and respect from their providers are essential aspects of their care. The combination of these factors is needed to keep them and their newborn infants safe. Low quality services or disrespectful care compromise the health and wellbeing of women and children, and can stall global reduction in maternal and newborn mortality and morbidity.

We developed and tested the framework using a range of sources of evidence. It incorporates the need to balance...
Panelf: Case studies

Brazil and China—reintroducing midwifery to countries in economic transition

We chose these countries since they have shown the most rapid economic development since the late 20th century and together account for 35% of births globally. They have very large and highly developed urban centres, remote rural populations, and large disparities between the rich and the very poor. They have high but falling rates of maternal mortality and some of the highest rates of caesarean section in the world. In India and China, progress in reduction of newborn deaths is slower than expected for their stage of development.12

Brazil (52% caesarean section rate in 2010)151,152 and urban China (54–64% caesarean section rate in 2008–2010)153,154 are two contexts where rapid economic growth in recent years has been accompanied by extraordinary increases in interventions, most notably caesarean sections, with growing concerns in each country over the medicalisation of birth and corresponding potential links with an increased maternal or perinatal mortality and morbidity. A 2010 study for WHO153 identified the two countries as first and second in a global ranking of unnecessary caesarean sections: China: 1976 606 and Brazil 960 687, with a combined cost per year of over US$553 million. This occurrence has been termed “unnecessareans” in Brazil.64

In China, the increase in caesarean sections has been reported to be a result of the national adoption and interpretation of WHO’s safe motherhood policy and the Millennium Development Goals (MDGs), resulting in the national policy for hospitalisation of all births.150 In Brazil, the increases were despite a Ministry of Health regulation in 2000 to reduce the increasing number of caesarean sections;150 at least some contribution to this is driven by social inequality and relates to women's wish to have a caesarean section to avoid substandard care in labour.155 Additionally, the underlying trend is towards the increase of caesarean sections without medical indications before labour. In China, caesarean sections without medical indications in some hospitals have grown from 5%65 in 1990 to 65–6% in 2010;153,154 China is somewhat unique in that its one-child policy minimises the likelihood of women having several caesarean sections and the associated long-term placental problems. Similar to the situation in China, Brazil’s data highlight a ten-fold increase in pre-labour caesarean sections between 1990 and 2010.156

The current policy discourses within both countries have now recognised that a continuation of present trends is neither sustainable nor supportive of women’s needs. A midwife-led unit established in China in 2008 has succeeded in great reductions in caesarean sections and other forms of medical intervention.160–163 The success led to further programatic steps to reintroduce midwifery by scaling up midwifery-led units in ten hospitals across the country. China is also reinstating the role of the midwife and striving to increase graduate numbers.164,165 In Brazil, a policy initiative by the Ministry of Health launched in March 2011, set up the Stork Network strategy, Rede Cegonha.96 The Network has a set of measures to guarantee all Brazilians in the public health system appropriate, safe, and humane care from confirmation of pregnancy, through to the first 2 years of the baby's life, by building a network of primary care services for women and children, including 280 midwifery-led birth centres. The Ministry of Health has launched the National Residency Program in Nursing and Midwifery, a federal government initiative to encourage higher-education institutions to promote the training of professionals with expertise in midwifery and nursing to work in the public health system. The initiative aims to enhance the role of midwifery and nursing to provide comprehensive health care of women and children, from the confirmation of pregnancy, to childbirth, post partum, and until the second year of the child's life.

Thus, two of the world’s most populous countries have had rapid growth in caesarean sections without medical indications in the past two decades, and then independently began steps to correct an over-reliance on obstetric-led care through enhancement of midwifery-led services. China and Brazil provide a cautionary case study for those developing countries now modelling their maternal and newborn care systems on those of the industrialised countries that rely heavily on costly medical interventions to improve maternal and infant outcomes in birth.

India

India is the leading example among a growing number of countries where there is simultaneous overuse and underuse of interventions. India has 27 million annual births, about one in every five births worldwide. Although India has a relatively large number of midwives, they are not consistently educated to international standards, and they attend fewer than one in six births,67 with doctors attending most births in urban areas and one fourth in rural areas. The UNICEF 2009 Coverage Evaluation Survey165 reported an Indian caesarean section rate of 15·1%, almost within the WHO recommended range. However, that overall rate masks enormous disparities within the country. Data from an earlier DHS survey (2005–2006),166 which reported an 8·5% overall rate, showed mothers in the poorest rural areas had a caesarean rate of 1·5%; and mothers in the wealthiest urban areas had a caesarean rate of 32·1%. Regionally, almost a third of mothers in Kerala (31%) gave birth by caesarean section compared with 2·3% of mothers in Nagaland.167 The Coverage Evaluation Survey165 noted a caesarean section rate of 34·6% in private hospitals compared with 12·4% in government hospitals. India has lost what was once a strong tradition of midwifery-based practice168 and has been slow to reintroduce it. Midwives have a restricted scope of practice and, over time, experience the associated loss of skills.69 India is already showing signs of following the model of China and Brazil, with high caesarean rates in wealthy mothers in urban areas, leading to a culture of non-medically indicated caesarean sections. As a rapidly emerging economy, with an improving health infrastructure and reliance on private obstetrical providers, India has obvious parallels to Brazil and China. Whether India will also follow a path of high levels of medical interventions followed by a re-emphasis on midwifery remains to be seen.
community-based preventive and supportive services for all childbearing women and newborn infants with the elective and emergency services needed by those with complications. Our findings are supported by recent empirical data from a multicountry WHO study, suggesting that women need a health system that helps them to stay healthy and care for their families and provides a timely transition to elective and emergency care for those who develop complications. The framework differentiates between what care is provided, how it is provided, and who should provide it, in all settings. As well as offering a context for debate about the care and services that childbearing women and infants need, the framework might have other uses, such as structuring analyses of health system provision, planning new services, or developing an education curriculum, and it can be tested, debated, and further refined for different settings and population groups. It could similarly be analysed using appropriate evidence to describe the scope and effect of obstetrics, family practice, nursing, skilled birth attendance, and community and public health systems.

Specifically, our analyses suggest that midwifery has a particular contribution to make to the quality care identified in the framework in regard to education, information and health promotion; assessment, screening, and care planning; and promoting normal processes and preventing complications in the context of respectful care that is tailored to need and works to strengthen women’s capabilities.

Analyses of systematic reviews of the maternal and newborn care workforce reported several providers active in providing midwifery care, but few benefits when reliance was solely on less skilled health-care workers. Care led by midwives—educated, licensed, regulated, integrated in the health system and working in interdisciplinary teams—had a positive effect on maternal and perinatal health across the many stages of the framework, even when compared with care led by other health professionals in combination with midwives. In the high-income settings in which resource use has been examined, there are indications that midwife-led care for low-risk women and in the context of an interdisciplinary team is a more cost-effective option than medically led care. Empirical evidence in low-income and middle-income settings is scarce, but analysis of the competencies of the midwife in relation to our framework shows that competent midwives offer comparative advantages in providing continuity of care across the spectrum needed by women and newborn infants regardless of setting. When midwives work in collaboration as part of interdisciplinary teams providing integrated care across community and hospital settings, they also provide effective midwifery care for women and infants who develop complications.

In low-income and some middle-income settings where there is a shortage of midwives and specialist and general medical practitioners, there is a focus on ‘skilled birth attendants’, defined as accredited 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 infants. The implementation of skilled birth attendants since the 1990s over the past two decades has contributed to the overall decrease in maternal mortality. However, its implementation in practice varies widely across countries, and skilled birth attendants have uneven levels of proficiency, restricted scope of practice, and varying levels of training. They might not work across the continuum of care or be trained to deal with unexpected complications, all of which can result in harm.

Findings from our case studies of countries in economic transition show that care led mainly by obstetricians without the balance of midwives bring to the health system might reduce mortality and morbidity, but might also reduce quality and increase cost. Beyond the effect on some women and infants of unnecessary interventions, the economic costs of such systems of care are likely to be unsustainable. For example, the cost of unnecessary interventions in maternity care in the USA has been estimated at around $18 billion annually. The case studies also suggest a need for a whole-system solution, rather than a focus on one component of maternal and newborn care, such as the centralisation of services in hospitals in the absence of well-developed community-based services. Implementation of midwifery without adequate education, regulation, support, and referral systems is likely to be ineffective, as Van Leberghe and colleagues show in the example of Indonesia in this Series.

The sample size of trials and even meta-analyses in maternal and newborn care are generally too small to provide insights into mortality, especially maternal mortality. To address this, Homer and colleagues, in this Series, use modelling to estimate the effect of midwifery on saving maternal, fetal, and neonatal lives. Our analyses are not designed to identify the scale of the effect of midwifery in different countries; this effect will depend on the resources available, the organisation of services, and the skills and competencies of the workforce. However, we have shown that midwifery can have an effect on specific practices that can save lives, such as the early initiation and support of breastfeeding in the first weeks of life. Continued breastfeeding has the potential to save the lives of hundreds of thousands of infants and to reduce health-care costs. Our Review has shown that midwifery can reduce maternal anaemia and infection, including malaria and HIV, and pre-eclampsia and eclampsia. Midwifery therefore has an important contribution to make to meeting international goals for both maternal and newborn mortality and health.

In common with studies of other complex interventions, the absence of detail included in some of the trials examined restricted our findings. The
characteristics of midwifery and of care offered to the women in control groups were ill-defined and inconsistent, which is likely to dilute the noted effect of midwifery. Recognising these constraints, we used a multimethod approach to maximise the strength and transparency of our analyses.

There is substantial under-investment in research on midwifery and specifically on midwives, and the research has been dichotomised by development status. Studies of care by midwives in low-income and middle-income settings, integrated into the health system and working in teams with medical staff and with properly trained support staff, are an urgent priority. A focus on long-term psycho-social outcomes and clinical outcomes is needed, in view of improved understanding of the links between the mental and physical health of the woman and the health and development of her infant. Future research will need resources of a scale that portrays the fundamental importance of midwifery to the short-term, medium-term, and long-term health and wellbeing of women and children in all settings. The achievement of consensus on research priorities will need partnerships between all relevant stakeholders, including the active engagement of service users and advocacy groups.

Conclusion

Despite progress in reducing the numbers of avoidable deaths in pregnancy, birth, post partum, and the early weeks of life, continued success in achievement of internationally targeted reductions in these numbers and meeting new challenges will need a substantial shift in direction. Our analyses have informed the development of a new framework for high-quality, cost-effective maternal and newborn care that can be used for analysis and planning of future services. With the use of this framework, we have shown that midwifery has specific contributions to make with regard to skilled supportive and preventive care for all, promotion of normal reproductive processes, first-line management of complications, and skilled emergency care; all in the context of respectful care that is tailored to need and works to strengthen women’s capabilities, and is integrated across facility and community settings. Midwifery was associated with more efficient use of resources and improved outcomes when provided by midwives who were educated, trained, licensed, and regulated, and midwives were most effective when integrated into the health system in the context of effective teamwork and referral mechanisms and with sufficient resources. There are few benefits from relying on less-skilled health-care workers. These findings support a system-level shift from fragmented maternal and newborn care focused on identification and treatment of pathology for the minority, to skilled care for all. Midwifery is pivotal to this approach. Future planning for maternal and newborn care systems can benefit from incorporating the quality framework into workforce development and resource allocation.

Contributors

MJR devised the paper and wrote the first draft of the article, contributed overall leadership to the project, and led revision of drafts. ED, AMcF, and AC contributed to the development of the paper and contributed to the writing and revisions. AMCf led the work on the literature reviews. ED, MHB, and NFC developed the case studies, and contributed to the analysis, writing, and revisions. FM contributed to the literature reviews and contributed to the writing and revisions. LW, AM, JC, HK, and SD contributed to the development of the paper, including analysis of the literature reviews, writing, and revisions. DD contributed a service user and advocacy perspective, and contributed to the writing and revisions. All authors contributed to the development of the framework, helped to interpret the findings, and undertook reviews and revisions of the paper.

Declaration of interests

We declare no competing interests.

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Midwifery 2

The projected effect of scaling up midwifery

Caroline S E Homer, Ingrid K Friberg, Marcos Augusto Bastos Dias, Petra ten Hoope-Bender, Jane Sandall, Anna Maria Speciale, Linda A Bartlett

We used the Lives Saved Tool (LiST) to estimate deaths averted if midwifery was scaled up in 78 countries classified into three tertiles using the Human Development Index (HDI). We selected interventions in LiST to encompass the scope of midwifery practice, including prepregnancy, antenatal, labour, birth, and post-partum care, and family planning. Modest (10%), substantial (25%), or universal (95%) scale-up scenarios from present baseline levels were all found to reduce maternal deaths, stillbirths, and neonatal deaths by 2025 in all countries tested. With universal coverage of midwifery interventions for maternal and newborn health, excluding family planning, for the countries with the lowest HDI, 61% of all maternal, fetal, and neonatal deaths could be prevented. Family planning alone could prevent 57% of all deaths because of reduced fertility and fewer pregnancies. Midwifery with both family planning and interventions for maternal and newborn health could avert a total of 83% of all maternal deaths, stillbirths, and neonatal deaths. The inclusion of specialist care in the scenarios resulted in an increased number of deaths being prevented, meaning that midwifery care has the greatest effect when provided within a functional health system with effective referral and transfer mechanisms to specialist care.

Introduction

Midwifery is one effective means to promote the health and wellbeing of women of childbearing age and their newborn infants and families, with a potentially rapid and sustained effect on population health outcomes through the provision of maternal and newborn interventions. The interventions known to be effective in improving health outcomes, such as antenatal corticosteroids for women in preterm labour and midwife-led care, have been detailed in the Cochrane Library and the Essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health. This last review identified 56 essential interventions that, when implemented in packages relevant to local settings, were most likely to save lives, especially in low-income and middle-income populations. As part of this Lancet Series about Midwifery, Mary Renfrew and colleagues re-examined the effective interventions that have been shown to improve maternity-related outcomes for women and newborn infants, and showed that midwifery, as delivered by midwives and others with midwifery skills, can deliver most effective maternal and newborn health interventions, including the elements (also known as signal functions) for basic emergency obstetrics and neonatal Care (BEmONC; i.e., assisted delivery, removal of retained products, manual removal of the placenta, administration of oxytocic drugs, antibiotics, and anticonvulsants, and neonatal resuscitation). Interventions, including blood transfusions or caesarean section capacity (indicative of comprehensive EmONC (CEmONC)), are classified as specialist (i.e., that require the input of a medical practitioner with advanced skills in obstetrics and advanced medical equipment and medicines). Renfrew and colleagues definition of midwifery is used in this and all other articles in this Series.

The practice of midwifery is defined as “skilled, knowledgeable, and compassionate care for childbearing women, newborn infants and families across the continuum from pre-pregnancy, pregnancy, birth, post partum and the early weeks of life. Core characteristics include optimising normal biological, psychological, social, and cultural processes of reproduction and early life, timely prevention, and management of complications, consultation with and referral to other services, respecting women’s individual circumstances and views, and working in partnership with women to strengthen women’s own capabilities to care for themselves and their families”. The effect of scaling-up midwifery and the associated interventions provided by midwifery services is not presently known. We used the Lives Saved Tool (LiST) to estimate deaths averted if midwifery was scaled up in 78 countries classified into three tertiles using the Human Development Index (HDI). We selected interventions in LiST to encompass the scope of midwifery practice, including prepregnancy, antenatal, labour, birth, and post-partum care, and family planning. Modest (10%), substantial (25%), or universal (95%) scale-up scenarios from present baseline levels were all found to reduce maternal deaths, stillbirths, and neonatal deaths by 2025 in all countries tested. With universal coverage of midwifery interventions for maternal and newborn health, excluding family planning, for the countries with the lowest HDI, 61% of all maternal, fetal, and neonatal deaths could be prevented. Family planning alone could prevent 57% of all deaths because of reduced fertility and fewer pregnancies. Midwifery with both family planning and interventions for maternal and newborn health could avert a total of 83% of all maternal deaths, stillbirths, and neonatal deaths. The inclusion of specialist care in the scenarios resulted in an increased number of deaths being prevented, meaning that midwifery care has the greatest effect when provided within a functional health system with effective referral and transfer mechanisms to specialist care.

Key messages

- Midwifery can deliver most effective maternal and newborn health interventions, and can enable access to specialist and comprehensive emergency care when necessary.
- Universal coverage of these interventions will result in reductions in maternal deaths, stillbirths, and neonatal deaths in 78 Countdown countries classified according to the HDI.
- In countries in the lower HDI tertile, maternal mortality would decrease by 27% with a modest (10%) increase in coverage of the interventions delivered by midwifery, including family planning, over a 15-year period (2% per year on present baseline estimates), by 50% with a substantial coverage increase (25%), and by 82% with universal coverage (95%). We noted similar reductions on stillbirths and neonatal deaths.
- Family planning alone also contributed to substantially decreasing deaths, since fewer women are exposed to the risk of maternal death. The full scope of midwifery practice should include family planning.
- In addition to the estimation of mortality, morbidity, quality of life, and wellbeing should also be measured to provide more detailed evidence on the full effect of midwifery.
- At all HDI levels, about 30% of maternal deaths could be averted by midwifery, with an additional 30% averted with the addition of specialist medical care.

HDI=human development index.
to estimate deaths averted if midwifery was scaled-up in 78 countries classified by Human Development Index (HDI).

Measurement of maternal and child health outcomes

An estimated 15–20 million women are affected every year by substantial morbidity as a result of childbirth,13 affecting not only the woman, but also her baby, other children, and members of the broader community. To determine the full effect of midwifery on women and newborn infants, biological (ie, morbidity and mortality), financial, social, and psychological outcomes would need to be measured.1 Poor maternal health contributes to economic hardship, with potentially longer-term outcomes, including violence, stigmatisation, isolation, and divorce.17 Additionally, mental health disorders in women have long-term implications for children,18 and the effects of maternal depression might affect children’s lives as they grow up, in the form of behavioural disorders, anxiety, depression, and impaired cognitive development.19–21 These morbidity outcomes are often not measured or available, and thus difficult to account for at a population level.15 Indexes of optimality have been proposed that count the frequency of optimum rather than suboptimum events during childbirth,15–20 although these are not widely used. Our analysis focuses on changes in maternal, fetal, and neonatal mortality estimated by scaling-up midwifery and specialist care.

Coverage of maternal and newborn health interventions

Regardless of the challenges associated with measurement, to improve outcomes, sufficient coverage of maternal and newborn interventions is required. The Countdown to 2015 for maternal and child survival tracks progress towards achievement of Millennium Development Goals (MDGs) 4 and 5 in 75 high-burden countries21–25 and has shown that the overall coverage of several components of midwifery is low, such as satisfaction of family planning needs (54%), four or more antenatal care visits (50%), skilled birth attendance (54%), and early initiation of breastfeeding (47%). Midwifery is one means by which to deliver the effective maternal and newborn interventions as a package of care,1 which is likely to be more effective than individual interventions alone.26

Renfrew and colleagues1 have shown that midwifery is an effective and probably cost-effective means to provide reproductive, maternal, and newborn services. Therefore, we sought to establish the effect of scaling-up such services on maternal and neonatal deaths. We aimed to estimate the effect of midwifery, as defined in this Series,1 on maternal and newborn outcomes. The two objectives to achieve this aim were to estimate maternal, fetal, and neonatal deaths averted using the Lives Saved Tool (LiST)26–30 under different scenarios of coverage of midwifery from 2010 to 2025 in 78 low-income and middle-income countries, classified into three groups using the human development index (HDI); and to estimate the value of the incremental addition of specialist care to midwifery on maternal, fetal, and neonatal lives saved.

The Lives Saved Tool

LiST is one module in the Spectrum Policy Modeling Software.31 Other Spectrum modules include HIV, demography, and family planning. LiST was selected as one tool that has the proven capacity to estimate the effect of discrete midwifery interventions, rather than a package of care as in the quality maternity framework, in The State of the World’s Midwifery 2014 Report.32 In brief, the LiST model starts with a given population’s current health and mortality status, and coverage of health interventions. The model then links those values to changes in coverage of health interventions with the effectiveness estimates to calculate the number of lives saved through changes in coverage (appendix). We used the Spectrum version 4.51 of LiST for all analyses.

LiST was developed by the Child Health Epidemiology Reference Group for the 2003 Child Survival Series33 and has since expanded to include interventions from the Lancet’s 2005 Neonatal Series,34 the 2008 Nutrition Series,35 the 2011 Stillbirth Series,36 and the 2013 Child Nutrition Series37 It has been updated by two supplements of effectiveness information38–40 and also now includes effects on maternal mortality,31 results of which were presented in The Lancet Stillbirths Series.36 Full details of effectiveness estimates and validation are available elsewhere.31,41,42,43

LiST can only estimate cause-specific changes in mortality (maternal, fetal, and neonatal), calculated by combining the best available evidence of health intervention effectiveness with population-specific health intervention coverage changes, mortality rates,39,43 and causes of death.31,43–45 Stillbirths are classified as either antepartum or intrapartum,36 with interventions affecting each type separately. LiST has only been used to estimate mortality effects in low-income and some middle-income countries, and cannot calculate indirect effects or all-cause
effects that have no known biological mechanism. LiST is limited to modelling effects on mortality and does not model effects on experience of care; morbidity; other potential benefits, such as wellbeing, empowerment, and self-reliance; morbidity; or intergenerational issues. As far as we are aware, there are no other methods that would allow for a similar quantitative analysis of non-mortality effects.

**Effective interventions and estimation of their baseline coverage**

The effective maternal and newborn health interventions were those identified in the *Essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health,* and in the study by Renfrew and colleagues, as being able to be delivered as part of hospital-based care for severe newborn infections. Essential interventions, including attendance at birth, facility delivery, and access to syphilis detection and treatment; between skilled antenatal care visits and activities, such as access to sulphur detection and treatment; between skilled assistance at birth; facility delivery, and access to emergency obstetric care and signal functions (including neonatal resuscitation); and between birth care and emergency obstetric care and signal functions (including attendance at birth, facility delivery, and access to syphilis detection and treatment; between skilled midwifery services, particularly by midwives educated to international standards and who are integrated into the health system. Specialist medical interventions were those requiring medical assistance such as blood transfusions or caesarean sections (indicative of CEmONC).

We obtained data for baseline coverage of maternal and newborn health interventions from the most recent Demographic and Health Surveys or Multiple Indicator Cluster Surveys (MICS). If no data were available for an indicator, we used the average for similar countries in terms of HDI. We identified assumptions or indicators used in the LiST model in *The Lancet Neonatal Series,* which are described in the LiST manual too. These assumptions include the association between four or more antenatal care visits and activities, such as access to sulphur detection and treatment; between skilled attendance at birth, facility delivery, and access to emergency obstetric care and signal functions (including neonatal resuscitation); and between birth care and hospital-based care for severe newborn infections (table 1). For many indicators, no standard LiST proxy is available so we selected unique ones for this analysis, aiming for consistency with the standard proxies.

**Active management of the third stage of labour Interventions**

We modelled the effect of increasing coverage of maternal and newborn health interventions by calculating effect sizes for every intervention and outcome linkage (see appendix for a full list of estimates used). Whenever an individual effect size could be established, we separated the specific interventions from the larger package and used them separately in the model. For example, we estimated the individual effect sizes of interventions, such as administration of magnesium sulphate for the management of severe pre-eclampsia or eclampsia, active management the third stage of labour, and neonatal resuscitation, from literature reviews of the evidence, and included them as individual effect sizes. When effect sizes were not known for individual interventions, we included them in the intervention of labour and birth care by a skilled attendant at birth. When we modelled this intervention at the level of an adequate CEmONC, we assumed it included caesarean sections and blood transfusions. When we modelled skilled attendant at birth at the level of an adequate BEmONC, we excluded caesarean sections, blood transfusions, or any interventions that would require these two CEmONC activities, but included other interventions that could be deemed to be BEmONC (eg, clean birth and management of post-partum haemorrhage and post-partum sepsis). For this analysis, we used all standard effect sizes available in LiST, except in a few cases, in which no published effect sizes were available—eg, maternal sepsis case management. We therefore estimated that 80% of all maternal sepsis deaths could be prevented with appropriate case management, including parenteral antibiotics, based on a Delphi analysis and additional historical data.

**Construction of the standard populations**

We included 78 countries, incorporating all 58 countries in *The State of the World’s Midwifery 2014 Report* and extending to all additional Countdown 2015 countries. These 78 countries are high-burden, low-income and middle-income countries, which account for 97% of maternal and 94% of neonatal mortality.

We used the HDI to classify the countries. The HDI is a composite statistic of life expectancy, education, and income indexes. We selected the HDI after examining several other databases that contained more women-focused indicators, including the Social Institutions and Gender Index and the Gender Inequity Index. These databases did not contain complete data for our countries of interest and we therefore excluded them. We also examined other possible social determinants, including women’s status, inequality, water and sanitation, and proportion of urban population. These searches resulted in country groupings similar to those obtained using HDI.

We used the HDI to categorise the 78 countries into three equal groups of 26 countries (table 2). We did this to generate estimates of deaths averted within every group. Group A includes the lowest HDI countries, group B includes low-to-moderate HDI countries and group C includes moderate-to-high HDI countries. Within every tertile (groups A, B, and C), we generated the average mortality rates and ratios, health intervention coverage values, HIV prevalence, contraceptive prevalence rate, and total fertility rates. For a baseline for every group, we applied the coverage of the effective interventions on a hypothetical standardised baseline population of 1 million people for the year 2010, using the UN population projections for 2010 built into the modelling software (appendix).

**Modelling scale-up of interventions on the standardised populations**

Using the standardised baseline populations, we developed several scenarios between 2010 and 2025.
The first scenario shows the numbers of deaths that are likely to be noted in 2025 with no change in coverage of the interventions and no change in present fertility rates, overriding the UN Population Division-projected secular trends in fertility and mortality (scenario 0; Table 3).

### Table 1: Health indicators modelled and proxies used for estimating baseline coverage of health interventions

<table>
<thead>
<tr>
<th>Indicator or proxy indicator and translation formula if no standard indicator is available</th>
<th>Description</th>
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<tbody>
<tr>
<td>Before conception (family planning)</td>
<td>Contraceptive prevalence rate Percentage of women at risk of getting pregnant using any method of contraception</td>
</tr>
<tr>
<td>Around the time of conception</td>
<td>Folic acid supplementation Proxy: ANC4+; formula: 5% of women who have ANC4+ receive folic acid (ie, assumes that 5% of women receiving four antenatal visits will receive folic acid supplementation)</td>
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<tr>
<td></td>
<td>Ectopic pregnancy case management Proxy: access to EmONC; formula: if facility delivery is &gt;50%, 0.75 x facility delivery; if facility delivery is 30-50%, 0.50 x facility delivery; if facility delivery is &lt;30%, 0.1 x facility delivery</td>
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<tr>
<td></td>
<td>Safe abortion services Percentage of women getting an abortion who have a safe abortion (ie, medical or surgical)</td>
</tr>
<tr>
<td></td>
<td>Post-abortion care Proxy: access to EmONC; formula: if facility delivery is &gt;50%, 0.75 x facility delivery; if facility delivery is 30-50%, 0.50 x facility delivery; if facility delivery is &lt;30%, 0.1 x facility delivery</td>
</tr>
<tr>
<td>After conception (antenatal care)</td>
<td>Tetanus toxoid Protected by tetanus toxoid at birth</td>
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<tr>
<td></td>
<td>IPTp Percentage of pregnant women protected against malaria with two or more doses of sulfadoxine-pyrimethamine (treatment options)</td>
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<td></td>
<td>Multiple micronutrient supplementation Percentage receiving iron-folate during pregnancy for ≥90 days</td>
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<tr>
<td></td>
<td>Calcium supplementation Proxy: ANC4+; formula: 5% of women who have ANC4+ receive calcium supplementation</td>
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<tr>
<td></td>
<td>Balanced energy supplementation Proxy: ANC4+; formula: ANC4+ x the proportion of children aged 6–23 months appropriately fed (included as effects on prematurity and neonatal death)</td>
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<td></td>
<td>Syphilis detection and treatment if needed Proxy: ANC4+; formula: ANC4+ x 0.75 for ANC4 is &gt;75%, 0.5 × ANC4+ if ANC is 40–75%, 0.5 × ANC4+ if ANC is &lt;40%, 0.25 × ANC4+</td>
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<tr>
<td></td>
<td>Diabetes case management Proxy: ANC4+; formula: 5% of women who have ANC4+ have diabetes requiring and receiving management</td>
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<tr>
<td></td>
<td>Screening for and management of pre-eclampsia with MgSO4 Proxy: ANC4+; formula: 5% of women who have ANC4+ are screened for preeclampsia and managed with MgSO4</td>
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<tr>
<td></td>
<td>Case management of malaria in pregnancy Proxy: ANC4+; formula: 5% of women who have ANC4+ are managed for malaria in pregnancy</td>
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<tr>
<td></td>
<td>Screening and management of fetal growth restriction Proxy: ANC4+; formula: 5% of women who have ANC4+ are screened and managed for fetal growth restriction</td>
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<tr>
<td></td>
<td>PMTCT Percentage of pregnant women who are HIV positive receiving option A</td>
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<tr>
<td>During labour and birth</td>
<td>Clean birth practices Formula: 50% skilled birth attendance at home; 60% essential care; 85% BEmONC; 95% CEmONC</td>
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<tr>
<td></td>
<td>Immediate assessment and stimulation Formula: 25% skilled birth attendance at home; 50% essential care; 80% BEmONC; 90% CEmONC</td>
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<td></td>
<td>Skilled birth attendant at birth Formula: 100% of skilled birth attendance</td>
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<td></td>
<td>Neonatal resuscitation Formula: 20% BEmONC; 70% CEmONC</td>
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<tr>
<td></td>
<td>Antenatal corticosteroids for preterm labour Formula: 20% essential care; 85% BEmONC; 95% CEmONC</td>
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<td></td>
<td>Antibiotics for pPRoM Formula: 20% essential care; 85% BEmONC; 95% CEmONC</td>
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<td></td>
<td>MgSO4 for eclampsia Formula: 20% essential care; 85% BEmONC; 95% CEmONC</td>
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<td></td>
<td>Active management of the third stage of labour Formula: 20% essential care; 85% BEmONC; 95% CEmONC</td>
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<tr>
<td></td>
<td>Induction of post-term labour Formula: 20% CEmONC</td>
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<tr>
<td>Post-partum and newborn care</td>
<td>Thermal care and clean postnatal practices Proxy: 100% of a postnatal visit within 48 h of birth</td>
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<tr>
<td></td>
<td>Kangaroo mother care Proxy: facility delivery; formula: 5% of facility delivery</td>
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<tr>
<td></td>
<td>Maternal sepsis case management Proxy: facility delivery; formula: if facility delivery is &gt;50%, 0.5 x facility delivery; if facility delivery is between 30–50%, 0.2 x facility delivery; if facility delivery is &lt;30%, 0.1 x facility delivery</td>
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<tr>
<td></td>
<td>Breastfeeding promotion Proxy: Percentage of newborn infants being breastfed exclusively, predominantly, partly, and not at all</td>
</tr>
<tr>
<td></td>
<td>Hospital-based care for severe newborn infections Proxy: facility delivery; formula: if facility delivery is &gt;50%, 0.5 x facility delivery; if facility delivery is between 30% and 50%, 0.2 x facility delivery; if facility delivery is &lt;30%, 0.1 x facility delivery</td>
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ANC4+ = four or more antenatal care visits. EmONC = emergency obstetrics and newborn care. IPTp = intermittent preventive treatment of malaria in pregnancy. SP = sulfamethoxazole-pyrimidine. PMTCT = prevention of mother-to-child transmission of HIV. BEmONC = basic emergency obstetrics and newborn care. CEmONC = comprehensive emergency obstetrics and newborn care. pPRoM = premature prelabour rupture of membranes. *In the absence of data, we used formulas to estimate the proportion of indicated cases that receive management. For example, we estimated the proportion of ectopic pregnancy patients that obtain treatment with the assumption that when facility-based deliveries are more than 50%, 75% of women who give birth in a facility who need the intervention receive ectopic management or post abortion care if required.
The remaining scenarios estimated the effect of different increases in coverage. The first estimated a modest increase for each of the health interventions (scenario 1). We defined modest as a relative 10% increase above baseline coverage rates for every intervention for every 5-year period between 2010 and 2025. The next scenario was a substantial scale-up (scenario 2), which we defined as a relative 25% increase above the baseline coverage rate for each intervention for every 5-year period between 2010 and 2025. In the third scenario, we postulated universal coverage to be 95% of all interventions by the year 2025 (scenario 3; appendix).

To highlight the risks of a deteriorating system (ie, population growth, but no additional resources, access, or staffing), we included a negative scenario, which estimated the deaths averted with a 2% decrease below baseline coverage of the interventions over every 5-year period between 2010 and 2025 (scenario 4). We analysed all four scenarios in three ways. The first analysis included all maternal and child health interventions, along with family planning (scaled-up contraceptive prevalence rates), whereas the second only included the maternal and child health interventions, with no change in contraceptive prevalence rate. The third analysis only looked at the changes in family planning through scaling-up contraceptive prevalence rate (data not shown for all analyses).

Quality of care cannot be modelled as a direct input into LiST. However, LiST was designed to assume that as coverage of delivery care services increases, there will be a corresponding increase in quality. This means that the model assumes that as coverage increases, services become more complete, moving from minimum access to skilled delivery care provision, and then through BEmONC to CEmONC, a full package of care including referral to specialist care. In the model, quality increases substantially faster when institutional delivery is greater than 50% (with a minimal increase in emergency care. At the highest level (group C), basic care is available to all people, so the scale-up results in substantial quality improvement. We noted similar results relative to the mortality rates and ratios (appendix). This is because quality, in terms of availability of CEmONC versus BEmONC, increases at a greater rate at higher levels of coverage.

A substantial increase in coverage every 5 years (scenario 2) resulted in a similar pattern, with the greatest reductions in numbers of maternal deaths, neonatal deaths, and stillbirths in 2025 being noted in group A countries (table 4). However, the greatest percentage reduction of maternal deaths was found in the group B countries, at 75-4% (table 4, figure 1).

In group A countries, stillbirths decreased by 26-3% from no change in coverage (scenario 0) to a modest increase in coverage (scenario 1). In scenario 2, with substantial increase in coverage, stillbirths reduced by 49-7%, whereas with universal (95%) coverage (scenario 3), there was a 75-9% reduction. By contrast with this was scenario 4 (attrition), where stillbirths had a marginal increase. We noted similar substantial reductions in neonatal deaths (table 4). The analyses in figure 1 included family planning as an integral part of midwifery as a package of care because family planning utilisation reduces fertility, which reduces the number of women at risk of maternal death and stillbirth or neonatal death.
To assess the effect that midwifery has on maternal, fetal, and newborn outcomes, we assessed the reduction in the number of deaths caused by the maternal and newborn health interventions separately from the increase in family planning use. With universal coverage of maternal and newborn health interventions only, excluding family planning, for group A countries, 60.9% of all maternal, fetal, and neonatal deaths could be prevented (appendix).

We did an additional analysis to examine the reduction with universal coverage (scenario 4), but excluding family planning. In the three HDI groups, 29.9% of maternal deaths are averted by midwifery care. Similarly, at all HDI levels, 23.8–31.0% of stillbirths can be averted with midwifery care. Alternatively, more than half of neonatal deaths can be prevented through midwifery care. If family planning was included as part of midwifery, 44.7–80.6% of maternal, fetal, and newborn deaths would be prevented (figure 2A). In particular, in Group C countries, family planning alone could avert 57.2% of all deaths because of reduced fertility and fewer pregnancies. In combination, the full package of midwifery care with both family planning and maternal and newborn health interventions could avert a total of 83.3% of all maternal deaths, stillbirths, and neonatal deaths (appendix).

Estimation of the additive value of specialist care

The second aim of this study was to estimate the value of adding specialist (obstetrician) care to midwifery on maternal, fetal, and neonatal lives saved. To do this, we included all activities that could reasonably be delivered by a midwife to be midwifery care, covering activities ranging from community-based to BEmONC-level care; these are included in the first four boxes in the framework for quality maternal and newborn care in this Series.

We included additional interventions deemed to be CEmONC or that require medical care as specialist care. These activities included safe abortion services, ectopic pregnancy case management, diabetes case management, labour and delivery at the CEmONC level (including caesarean section and blood transfusion), antenatal corticosteroids for preterm labour, induction of labour for post-term pregnancies, and hospital-based case management of severe newborn infection. We deemed antenatal corticosteroids for preterm labour and
induction of labour to be part of specialist care as they required obstetric and newborn service provision. This analysis allowed us to examine the effect of midwifery as a package of care, with the cumulative effect of linking to specialist medical care.

We noted an additional effect on deaths averted when specialist care is included in the model for scenario 3 (universal coverage). However, this effect is far less pronounced than that of midwifery care (both maternal and child health, and family planning), regardless of the inclusion of family planning (figure 2).

**Interpretation**

**Even modest increases in coverage can save lives**

Even at the lowest level of scale-up, of 10% per 5 years relative to baseline, we noted a noticeable reduction in the number of maternal and neonatal deaths, with the greatest absolute reduction in the low-HDI countries. The largest percentage reduction was seen in the moderate-to-high HDI category, possibly because the overall coverage was already high (75% of institutional births), so quality was most likely to be affected.

Analyses and reports in the past two decades have highlighted the need to scale-up coverage of maternal and newborn interventions. In many countries, this has not occurred because of a range of political, social, cultural, and resource constraints. The challenge facing health policy makers and planners is how to scale up high-quality midwifery services while addressing the complexity of the underlying issues.

For the most part, scaling up is a political decision that includes the allocation of resources, along with the buy-in of professional groups and the views and demands or needs of the population, with countries trying to make decisions that provide the best outcomes for the lowest cost.

We recognise that our best-case scenario (universal coverage by 2025) assumes that efficacious, quality interventions are effectively delivered within a functional health system by a team of fully-competent midwifery and specialist medical staff linking from community to primary, secondary, and tertiary services. In view of the current worldwide challenges associated with competencies and quality of care, and the insufficient attention to life-saving functions in many midwifery curricula, this is probably an overestimation of the effect. The best-case scenario will be challenging for many countries to achieve; nonetheless, it shows the possible effects if political will and substantial planning and resources were in place. Some countries have managed to show important improvements in maternal mortality with substantial scale-up of access to effective interventions.

**Contribution of family planning**

Midwifery includes community-based interventions such as family planning. In a combined model of care that included maternal and newborn infant interventions, and family planning, family planning has the most substantial effect on deaths averted because of a reduction in the number of pregnancies that are of potential risk for mother, foetus, and newborn infant. The importance of family planning in preventing deaths has been well articulated. The Series on family planning in *The Lancet* again emphasised the importance of a focus on family planning to improve the health of communities. It has been estimated that increasing contraceptive use in developing countries has reduced the number of maternal deaths by 40% over the past 20 years because of a reduction in the number of unintended pregnancies.

The full scope of midwifery includes family planning, highlighting the substantial contribution that midwives

### Figure 2: Number of maternal, fetal, and neonatal deaths averted by midwifery care and specialist care of deaths that would have occurred in 2025 with no scale-up, per 1 million population

(A) Including family planning. (B) Excluding family planning. *Deaths that would not necessarily be averted by the achieved coverage of the specific interventions in the model.*
can make to averting deaths through enabling access to family planning. Another modelling analysis using Spectrum in two small island nations in the South Pacific showed that meeting family planning needs would substantially reduce the number of unintended pregnancies, high-risk births, and maternal and infant deaths. Furthermore, preventing unintended pregnancies would have substantial economic benefits for the health and education sectors.72

In practice, scaling up of maternal and newborn interventions, and family planning, as part of midwifery as a package of care has to occur in parallel, since both are dependent on a functional workforce and health service. Family planning is an integral part of midwifery74 and so midwifery could be a means to gain access to family planning. Countries that have increased family planning coverage have shown reductions in maternal mortality.75 For example, the total fertility rate in Bangladesh has fallen from 6.3 to 2.7 between 1975 and 2007; the contraceptive prevalence rate increased from 8% to 56% between 1975 and 2007, and the maternal mortality ratio has decreased from 800 in 1990 to 240 in 2010.76

Effect of specialist care
In our second analysis, we estimated the lives saved based on an incremental increase from midwifery alone to midwifery with specialist medical care. Regardless of the inclusion of family planning, the effect of specialist medical services is less pronounced than the initial effect noted from activities deemed to be part of midwifery as a package of care. In our analysis, we found the incremental benefit of specialist medical care to be most substantial on maternal mortality, where up to 20% of maternal deaths are able to be prevented by activities that require CEmONC. We recognise that, just like medical and surgical care, midwifery must be situated within a functional health system with an effective referral system, including communications and transportation equipment, and readily-accessible, equipped, and staffed health facilities that can provide specialist medical care.7 We also assumed in this analysis that specialist medical skills are available in a functional health system. In countries that do not have sufficient obstetricians and gynaecologists, the ability to provide specialist medical care will be restricted and the potential benefits therefore less.

Investing in improved outcome measurement for the future
We used maternal, fetal, and neonatal mortality as the primary outcomes of our analysis because they are the most readily available. Most clinical outcomes in maternal and newborn infant health take a negative rather than positive perspective, such as the measurement of death or disability. Future analyses should focus on broader outcomes, particularly morbidity, mental health, and quality of life, as these can also be affected by midwifery.7 Substantial investments in the development of standardised methods and the implementation of strategies to collect and collate data need to occur. Measurement strategies for mortality and morbidity should be suited to the needs and resources of the particular country, and must strengthen the country’s technical capacity to generate and use credible estimates too.77 Measurement of broader maternal and newborn outcomes will provide more detailed evidence about quality of services, which can then be tied to the measurement of accountability and action for scaling up midwifery to improve maternal and newborn services, and to ensuring that services are designed to better meet the needs of women.65,79

Outcomes in high-income countries, where quality of care and other health outcomes might have a different priority than additional deaths averted, need to be examined differently. Nonetheless, quality of care and the experiences of women are important in settings of high, middle, and low incomes, and are likely to influence health-seeking behaviours and outcomes. The panel explains the contribution that midwife-led care and units in high-income countries have on improving outcomes, including positive outcomes such as breastfeeding and women’s views and experiences. In high-income countries, inappropriately used interventions—eg, unnecessary caesarean section or induction of labour, are also likely to contribute to morbidity and mortality.1 Different approaches need to be developed to model the effect of too many interventions compared with too few, and the effect of midwife-led care in countries with different income levels.13,48

Ensuring midwives can be the providers of care
We used this modelling to examine the contribution of midwifery interventions rather than midwives themselves as providers of health care. The midwife, as a health-care worker, can efficiently and effectively deliver the package of intervention as highlighted by Renfrew and colleagues.1 Although the full spectrum of care up to and including specialist medical care averts the most deaths, the midwife addresses the continuum of care from the community through to complex clinical care,9 whereas the medical specialist might not. Midwives can potentially bring the woman into the health-care system at the most effective and efficient time and level. Effective referral is often hampered by practical considerations, such as poor finance and transport services, and access to specialist medical care once in higher-level facilities. Again, this highlights the need for midwifery, specifically midwives, to be part of a team within a functional and enabling health system that has a skilled health workforce with the appropriate competencies and is based in the community and hospital or health facility. This is an important step towards ensuring that women can have access to a quality midwifery service that can provide the
maternal and newborn health interventions, and preventive health-care strategies.

Limitations
LiST provides a user-friendly method to quantify the effect that can be achieved by scaling up different maternal and newborn interventions. It has also been used to guide strategic planning at a country-specific level. The method was originally developed for child health in what became the *Lancet*’s Child Survival Series and has since been expanded to model the effect of scaling up in newborn infant, fetal, and maternal health. LiST, however, has limitations. It can only model mortality effects in low-income and some middle-income countries, and cannot examine broader, more sociological effects, such as empowerment or quality of life. Although it was initially designed to measure community-based effects on child survival, it has now been expanded to model maternal mortality and stillbirths, and some facility-based interventions. It was not designed to model the effect of intervention overuse, as might be seen in some high-income countries. This method is also reliant on the data available for those countries, which is particularly important since the countries that can be modelled are those with the poorest quality and quantity of data, especially in terms of causes of maternal mortality. LiST is based on the estimation of mortality outcomes that includes only the interventions with known effect size differences. This characteristic means that interventions for which little research has been done to generate the data on effect size differences cannot be included, with the wide range of other non-mortality outcomes also unable to be included. Proxy indicators and interventions might have large variations and further research is needed to quantify these indicators.

Because of the emphasis of biomedical interventions, LiST does not take into account the effect of broader social determinants of health. Victoria has argued that most of the effect of broad social determinants on child mortality will be mediated by interventions included in LiST, such as improved water and sanitation, better antenatal, labour and birth care, improved nutrition, and greater access to high-quality case management of diseases, such as pneumonia, diarrhoea, and malaria. In the future, tools that are more sensitive to midwifery as a package of care need to be developed to enable the measurement of increase in the coverage of interventions, quality of care, and the broader aspects of care, including the interpersonal elements, which are part of midwifery.

Another limitation of LiST is that quality cannot be included as a separate and specific indicator. We based our analysis on the assumption that, as coverage of delivery care increases, so does quality. This statement might not be correct in all situations. The other elements that cannot presently be modelled include respect for and understanding of the individual needs of the mother, child, and family, and a commitment to active promotion of normal biopsychosocial cultural processes of pregnancy, childbirth, and the early weeks after birth. In future, it will be important to go beyond the interventions that often focus on mortality and include these elements of broader quality of care in such analyses.

We used the HDI to categorise 78 countries into three groups. HDI is not the only measure that could have been used. We did examine other indexes and did not find substantial differences in the classification of individual countries, hence we used the HDI.

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Panel: Improving quality and safety in maternity care: the contribution of midwife-led care and units in high-income countries

This Panel considers how the organisation of care providers, models of care, and birthplace setting contribute to high-quality and safe care for mothers and their newborn infants in high-income countries.

The philosophy behind midwife-led continuity models is “normality, continuity of care and being cared for by a known, trusted midwife during labour. The emphasis is on the natural ability of women to experience birth with minimum intervention.” Midwife-led continuity of care can be provided in small teams or as a caseload model, and occurs within a multidisciplinary network of consultation and referral with other care providers. Midwife-led continuity of care is associated with substantial benefits for mothers and their newborn infants, and has no identified adverse effects compared with shared or medically-led care in high-income countries according to one systematic review. The authors of a second systematic review concluded that midwife-led services might offer a cost-effective alternative to the prevailing maternity care model. More recently, an Australian randomised controlled trial reported that caseload midwifery is associated with cost savings in women of all risks, with similar clinical outcomes.

Midwife-led birth settings include midwife-led units sited alongside obstetric units and freestanding midwife units. Midwife-led units that are based in or next to hospitals compared with conventional hospital labour wards produce an increased likelihood of spontaneous vaginal birth and decreased likelihood of oxytocin augmentation, assisted vaginal birth, caesarean birth, and episiotomy, with no difference in infant outcomes. With regard to freestanding midwife units, there is less evidence. A prospective study of freestanding midwife unit care in Denmark found important benefits, such as higher levels of satisfaction, decreased maternal morbidity, decreased use of birth interventions, including caesarean sections, and increased likelihood of spontaneous vaginal birth compared with labour ward care. There were no differences in perinatal morbidity in infants of low-risk mothers.

The Birthplace in England Study assessed outcomes by intended place of birth for women at low risk. For low-risk women, the overall incidence of adverse perinatal outcomes was low in all birth settings. For multiparous low-risk women, no differences were noted in adverse perinatal outcomes between settings. However, the risk of an adverse perinatal outcome was higher for women having their first baby who planned to give birth at home compared with those in an obstetric unit, although the overall level of risk was low. The intrapartum transfer rate for women having their first baby was high (36–45%), which might explain the adverse outcome rate. The costs were lower for births planned at home, in a freestanding unit, or alongside a midwife unit than for planned birth in obstetric units.

Overall, in high-income settings, both the model of care and place of birth are important influences on a range of health and clinical outcomes for mothers and newborn infants, and have economic implications for the health system. Systems need to be in place to allow safe and timely transfer to obstetric care and skills without financial, professional, and organisational barriers.
We found it difficult to decide which interventions were deemed part of midwifery or specialist medical care. We recognise that some interventions, such as safe abortion services, could be considered part of midwifery as a package of care because of an increasing proportion of manual vacuum aspirations being safely done by mid-level providers, including midwives and nurses, at a primary care facility level. Another intervention that was classified as specialist care was antenatal corticosteroids. The classification of the interventions was a consensus decision and might not be universally acceptable. Nonetheless, the inclusion of antenatal corticosteroids as part of midwifery interventions would probably only enhance midwifery effectiveness.

For interventions such as ectopic pregnancy, we used a low-effectiveness estimate. We assumed that a CEmONC-level facility and caregiver would have the skills and means needed to deal with an ectopic pregnancy or post-abortion care. Additionally, LiST always assumes that women accessing CEmONC for emergencies would also have access to and use non-CEmONC for standard cases, which therefore means that both midwives and specialist providers are working within a functioning health system, something that is not the situation in many health systems worldwide.

Conclusions
We have described the range of potential benefits that full and comprehensive scale-up of midwifery can bring to communities and families worldwide, regardless of their present level of development. Although it is clear that these benefits can be very important, further critical assessment and research is required to establish how health systems and community services can be best improved and strengthened in order for midwifery to be available and accessible to all.

Contributors
CSEH devised the study and wrote the first and final drafts of the article, was responsible for overall leadership of the project, and led revision of all drafts. IKF and LAB led the statistical modelling and analysis, contributed to the design of the study and the writing. All authors helped to interpret the results and undertook reviews and revisions of the report.

Declaration of interests
We declare no competing interests.

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References


Country experience with strengthening of health systems and deployment of midwives in countries with high maternal mortality

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This paper complements the other papers in the *Lancet* Series on midwifery by documenting the experience of low-income and middle-income countries that deployed midwives as one of the core constituents of their strategy to improve maternal and newborn health. It examines the constellation of various diverse health-system strengthening interventions deployed by Burkina Faso, Cambodia, Indonesia, and Morocco, among which the scaling up of the pre-service education of midwives was only one element. Efforts in health system strengthening in these countries have been characterised by: expansion of the network of health facilities with increased uptake of facility birthing, scaling up of the production of midwives, reduction of financial barriers, and late attention for improving the quality of care. Overmedicalisation and respectful woman-centred care have received little or no attention.

**Introduction**

To argue that strengthening health systems makes the difference between successes and reversals in maternal and newborn health has become a cliché. This consensus contrasts with the paucity of empirical documentation of the long-term efforts to adapt and strengthen health systems in support of maternal and newborn health.

Of the low-income and middle-income countries with currently more than 5 million inhabitants, 48 had a maternal mortality ratio of 200 per 100 000 livebirths or more in 1990 (Afghanistan, Angola, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Chad, Côte d’Ivoire, Democratic Republic of the Congo, Dominican Republic, Eritrea, Ethiopia, Ghana, Guatemala, Guinea, Haiti, Honduras, India, Indonesia, Kenya, Lao, Madagascar, Malawi, Mali, Morocco, Mozambique, Myanmar, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Peru, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Tanzania, Togo, Uganda, Yemen, Zambia, and Zimbabwe). 21 of these 48 countries reduced this maternal mortality ratio by at least 2-5% per year between 1990 and 2000, and again between 2000 and 2010, a median drop in maternal mortality ratio of 63% over 20 years (appendix p 15). These 21 countries are all either on track or making good progress towards Millennium Development Goal 5; in four (Bangladesh, Bolivia, India, and Pakistan), although professional care at birth has increased, the proportion of births attended by a midwife, auxiliary midwife, or nurse-midwife has decreased in favour of those attended by medical doctors. In Burkina Faso, Cambodia, Indonesia, Malawi, Morocco, and Nepal, and to a lesser extent in (figure 1B). Five of those countries made slow but steady gains in facility birthing (Haiti, Honduras, Mali, Senegal, and Uganda). Three experienced drops in mortality from a high baseline, with little progress in facility-birthing (Chad, Nigeria, and Niger). Finally, the remaining nine countries made little or no progress or had a reversal in either maternal mortality ratio or facility birthing.

The evolution of the proportion of births attended by a midwife, auxiliary midwife, or nurse-midwife was documented in 15 of the 21 countries with sustained improvement in maternal mortality ratio: in four (Bangladesh, Bolivia, India, and Pakistan), although professional care at birth has increased, the proportion of births attended by a midwife, auxiliary midwife, or nurse-midwife has decreased in favour of those attended by medical doctors. In Burkina Faso, Cambodia, Indonesia, Malawi, Morocco, and Nepal, and to a lesser extent in

**Key messages**

- Effective coverage in the countries reviewed has crucially depended on the investment in the overall service delivery network and facility birthing. The expansion of the service network has kickstarted a virtuous cycle of uptake of care by mothers, deployment of midwives to both meet and generate increased demand, pressure to lift financial barriers and further uptake of maternal care.
- Attention for quality of care in the countries reviewed has taken off only when uptake of care had already substantially increased. Until very recent years they have given little or no attention to what midwives and doctors can do to curb overmedicalisation and promote respectful woman-centred care.
- The deployment of midwives in the countries reviewed has been the result of managerial choices to accelerate and operationalise universal access to care. Endorsement in the national political arena came only later in the process, once appreciation by the population of the successful deployment of midwives became apparent and civil society more vocal and assertive.

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*This is the third in a Series of four papers about midwifery*

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Lund University, Sweden (L Liljestrand PhD); Evidence for Action, University of Southampton, Southampton UK (Prof Z Mathews PhD); Rabat, Morocco (A Mechbal MPH); International Development Institute, King’s College London, London, UK (S F Murray PhD); Evidence for Action, London, UK (H Rehr MSc); Institute of Tropical Medicine, Antwerp, Belgium (F Richard PhD); National Reproductive Health Program, Phnom Penh, Cambodia (T Rathavay MPH); Afghan Midwives Association, Bangladesh and Eritrea, this proportion has increased (figure 2).

As a complement to the other papers in this Series on midwifery, this paper documents the constellation of health-system efforts in support of maternal and newborn health in four of these 21 countries: Burkina Faso, Cambodia, Indonesia, and Morocco. These four countries have shown sustained and substantial reduction of maternal and newborn mortality while deploying midwives as a core constituent of their strategy (appendix p 1–14). These countries have shown gains in facility birthing in every wealth asset quintile (figure 3A) and the proportion of births attended by a midwife, auxiliary midwife, or nurse midwife has increased in the four lowest quintiles (Cambodia, Indonesia, and Morocco) or in all five quintiles (Burkina Faso; figure 3B).

Methods and data limitations
Burkina Faso, Cambodia, Indonesia, and Morocco were selected as countries for three reasons: they have shown two decades of reduction of maternal and neonatal mortality (appendix pp 15–17); they have started up or accelerated investment in cadres of midwives; and accounts by expert witnesses and documented evidence permit a credible reconstruction of the pathways of the efforts in health systems strengthening in support of maternal health services over the past 20–25 years. The appendix (p 15) summarises how data availability has constrained the selection of countries for in-depth study. We triangulated interviews with key informants and expert witnesses with documentation obtained through a structured literature search across a range of electronic databases, complemented by documentation obtained through the country-specific key informants and ministry of health sources.

For every country, we identified specific interventions in health system strengthening relevant to the deployment of midwives and maternal health and iteratively validated them through the literature review and interviews with key informants. We collated and assessed available information on progress with maternal and newborn outcomes against the aspirational quality maternal and newborn health framework.1 Interviews with the expert-informants related outcomes to efforts in health system strengthening in three linked layers. First, we mapped efforts to enhance the effectiveness of coverage and examined plausible links with outcomes. Second, we identified the efforts to enhance coverage through improved access and uptake of services. Third, we examined the initiatives to improve steering or governance and resource allocation (focusing on availability of information and research, evidence of priority setting, and budgeting) as to their contribution to improved access and effective coverage, with specific attention for the role of domestic political leadership and the sensitivity of external aid to the maternal and newborn health agenda. We gave particular attention to ascertaining the time sequence of these efforts and initiatives.

Extrapolation from individual country experience is hazardous and complicated by the paucity, poor precision, and, at times, contradictions in the data for some years in the period of interest. This issue is compounded by the leaps of faith required to link decades of health system initiatives plausibly to outcomes. Even an in-depth review of sources and documentation inevitably leaves gaps in the reconstitution of the sequence of events.

Data on the decline of maternal mortality—crucial for assessing outcomes—have to be interpreted with some caution. We have used the 2013 WHO/UNFPA/UNICEF/World Bank estimations for decadal change.2 These are modelled from censuses and surveys, adjusted for under-reporting and misclassification, and finally combined with best-estimate-envelopes of birth and death totals from

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Figure 2: Change in maternal mortality ratio and proportion of facility births since the 1990s. (A) Countries with a sustained and rapid reduction in maternal mortality ratio over two decades. This graph shows 16 countries with data; time series data were not available for five other countries (Lao, Myanmar, Papua New Guinea, South Sudan, and Sudan) with a sustained reduction of maternal mortality ratio over two decades. (B) Countries without a sustained and rapid reduction in maternal mortality ratio over two decades. These countries have shown substantial and rapid reduction of maternal and newborn mortality while deploying midwives as a core constituent of their strategy (figure 3A) and the proportion of births attended by a midwife, auxiliary midwife, or nurse midwife has increased in the four lowest quintiles (Cambodia, Indonesia, and Morocco) or in all five quintiles (Burkina Faso; figure 3B).
WHO/UN databases. They are in line with modelled estimates published in 2012,15 but diverge substantially from other recently published modeled estimates.26 Although systematic modelling might provide for more robust estimates of aggregate trends and inter-country comparison, the analysis of individual trajectories over a timespan can be problematic. For example, Cambodia’s spectacular acceleration in the decline of maternal mortality ratio after 2005 shown by the direct survey data is smoothed out in the modelled estimates. In Indonesia, recent measurements are above the smoothed modelled trend estimates, whereas in Morocco a large recent multiround survey has generated robust measurements that are lower than the modelled estimates.

Where some data for the evolution of neonatal mortality are available, the story is usually incomplete for stillbirths. Information about morbidity is anecdotal at best, as is information about unsafe abortion, an important cause of maternal mortality. The social outcomes to which better maternal and newborn health care is expected to contribute (social integration, gender equity, women’s autonomy and participation) are poorly documented and difficult to attribute to programme performance, as are the contextual elements that influence health decision making and uptake of care: the capabilities of women in a modernising society to make use of the opportunities offered by improved transport, mobile phones, audio-visual information, and education.

Reconstruction of trends in programme output is equally precarious. What is “skilled attendance” and even what is understood by the categories of “nurse-midwife” or “auxiliary midwife” used in the Demographic and Health Survey (DHS) questionnaires varies from one country to the other and over time—and so does the range, effectiveness, and quality of services provided.26–32 For all the standardisation of the DHS surveys, “facility birthing” covers very different realities, from a midwife’s home in an isolated village to well equipped specialised hospitals. By contrast with antenatal care, metrics of quality of birthing care or access to referral care are not readily available in ways that allow for comparison across countries or across time. Metrics to assess trends over time in compassionate and respectful care do not currently exist. Policy and systems interventions are rarely systematically documented, and few key informants can claim objectivity and continuity of memory for the whole period. Past events might be rationalised selectively, underestimating serendipity. Inference about the relative contribution of specific health system efforts is thus tentative at best and requires careful triangulation.

**Commonalities and lessons**

**Creation of a virtuous cycle of access, uptake, and effective coverage**

Despite these limitations it has been possible to reconstitute how countries deployed a collection of partly connected initiatives and measures to adapt to and improve on a changing environment, where strategies emerged and self-organised over time, rather than as implementations of a predefined comprehensive plan. The appendix maps the multiple measures that have contributed to making coverage more effective, access and uptake more universal, and steering and resource mobilisation more purposeful. Rather than relying on a magic bullet, each of the four case-study countries has intervened at various levels in the health-care system, innovating or adapting policies, procedures and approaches as obstacles were encountered. The appendix maps measures of health system strengthening taken over the past 25 years to improve maternal and newborn care in each of the case-study countries. Individual country narratives, which for reasons of editorial space policy has been put in the appendix (pp 1–14),16–26,34–105 provide further documentation, evidence, and details about the interlinkages between the various measures, their time sequence and their relevance to the outcomes that were obtained (figure 4 and 5).

A common pattern emerges from the various interventions for health-system strengthening detailed in figure 4 and in the appendix (pp 1–14). Four sequential lines of action have jointly contributed to improved maternal and newborn health outcomes: (1) extension of a close-to-client network of health facilities, resulting in improved access to and uptake of facility birthing and hospital care for complications; (2) scale-up of the workforce providing professional birthing care to respond to the growing demand; (3) reduction of financial barriers to access to further enhance uptake of care; and (4) attempts to improve quality of care. Figure 6 shows the sequence of those system-wide efforts along an approximate timeline—with somewhat arbitrary starting dates given the gradual build-up of such interventions over years.

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**Figure 2: Trend in facility birthing and proportion attended by midwives after 1990 in countries with a rapid and sustained reduction of maternal mortality ratio over two decades**

Source of data for health facility births: DHS surveys. Data for reduction in maternal mortality ratio: WHO, UNICEF, UNFPA, World Bank 2014. This graph shows 15 countries with data; time series data were not available for six other countries (Ethiopia, Lao, Myanmar, Papua New Guinea, South Sudan, and Sudan) with a rapid and sustained reduction of maternal mortality ratio over two decades.
In all four countries, enhanced close-to-client access to facility birthing has been the foundation of improved effective coverage. Increased facility birthing in the case-study countries was part of a wider trend in low-income and middle-income countries in the 1990s. It resulted from a combination of increased supply and increased uptake of services, the latter facilitated by modernisation, rising incomes, better roads and transport, improved communication, urbanisation, and more readiness to use services. The slower pace of this trend in sub-Saharan Africa can at least partly be explained by the difficulty of scaling up supply at a speed commensurate with the ongoing annual growth of the number of births, as is well illustrated by the case of Burkina Faso (pp 5–6).

The extension of the network of health facilities, and its subsequent increase in workforce has characterised all four case-study countries from an early stage. In Morocco the extension of the network of health facilities started in the 1980s—first with extension of primary care centres, and in the 1990s with major, albeit not maternal health-specific investments in hospitals. In Indonesia the expansion of the (less systematically structured and unequally distributed) network of public and private facilities started well before the 1990s. In Burkina Faso, the extension dates back to the beginning of the 1990s and accelerated after 2000. In Cambodia, a district system was built from scratch from 1993–95 onwards. The investment in these networks of health facilities was not specific to maternal and newborn health but rather resulted from a generic desire to expand access to health care.

Building a network of facilities from scratch, as in Burkina Faso and Cambodia, takes time. Once it is in place, deploying a workforce can proceed quite rapidly. Nevertheless, there has been a substantial lag between the expansion of infrastructure and the deployment of midwives in Burkina Faso, Cambodia, and Morocco. Indonesia stands out as a country where that new workforce was not just intended to staff expanded service infrastructure, but also designed to lead to the ex-novo creation of dedicated, village-level delivery points for maternal health services in parallel to the expansion of infrastructure. However, the low productivity of the Indonesian village midwives operating as a solo practitioner suggests that most of the benefits were reaped through improved access to formal facilities—to which a large proportion of the midwives were deployed.

Women are quick to seize the opportunities of a denser service network, particularly when transport and communications further facilitate physical accessibility. In many countries, the expanded network has kick-started a virtuous cycle of increased supply, expanded access, increased uptake and demand, and scaling up of the midwife cadre. In countries such as Egypt or India, a large supply of doctors has been able to meet the increasing demand, in line with social pressure and professional lobbying. By contrast, health authorities in the countries documented in this paper, as well as Afghanistan, Malawi, and Nepal, or earlier Chile, have opted for the training and deployment of large cohorts of midwives to meet the workforce. They did so by scaling up existing efforts, and multiplying new initiatives of pre-service education. The scale-up seems to have been mainly a managerial response to the challenge of service delivery consequent on expansion of the health infrastructure rather than an ideological preference for midwives over medical doctors. Speed and cost considerations have been the determining factor (appendix pp 3, 6).

After densification of the service network and scaling up the workforce, all countries have been confronted with the need to address the financial barriers that continued to constrain access. Cambodia stands out as a country where concerns for financial accessibility, albeit not specific to maternal health, preceded the scaling up of the production and deployment of midwives (figure 5). In the other countries, such efforts came at a later stage. The actual techniques adopted have ranged from equity funds,
Figure 4: Health systems strengthening measures aimed at improving maternal and newborn health in Morocco and Burkina Faso since the late 1980s

A Morocco

2010: standardisation of care.


2008: delivery care free in public facilities.

Unmet Obstetric Needs survey 1980s; 5 yearly population surveys; near-miss research programme; EmONC survey.

2008: Minister of Health makes maternal health top priority.

More equitable maternal and newborn outcomes

Outcomes

Improved social inclusion, gender equity, participation

Effective coverage

Hospital backup and parsimonious referral

Mother- and baby-centred care

Access and uptake

Close-to-client facilities, equipped and supplied

Midwives: supply, deployment, remuneration, retention

Close-to-client facilities, equipped and supplied

Strategic information and intelligence

Recognition as priority

Translation into budget allocation and regulation

Commitment of political leadership

Aid sensitive to MNH priorities

Steering and resource mobilisation

More equitable maternal and newborn outcomes

B Burkina Faso


1998: maternal health targets. 2006: broad professional and political consensus on priority and 10-year MNH acceleration plan.


2003–12: 804 facilities upgraded, bringing the total to 1054.


2003–12: 804 facilities upgraded, bringing the total to 1054.


2002: antenatal is free of charge. 2006: government partially reimburses household expenditures for normal deliveries, complications and C sections.


Seed funding by WHO/UNICEF/UNFPA.

2008: Ministry of Health makes maternal health top priority.

More equitable maternal and newborn outcomes

Outcomes

Improved social inclusion, gender equity, participation

Effective coverage

Hospital backup and parsimonious referral

Mother- and baby-centred care

Access and uptake

Close-to-client facilities, equipped and supplied

Midwives: supply, deployment, remuneration, retention

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Strategic information and intelligence

Recognition as priority

Translation into budget allocation and regulation

Commitment of political leadership

Aid sensitive to MNH priorities

Steering and resource mobilisation

More equitable maternal and newborn outcomes

Figure 4: Health systems strengthening measures aimed at improving maternal and newborn health in Morocco and Burkina Faso since the late 1980s

(A) Morocco. (B) Burkina Faso. Document analysis and expert witness interviews made it possible to identify health-system strengthening measures that can plausibly be linked to improved outcomes. We mapped these measures according to their contribution to steering and resource mobilisation, improving access and uptake of care, and effective coverage—taking into account key dimensions of quality. This figure only represents a small portion of the analysis that is available in the appendix, which shows a detailed narrative for every case (summarising the available evidence and detailing the inter-linkages between the various measures, their time sequence and their relevance to the outcomes). This information was put in the appendix (pp 1–14) for editorial reasons of space policy. EmONC=emergency obstetric and newborn care. MNH=maternal and newborn health. MOH=ministry of health.
Figure 5: Health systems strengthening measures aimed at improving maternal and newborn health in Indonesia and Cambodia since the late 1980s

(A) Indonesia. (B) Cambodia. Document analysis and expert witness interviews made it possible to identify health-system strengthening measures that can plausibly be linked to improved outcomes.

We mapped these measures according to their contribution to steering and resource mobilisation, improving access and uptake of care, and effective coverage—taking into account key dimensions of quality. This figure only represents a small portion of the analysis that is available in the appendix, which shows a detailed narrative for every case (summarising the available evidence and detailing the inter-linkages between the various measures, their time sequence and their relevance to the outcomes). This information was put in the appendix (pp 1–14) for editorial reasons of space policy.

MOH=ministry of health. DHS=demographic and health survey. MNH=maternal and newborn health. NGO=non-governmental organisation. CSO=civil society organisation.
exemptions, insurance mechanisms, government reimbursement, vouchers, and conditional cash transfers, to, in some instances, a return to free health services (appendix pp 3, 7). Mainly targeted at covering the medical costs for both childbirth and referral, initiatives to cover transport costs have appeared since the 2000s. Cambodia has made explicit attempts to overcome the ubiquitous informal payments to government officials. In the other countries, how the complex equilibrium of financial incentives to public sector staff performance has played out is less clear.

The quality challenge
As of the mid 2000s, these efforts had radically enhanced access and uptake of maternal health care, with midwives taking up a large share of the workload. Concerns about quality of care—about effective coverage as opposed to mere uptake of care—appeared late, well after the countries had started expanding networks and workforces, and reducing financial barriers. Some attention to improve technical standards, competencies, and equipment, has been noted, and death audits and near-miss audits have had an important role in highlighting quality issues. Nevertheless, in the countries studied, the quality maternal and newborn health framework is far from being translated into the practice of midwives and medical personnel. Awareness among managers of maternal and newborn health programmes of the various dimensions of quality is just beginning.

All observers agree that much remains to be done, not just in terms of technical quality but also in terms of coordination of care and referral between peripheral units and hospitals. The organisation of referrals continues to be a sore point, particularly in situations in which the overall coordination of the care network is wanting, such as in Indonesia. Women and families themselves are, however, becoming smarter at overcoming the deficiencies in system integration and coordination, by taking advantage of improved knowledge, communication, and transport to procure access to specialised services when problems occur. The surprisingly low maternal mortality ratio among home births in Morocco and the selective uptake care for complicated cases in public hospitals in Indonesia confirm this trend.

Surveys on the size of the challenge and the progress towards addressing the remaining needs have had a real role in all countries (appendix pp 3, 7, 15). In the 1980s and 1990s, information was used for putting maternal health on the policy agenda and keeping it there. Development partners and agencies had a key role in doing so. Later, there seems to have been a shift towards more detailed analytical work that highlights problems with access and performance. All countries can currently avail themselves of much improved—if still patchy—information that combines regular population surveys with improved routine information systems and specific instruments such as maternal death and near-miss audits.

Policy implications
The experience of the four countries suggests that a strategy for improving maternal and newborn health cannot be reduced to a choice of professional category to be scaled up, but crucially depends on the design and investment in the overall network of service delivery: the way it provides a compromise between proximity and technical resources and creates space for uptake of facility birthing. The deployment of the workforce within this network is a question of managing speed, cost and quality. The four countries documented here have opted for a rapid scale-up of a midwife workforce. Over the next decade the absolute number of births primarily assisted by midwives or auxiliary midwives will increase in all four countries. In sub-Saharan Africa, where contrary to much of the rest of the world the number of pregnancies is set to increase year on year, current trends suggest the workload...
The growth of the workforce will need to accelerate to keep up with this increase. Only if the economic growth of the past decade continues, will Africa be able to afford the workforce expansion required to accelerate coverage and make it more effective.

Both the professional categories of doctors and midwives constitute such an important interface between health services and the population that a dedicated effort to improve quality of care is justified—without the time lag experienced in the past decades between improvement of accessibility and improvement of quality. Managing quality also means addressing two remaining blind-spots.

First, policy makers are only beginning to take the quality dimension of respectful woman-centred care to heart. Things might begin to change: person-centredness and people-centredness is a rapidly growing concern for primary care managers across the world; academic research, the press, and the judiciary system are drawing attention to long existing issues specific to maternal and newborn health.\textsuperscript{22},\textsuperscript{110},\textsuperscript{111} In the rare instances in which these issues were recognised, they have often been dismissed as something that pre-service education would address perfectly adequately. None of the four countries has designed and implemented a systematic approach on a large scale. This absence of systemic approach is worrying, since quality, along with access, is at the core of legitimate expectations and the rights of mothers and their families.

The second blind-spot is that of overmedicalisation. The most obvious is the epidemic of caesarean sections. This epidemic is clearly linked to the ability and willingness to pay, particularly among the richer. The shift from midwife-assisted to doctor-assisted birthing, which is already visible for the higher income groups in Cambodia and Indonesia, is likely to accelerate the trend. The role midwives can have in mitigating the excessive reliance on birthing by caesarean section is unclear, in contexts in which financial incentives are combined with biased risk-perception, supply-induced demand, and the social sense of what is “modern”. Other types of overmedicalisation and iatrogenesis (abuse of anaesthetics, induction drugs, labour augmentation, antibiotics, and others) are poorly documented in the case-study countries, as in most low-income settings. All categories of professionals (doctors, midwives and auxiliary midwives) seem to contribute. The relative role of various professional categories (particularly of doctors versus midwives, auxiliaries, nurse-midwives), of facility ownership (public, private-for-profit, private not-for-profit), and of the interaction between quality standards, working environment and financial considerations remains a largely unexplored area. There is clearly a need for better documentation and intervention research on mitigating of overmedicalisation, specifically of intrapartum care, in midwife-led facilities and in hospital environments.

The four case-study countries currently have high-level political commitment to improvement of maternal and newborn health and to the expansion of the cadre of midwives. With the exception of Indonesia, this phenomenon is relatively recent. In the three other countries the political commitment in the early 1990s was first to a general expansion of the health-care network, with limited visibility of specific commitment to an agenda for maternal newborn and child health and no specific strategy of investment in midwives. Nevertheless, staff from ministries of health and non-governmental organisations in Morocco, Burkina Faso, and Cambodia used the generic drive towards universal access as the vehicle to promote the maternal health agenda. They opted for investment in midwives as matter of expediency in scaling up of the supply of services, and resulted in rapid increase of uptake and coverage.

The absence of political support in these early phases was compensated to some extent by the support of the international community. Later, during the 2000s, the investment in midwives gained political traction: politicians endorsed it publicly and actively, as the maternal health agenda gained visibility and increased access to midwives proved effective and popular (appendix pp 3, 4, 7, 14). This political support gives impetus and continuity to current efforts: failure to provide adequate maternal care is becoming a political liability as civil society becomes more critical and vocal. Civil society’s increased assertiveness exposes both politicians and health authorities to the risk of a backlash if no satisfactory response is given to the quality issues that affect birth ing care. The expectations of the increasingly well informed public are rising: access, without crippling financial barriers, to health-care providers (midwives and doctors) who provide effective, safe, respectful, and compassionate care. The credibility and legitimacy of health authorities, also in low-income and middle-income countries, depends on their will and ability to respond to these expectations, and to do so without the delays that have occurred too often in recent years.

Figure 7: Projected births attended by midwives, auxiliary midwives, and nurse-midwives; by doctors; by traditional birth attendants; and by lay persons or not attended, in 14 Sub-Saharan countries.
Contributors
WVL redesigned the analysis after the first review, provided the health systems framework for the case studies, and wrote the final version of the paper and the case studies. ZM devised the first version of the paper and assisted WVL with the reformulated paper after review. EA participated in the development of the case studies and overall writing and revisions. CA participated in revision discussions and in structuring and finalising the second version. HB was involved in creating a case study that was subsequently dropped and contributed with discussions and comments. JC participated in the initial development meetings, provided comments throughout the process, and collaborated in managing the reference database. AC provided the equity survey data analysis and the projection of births for African countries. LB participated in the initial development meetings, contributed to the case studies, and provided comments throughout writing and revisions. VDB contributed to the reconstruction and interpretation of the sequence of health systems interventions in Burkina Faso and Morocco and in the identification of relevant grey and published documentation. VP participated in the initial development meetings, contributed to the Cambodia and Morocco case studies, and provided comments throughout the process. HF assisted with initial conceptualisations of the paper, writing of the first version, and discussion of the governance and quality of care issues for the final version. MK participated in the initial development meetings, contributed to the Indonesia case study, and to the design and writing of the final version. JL developed the case studies and contributed to the overall writing and revisions. AM contributed to the overall design of the second version of the paper, identification of the relevant publications, grey literature, and documentation for the Morocco case study. SM participated in the initial development meetings, provided comments throughout the process of drafting and revision, and developed a case study that was subsequently dropped. HR contributed to the paper development, and helped to produce data for some tables and figures. FR helped develop the Burkina Faso case study and commented on the overall revisions. TR helped develop the case studies and commented on the overall revisions. PH participated in restructurating the paper after the first submission and finalising the paper. ST was involved in creating case studies that were subsequently dropped and commented on the overall revisions.

Declaration of interests
We declare no competing interests.

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References
Improvement of maternal and newborn health through midwifery

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In the concluding paper of this Series about midwifery, we look at the policy implications from the framework for quality maternal and newborn care, the potential effect of life-saving interventions that fall within the scope of practice of midwives, and the historic sequence of health system changes that made a reduction in maternal mortality possible in countries that have expanded their midwifery workforce. Achievement of better health outcomes for women and newborn infants is possible, but needs improvements in the quality of reproductive, maternal, and newborn care, alongside necessary increases in universal coverage. In this report, we propose three priority research areas and outline how national investment in midwives and in their work environment, education, regulation, and management can improve quality of care. Midwifery and midwives are crucial to the achievement of national and international goals and targets in reproductive, maternal, newborn, and child health; now and beyond 2015.

Introduction

This is the final paper in a Series in which we provide evidence (analyses of systematic reviews, case studies, analysis, and modelling of deaths averted) for the contribution of midwifery to the survival, health, and wellbeing of childbearing women and newborn infants. We present the Series from the perspective of what childbearing women need and want for themselves and their newborn infants—to be healthy, safe, supported, respected, and to give birth to a healthy baby that can thrive. To meet these needs is a crucial element in realisation of the right for all people to have the highest attainable standard of health. In the Series, we discuss the values, philosophy, and health system functionality needed to deliver high-quality maternal and newborn care. The evidence shows that increases in crude-population coverage of services alone do not guarantee high-quality care or a reduction in maternal and newborn morbidity and mortality. Therefore, policies should address improvements in coverage and quality at the same time—both are equally important. This balance is the concept of effective coverage4,5 (the proportion of the population who have need of an intervention and receive that intervention with sufficient quality to be effective, and benefit from it6). Women’s use of midwifery services should be supported, more should be done to meet women’s needs, and improvements should be made in the quality of care received by women and newborn infants. Progress in all three areas is needed to obtain a comprehensive health gain.1

In this paper, after briefly summarising the other three papers in the Series,4,6 we discuss the lessons learned from efforts to improve the coverage and quality of maternal and newborn care and then identify actions that are necessary, urgent, and feasible to improve the health and wellbeing of women, newborn infants, and children. Proactive and substantial changes are needed to make services for maternal and newborn health available and ensure that they are used and of high quality. We highlight research priorities to generate better evidence and suggest practical steps for all countries to move towards people-centred6 and woman-centred6 care, which includes the baby, the family, the partner, and others identified by the woman. In the final part of the article, we discuss how achievement of universal, effective coverage of high-quality maternal and newborn care is of central importance to primary health care and the broader agenda for global health.

Recognising the diversity of care providers across countries, the contributors of the other reports in this Series4–6 examine both midwifery and the people who provide that care (midwives and others). This consideration has allowed an examination of the evidence base that distinguishes between what care is needed, how it is provided, and who should provide it, and thereby it can offer essential information to educators, regulators, health system planners, and decision makers (panel 1).

The article by Van Lerberghe and colleagues3 provides a review of four countries’ efforts (Burkina Faso, Cambodia, Indonesia, and Morocco) over the past three decades to improve maternal and newborn survival and health through investment in midwives and strengthening of other aspects of their health systems. In all these countries, a combination of system changes and initiatives were used to achieve sustained reductions in maternal and newborn mortality. The article shows a recurrent sequence of events, beginning with the expansion of networks of health facilities, then the scaling up of education and deployment of midwives and reductions in financial barriers, and, finally, improvements in quality of care. In every case, access issues (expansion of networks and workforces; reductions in financial barriers) were addressed well before concerns...
Key messages

- Provision of accessible quality midwifery services that are responsive to women’s needs and wants should be part of the design of health-care service delivery and should inform policies related to the composition, development, and distribution of the health workforce in all countries.
- Efforts to scale-up quality maternal and newborn care should include effective measures to identify and tackle systemic barriers to high-quality midwifery—eg, the low status of women, interprofessional rivalries, poor understanding of midwifery care and what it can do, and unregulated private sector maternal and newborn health care.
- To recognise and enable the important contribution of midwifery to improve health in both mothers and newborn infants is important for national, regional, and global health programmes, initiatives, and institutions.
- Midwifery care can lead to positive health outcomes, especially in settings in which midwifery services are valued and respected, community-based, and integrated effectively into a functioning health system.
- Expansion of equitable coverage and improvements in the quality of midwifery care will be challenging for many countries, especially those in which the number of births per year is projected to rise.
- Women and communities should be included in decision making to improve midwifery services.
- Midwifery care can be cost effective, affordable, and sustainable; national governments should invest in deploying midwives and national health plans should have a strategy to scale-up midwifery.
- More investment is needed (by countries and development partners) in relevant research and routine collection of data for quality maternal and newborn care and on the reproductive, maternal, and newborn health workforce.
- The coverage and quality of midwifery care should be monitored regularly and be used to hold stakeholders, including providers and programme managers, accountable.

Panel 1: Definitions used for midwifery and midwives

In this Series, we define the practice of midwifery as: “skilled, knowledgeable and compassionate care for childbearing women, newborn infants and families across the continuum throughout pre-pregnancy, pregnancy, birth, post-partum and the early weeks of life. Core characteristics include optimising normal biological, psychological, social and cultural processes of reproduction and early life, timely prevention and management of complications, consultation with and referral to other services, respecting women’s individual circumstances and views, and working in partnership with women to strengthen women’s own capabilities to care for themselves and their families.”

The International Labour Organisation describes midwives as the primary professional group to provide midwifery. The International Confederation of Midwives defines the midwife, as well as core competencies and standards for education and practice as: “A midwife is a person who has successfully completed a midwifery education programme that is duly recognised in the country where it is located and that is based on the International Confederation of Midwives’ (ICM) Essential Competencies for Basic Midwifery Practice and the framework of the ICM Global Standards for Midwifery Education; who has acquired the requisite qualifications to be registered and/or legally licensed to practise midwifery and use the title midwife; and who demonstrates competency in the practice of midwifery”.

We define reproductive, maternal, and newborn care as the care provided to girls, women, and newborn infants during pre-pregnancy, pregnancy, and birth, the post-partum period, and the postnatal period, and through to the early weeks of life.

become aware of the multiple dimensions of quality— ie, the technical (competencies, equipment), the interpersonal (respectful, responsive, inclusive care), and the organisational (facilities, referral mechanisms).

Using analyses of what women and infants need, and recognising that the midwifery care that women and newborn infants need can be provided by a diverse workforce composed of midwives and others, Renfrew and colleagues define the key aspects of quality maternal and newborn care. These features include: provision of preventive and supportive care and effective treatment for problems when they arise; respect for women and newborn infants and being responsive to their needs, including those for safety, privacy, and dignity; use of interventions only when they are indicated; and strengthening of the capabilities of women to care for themselves and their infants. The contributors propose an evidence-based framework for quality maternal and newborn care, which expands the notion of quality of care from the conventional technical dimensions of what is done, to include how, where, and by whom this care is provided. The framework shows a balance between preventive and supportive care, in addition to elective...
and emergency care, and allows for continuity of both the care and the caregiver from community to facility settings. The report proposes a shift from a system that focuses on identification and treatment of disease and disorders to a system of skilled care for all (figure 1).

The report by Homer and colleagues uses the Lives Saved Tool to model the potential effect of scaling up essential interventions for reproductive, maternal, and newborn health that are within the competencies of the midwife. Findings show that scaling up midwifery could help reduce adverse health outcomes, even in resource-constrained environments, and could be implemented with successful outcomes at any stage of a country’s transition to lower maternal and newborn mortality rates. Policy makers can use this paper as a guide to strengthen the efficiency and effectiveness of their services for reproductive, maternal, and newborn health and to measure how they affect outcomes.

The scope of midwifery practice combines both technical interventions and family planning, providing a substantial return on investment that is enhanced further by appropriate and timely referral to specialist care. In low-resource settings, as an example, the model predicts that, compared with present baseline estimates, and over 15 years, a 10% increase in coverage (every 5 years) of interventions (including family planning) given by midwives would lead to a 27% drop in maternal mortality. A 25% increase from available baseline estimates would lead to a 50% reduction of maternal mortality, and 95% coverage would prevent 82% of maternal deaths. The effect on reductions of stillbirths and newborn infant deaths would be similarly great. In Malawi (which has a population of slightly less than 15 million people and a maternal mortality ratio of 460 per 100 000 livebirths) a 10% increase in coverage every 5 years would reduce maternal deaths from 4500 per year in 2010 to 1200 per year in 2025, fetal deaths would decrease from 27 500 to 7200, and newborn infant deaths would fall from 30 000 to 8000. A list of modelled deaths averted for the 78 countries is available in the online appendix for the paper by Homer and colleagues.

In their paper, they suggest that there is unexploited potential to improve outcomes for women and newborn infants through collaborative practice of health-care professionals working along the continuum of care, provided that there are accessible health services, provisions for communication and transportation, and no financial barriers.

Towards effective coverage of maternal and newborn health care

In many countries, multiple health-care professionals, such as doctors, midwives and nurses, are engaged in services for reproductive, maternal, and newborn health, and supported by auxiliary health staff, and community health workers. To ensure continuity and quality of care, their varied competencies and expertise should be brought together into an interprofessional practice-ready team. Health-care professionals working together with local providers can increase the reach of the health system, thus combining coverage with quality of care. Midwives, provided they are well educated and supported, possess the competencies across the reproductive, maternal and newborn health continuum and are both a connector across and a driving force behind that continuum.

Scaling up the contribution of midwives to the expansion of available reproductive, maternal, and newborn health care is a strategic option of great appeal for policy makers.

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**Figure 1:** The framework for quality maternal and newborn care: maternal and newborn health components of a health system needed by childbearing women and infants, and care providers.

Used from Renfrew and colleagues, the first report in this Series.

www.thelancet.com Published online June 23, 2014 http://dx.doi.org/10.1016/S0140-6736(14)60930-2 3
The effectiveness of midwives is evident in the countries documented in this Series and by modelling of the potential effect of technical interventions that are in midwives’ scope of practice. The health and social effect of scaling up the contribution of midwives would be enhanced further through fuller attention to the other dimensions of the framework for quality maternal and newborn care—and the optimisation of normal processes of reproduction and early life; continuity of care; and competent, caring, and trustworthy care providers.

However, the challenges for implementation of the framework for quality maternal and newborn care are substantial in low-income and middle-income countries with high maternal and newborn mortality, incomplete service delivery networks, and insufficient human resources. Additionally, inefficiencies can occur when midwives and other health cadres are not given the chance to practise to their full competence. Sub-Saharan Africa, where the number of pregnancies and births per year will continue to rise, is of particular concern, in view of the projected deficits in the health workforce to meet increasing demand. According to the medium scenario in UN Population Projections, the number of births will grow from 11 million in 2010 to 16·8 million in 2035. The extent of the challenge is shown by the 14 sub-Saharan countries with high maternal mortality that have available trend data on the midwife-share of assistance at childbirth. In 2009–10, 71 243 midwives and nurse-midwives in these countries attended an average of 42 births per year (3 million in total), resulting in a coverage of 27%. Although this figure is nearly 1 million more than the 2·1 million births attended by midwives in the early 1990s in sub-Saharan Africa, this increase in service provision is not sufficient to keep up with the demographic growth. Improvements in effective coverage while midwives work with this additional workload will not only need an accelerated expansion of the number of full-time equivalent midwives (the workforce stock), but will also need substantial increases in their productivity. No golden standard exists to measure health workforce productivity and determine staffing requirements, but for the purpose of the challenge, we use the number of births per year attended by a midwife (figure 2).

At present levels of productivity, a doubling of the number of midwives by 2035 (a net increase of nearly 3% per year) would achieve only 36% coverage. Coverage of 75% of births in 2035 would require an increase of stock to 299 661 full-time midwives—a net growth of nearly 6% per year. Without an expansion in the number of midwives, productivity would have to increase to an average attendance of 175 births per midwife per year (the current WHO benchmark) to achieve 75% coverage, which could exceed the available working time of a midwife for health service activities, restrict the care provided to attendance in labour and birth, and compromise woman-centred quality care.

In the report State of the World’s Midwifery 2014 new calculations based on data from many countries make it possible to refine staffing requirements in relation to women’s needs for the continuum of maternal and newborn care.

Investment in education alone will not suffice and will have to be combined with investment in regulation, effective human resource management, and the service delivery environment in which future midwives will work, so that they will not only be able to cope with the increased workload, but will also ensure quality clinical and psychosocial care. More evidence is needed to inform effective ways of scaling up the midwifery workforce: education, regulation, in-service training, career progression, deployment, and retention and increasing of the quality, relevance, and productivity of midwives across public, private, and not-for-profit sectors. Three priority research areas are of interest.

First, better evidence is needed about labour mobility—the recruitment, posting, and transfer of staff to remote and underserved areas; how to measure and improve staff deployment and retention; and how to ensure that the net increase in the number of midwives matches increases in demand in rural and urban areas. New thinking on posting and transfer is emerging and WHO guidelines are available for recruitment and retention of health workers in rural and remote areas. New technologies allow for the identification of subnational geographical differences in the supply of and demand for maternal and newborn health services; information that is essential to identify and address inequities in access to these services. Disaggregated, locally driven data are also important to inform appropriate strategies for labour mobility and effective coverage.

Second, a better appreciation of productivity is needed. Assessment, understanding of, and improvements in productivity is an area of increased interest that is partly based on health labour market studies and new initiatives for results-based or performance-based financing but is also associated with discrepancies between health-care providers’ knowledge, behaviours, and skills (competence); what they personally can or cannot do (capacity); and what they ultimately do (performance). A deeper understanding is needed of the productivity of the midwifery workforce, maternity units, and the models of practice, such as midwifery led care and collaboration with traditional birth attendants and community health workers that can drive gains in efficiency in low-income and middle-income countries. However, any work in this area must be careful not to lose sight of the essential need to prioritise delivery of quality of care over simple economics.

The 2005 WHO benchmark of attendance of 175 births per midwife per year is a frequently used productivity benchmark for workforce planning and projections. However, this figure, which is well above the current...
average of 42 in sub-Saharan Africa, needs to be refined to allow for greater sensitivity in subnational settings and contexts so that future guidance can propose a range of estimates that meet women’s needs throughout pre-pregnancy, pregnancy, birth, and post-partum and postnatal care, in remote, rural, peri-urban, and urban areas. Also needed is a set of effective implementation strategies that both enhance productivity and are compatible with the framework for quality maternal and newborn care for health services provided by teams in facilities and close to the community.

Third, rising demand in a tight labour market is likely to accelerate the commercialisation of childbirth. The rapid growth of private sector for-profit maternity services, insufficient regulatory mechanisms, and informal fee-for-service payments are examples of policies and practices that lead to overmedicalisation. To address the social and economic mechanisms underlying the commercialisation of childbirth has not been at the top of the agenda for maternal and newborn health research, policy, and practice development over the past three decades. The development of adequate strategies to manage increasing commercialisation needs a better understanding for emerging trends and feasible options that will mitigate the adverse effects of commercialisation and tackle the resulting inequalities.

**Improvement of the quality of maternal and newborn health care**

Over the past decade, the primary health-care movement has fully recognised the importance of people-centred care, whereas within maternal and newborn health, the main focus has been on life-saving interventions and increases in coverage. This difference has led to the quality agenda for maternal and newborn health only now starting to emerge. Attention to quality of care has been shown in documentation about the sometimes difficult relationship between care providers and women, which can result in disrespect, abuse, and abandonment of care. But these situations are often symptoms of deeper health system problems, rather than simple measures of poor quality, and their documentation has not led to coherent political strategies to address these issues. In high-income countries, quality of care often focuses on informed choice without addressing the other aspects of the framework for quality maternal and newborn care, resulting in a focus on relatively quick-fix technical solutions while little attention is paid to the more difficult longer-term building of systems that include preventive care and that with care users and communities. The framework for quality maternal and newborn care provides evidence-based guidance to help to adjust education and regulation of practice are important components to make that environment possible, but it is also important to create partnership and dialogue between care providers and with care users and communities. The framework for quality maternal and newborn care provides evidence-based guidance to help to adjust education and regulation to the needs of such a collaborative environment.

To deliver high-quality care, health professionals and policy makers need to create an environment in which the 72 effective midwifery interventions identified in this Series can be implemented consistently with the woman-centred values and philosophy outlined in the framework for quality maternal and newborn care. Midwifery productivity is identified as births attended per midwife per year. At present, there are an average of 42 births per midwife per year in sub-Saharan Africa.

**Figure 2: Projected number of midwives needed to achieve specified coverage levels by 2035 in 14 sub-Saharan countries made under various assumptions of midwifery productivity**

The countries included are Benin, Côte d’Ivoire, Ghana, Kenya, Madagascar, Malawi, Mali, Namibia, Niger, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. Midwifery productivity is identified as births attended per midwife per year. At present, there are an average of 42 births per midwife per year in sub-Saharan Africa.
and childbirth are slowly moving from a normal life event to a medicalised intervention. As in many high-income countries, care is also becoming more medicalised, resulting in similar shortcomings in quality. Experience from some high-income and middle-income countries, as discussed in other papers in this Series,7 shows the importance of using a framework such as the framework for quality maternal and newborn care to strengthen the quality of services and service providers and to ensure that all aspects of quality care are monitored and addressed.

In low-income and middle-income countries, there are signs of increasing user expectations for high-quality, safe care during pregnancy and childbirth. Individual and community drivers (eg, expectation of high-quality care, experience at facilities by other members of the community, absence of equipment and drugs, and a bad reputation for interpersonal relations) are strong influences on people’s decisions about choice of birthing facility, with patients bypassing nearby facilities in favour of those with a better reputation further away. A recent study showed that the quality of care in bypassed clinics was indeed worse.4 This finding led to suggestions that it would be more efficient to invest in making birthing services available at a level at which quality care can be provided, rather than to provide care unconditionally at community level.4d

Countries across a wide geographical and income range have reduced maternal and newborn mortality by offering more effective services. Several countries have tackled the entrenched financial and health system barriers to midwifery services and attempted to solve fragmentation of the scope of midwifery among different cadres, but most countries are still contending with ineffective policy environments for quality maternal and newborn care, the low status of women,4e–4g and the domination of midwifery by medicine.4h–4j Countries are showing a trend towards increased service provision by doctors, which, in some countries, has led to a significant reduction in the number of practising midwives4k and increased medicalisation of pregnancy and childbirth.

Professional education is core to increases in the quality and coverage of quality maternal and newborn care.23 WHO guidelines24 on transformative education targeted to low-income and middle-income countries, emphasise that both pre-service and in-service health professional education must increase the quantity, quality, and relevance of future providers for them to meet the needs and expectations for population health. New ideas and avenues need to be explored to produce a workforce that is fit for purpose24 and regulated to enable their full scope of practice to contribute to the effective delivery of quality maternal and newborn care.

**What midwifery can contribute to effective coverage and person-centred agendas**

Midwives, when working to the framework for quality maternal and newborn care and within an enabled environment, have the potential to bring care close to women and communities and tailor it to their social and cultural needs. As this Series shows, midwives can optimise the normal processes of reproduction and the early years of life, and still ensure the identification and management of complications before they become life threatening and to refer women when necessary. Results from the reviews of systematic reviews done in this Series show that midwifery, as defined in this Series, can result in a decrease in maternal and newborn mortality, stillbirths, perineal trauma, instrumental births, intrapartum anaesthesia, severe blood loss, preterm births, newborn

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**Panel 2: Pragmatic actions to improve the coverage and quality of maternal and newborn care through midwifery.**

- Regularly discuss and refocus the package of care and the quality (technical capacities, interpersonal relationship capacities, and ability of health systems to create the enabling environment) that reproductive, maternal, and neonatal health teams provide using the framework for quality maternal and newborn care.
- Involve women, families, and communities in the design and delivery of quality maternal and newborn care.
- Ensure that education covers all the elements of the framework for quality maternal and newborn care and is taught to all providers of reproductive, maternal, and neonatal health care. Ensure that there is a balance between theory and practice so that midwives can be fully functional in all contexts as soon as they graduate. Ensure effective interdisciplinary education at all stages (pre-service and in-service), which is likely to result in a stronger integrated team for quality maternal and newborn care, decrease professional silos, and improve collaboration along the continuum of care.
- Use the framework for quality maternal and newborn care and its evidence base to identify, analyse, and solve problems in service provision and to strengthen regulation and legal frameworks used across reproductive, maternal, and neonatal health teams that promote and support collaborative practice and accountability.
- Undertake regular midwifery workforce assessments and reorganise the health system so as to ensure available, accessible, acceptable, and good-quality maternal and neonatal health services.
- Make the necessary health system and regulatory changes for midwives to work to their full capacity and to carry out all the basic emergency obstetric and newborn care functions as close to women as possible without compromising the quality of care. Those functions include prescription authority for essential medicines.
- Ensure that midwives have effective back-up when needed and that they are part of a collaborative team of health-care professionals to provide the continuum of care along the reproductive life cycle and from home to hospital. Midwife-led units that work closely with communities and community health workers are an effective mechanism to bring health systems closer to people.
- Secure a fully enabled environment, including functioning facilities and equipment, effective communication, and transportation for women and newborn infants in need, in addition to an efficient recruitment and retention of staff, an appropriate living wage, supportive supervision, and professional and career development opportunities.
- Test and develop the effectiveness of reproductive, maternal, and newborn health services with use of indicators such as rates of intrapartum stillbirth, early neonatal mortality, and maternal death surveillance and response mechanisms to monitor the quality of care and to guide and measure progress.
infants with a low birthweight, admissions to neonatal intensive care units, and hypothermia. The analyses also reported that midwifery can result in increases in spontaneous onset of labour, numbers of unassisted vaginal births, and incidence and prevalence of breastfeeding. Importantly, women reported a higher rate of satisfaction with care in general, particularly with pain relief. Panel 2 presents some essential actions in the areas of education, regulation and team development that can be initiated immediately to increase women's access to midwifery services and quality maternal and newborn care.

Evidence has been established for the potential gains for quality care being given closer to women and communities. New approaches to identify students from rural locations will enable this goal, and it will be key for communities. Evans reviewed the community-based midwifery diploma programme in Bangladesh and showed that a hub-and-spoke model of midwifery education reduced the cost per midwifery student per year to a third of the cost of traditional education models. The return on investment predicted from the deployment of additional midwives in rural communities in which maternal and newborn health needs are greatest includes increases in the number of lives saved, decreases in morbidity, and reductions in the number of caesarean sections. The assessment identifies the return on investment from the education and deployment of community-based midwives as similar to the cost per death averted by vaccination—known in public health as one of the most cost-effective ways to save lives.

High-quality maternal and newborn care: a global health priority
People-centred care that recognises people’s legitimate right to and expectations for equitable, high-quality, safe, and respectful care should be a global health priority and be put at the heart of the movement to improve maternal and newborn care. Midwifery is a vital solution to the challenges of providing high-quality maternal and newborn care for all women and newborn infants, in all countries. Improvements in availability, accessibility, acceptability, and quality of midwifery services, within a functioning health system that is responsive to women’s needs and requirements, is crucial not only to accelerate efforts to attain the Millennium Development Goals (MDGs) by 2015, but also to the development of the post-2015 agenda’s goals and targets, in which emphasis on reduction in maternal and newborn morbidity should be even stronger than it has been in the past.

Available guidelines and global initiatives for stillbirths, family planning, maternal, newborn, child, and adolescent health, HIV/AIDS, and non-communicable diseases are opportunities to promote the widespread adoption of the framework for quality maternal and newborn care proposed in this Series. This approach to midwifery is an effective solution to enable the achievement of these ambitious targets. Countries urgently need to put policies in place that allow for its implementation (table).

The health workforce has long been recognised as crucial to improvements in health outcomes. The 2013 report A Universal Truth: No Health Without a Workforce re-emphasised this notion. Unfortunately,

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<th>Target year</th>
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<td>Stillbirths (2011)</td>
<td>2020 For countries with a stillbirth rate of more than five per 1000 births, reduce stillbirth rates by at least 50% from 2008 rates; for countries with a stillbirth rate of less than five per 1000 births, eliminate all preventable stillbirths and close equity gaps</td>
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<td>Preventing early pregnancy and poor reproductive outcomes among adolescents in developing countries (2011)</td>
<td>- To improve adolescent morbidity and mortality by reducing the chances of early pregnancy and its resulting poor health outcomes: Reduce pregnancy before age 20 years Increase use of contraception by adolescents at risk of unintended pregnancy Reduce unsafe abortion in adolescents Increase use of skilled antenatal, childbirth, and postnatal care in adolescents</td>
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<tr>
<td>Global Plan Towards the Elimination of New HIV Infections Among Children by 2015 and Keeping Their Mothers Alive (2011)</td>
<td>2015 Estimated number of new HIV infections in children reduced by at least 85% in each of the 22 priority countries; estimated number of HIV-associated pregnancy-related deaths reduced by 50%</td>
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<td>Family Planning 2020 (2012)</td>
<td>2020 To make available affordable lifesaving contraceptive information, services, and supplies to an additional 120 million women and girls in the world’s poorest countries by 2020</td>
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<td>A Promise Renewed (2012)</td>
<td>2035 All countries to lower child mortality rates to 20 or fewer deaths per 1000 livebirths by 2035</td>
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<tr>
<td>Ending Preventable Maternal Mortality (2012)</td>
<td>2030 Proposal at consultation: to reduce maternal mortality ratios to less than 70 deaths per 100 000 livebirths by 2030</td>
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<tr>
<td>Every Newborn Action Plan (2014)</td>
<td>2035 Proposal at consultation: to reduce neonatal deaths to less than 10 deaths per 1000 livebirths and to reduce stillbirths to less than 10 per 1000 total births, by 2035, with interim targets for 2020</td>
</tr>
<tr>
<td>Framework of Actions for the follow-up to the Programme of Action of the International Conference on Population and Development Beyond 2014 (2014)</td>
<td>- States should remove legal, regulatory, and policy barriers to sexual and reproductive health services for adolescents, and ensure information and access to contraceptive technologies, prevention, diagnosis, and treatment for sexually transmitted infections and HIV, including the human papilloma virus vaccine, and referrals to other health concerns such as mental health problems</td>
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Table: Guidelines and global actions and targets in reproductive, maternal, newborn, child, and adolescent health
progress made in the midwifery workforce has not been sufficient in the almost 30 years of the Safe Motherhood and Making Pregnancy Safer initiatives to enable the attainment of MDG 4 and MDG 5 in all countries by 2015. Horton\textsuperscript{64} argues that the lack of a skilled health workforce is failing women badly, and that this failure is now the biggest obstacle to improvements in women’s and children’s health. The independent Expert Review Group on Information and Accountability for Women’s and Children’s Health\textsuperscript{65} calls for quality of care to be a route to equity and dignity for women and children and to make health-care professionals that serve women and children with measurable effect count. Langer and colleagues,\textsuperscript{71} in A Manifesto for Maternal Health Post 2015, call for “universal access...to properly trained health individuals, especially midwives and those providing midwifery services”. The global consultation for the Every Newborn Action Plan\textsuperscript{66} includes several calls to strengthen the role of the midwife.

The Lancet Commission on investing in health\textsuperscript{72} shows that the return on investment in health is large, and that, with the technical and financial capacities available worldwide, it is possible to lower mortality rates to the levels of the best performing middle-income countries by 2035. This grand convergence can be achieved through a focus on infections; reproductive, maternal, newborn, and child health; and non-communicable diseases with targeted approaches not only in low-income countries, but also in lower-income and rural subpopulations of middle-income countries. Similarly, WHO, World Bank,\textsuperscript{73} and WHO Consultative Group on Equity and Universal Health Coverage\textsuperscript{74} identify reproductive, maternal, newborn, and child health; non-communicable diseases; and injuries as areas that will support the achievement and measurement of progress towards universal health coverage. Each of these forward-looking perspectives focuses on equity and improvements in the effective coverage of reproductive, maternal, and newborn health services, especially in the crucial period around pregnancy, childbirth, and the early weeks of life.\textsuperscript{75} These are further justifications that investment in midwifery is an effective solution to attain MDG 4 and MDG 5 and the new global targets, provide a basis for primary health care and universal health coverage, achieve the grand convergence in global health by 2035, and deliver on women’s rights to sexual and reproductive health.\textsuperscript{44}

Conclusion
As the 2015 target date for the MDGs draws near, and attention turns to the post-2015 sustainable development agenda,\textsuperscript{26–29} this Series comes at an opportune moment to support the move towards universal coverage of high-quality maternal and newborn care. As shown by the estimates of lives saved through increases in coverage of the midwifery package of care\textsuperscript{4} and the experiences of a few exemplary low-income and middle-income countries that have invested in midwives,\textsuperscript{2} use of the framework for quality maternal and newborn care is a means to good health and improved social outcomes for women, men, and children.

The momentum is tangible. Reproductive, maternal, and newborn health are global health priorities. Economic growth in Africa and southeast Asia creates opportunities for change, which could make greater the return on investment in quality maternal and newborn health care. However, many of the commitments that have been made to Every Woman Every Child by countries and development partners still only relate to provision of medical interventions for life-threatening complications. But essential medical interventions only cover a fraction of the needs of women and their families and miss the opportunity to prevent the occurrence of such life-threatening situations. The midwifery package of support and care is an efficient and effective way to optimise normal reproductive processes, improve health and psychosocial outcomes, and strengthen the capabilities of women and their communities in all countries.

The high-quality maternal and newborn care described in this Series should be at the heart of all subnational, national, regional, and global efforts to improve women’s and children’s health and wellbeing, and it needs a core position within the post 2015 agenda. The knowledge and methods are available to achieve quality maternal and newborn care. Political will and commitment are increasing, women’s and families’ voices are growing louder, and economic growth and education for girls are on the rise. The opportunity to transform health, education, and social systems and to make maternal, newborn, and child health a reality for all, is here.

Contributors
PH-B prepared the first draft. All co-authors, except WVL and VF, contributed sections to that draft and reviewed the paper. PH-B, WVL, and JC further developed the second draft. All co-authors contributed to the further development, revision, and finalisation of the paper. All authors approved the final version.

Declaration of interests
We declare no competing interests.

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