Introduction

During the 1990s, more than 4 million neonatal deaths worldwide each year were hardly mentioned in global health circles, and newborn care was perceived as technical, expensive, and deficient in cost-effective solutions feasible for low-income countries.\(^1\)\(^-\)\(^3\) It was widely assumed that investment in newborn health should wait until countries had greater wealth and more functional health systems. These myths were challenged in 1999, when Abhay Bang published results\(^4\) from rural India showing that a home-based package of maternal and newborn health interventions delivered by community health workers (CHWs) could reduce neonatal mortality by 62%. In 2000, the Bill & Melinda Gates Foundation funded Save the Children’s Saving Newborn Lives initiative to develop evidence, policy, and programmes to improve global newborn survival. The Lancet Child Survival Series in 2003\(^5\) catalysed rethinking of the global child-health agenda, and noted the important burden of newborn deaths, but at the time details were insufficient on neonatal causes of death, interventions (especially at community level), and how to deliver newborn care at scale in low-resource settings.\(^6\)\(^-\)\(^8\)

In 2005, the Lancet Neonatal Survival Series sought to accelerate action by describing the timing, causes, and location of neonatal deaths;\(^9\)\(^-\)\(^11\) identifying highly cost-effective interventions that could avert more than two-thirds of neonatal deaths, including about a third through community care;\(^12\)\(^-\)\(^14\) and outlining how these solutions can be delivered by integration and scaling up at both facility and community levels\(^15\) for an estimated additional cost of US$1 per person, of which about 70% would also benefit mothers and older children.\(^16\) A “new category of vulnerable persons that did not exist in the minds of many global health actors”\(^17\) received widespread attention for the first time, driven especially by the recognition that Millennium Development Goal (MDG) 4 for child survival could not be achieved without increased attention to newborn health.\(^18\) An ambitious call was made for ownership of newborn health outcomes across the continuum of care for reproductive, maternal, newborn, and child health and nutrition (RMNCH) for women and children, and linking community, outreach, and facility care. 1 year later progress seemed promising,\(^19\) but in 2013, the independent Expert Review Group of the UN Secretary General’s Every Woman Every Child movement highlighted that neonatal deaths still need more attention, and they account for an increasing proportion (now 44%) of deaths of children younger than 5 years.\(^20\)\(^-\)\(^23\)

This paper is the first in a five-part Series on newborn health and survival and stillbirths\(^24\)\(^-\)\(^28\) in which we analyse the extent to which the 2005 call to action in the Lancet was acted on, in the broader context of changes in global health (panel I). We acknowledge that measurement of effects on policy and practice is complex,\(^29\)\(^-\)\(^31\) and do not seek to attribute changes to the Lancet Neonatal Survival Series; rather, we aim to assess what has changed and, if something has not, then why not, as a basis for accelerating progress for every newborn baby (figure I).
Assessment of changes and challenges

Agenda setting

We rate agenda setting for newborn health (figure 1) overall as "green", indicating major advances (figure 2, appendix). This shows the rapidity with which evidence has been generated and disseminated. As noted by Shiffman,12 “Researchers produced reviews of evidence that summarised successful strategies for newborn care

Key messages

Change during the past decade

- Agenda setting for newborn health has advanced remarkably, fuelled by effective evidence generation and driven partly by a relatively small group of technically oriented newborn-health champions. Newborn health is now widely recognised as a crucial element of the reproductive, maternal, newborn, and child health and nutrition (RMNCH) continuum of care that needs more systematic attention, and political mobilisation in countries is growing.
- Advances have been notable for burden of disease measurement and evidence for interventions for the three main causes of newborn deaths—preterm birth, intrapartum-related deaths, and infections—and, more recently, for stillbirths. Evidence is scarce, however, on prevention of preterm birth, and stillbirths remain silent on the global agenda.
- Policy formulation and adoption has been relatively rapid at global level and in some countries. Country commitments, plans, and budgets are variable and poorly tracked. Coalition building for wider ownership and integration of newborn health is now needed.
- Where progress in countries has occurred, it has been enabled by strong leadership and partnerships, use of data and locally generated and adapted evidence to inform policy and programme design and implementation, and linking of community and facility-based care, bringing life-saving newborn care interventions closer to communities and engaging and equipping front-line health-care workers.

Challenges to address

- The newborn health movement aimed to promote a comprehensive, context-specific approach, with facility and community newborn care integrated in RMNCH programmes, but this has been in a context of single-issue global health investment; newborn health has only recently started to connect with global initiatives and funders.
- Partnerships across the RMNCH continuum of care are fragmented and oriented toward single-issue advocacy and funding, and newborn survival has not been among the main issues. Links with maternal health, family planning, child health, and nutrition are particularly crucial, and countries successful in reduction of neonatal mortality rate have had alliances with some of these specialties—most commonly maternal health.
- Low investment by donors and limitations in technical capabilities and capacity in many countries, absence of prioritisation among newborn health interventions, and the belief that improved maternal care or child care would trickle down to newborn care has hampered progress; countries with rapid neonatal mortality rate (NMR) change added specific care for small and ill newborn babies.
- Leadership for newborn health is poor. In high-income countries a new professional group (neonatologists) took the lead, but this cadre of health work does not exist in most areas of the world. Clinical cadres are not clear on who is responsible for newborn care (assessing all newborn babies, managing small and ill babies, and counselling the mother and family).
- Coordination of partners has been poor in provision of technical assistance and funding in countries, and Ministries of Health typically do not have designated programme managers with clear responsibility or expertise in newborn health.
- Quality of care at facilities is a key missed opportunity, and also necessitates better linkages with communities.
- Metrics and data for coverage of interventions and programme implementation, as well as accountability are limited and often poor.
- In high-income and middle-income countries, parent voices and professional groups (especially neonatologists) have pushed the agenda for newborn health and stillbirths. In low-income countries, parents—especially women—do not have powerful voices, and professionals might not speak up for newborn care.

Opportunities

- Strong consensus exists that the burden of neonatal mortality (44% of under-5 deaths), plus stillbirths and neonatal morbidity or disability is substantial, and improvement of child survival will depend on greater investment in newborn survival. Rapid progress is possible in view of highly cost-effective interventions that can be delivered through facility and community platforms.
- The Every Newborn Action Plan is the best opportunity yet to reach a high level of leadership and investment, with clear priorities, and improved stakeholder coordination with countries, tracking data and accountability at all levels. To succeed it must:
  - Set goals that are part of the post-2015 framework
  - Intensify political attention and leadership, including supporting women, families, and communities to speak up for their newborn babies and shifting from social norms that accept these deaths as inevitable
  - Invest for impact as well as harmonise funding channels and technical assistance
  - Implement at scale, with particular attention to increasing health worker numbers and skills, and quality care for newborn babies, as well as mothers and children
  - Innovate and undertake context-specific research
  - Evaluate and track coverage of priority interventions and have clear indicators and accountability to accelerate progress and reach the poorest.
Figure 1: Policy process heuristic used to frame assessment of changes and challenges for newborn survival

Panel 1: Policy analysis

We synthesise learning and progress in global newborn health and survival and for stillbirths during the past decade across five categories adapted from a policy process heuristic.\(^{15,20}\) agenda setting, policy formulation and adoption, leadership and partnerships, implementation, and evaluation (defined in figure 1).

Our theory of change includes these five components (figure 1), and posits that evidence and issue-attention stimulate policy formulation and adoption, that advocacy and leadership alongside country commitment and domestic funding drive programming, resulting in increases in coverage of interventions and, ultimately, reductions in neonatal mortality. Leadership and partnership is not a phase in the policy process but a support to all phases; technical assistance and funding from global partners might also contribute to these processes. In reality, it is well recognised that policy progress is rarely linear, and many changes might occur at once, because a particular input might often address more than one element in the process of change. Inadequate assessment leads to missed opportunities to accelerate progress all along the path to effect.

To enable our assessment of progress against the 2005 call for action,\(^ {1,2}\) we created a method to enable our assessment of progress against the 2005 call for action,\(^ {1,2}\) we created a method for assessment of actions in newborn health across the five categories (appendix). We grouped the calls to action according to these categories and summarised progress in a scorecard (figure 2).

The quality, frequency, and visibility of data for newborn health have improved notably (appendix).\(^ {22}\) A decade ago, the frequency with which country-level neonatal mortality estimates were published was erratic and, in many cases, limited in a particular country to only one timepoint.\(^ {6,9}\) Neonatal mortality trend estimates are now produced annually by more than one group.\(^ {13,23–26}\) Neonatal health is represented in the Global Burden of Disease study (although stillbirths are missing),\(^ {27}\) and data inputs and methods are well described in peer-reviewed journals and in the public domain, enabling use of estimates for decision making.\(^ {28–31}\)

Substantial increases have occurred in absolute numbers and proportions of publication search terms that mention newborn (11.4% in 1990–95 to 22.0% in 2006–10) and stillbirth (16.8% to 26.1%), and are set in low-income and middle-income countries (appendix). However, few publications address stillbirths (0.04 ratio of stillbirth:newborn) and, because all publications related to human health are continuing to increase, the proportions that mention newborns (4.5%) or stillbirths (0.2%) have not changed. Preterm birth—the biggest cause of newborn deaths and the second biggest cause of death in children younger than 5 years—has gained wider attention (panel 2).\(^ {32,39}\) Stillbirths are woefully neglected in research, advocacy, policy, and programme action, despite the case presented in the *Lancet* Stillbirths Series.\(^ {42,43}\) The estimated 1–2 million intrapartum stillbirths are the largest burden for deaths at birth,\(^ {4,6}\) and this rate might be the most sensitive indicator of quality of a country’s health system.\(^ {22,40}\) Analyses of neurodevelopmental impairments and disabilities after neonatal insults emphasise the importance of improvement of measurement and follow-up systems, especially when neonatal intensive care is being scaled up.\(^ {8}\)

Several journal supplements and *Lancet* Series summarise evidence on the burden, interventions, and approaches to scaling up solutions for stillbirths,\(^ {27,42–44}\) intrapartum-related deaths (birth asphyxia),\(^ {41}\) and preterm birth.\(^ {27,44–46}\) Influential reports have helped policies to gain momentum, achieve media coverage, and draw attention to these issues.\(^ {21,5,48}\) Evidence has emerged for the efficacy of several interventions—eg, kangaroo mother care, chlorhexidine cord cleansing, topical emollient therapy—and four commodities for newborn health have been prioritised by the UN Commission on Life Saving Commodities (appendix).

More than a dozen large randomised controlled trials have examined the effectiveness of community-based care, including home visits for maternal and newborn care, women’s groups,\(^ {59}\) and community
Agenda setting
Generation of evidence and epidemiological data, problem identification, issue-attention, and political prioritisation:
“Invest in health-systems research advancing how to reach the poor, as well as new research into postnatal care, stillbirth, and not-fatal outcomes around time of birth”

Policy formulation and adoption
Exploration of courses of action, leading to global and country policies:
“At national level: by the end of 2007, produce and publish a plan of action (with defined targets and timelines) to reach neonatal survival targets to be implemented within maternal health and child survival programs. This plan should be based on situation analyses, including a defined baseline NMR, be evidence-based, and specify strategies to reach the poorest families”

Leadership and partnerships
Role of leadership and partnerships in setting a course of action supported by advocacy and leading to implementation:
“Promote partner and donor convergence at country level as promoted by the Partnership for Maternal, Newborn, and Child Health (PMNCH), to increase efficiency and reduce reporting load on national governments”

Implementation
Putting policies into practice, based on domestic and donor investments, country commitments and programmatic inputs:
“Finance implementation of the plan by identification and mobilisation of internal resources, and by seeking external support when necessary
“Find the resources to meet additional needs identified, to achieve high coverage of interventions” “Implement plan (with defined targets and timelines)”

Evaluation
Of changes in intervention coverage and newborn survival and stillbirths:
“Monitor progress and publish results regularly” “Include neonatal mortality rate as an indicator for MDG4, with a target of 50% reduction between 2000 and 2015”

Non-research donor disbursements mentioning newborn search terms increased from US$52 million in 2003, to US$121 million in 2010, about 30% of MNCH donor funding. 4% of child health investments go to newborn health, despite 44% of under-5 deaths occurring in the newborn period. The words “stillbirth” or “foetal” are absent from donor funding databases. UN Commission on Life-saving Commodities has included newborn health commodities. Lessons from implementation corroborate the four-step framework for scaling-up of newborn health proposed in 2005, and the policy process heuristic. Key factors for success in scaling-up effect in newborn health include:
1) Strong national leadership, especially partnerships of organisations central to health-care delivery at scale
2) Use of data and locally generated and adapted evidence to inform policy and programme design and implementation
3) Linking of community with high-quality facility-based care, building on national cadres of CHWs
4) Availability of life-saving newborn health commodities
5) Appointment of a national newborn health-specific programme manager with clear accountability for newborn health and survival Addressing of barriers to care seeking for newborn infants, improvement of quality of care at all levels (including health facilities), and clear definition of clinical roles and responsibilities in newborn care are essential for further advances in neonatal mortality reduction.

Mortality is now reported annually by UN-IGME and IHME. From 2000-10, post-neonatal child mortality during months 1-59 of age decreased at a rate of 4.5% per year, whereas neonatal mortality was reduced by only 2.8% per year; thus, the proportion of under-5 deaths in the neonatal period increased from 36% in 2000 to 44% in 2012, and is >50% in five developing regions. Since 2000, NMR decreased by >50% in 13 countries and by 25-50% in 102 countries. Coverage data are available and tracked for only five of 16 Lancet Neonatal Survival Series interventions. iERG reports on 11 indicators (including NMR as a % of U5MR), tracked annually by Countdown to 2015. Postnatal care data are available for 38 countries, with 17 countries now reporting postnatal care for newborns. Skilled birth attendance has increased, mostly in countries with NMR >15, indicating that improvements are reaching settings where the need is greatest. Tetanus has been eliminated from 25 countries (as of May 2013), and coverage of intermittent preventive treatment of malaria in pregnancy has increased. Quality-of-care indicators are poor; Vital registration and HSMs in high-burden countries are weak. Data on stillbirths are still not routinely collated by the UN

processes for integration of newborn health care into low-income health systems is limited. Similarly, the research gap into understanding of solution pathways for preterm birth—eg, the biological basis of term and preterm labour and invention of new ways to prevent preterm birth—needs to be bridged.11

Policy formulation and adoption

Our overall scorecard assessment of progress is “yellow” for partial progress (figure 2, appendix), with substantial variability across countries. Since 2005, newborn survival has attained increased policy visibility. Maternal, newborn, and child health (MNCH) has become everyday parlance in the public health community, replacing “maternal and child health” and indicating the expectation that care for mothers and children will include newborn health interventions.12 Several important policy changes and programmatic shifts have occurred during a relatively brief period (appendix), such as global guidance from WHO and UNICEF on content and timing of postnatal home visits for newborn care in 2009, and recommendations for implementation of women’s groups.12

In 2005, a major call to action was for countries to do situation analyses and develop national plans of action, with defined neonatal mortality reduction targets and timelines, to be implemented within maternal health and child survival programmes (appendix). 13 high-burden countries, six since 2007, have produced national newborn situation analyses (appendix). Among these 13 countries, 11 have national health plans that mention “newborn” or “neonatal” (plans for the other two could not be accessed), six mention “stillbirth” or “fetus” (appendix), and nine have targets for reduction of neonatal mortality, with timelines (appendix). The Countdown to 2015 profiles suggest that 40 Countdown countries have developed costed implementation plans for maternal, newborn, and child health,13 although we have not verified whether these plans specifically address newborn health, and donor response to these plans has been poorly coordinated (appendix). After WHO and UNICEF issued the Joint Statement on Home Visits for the Newborn Child,12 all countries in south Asia and most in Africa reportedly began implementing home-visit packages for women and newborn babies, and most included postnatal family planning.14 Countdown found, in 2012, that 30 countries had a policy recommending early postnatal home visits to mother and baby within the first week of life, and CHWs were authorised to do postnatal home visits in the first week of life in 18 countries.

Although the evidence base for interventions and packages was presented in 2005, the call for a comprehensive, integrated approach might have been an impediment for countries with poor technical capabilities in newborn health. In 2005, at least 20 African governments approached WHO for technical assistance in addressing newborn health, and from 2006–08, WHO led a series of African regional workshops on integration of newborn health into existing maternal and child health platforms.15,16 Countries that adopted newborn health policies had strong local leadership and consistent convening mechanisms supported by ongoing technical and funding inputs.13

Policies have tended to be heavily focused on the public sector even though an increasing proportion of families are delivering babies and seeking treatment in the private sector, especially in Asia.17 After the 2005 series, development partners were promoting, and countries were demanding, support for community-based newborn

Panel 2: Born Too Soon and World Prematurity Day—collective power of parents, professionals, and politicians

Although preterm birth is well recognised in high-income countries as the most common cause of deaths and disability in children, global health circles rarely note that this is the second most common cause of death for children worldwide, and should be a major global issue. In 2012, the combination of new data, a policy-relevant and programme-relevant report, and parent power with media coverage led to major global issue-attention.

The first national estimates of preterm birth undertaken by WHO and published in The Lancet33 drew attention to the fact that 15 million babies are born preterm every year—not 11% of all births. Born Too Soon: the global action report on preterm birth delineated evidence-based solutions, especially for the care of preterm babies, feasible even in low-income settings.32,34 The report involved more than 100 experts from more than 50 international, regional, and national organisations, showing collective action by the global reproductive, maternal, newborn, and child health and nutrition (RMNCH) community and with high-level leadership given in a foreword by the UN Secretary General. The report achieved major media coverage, reaching an audience of more than 1 billion through traditional and social media.34 In 2012, World Prematurity Day was accompanied by events with parliamentarians, health professionals, and parents in more than 60 countries.35 In 2013, World Prematurity Day reached an estimated 1.5 billion people through a global media release of new preterm data, television coverage, and coordinated Facebook and Twitter campaigns.36 This momentum led to the development of the Every Newborn Action Plan.21,37 Strategies that worked to raise attention included repeated and refreshed messaging with new data, leveraging of partner networks at global and regional level, promotion of cooperation not competition between partners, and agreeing on common messaging, timing, and branding, including freely available planning methods with new national data.36 These methods built on learning from HIV/AIDS activism, and also on what worked and did not work in the 2005 Lancet Neonatal Survival Series.38

The voices and actions of parents and people affected by preterm birth were the most vocal agents for change, as in the AIDS movement. Thousands of people shared personal stories on the World Prematurity Day Facebook page, millions of people engaged in Twitter discussions, and many blogs were written and videos and photos shared. Increasingly, parents are organising among themselves to raise awareness, petition governments for policy changes, and call for improved quality of facility health professional training and public education on care for premature babies.39 To maximise the influencer role of parents necessitates coordinated political and social mobilisation strategies and an intentional effort from all stakeholders to engage affected parents in media and in accountability fora.

The effectiveness of the Every Newborn Action Plan will need data and technical content from professionals and accountability from politicians for their most vulnerable citizens—their newborn babies. But the most important and powerful voices are those of parents, especially women who are the primary carers of newborn babies and carry the heaviest load of loss, and even stigma, if their babies die or are disabled.
care approaches, in view of the evidence for their effect. However, a more balanced emphasis across community and facility care is necessary, especially in view of increasing birth facility coverage and the imperative to address preterm birth and intrapartum complications.

Leadership and partnerships

Our overall assessment for leadership and partnerships is “yellow” for partial progress (figure 2, appendix). As noted by Shiffman, newborn health has been taken up by several global initiatives and organisations during the past decade (figure 3, appendix). The establishment in 2010 of Every Woman Every Child has created a potentially powerful umbrella “to mobilize and intensify global action to improve the health of women and children around the world”. The Saving Newborn Lives programme, with support from the Bill & Melinda Gates Foundation, in close collaboration with the US Agency for International Development (appendix) linked to leadership from a highly aligned group of champions and technical experts, is credited with playing a central part in the rise of the political prioritisation of newborn health. UNICEF and WHO, potentially two of the most influential organisations at country level, have shown variable involvement and leadership (appendix). In 2013, they began to cochair the development of ENAP, signalling new leadership from both institutions.

Shiffman noted little evidence that grassroots organisations have fuelled awareness of the importance of newborn health; our assessment has shown civil society to be weak to non-existent in driving accountability for newborn care at a country level, and in need of activation (appendix). Since 2012, parent groups and an engaged public, largely in high-income countries, have actively supported newborn health, for example in the Born Too Soon movement and World

Figure 3: Timeline for global initiatives, partnerships, and organisations relevant to newborn health, January 2000–December 2013

MDG=Millennium Development Goal. IPU=Inter-Parliamentary Union. PEPFAR=President’s Emergency Plan for Aids Relief. MNCH=maternal, newborn, and child health. RMNCH=reproductive, maternal, newborn, and child health and nutrition. GAVI=Global Alliance for Vaccines and Immunisation.
Prematurity Day (panel 2), and helped to energise the emergence of ENAP.

Since 2005, several initiatives and partnerships have emerged that focus on elements of the RMNCH continuum with relevance to newborn health. However, few have prioritised newborn health, nor has it had high-level political prioritisation among global stakeholders or in most countries (figure 3, appendix). Several corporate players have committed to participate in and fund RMNCH initiatives in low-income countries. While global rhetoric has promoted integrated RMNCH programming, several single-issue initiatives and partnerships have received high-level attention and substantial commitments of funds from donors (figure 3). In this context, the call to action of the 2005 Lancet Neonatal Survival Series—which resembled comprehensive primary health care in calling for integration of newborn care along the continuum of care and across the health system—might have put newborn survival at odds with single-issue initiatives. In the past several years, there has been a shift among several global health funders, for example the World Bank through its Health Results Innovation Trust Fund, and by countries, towards funding across the RMNCH continuum, recognising that to strengthen antenatal or postnatal care, or both, and the overall system, results in benefits for disease-specific initiatives and the continuum of care, including newborn survival.

The Partnership for Maternal, Newborn and Child Health (PMNCH) was formed in 2005, from three separate partnerships for maternal, newborn, and child survival, and now represents more than 500 organisations across seven constituencies spanning the RMNCH continuum. PMNCH is beginning to assume leadership in advocacy for newborn babies, especially in the lead-up to the launch of ENAP in 2014, identifying interventions for scale-up in country programmes and including newborn health in policy briefs for countries. However, a major challenge for the PMNCH is to try to coordinate across the plethora of global health initiatives and partners, and to track their commitments (figure 3).

Absence of clear leadership and mechanisms across global partners and initiatives for coordination in funding, advocacy, and technical assistance to country programmes, and absence of feedback loops linking global action with clear country plans and their needs for budgetary and technical support, have hampered advancement of newborn survival (appendix). The RMNCH Steering Committee was created to help to fill these gaps, specifically among UN agencies. A Promise Renewed emerged from the Child Survival Call to Action in 2012 and more than 175 governments and 400 civil society and faith-based organisations have been enlisted in a pledge to end preventable child deaths. A Promise Renewed’s weak engagement in maternal and reproductive health needs to be strengthened if this platform is to deliver on its promise to improve newborn health and survival.

Tapping into additional individuals and organisations across the continuum will be necessary to effectively integrate newborn health into health policy. However, some stakeholder groups along the RMNCH continuum have shown reluctance to embrace newborn care. A misperception that the 2005 Lancet Series promoted a community focus to the neglect of facility-based care necessary for maternal survival created tension and inhibited partnership between maternal health and newborn health champions. More recently, however, there has been increased common ground in approaches to programmes for maternal health and newborn health.

Global communities for maternal health and reproductive health might have concerns that taking up the cause of newborn health could result in diminished attention and funding for their elements of the continuum of care, just at a time when they have begun to receive greater priority in global health. Another challenge impeding integration is that the single-issue initiatives might advocate within countries for one issue at a time for fear that integrated messages seem unfocused and do not engage policy makers in the short facetime available. Ministries of health need to consider context and prioritise based on need, but they might be swayed to focus attention in areas in which donors have prioritised funding. As noted by Shiffman, some child survival specialists also question the need for separate attention to newborn health, since this might diminish resources for other unfinished aspects of the child survival agenda. It will be important to systematically identify constituencies within the RMNCH continuum, and better understand their interests and perceptions of the benefits and risks of engaging in newborn health; identification of common ground is essential for development of joint messaging and advocacy, and to capitalise on potential synergies in integration of newborn health into broader programmes.

**Implementation**

**Overview**

In view of the wide variability in progress across and within countries, our overall assessment of progress in implementation (across funding and country programmes) is “red”, indicating minimum progress in institutionalisation of newborn health across RMNCH programmes in most countries (figure 2, appendix).

As noted by Shiffman, “The fate of newborn health in the next decade depends on the extent to which this unfinished agenda reaches beyond global health actors and is successfully pursued within countries”. Although developments in global leadership and partnerships provide new opportunities for newborn health, the key to progress in increasing coverage of interventions and saving newborn lives lies with and within countries.

**Funding**

In the future, increases in support for health programmes in developing countries will come primarily from
domestic budgets; however, data for country spending on newborn health are inaccessible. National Health Accounts data, for example, do not separate financing for newborn health or even for RMNCH as a category; efforts are underway to track this financing in the future. Trend data on specific human resources, such as midwives with newborn care skills, are incomplete, and in high-burden countries neonatal nurses or neonatologists are almost absent.

To understand aid flows for newborn health, we updated (appendix) the analyses by Pitt and colleagues,75 who used key terms associated with newborn survival to search donor disbursement records and identify investments that affect newborn health (but also benefit maternal health and child health), and by Hsu and colleagues,76 who analysed official development assistance disbursement mentioned the word newborn, whereas by 2010, 10% mentioned newborn. Only about 4% of child health investments go to newborn health, despite 44% of deaths of children younger than 5 years being in the neonatal period; the bulk of this funding goes instead to immunisation, HIV, and malaria. Opportunities exist to improve the effectiveness of maternal and child health funding for newborn survival—eg, through the Health Results Innovation Trust Fund and other performance-based mechanisms, and the use of Global Fund non-research donor disbursements increased substantially from about US$52 million in 2003, to $613 million in 2010 (figure 4). In 2003, only 2% of MNCH official development assistance disbursement mentioned the word newborn, whereas by 2010, 10% mentioned newborn. About 25% (n=75) of all commitments under Every Woman Every Child include newborn survival, with 31% of these commitments from middle-income and low-income countries and another 20% from non-governmental organisations; the remaining commitments from high-income countries, health-care professional associations, the private sector, and others vary from 3–15% across these categories.79 Most of these commitments were linked to the launch of the Born Too Soon report.22 A new Global Investment Framework for Women’s and Children’s Health37 estimates that the right investment of $5 per person per year could prevent 147 million child deaths (including 60 million newborn babies), 32 million stillbirths, and 5 million maternal deaths cumulatively by 2035, and would yield a return of close to nine times in the form of social and economic benefits during the 23 year period 2012–35. The costing methods and approaches used in this framework, as well as the Lives Saved Tool,66 are available to countries.66

**Country programmes**

Here we draw from data collected through a systematic process in six Saving Newborn Lives focus countries which assessed progress towards programme readiness for implementation of newborn health interventions at scale,85 examined country context and changes in health systems, and mapped pathways to change in newborn health (appendix).84–88 Outside Saving Newborn Lives-supported work22,83–90 and analyses of political prioritisation of newborn health in selected countries,91–93 little programme-learning is published on scaling up of newborn health interventions. Several key factors exist for success in scaling up newborn health interventions: strong national leadership, especially partnerships of organisations central to health-care delivery at scale, and early engagement of these partners in policy dialogue and as network agents for spread of learning; use of data and locally generated and adapted evidence to inform policy and programme design and implementation; linking of community with good facility-based care, building on national cadres of CHWs to bring life-saving newborn care interventions closer to communities, engaging well trained and well supervised frontline workers and communities in intervention design and adaptation, and in behaviour change of both providers and beneficiaries; availability of life-saving newborn health commodities;95–97 formation of a national interest group early in programme development to convene partners with focus on newborn health; and appointment of a newborn health-specific programme manager, for example within the Ministry of Health, with clear accountability for newborn health and survival.98

A crucial element missing in both communities and in facilities in many countries is a clear definition of clinical roles and responsibilities in newborn care—ie, which cadre is accountable for assessment, management, and treatment of the newborn baby, counselling of the mother and family, and ensuring the newborn baby
survives? Additionally, community-based interventions depend heavily on social and behavioural change and a functional system of support for CHWs and extension workers for scale-up. There is no single starting point (eg, newborn single-issue vs linking of newborn health to maternal health, child health, or both) or sequencing (eg, starting with maternal or child health) that is necessary in development of newborn health programmes. As country programmes evolve, they tend to strengthen links between community and facility care, and across maternal health and child health. Well-functioning health systems are not necessary to begin the process of improvement of newborn survival, and experience has shown that, as country health systems develop, and women and newborn babies seek facility-based care, the gap in quality of care at all levels, including health facilities, becomes more visible, and overcrowded facilities might either be agents for change or could put off women and families from seeking care.96,97 Provision of obstetric care is crucial, but will not automatically trickle down to improve perinatal outcomes; active steps are needed to improve skills of health workers and availability of commodities for newborn care.98 The reduction of 1·2 million intrapartum stillbirths needs specific attention to intrapartum fetal monitoring and timely assisted delivery or caesarean section if necessary.99 Reduction of neonatal deaths necessitates that the attendant be able to provide emergency care for the baby as well as the mother—notably resuscitation.10 No country has achieved major reduction in neonatal deaths without specifically targeting the sick and small (either preterm, small for gestational age, or both) baby for extra care.

Evaluation
Overview
Our overall assessment of progress in coverage of care and in newborn survival is “red”, in view of the fact that coverage of some aspects of care has improved but is poorly tracked, and rates and numbers of neonatal deaths and stillbirths are decreasing, although progress is substantially slower than for older children and highly variable across countries (figure 2, appendix).

Coverage of care
In 2005, we reported110 that scaling up of 16 proven interventions in the context of maternal and child health programmes to universal (99%) coverage could avert an estimated 41–72% of neonatal deaths worldwide. A decade later, however, population-based data are available for only five of the 16 specific interventions, and trend data for just one (figure 5). How to measure several others is better understood, but the rest still do not have agreed indicators that are routinely measured across countries.106 Postnatal care is now tracked by the WHO independent Expert Review Group and Countdown to 2015.106 However, data are only available for about 38 countries, and only 17 countries measure postnatal care of newborn babies specifically, although this number is increasing.101,102 An estimated 44% of mothers and 30% of newborn babies receive postnatal care within 48 h in these countries. The Newborn Indicators Technical Working Group has achieved consensus on indicators for care of the newborn baby that can be collected through household surveys (ie, drying, delayed bathing, and cutting the cord with a clean instrument) and on testing of two further indicators (immediate skin-to-skin care and applications to the umbilical cord).103

Maternal tetanus toxoid immunisation rates increased from 65% in 2000, to 85% in 2010 (figure 5), with corresponding reductions in newborn deaths attributable to tetanus (93% reduction globally since 1988) and elimination in 25 countries as of December, 2013,104,105 with credit to the UNICEF and WHO Maternal Neonatal Tetanus Elimination Initiative.106 Rates of intermittent preventive treatment of malaria in pregnancy have increased from 25% in 2005, to 41% in 2010, fuelled by a successful single-issue programme.107 Skilled birth attendance has also increased from 55% in 2000 to 62·5% in 2010, probably because of a complex interplay between various factors, including girls’ education.107,108 Most of the increase in coverage of skilled care at birth has occurred in countries in the two highest mortality bands (neonatal mortality rate [NMR] 15 to ≤30 deaths per 1000 livebirths: annual rate of change 1·9%; NMR ≥30 deaths per 1000 livebirths: annual rate of change 1·8%; table). Although this correlation is to be expected, in view of the fact that coverage of skilled care is already very high (>90%) in countries where NMR is less than 15 deaths per 1000 livebirths, it indicates that improvements are reaching settings where the need is greatest. Moreover, countries with faster increases in coverage of skilled birth attendance have also tended to reduce inequalities.109

Mortality
Since 2000, 13 countries have reduced their NMR by more than 50%, including one country from sub-Saharan Africa: Rwanda. Moreover, 102 countries achieved reductions in NMR of 25–50% from 2000–12, and 17 of these are in Africa.110 The average annual rate of reduction (ARR) in global NMR was 1·3% from 1990–2000. Between 2000 and 2010, post-neonatal child mortality between 1 and 59 months reduced by 4·5% per year, whereas neonatal mortality reduced at a slower rate.
| 16 interventions included in The Lancet Neonatal Survival Series (2005) (unshaded rows) | Changes in the approach | Is the indicator agreed and tracked? | Coverage for 75 Countdown countries, median (IQR; number of surveys)  
2000 | Most recent since 2010 |
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</tr>
</thead>
<tbody>
<tr>
<td>Preconception</td>
<td>Folic acid supplementation</td>
<td>Shift from supplementation to fortification of foodstuffs</td>
<td>-</td>
<td>No coverage data</td>
</tr>
</tbody>
</table>
| Antenatal care | At least one antenatal care visit during pregnancy  
At least four antenatal care visits during pregnancy | Yes; Countdown UNICEF, WHO Included in most HMIS | 75·3 (IQR 62·1–87·1) | 86·1 (IQR 74·9–93·7) |
| Tetanus toxoid immunisation | Campaigns and increased progress towards Maternal Neonatal Tetanus Elimination | Yes; Countdown UNICEF, WHO | 65·1 (IQR 54·4–78·5) | 85·0 (IQR 76·0–88·3) |
| Syphilis screening and treatment (percent of women being tested for syphilis at first antenatal care visit) | Rapid diagnostics and more focus on health system approaches | Yes, in high-prevalence countries (DHS) | No coverage data | 44·1 (IQR 73·7–74·7; 47 countries) |
| Calcium supplementation to prevent pre-eclampsia and eclampsia | Trials still in process and limited policy cohesion | No | No coverage data | No coverage data |
| Intermittent preventive treatment for malaria | Added insecticide-treated bednets in pregnancy | Yes | No coverage data | IPTp 41·0 (IQR 32·0–48·0)  
Insecticide-treated bednets in pregnancy 26·5 (15·0–42·9) |
| Detection and treatment of asymptomatic bacteriuria | Less policy agreement on scale-up because complex to test and impact not so convincing | No | No coverage data | No coverage data |
| Skilled birth attendance | Skilled attendant at delivery | Yes, Countdown, CoA Included in most HMIS | 54·7 (IQR 39·4–69·2) | 62·5 (IQR 46·2–81·9) |
| Antibiotics for PPROM | | No | No coverage data | No coverage data |
| Corticosteroids for preterm labour (betamethasone) | Present focus on dexamethasone, cheaper, available and on Essential Medicines List, while awaiting comparison trials | No | No coverage data | No coverage data |
| Detection and management of breech (caesarean section) | Shift to EMoC and appropriate caesarean section | Yes, tracked caesarean section—not for breech Included in most HMIS | No coverage data | 5·9 (IQR 3·4–8·8; 57 countries) |
| Labour surveillance (including parograph) | Some small-scale innovations for electronic monitoring and documentation aids, fetal heart rate monitoring, perinatal audit | No | No coverage data | No coverage data |
| Clean delivery practices | Including chlorhexidine cord cleansing where appropriate | Yes, in some DHS, clean cord care is defined locally as per policy | No coverage data | <10 countries with data |
| Resuscitation of newborn | Innovations in simplified algorithms, devices and investment through private public partnerships | Yes, not possible in household surveys. In most service provision data tools and HMIS | No coverage data | No coverage data |
| Postnatal care visit | Within the first 24 h of life, day 3, and day 7 | Indicator reflects the first visit within 48 h with available questions to obtain more detailed indicators | Yes, and increasing data with new DHS and MICS module, CoA, Countdown | Inconsistent coverage data |
| Early initiation of breastfeeding | Opportunity to scale-up, through antenatal and postnatal home visit packages for women and newborns and improved care at birth | Yes, in DHS, Countdown | 51·4 (IQR 41·4–57·0) (42 countries)  
42·6 (IQR 31·8–60·5) (48 countries) |
| Prevention and management of hypothermia | More attention on skin-to-skin care for all babies, delayed bathing, maintaining the warm chain | Various indicators agreed, few collected routinely | No coverage data | No coverage data |
| Emergency newborn care | Kangaroo mother care (low birthweight babies in health facilities) | More convincing mortality RCT evidence for facility NICU and wide-scale experience of scale-up | Yes, possible to track in surveys, HMIS but not yet done | No coverage data |
| Case management of neonatal infections including community-based pneumonia case management | Simplified antibiotic trials allowing for outpatient or home-based treatment of neonatal sepsis | Possible to analyse in DHS but small numbers and low sensitivity and specificity | Possible to track in HMIS | No coverage data |
of 2·8% per year—still more than double the ARR for NMR for the preceding decade.22,111 As a result, the proportion of under-5 deaths that occur in the neonatal period increased from 36% in 2000, to 44% in 2012, and now exceeds 50% in five developing regions.13 An analysis of factors associated with changes in NMR showed that, when adequate data were available outside developed regions (ie, north Africa, Asia, central Asia, Caucasus, Latin America), countries with high total fertility rates had slower declines in NMR,22 emphasising the importance of linking of newborn health and family-planning programmes.

Examination of progress shows important shifts in the numbers of countries (table) and movement of populations from high to low neonatal mortality settings between 2000 and 2012 (appendix). The highest mortality countries, however, have had the lowest ARRs for NMR and for stillbirths, and ARRs for stillbirths are slower than for neonatal deaths across all mortality bands.

The adage “what gets measured gets done” is important—where attention has been prioritised and indicators tracked, coverage of key interventions has improved. The focus of the independent Expert Review Group on 11 indicators across RMNCH is not to provide the level of detail necessary to accelerate progress in countries for specific programmes. Moreover, many important newborn health, and indeed maternal care, indicators are not measured (eg, kangaroo mother care) or cannot be measured through large household surveys, such as demographic health surveys and multiple indicator cluster surveys (eg, newborn resuscitation, antenatal corticosteroids), and require incorporation in routine health information systems. Coverage for kangaroo mother care and antenatal corticosteroids are examples of highly effective interventions for which assessment, policy formulation and adoption, and programme implementation have lagged (appendix).32,39 Monitoring of quality childbirth care is crucial to advance maternal and newborn health, and especially to reduce intrapartum stillbirths.

**Conclusion**

During the past decade, progress has been made in each category of the heuristic policy process (figure 2). Remarkably, rapid progress occurred in agenda setting, and newborn babies have shifted from being almost invisible on the global health agenda in the 1990s to being a central element in the RMNCH continuum of care in several countries. However, in view of the size of the burden (almost 10% of the Global Burden of Disease 2010, without including 2·6 million stillbirths),112 the potential for major and rapid change, and synergies with

<table>
<thead>
<tr>
<th>Birth outcomes</th>
<th>NMR group 1 (NMR &lt;5 deaths per 1000 livebirths)</th>
<th>NMR group 2 (NMR 5 to ≤15 deaths per 1000 livebirths)</th>
<th>NMR group 3 (NMR 15 to ≤30 deaths per 1000 livebirths)</th>
<th>NMR group 4 (NMR ≥30 deaths per 1000 livebirths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMR ARR%</td>
<td>3·80%</td>
<td>3·10%</td>
<td>2·50%</td>
<td>1·30%</td>
</tr>
<tr>
<td>1-59 month mortality rate ARR%</td>
<td>4·27%</td>
<td>4·45%</td>
<td>5·63%</td>
<td>3·15%</td>
</tr>
<tr>
<td>Maternal mortality ratio ARR%</td>
<td>1·54%</td>
<td>1·98%</td>
<td>3·52%</td>
<td>3·74%</td>
</tr>
<tr>
<td>Stillbirth rate ARR%</td>
<td>2·2%</td>
<td>1·4%</td>
<td>1·1%</td>
<td>0·6%</td>
</tr>
<tr>
<td>Contextual factors and coverage of care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross national income per person ARC%</td>
<td>0·004%</td>
<td>0·010%</td>
<td>0·033%</td>
<td>0·052%</td>
</tr>
<tr>
<td>Total fertility rate ARR%</td>
<td>0·68%</td>
<td>2·24%</td>
<td>1·65%</td>
<td>1·20%</td>
</tr>
<tr>
<td>Contraceptive prevalence rate coverage ARC%</td>
<td>0·49%</td>
<td>1·08%</td>
<td>3·13%</td>
<td>3·60%</td>
</tr>
<tr>
<td>Change in coverage of skilled attendance at birth ARC%</td>
<td>99·3% in 2000; 99·5% in 2012; 0·02%</td>
<td>89·6% in 2000; 95·2% in 2012; 0·54%</td>
<td>42·3% in 2000; 54·2% in 2012; 1·91%</td>
<td>40·6% in 2000; 50·3% in 2012; 1·81%</td>
</tr>
<tr>
<td>Donor funding official development assistance (US$ 2010)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of countries with ODA data in 2010</td>
<td>10</td>
<td>41</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>To maternal health per livebirth (median with IQR)</td>
<td>7·4 (1·8–14·7)</td>
<td>27·4 (14·7–37·1)</td>
<td>39·0 (19·3–48·6)</td>
<td></td>
</tr>
<tr>
<td>To child health per child (median with IQR)</td>
<td>3·6 (9·7–3·9)</td>
<td>17·7 (6·7–23·2)</td>
<td>20·3 (14·3–30·6)</td>
<td></td>
</tr>
<tr>
<td>Value of MNCH ODA with mention of newborn health as % of total MNCH ODA</td>
<td>6·5%</td>
<td>9·5%</td>
<td>13·8%</td>
<td></td>
</tr>
</tbody>
</table>

ARR=average annual rate of reduction. NMR=neonatal mortality rate. ODA=official development assistance in 2010 constant US$. MNCH=maternal, neonatal and child health. KMC=kangaroo mother care. ARC=annual rate of change. ARR is presented for negative changes and ARC presented for positive changes. For input data sources for this analysis see appendix—UN-IGME,13 WHO,109 Pitt and colleagues,75 and Hsu and colleagues76—with special analysis for supplement. The average rate of change (ARC) includes change from 2000–12, except data for stillbirth rate are only available until 2009.
RMNCH, there has been disappointingly little investment and inadequate translation of attention into country policies, programmes, and evaluations. Progress at the country level has been erratic, with some making major advances despite many challenges, some making almost no progress, and some seeing newborn deaths increasing. As a result, neonatal mortality and stillbirths continue to decrease more slowly than does mortality in older children and maternal deaths.112

The 2005 *Lancet* Neonatal Survival Series called for health systems to change at community and facility level at a time when the global agenda was focused on more vertical, commodity-driven programmes. Recent advocacy for specific commodities (neonatal resuscitation equipment, antenatal corticosteroids, chlorhexidine for cord cleansing, simplified antibiotic regimens) and for kangaroo mother care seem to have gained traction.113 The myth persists that investment in maternal and child health will trickle down to improve newborn health in the absence of purposive investment in specific skills, commodities, and practices. Additionally, despite evidence of a large burden with feasible solutions, political prioritisation, increased investment, and concerted country action, especially in view of poor global leadership, coordination, and accountability. Clarity regarding who (which cadre of worker, which programme, or agency) was responsible for implementing newborn care was poor. Although some data have improved, this improvement has been slower for programme data—eg, improvement of the postnatal care coverage assessment modules in surveys took several years.

Leadership of an aligned group of champions and technical experts credited by Shiffman12 with putting newborn health onto the global agenda in the past decade cannot alone bring about the necessary change. Mobilisation of communities and civil society, parents, professional groups, private corporations, and increased leadership from the UN could help to bring rapid change, as was seen for HIV/AIDS in the early 2000s. ENAP could catalyse greater change, but must set clear priorities, address partner coordination, increase investment for implementation at scale, and ensure effective use of programme indicators and accountability for results. Above all, country leadership and technical capacity must be intentionally enabled.

To stop responsibility for newborn health from falling between organisations and programmes will necessitate active roles for many more global health stakeholders to stand with mothers and families in holding their babies. Collectively, we must ensure that gaps are closed between burden and investment, and between policy and action, to safeguard survival and health, reaching every woman and every newborn baby.

**Contributors**

GLD, MVK, and JEL wrote the first draft of the Series paper. All authors provided conceptual input and approved the final paper for submission.

**The Lancet Every Newborn Study Group**


**Declaration of interests**

All authors have been actively involved in newborn survival issues for several years. GLD is employed at the Bill & Melinda Gates Foundation, JK is employed by USAID, MC is employed by UNICEF, and JM was formerly employed by WHO. MVK is employed by Save the Children’s Saving Newborn Lives programme, which is funded by a grant from the Bill & Melinda Gates Foundation, and JEL, ZAB, SC, and VP have received funding from the Bill & Melinda Gates Foundation through Save Newborn Lives and other sources.

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**References**


Every Newborn 2

Every Newborn: progress, priorities, and potential beyond survival

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In this Series paper, we review trends since the 2005 Lancet Series on Neonatal Survival to inform acceleration of progress for newborn health post-2015. On the basis of multicountry analyses and multi-stakeholder consultations, we propose national targets for 2035 of no more than 10 stillbirths per 1000 total births, and no more than 10 neonatal deaths per 1000 livebirths, compatible with the under-5 mortality targets of no more than 20 per 1000 livebirths. We also give targets for 2030. Reduction of neonatal mortality has been slower than that for maternal and child (1–59 months) mortality, lowest in the highest burden countries, especially in Africa, and reduction is even slower for stillbirth rates. Birth is the time of highest risk, when more than 40% of maternal deaths (total about 290000) and stillbirths or neonatal deaths (5·5 million) occur every year. These deaths happen rapidly, needing a rapid response by health-care workers. The 2·9 million annual neonatal deaths worldwide are attributable to three main causes: infections (0·6 million), intrapartum conditions (0·7 million), and preterm birth complications (1·0 million). Boys have a higher biological risk of neonatal death, but girls often have a higher social risk. Small size at birth—due to preterm birth or small-for-gestational-age (SGA), or both—is the biggest risk factor for more than 80% of neonatal deaths and increases risk of post-neonatal mortality, growth failure, and adult-onset non-communicable diseases. South Asia has the highest SGA rates and sub-Saharan Africa has the highest preterm birth rates. Babies who are term SGA low birthweight (10·4 million in these regions) are at risk of stunting and adult-onset metabolic conditions. 15 million preterm births, especially of those younger than 32 weeks’ gestation, are at the highest risk of neonatal death, with ongoing post-neonatal mortality risk, and important risk of long-term neurodevelopmental impairment, stunting, and non-communicable conditions. 4 million neonates annually have other life-threatening or disabling conditions including intrapartum-related brain injury, severe bacterial infections, or pathological jaundice. Half of the world’s newborn babies do not get a birth certificate, and most neonatal deaths and almost all stillbirths have no death certificate. To count deaths is crucial to change them. Failure to improve birth outcomes by 2035 will result in an estimated 116 million deaths, 99 million survivors with disability or lost development potential, and millions of adults at increased risk of non-communicable diseases after low birthweight. In the post-2015 era, improvements in child survival, development, and human capital depend on ensuring a healthy start for every newborn baby—the citizens and workforce of the future.

Introduction

Unprecedented progress in halving worldwide maternal and child deaths over the past two decades has been called the greatest success story of human development, coinciding with progress in reduction of AIDS, tuberculosis, and malaria.1–3 During this era, the Millennium Development Goals (MDGs) have driven global health priorities in countries.4 Donor funding for reproductive, maternal, and child health has doubled.5,6 This recent rapid progress enables us for the first time to envisage a grand convergence, in which health outcomes in the poorest countries converge with those in the richest countries.

However, a major unfinished agenda is the annual toll of 2·9 million neonatal deaths (deaths in the first 28 days after birth), more than half of under-five child deaths in most regions of the world (44% globally).7 Neonatal and congenital conditions account for almost 10% of the global burden of disease. Although deaths account for 95% of this burden, disability is increasingly important in middle-income and high-income settings.8,9 A closely linked unfinished agenda is that attributable to undernutrition,10 including 800000 neonatal deaths among babies born small for gestational age (SGA; defined as under 10% birthweight for a particular gestational age and sex-specific reference), plus 800000 deaths due to suboptimum breastfeeding, dependent on practices commenced in the neonatal period.

Since the Lancet Neonatal Survival Series in 2005,11 some improvements have occurred for the more than 135 million newborn babies entering the world each year. However, the average annual reduction rate (ARR) in neonatal mortality between 1990 and 2012 (2·0%) is much lower than that for children aged 1–59 months (3·4%), and lower than for maternal mortality between 1990 and 2013 (2·6%).12,13 From a position of near-invisibility, newborn survival, and particularly preterm birth, is now on national agendas,14 having been pulled into the limelight by the policy hook of the MDGs and improved epidemiological estimates. Funding and action, however, are lagging.15 As well as the disappointing worldwide reduction in neonatal mortality, the global average hides huge variations

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This is the second in a Series of five papers about newborn health:

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Key messages

Progress beyond 2015

- The Millennium Development Goals (MDGs) have been associated with remarkable progress for maternal and child deaths, but neonatal mortality reduction has progressed about 30% slower, and stillbirth reduction slower still.
- Every Newborn sets national targets by 2035 for NMR (≤10 per 1000 livebirths) and SBR (≤10 per 1000 total births) in line with the A Promise Renewed under-5 mortality target of less than or equal to 20 per 1000 livebirths by 2035, and maternal mortality ratio (MMR) targets.
- Adverse birth outcomes are the biggest drain on human capital, especially in the world’s poorest countries. By 2035 almost one third of births will be in Africa.
- Without more action, by 2035 there will be an additional 49 million neonatal deaths and 52 million stillbirths, 5 million maternal deaths, and 99 million children who will not reach their development potential due to disability or stunting after preterm, SGA, or both.
- Actions must address unmet need for family planning, mortality risk, and size or gestational age risk.

Priorities to accelerate progress

- Where?
  - More than half of neonatal deaths occur in the five highest burden countries: India (779 000 deaths), Nigeria (276 000), Pakistan (202 400), China (157 400), Democratic Republic of Congo (118 100).
  - The countries with the highest stillbirth and neonatal mortality risk are in Africa, emergency contexts, or both.
  - When? Focus around the time of birth (triple return for women, stillbirths, neonatal deaths, and also to prevent disability).
  - What?: The three leading causes of neonatal deaths are severe infections, intrapartum and preterm birth complications.
  - Who?: Targeting preterm and small babies is crucial for effect (>80% of neonatal deaths, of which two-thirds are preterm). Boys have higher biological risk, but girls often have higher risk associated with social practices.
  - Rapid change for newborn and child survival is associated with accelerated fertility transition.

between countries and regions, and also between causes of death. Burden estimates have improved, especially for mortality and major risk factors including preterm birth (<37 weeks completed gestation) and SGA. However, important data gaps remain, such as tracking of progress for programmatic scale-up, especially quality of care at birth.12

The estimated 2·6 million annual stillbirths (WHO definition: fetal death at ≥1000 g or ≥28 weeks’ gestation) were not included in the MDGs and remain invisible.13 1·2 million of these stillborns die during labour (intrapartum stillbirths), with similar causes and interventions as early neonatal deaths.15 However, these stillborn babies are not included in global tracking mechanisms such as the Global Burden of Disease study, routinely reported to the UN from vital registration, or routinely measured in Demographic and Health Surveys or UNICEF’s Multiple Indicator Cluster Surveys.17 Failure to count stillbirths ignores their effect on women and families, and leads to underestimation of the benefits of investments in maternity care.18 Despite the large numbers of neonatal deaths and stillbirths, global attention is inadequate, and analyses of official development assistance underline low investment.14,15

As the MDG era comes to an end, the health policy focus beyond 2015 (the so-called post-2015 era) is
widening beyond survival to include wellbeing and human capital, the increasing importance of disability, non-communicable diseases (NCDs) and mental health, and the links between environment and health. Astonishingly, neither stillbirths nor neonatal deaths are mentioned in post-2015 documents. With this broader agenda, the new momentum for newborn babies risks being lost with stillbirths still invisible. Where do newborn babies and a healthy start in life fit in the post-2015 era?

Objectives
Recognising these challenges, countries have requested attention from the global community, leading to the Every Newborn Action Plan—a multi-partner movement that aims to end preventable newborn deaths and stillbirths, intimately linked with maternal mortality reduction. In this Series paper, we review the status of newborn health and progress since the 2005 Lancet Neonatal Survival Series to inform action in countries and globally.

Progress towards newborn survival
Neonatal mortality trends
Since 1990, the global neonatal mortality rate (NMR) has decreased by 37%, from 33 to 21 deaths per 1000 livebirths, compared with greater than 50% reduction for mortality rates among children aged 1–59 months. Substantial regional variations in NMR reductions (from 1990–2012) have been achieved, from 65% in eastern Asia to only 28% in sub-Saharan Africa, and 17% in Oceania. Generally, sub-Saharan African and southern Asian regions had the highest NMRs in 1990, and have made the slowest progress in reducing them. Although the global NMR ARR has accelerated from 1·3% (1990–2000) to 2·7% (2000–12), progress is slower than for mortality in children aged 1–59 months (4–6%) between 2000 and 2012. If the present rate of decline continues, it will be over a century before an African newborn baby has the same survival probability as one born in Europe or North America in 2013—three times longer than this decline took in industrialised countries before neonatal intensive care began (figure 1).

NMR varies greatly between countries: from one (per 1000 livebirths) in Japan to 49·5 in Sierra Leone (figure 2). The countries with the highest NMRs (≥30) in 1990 made the slowest progress, with a 1990–2012 ARR of 1·9% (figure 2). Mali, Sierra Leone, and Guinea-Bissau, with the highest NMRs in 1990, had ARR of 1·6, 0·8, and 1·1% respectively (1990–2012). By contrast, countries with NMRs between 5 and 15 in 1990, had an average ARR of 3·3% in the same period. In 2000, 53 countries had NMRs greater than or equal to 30, but, by 2012, only 25 countries did. In 2014, most births and neonatal deaths are in middle-income countries, with more scope for rapid change.

Countries making rapid progress
Some countries have achieved rapid NMR reductions (figure 2). Despite having an NMR of 50·0 in 1990, Malawi achieved an ARR of 3·2% from 1990–2012. Rwanda, which has an NMR of 20·9, made slow progress in the 1990s, but now has the fastest ARR (5·7%, 2000–12) in sub-Saharan Africa. The fastest progressing countries in other regions since the 1990 MDG baseline include Saudi Arabia (ARR 6·2%), Brazil (5·0%), Estonia (8·5%), and China (4·7%). Some of these countries achieved substantial reductions despite low baseline NMRs. The factors driving progress vary, but some themes recur, with fertility change and gross national income being important predictors in middle-income countries. However, analyses of health system factors are constrained by the absence of data for coverage and quality of maternal and newborn care. Few of the high-effect neonatal interventions are measured in household surveys, and some, such as neonatal resuscitation or antenatal corticosteroids for preterm birth, are not possible to ascertain through retrospective surveys.

Setting of neonatal mortality targets for 2035
To inform NMR target setting, epidemiological analyses were done for all UN member states, including an absolute target, relative target, and application of
Additionally, lives-saved analysis assessed potential for reduction of neonatal deaths and stillbirths through scale-up of known interventions. Through the Every Newborn Action Plan, extensive consultations were done to inform these potential national targets for neonatal mortality reduction including 20 country-level meetings, two regional consultations, and several discussions at global conferences; WHO Executive Board review and feedback from member states, along with online consultation to which more than 40 national governments sent reviews; the Every Newborn Advisory Group, including at least 50 organisational representatives; and a global target-setting group with representation of other global plans to ensure harmonisation of targets (appendix pp 23–27). Messages frequently voiced were the importance of completion of the MDG agenda, particularly ending of preventable neonatal deaths, the need to align the neonatal target with the A Promise Renewed (APR) under-5 mortality target of fewer than or equal to 20 per 1000 livebirths, and the proposed maternal mortality ratio (MMR) target of fewer than or equal to 50 per 100 000 livebirths. Especially in high-mortality African countries, some preference exists for a relative (proportionate reduction) mortality target as used in the MDGs. An absolute target might be considered more equitable, because the target is the same for all countries, but means that the ARRs needed to achieve the goal by 2035 will be more variable, with some countries needing more ambitious reductions.

On the basis of these analyses and consultations, an absolute NMR target of fewer than or equal to 10 per 1000 livebirths in all countries was selected (figure 3). This figure is half of the APR under-5 mortality target of 20 or fewer per 1000 livebirths, which is appropriate on the basis of epidemiological analysis of the proportion of under-five deaths that are neonatal at different mortality levels (appendix p 16). For countries already with NMRs of less than 10 per 1000 livebirths, continued progress is crucial. Because the equity gap is substantial within many of these
countries, they need to develop population-specific action plans to reduce inequalities. This explicit focus of “no one left behind” is in line with post-2015 priorities. Importantly, as neonatal intensive care is scaled up, countries need to systematically track disability as well as death.

The national NMR target of 10 or less deaths per 1000 livebirths sums to a global weighted mean of seven by 2035, aligning with an estimated NMR of seven per 1000 in 2035, with universal coverage in the Lancet Global Investment Framework for Women’s and Children’s Health. With full coverage of known interventions including neonatal intensive care, as detailed in paper 3 of this Series, this reduction is likely to be feasible before 2035. The appendix details national and global analyses with NMR levels for interim target years (2025, 2030) and 2035 (appendix pp 28–29).

Setting of stillbirth rate targets for 2035
The Lancet Stillbirth Series called for countries with third trimester stillbirth rates (SBR) of fewer than five per 1000 total births to eliminate all preventable stillbirths and close equity gaps by 2020, and for all other countries to reduce SBRs by at least 50% by 2020, from a 2009 global average baseline of 18·9 per 1000 total births. This timeline was ambitious, and the ongoing failure to invest in stillbirth reduction has resulted in little progress. During the country and global consultation for the Every Newborn Action Plan, a strongly stated view was that an SBR reduction target was essential because absence of counting has contributed to invisibility, and absence of accountability.

Epidemiological analyses were undertaken, using several national SBR target scenarios, including various absolute or relative targets or historical reductions in stillbirth rates (appendix pp 17–22, and 30–31). Additionally, we considered feasibility based on scale-up of existing interventions, and analyses from the Lancet Investment Framework for Women’s and Children’s Health.

The selected target is for all countries to have a stillbirth rate of fewer than or equal to 10 per 1000 total births by 2035 (figure 3). Countries with SBRs of fewer than or equal to 10 should focus on addressing inequalities, including setting specific target population action plans and using audit data to track and prevent all avoidable stillbirths. The resulting global average SBR of eight from this target is higher than the previously proposed target, and emphasises the need for increased innovation to reduce stillbirths.

Priorities to accelerate progress towards newborn survival
To ensure that national targets for mortality reduction are achieved, we examine which countries need the most attention, when deaths occur, and which causes of death and major risk factors should have priority.

Which countries?
The countries with the most neonatal deaths tend to be those with the most births and also with the slowest progress in reducing mortality (figure 2), notably India (779 000 deaths) and Nigeria (276 000), which together...
account for more than a million deaths. Brazil, with reductions in both births and NMR, has moved from eighth highest in neonatal deaths in 1990 to 19th in 2013. Nigeria, by contrast, where the risk of neonatal death is high and births have continued to increase, moved from fourth to second place, with more newborn deaths now than in 1990 at the start of the MDGs.

In 2012, nine countries had NMRs greater than or equal to 40, of which eight were in sub-Saharan Africa (figure 2), and half had been affected by conflict. More focus is needed to ensure these women and babies are not left behind. Overall, 1·7 million neonatal deaths and 1·4 million stillbirths occur in the 25 countries with NMRs greater than or equal to 30. Alongside high NMRs, these countries have high fertility rates coupled with low coverage of care, and few data (figure 4). Urgent efforts are needed to improve access to family planning and maternal and newborn care for everyone, or the equity divide for women and their babies will continue to increase.

### Closing the equity gap

On the basis of an analysis of survey data for 51 countries that account for about 75% of all neonatal deaths, if all households in a country had the same risk of neonatal death as did the richest 20%, the median percentage reduction in NMR in 2012 would be 19% (IQR 12–32; appendix p48). Closing the equity gap in these countries would mean 600 000 fewer neonatal deaths. The countries with the biggest relative neonatal mortality reductions would be Cambodia (48%), Nepal (46%), Bolivia (45%), Philippines (41%), and India (41%). Some countries would have a negligible gap between the richest and poorest quintiles (eg, Ghana, Uganda, Senegal, and Malawi).

<table>
<thead>
<tr>
<th>Metric/Contextual factors</th>
<th>NMR Group 1 NMR&lt;5</th>
<th>NMR Group 2 NMR 5 to &lt;15</th>
<th>NMR Group 3 NMR 15 to &lt;30</th>
<th>NMR Group 4 NMR≥30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of countries</td>
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<td>71</td>
<td>49</td>
<td>25</td>
</tr>
<tr>
<td>Gross national income per person (US$ median)</td>
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<td>9050</td>
<td>2360</td>
<td>1960</td>
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<tr>
<td>Birth outcomes</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Births</td>
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<tr>
<td>Stillbirths</td>
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<td>459762</td>
<td>710236</td>
<td>1399695</td>
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<tr>
<td>Neonatal deaths</td>
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<td>40W 553</td>
<td>731207</td>
<td>1673 659</td>
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<td>NMR ARR % 2000–12</td>
<td>3.8% (IQR 1.8–4.9)</td>
<td>5.1% (IQR 2.1–4.3)</td>
<td>7.5% (IQR 1.8–3.5)</td>
<td>13% (IQR 1.0–1.7)</td>
</tr>
<tr>
<td>ARR for countries with fastest reductions in neonatal mortality 2000–12</td>
<td>Estonia (9.9%) Lituania (8.4%) Luxembourg (8.1%)</td>
<td>Maldives (9.5%) Saudi Arabia (6.7%) Russia (6.7%)</td>
<td>Rwanda (5.7%) Cambodia (5.4%) North Korea (4.3%)</td>
<td>Mozambique (3.1%) India (6.6%) Guinea (2.4%)</td>
</tr>
<tr>
<td>Total fertility rate (median)</td>
<td>15.1 (IQR 12.6)</td>
<td>23.3 (IQR 19.6–28.6)</td>
<td>34 (IQR 29.6–39.0)</td>
<td>51.1 (IQR 42.0–62.0)</td>
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<td>Adolescent fertility rate (median)</td>
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<td>23.3 (IQR 19.6–28.6)</td>
<td>34 (IQR 29.6–39.0)</td>
<td>51.1 (IQR 42.0–62.0)</td>
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<td>Female literacy rate (% median)</td>
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<td>91.5</td>
<td>67.5</td>
<td>51.1</td>
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<td>At least one ANC visit (% median)</td>
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<td>69.0</td>
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<tr>
<td>Cesarean section (% of births)</td>
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<td>9.9</td>
<td>4.3</td>
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<tr>
<td>Overall Rural</td>
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<td>Countries modelled without VR input</td>
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<td>8</td>
<td>47</td>
<td>25</td>
</tr>
</tbody>
</table>

Figure 4: Countries (N=194) according to four levels of neonatal mortality rates (NMRs) in 2012, showing variation in context and health systems capacity with change since 2000.
When to focus?

The time of labour and the day of birth (about 48 h length) is when 46% of all maternal deaths (133 400) and 40% of all stillbirths and neonatal deaths (2·2 million) occur (figure 5).

For liveborn babies, the risk of death is greatest on the day of birth (figure 6). The proportion of deaths during the first day and week of life is remarkably consistent across regions and economic settings. In 2012, an estimated 73% of all neonatal deaths occurred during the first week of life, with 36% (1 million) occurring on the day of birth. In addition to the 1 million liveborn babies who die on their birth day, an estimated 1·2 million babies die during labour. Not counting stillbirths understates the triple return on investments from intrapartum care.

These numbers emphasise the urgent need to provide timely, high-quality care around time of birth. The time between a potentially catastrophic event and death can be very short—e.g., a baby who does not breathe at birth will die within a few minutes, and a fetus with a severe hypoxic event or a woman with post-partum haemorrhage could die in less than an hour. The first minute after a baby is born—the so-called golden minute—is the crucial window for neonatal resuscitation for the 10 million non-breathing babies born annually. Preterm babies are especially vulnerable, and can become hypothermic within minutes, increasing the risk of respiratory distress, hypoglycaemia, infections, and death. A health system can be judged on its capacity to deal with these urgent events for women and their babies.

Which causes of death to focus on?

Information on cause-of-death is essential for programme design and monitoring. The 2005 Lancet Neonatal Survival Series published the first neonatal cause-of-death estimates for over 190 countries. These estimates are updated every 2 years, involving country reviews by WHO. For the first time, we estimate cause-of-death by the early (days 0–6) and late (days 7–27) neonatal periods, also with increased data inputs and improved modelling techniques (figure 6).

Globally in 2012, complications from preterm birth (1·03 million, 36%), intrapartum-related conditions (previously called birth asphyxia; 0·66 million, 23%), and infections (notably sepsis, meningitis, and pneumonia; 0·66 million, 23%) were the main causes of neonatal deaths. Intrapartum-related conditions (27%) and preterm birth (41%) dominated in the early neonatal period, and infections (48%) were common in the late period (figure 6).

The cause-specific risk varies substantially by NMR level (figure 6). Whereas preterm birth complications are the leading cause of death, with similar proportions in low-mortality and high-mortality countries, the cause-specific risk differs by NMR, showing poor care for preterm babies in most high-mortality countries. Congenital malformations cause a higher proportion of deaths in low-mortality than in high-mortality settings, after other conditions are reduced and diagnostics improve, especially for cardiac abnormalities that are commonly misclassified as pneumonia deaths. In high-mortality settings, infections and intrapartum-associated disorders still account for a high proportion of deaths, especially among the poorest families, despite available low-tech interventions.

On the basis of cause-of-death trends (2000–12), tetanus had the largest relative decrease, of more than two-thirds from 1·3 deaths (per 1000 livebirths) to 0·4. This decrease is associated with substantial increases in tetanus toxoid vaccination, but might also relate to improved cleanliness, cord care practices, and...
education of females. Intrapartum-related complications decreased by about a third, from 8·2 to 5·3 per 1000 livebirths during 2000–12, possibly associated with increased institutional deliveries. The smallest relative reductions occurred for preterm birth complications (<20%) and congenital malformations (<10%). Addressing preterm birth is fundamental to acceleration of NMR reduction in view of slow progress, many deaths from direct complications of preterm birth (including 134 000 after the neonatal period), and additional neonatal deaths when preterm birth is a risk factor (notably infections).

Boys and girls
Male babies are at higher biological risk of neonatal complications contributing to death—such as preterm birth (14% increased risk), severe neonatal infection (12%), and intrapartum-related neonatal encephalopathy (42%)—and have a higher risk of death in the neonatal period than do their female peers, regardless of gestational age. However, in some cultures baby girls are at increased social risk. Increased availability of ultrasound screening in settings in which a male child is valued more highly than a female has been associated with sex-selective termination of pregnancy, including in India and China. Female child survival advantage might be lost or even reversed in settings where baby girls receive sub-optimum nutrition and caretakers are less likely to access health services—eg, measles immunisation—or to seek timely health care for their sick girl.

Small newborn babies are at greatest risk of death
Small babies face the highest risks of death in utero, during the neonatal period, and throughout childhood. Being born small might be due to preterm birth or SGA, or a combination of the two. Traditionally, low birthweight (<2500 g) was used as a marker for highest mortality and morbidity risk. Globally, about 20 million babies are born each year with low birthweight, and ambitious goals have been set to reduce this figure by 30% by 2025. However, the absence of highly effective preventive interventions presents a major challenge to achievement of this goal. The dichotomous low birthweight cut-off at 2500 g is clearly simplistic because risk changes continuously with birth size and gestational age. Further, granularity is crucial to understand and reduce the burden, but fewer than half of babies are weighed at birth in the highest-burden settings, and fewer still have accurate gestational age dating to delineate preterm and SGA. There are more than 20 SGA reference standards in the published work, and prevalence and hence burden depend on the standard used. SGA estimates are based on 1991 US livebirth data; however, the Intergrowth 21st consortium will provide a standard describing optimum

Figure 6: (A) Cause of death distribution for the neonatal period, and by the early (<7 days) and late (7–27 days) neonatal periods, for 194 countries in 2012 and (B) variation in cause-specific neonatal mortality rates (NMRs) by level of NMR in 2012, showing risk difference by cause of death compared with the lowest mortality group (NMR<5). Data from Child Health Epidemiology Reference Group and WHO estimates for 194 countries for 2012. Estimates are based on multicause statistical models, as described in detail elsewhere. In 2012, there are an additional estimated 396 000 deaths in the post-neonatal period due to neonatal conditions (preterm birth and intrapartum-related) and an estimated further 309 000 due to term small for gestational age. More detail is given in the appendix pp 51–65.
fetal growth in eight geographically diverse populations (appendix pp 72–73). In 2012, an estimated 15 million babies worldwide (11% of livebirths) were born preterm, 85% of these born at 32–36 weeks (table 1). Africa has the highest rates (up to 18%). Rates are increasing in most countries with reliable data. Table 2 presents estimates for SGA for sub-Saharan Africa and south Asia, the two regions in which, in 2012, an estimated 32 million babies were SGA (2.8 million preterm/SGA, 29.1 million term babies, of whom 10 million are low birthweight). Most SGA babies are born in south Asia, where 40% are categorised as SGA. SGA babies might have grown healthily but be constitutionally small, or might have suffered intrauterine growth restriction due to placental insufficiency (eg, pre-eclampsia or placental malaria), fetal reasons (such as multiple birth), environmental exposures, or nutritional factors especially driven by maternal pre-pregnancy nutritional status. Babies born very early (<28 weeks’ gestation) have the highest risk of neonatal death, with a greater than 95% mortality for these babies without specialised newborn care. Babies born between 32 and 37 weeks have at least a seven-times risk of neonatal mortality, and a 2.5-fold risk of post-neonatal infant mortality. Term-SGA babies are nearly twice, as likely to die in the neonatal period than are their term-appropriate peers, and preterm-SGA babies 15 times more likely, with ongoing mortality risk after the neonatal period (table 1, appendix pp 72–73).

In 2012, more than 80% of neonatal deaths in sub-Saharan Africa and south Asia were of small babies (65% attributable to preterm and 19% to term-SGA).
Two-thirds of SGA neonatal deaths were of term low birthweight babies (table 2). Urgent attention is necessary to ensure that all small babies receive appropriate newborn care and nutritional support. Many preterm babies were the basis of essential newborn care and the discipline of modern neonatology. Strategic research is necessary to better understand and prevent preterm birth and in-utero growth restriction, neither of which have available high-effect solutions.

Can we predict the women and pregnancies at greatest risk?
Perinatal mortality is associated with risk factors along the continuum, including preconception (odds ratio [OR] range for risk factors for perinatal/neonatal deaths of 1–5), pregnancy (OR 2–14), and, most predictive of all, intrapartum factors (OR 2–85). The concept of risk screening is routine in high-income and middle-income settings and was promoted by WHO as the risk approach during antenatal care in the 1980s. However, UN agencies dropped this screening in the 1990s, in view of the poor predictive value of risk screening methods combining many common, low-risk conditions—eg, too old, too young, too short. We question whether this has thrown the mother and baby out with the bathwater, because screening for low-prevalence high-risk pregnancy complications (eg, primiparous women younger than 16 years, multiple pregnancy, malpresentation, hypertension, diabetes, vaginal bleeding in late pregnancy, severe anaemia) are more predictive, forming the basis of modern maternal and fetal medicine. Effectiveness trials are needed to develop and test feasibility of more targeted, feasible risk-screening algorithms. Sensitive, specific, and simpler methods for detection of fetal compromise during labour could have a major effect on intrapartum stillbirths and early neonatal deaths, as long as linked with emergency obstetric care.

Maternal intrauterine infection plus intrapartum hypoxia might have a synergistic effect, resulting in neonatal encephalopathy and cerebral palsy. Few studies in low-income and middle-income countries (LMICs) have assessed multiple infection exposures (eg, chorioamnionitis, HIV, malaria) with other insults such as hypoxia, and included all perinatal outcomes, notably stillbirth and preterm birth, and long-term impairment. The apparently low effect of treating one infection in pregnancy might be due to missing other infections or only measuring some birth outcomes. Improvement of this monitoring and measurement is a priority for prospective epidemiological assessment and intervention trials.

Where to focus—at home or in the health system?
In 2012, 71% of all births occurred with a skilled birth attendant present, compared with 62% in 2000. Change has been fastest in countries in the middle mortality band in 2000 (figure 4). Nevertheless, about 50 million births (40% worldwide) happen outside facilities, most without a skilled attendant. In south Asia, two thirds of home births occur with a traditional birth attendant, whereas in sub-Saharan Africa only a third occur with a traditional birth attendant, and most are at home alone.

The equity gap has widened in some countries, and in many countries is driven by the urban–rural gap. Analysis from 56 of 75 Countdown countries with available survey data shows a median gap of 35-4% (IQR 22–43) between urban and rural women for skilled birth attendance. The median Slope Index of Inequality (a score which represents the gap between the richest and poorest, zero indicating no inequality) was 59% (IQR 47–72%), indicating substantial wealth-related inequality (appendix pp 68–71).

Worldwide, information is poor regarding place of newborn deaths. Improved data on where newborn babies are dying and understanding of delays in receipt of care are a priority for design of context-specific community and health system strategies. Focus is necessary at home and in facilities, and on communication and transport links to reduce delays. Intrapartum stillbirths and neonatal deaths are sensitive markers of delay, since these babies die quickly. These deaths are especially common for poor women in rural areas, who are left behind in coverage of facility birth and caesarean sections (figure 4).

Children having children
In the highest mortality countries 122 per 1000 girls aged 15–19 give birth each year. Girls who become pregnant before 18 years are at higher risk of mortality, morbidity (such as fistula), stillbirth, neonatal death, preterm birth, and SGA birth. These risks are highest for young girls (<13 years) and those already undernourished. This scenario is most common in cultures with high rates of child marriage. Many surveys do not ask about childbearing for those younger than 15 years or those who are not married, masking the magnitude of the issue.

Deferring first birth until after the age of 18 years reduces risks for women and babies. Empowerment of women and girls in these settings is crucial to change these and other social norms such as female genital mutilation, which is associated with adverse pregnancy outcomes.

Newborn survival and family size
Improved newborn and child survival in countries is closely linked to fertility transition, which can occur even in the absence of major economic change (appendix p 75). Family planning and child survival programmes could be better linked—eg, integration of contraceptive and maternal and newborn care commodities supply systems. Whereas coverage of family planning services has increased for both urban and rural women in south Asia, with 87% of urban and
79% of rural women having met need, both the total fertility rate and unmet need are high in sub-Saharan Africa, with only 58% of urban and 37% of rural women having met need. The same communities have the highest fertility rates and neonatal deaths, having no basic family planning, or maternal and newborn care.

New frontiers beyond survival and the post-2015 era
Beyond survival: shifting to include child development and human capital
The first worldwide burden estimates of neonatal morbidities have drawn attention to 19 million neonates with life-threatening conditions (including intrapartum-related brain injury, severe bacterial infection, pathological jaundice, and preterm birth) who need specific and special care, many of whom do not receive even basic warmth and feeding support.32,40,42,79,80

Among 15 million preterm babies born each year, an estimated 1 million die of direct preterm birth complications, 1 million of other causes where preterm is a risk factor (eg, infection), and 13 million survive beyond the first month of life. Of these survivors, 345 000 (2.7%) have moderate or severe long-term neurodevelopmental impairment, and 567 000 (4.4%) have mild impairment.60 Additionally, 185 000 preterm birth survivors are affected by retinopathy of prematurity, with 32 000 developing visual impairment, including blindness, which could be prevented by improved quality of neonatal care, screening, and timely treatment. Preterm babies born at the lowest gestational ages have the highest risk of acute complications, and subsequent long-term effects on neurodevelopmental and behavioural outcomes, and are the main driver of neonatal care and severe disability in high-income countries, but rarely survive in LMICs settings. However, those born at 32–36 weeks account for 85% of all preterm births and contribute the greatest number of impaired survivors, mainly with less severe cognitive impairment.40 Additionally, the risk of important conditions such as neonatal infections, hyperbilirubinaemia, and feeding difficulties is higher even among late preterm births (34–36 weeks’ gestation) than in infants born at term.51

Severe neonatal infections affect about 2.5 million term and late-preterm babies in LMICs annually, many of whom are not treated with antibiotics. About 200 000 of these babies have meningitis, with 22 000 surviving with severe impairments and 9000 with mild impairments.42 Despite high rates of systemic infections (sepsis) in the neonatal period, and the biologically plausible effect of this on the developing brain, research has focused almost exclusively on very early preterm neonates,82 and long-term impairment after neonatal sepsis in term infants is poorly understood.42

Each year, intrapartum-related complications (birth asphyxia) result in 1.2 million stillbirths, 700 000 term newborn deaths, and an estimated 1.2 million babies developing neonatal encephalopathy (previously called hypoxic ischaemic encephalopathy).32 Among survivors, 233 000 develop moderate or severe neurodevelopmental impairment and another 181 000 develop mild impairments.32

Pathological neonatal jaundice affects at least 481 000 term or near term newborn babies annually, with 114 000 dying and more than 63 000 surviving with

<table>
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<tr>
<th>NMR group</th>
<th>NMR ≤5</th>
<th>NMR 5 to &lt;15</th>
<th>NMR 15 to &lt;30</th>
<th>NMR ≥30</th>
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</thead>
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<tr>
<td>Number of neonates affected</td>
<td>1.2 million</td>
<td>3.8 million</td>
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*These estimates do not include neonatal mortality and morbidity from neonatal infections. Estimates from sub-Saharan Africa, southern Asia, and Latin America suggest 2.5 million cases of neonatal infection in these regions each year, with 32 000 impaired cases attributable to neonatal meningitis or tetanus. Estimates for the burden in other regions and impairment following other infections in the neonatal period have not yet been done. Data from references 32, 40, 42, 80, and 81.
moderate or severe disability, the classic case having choreo-athetoid cerebral palsy. Rhesus incompatibility is a major underlying cause, and could be prevented with Rhesus immunoglobulin prophylaxis for Rhesus-negative women.

The risk of death and disability depends on where a baby is born (figure 7). In low-mortality settings (countries with an NMR<5), where timely, appropriate birth and newborn care are usually available, few term babies develop complications, more than 80% of preterm babies survive and thrive, with the risk of death and disability greatest for those born at less than 26 weeks. In middle-income countries with progress in reduction of neonatal deaths (NMR 5 to <15), and wider scale-up of neonatal intensive care, the risk of disability (28–32 weeks) is nearly double that in high-income countries, indicating the scope for improvements in quality of care. In higher mortality countries (NMR ≥15) the incidence of birth complications (intrapartum-related death, and neonatal encephalopathy) increases with increasing NMR, showing decreasing availability of high-quality obstetric and neonatal emergency care. However, impairment of the survivors is uncommon because those at greatest risk of long-term sequelae (<28 weeks) are unlikely to survive (figure 6).

Small babies—big consequences for development of potential and NCDs

Size at birth is well known to predict long-term health. Fetal and early-life environmental influences are important risk factors for stunting, loss of human capital, and NCDs (tables 1 and 2). Data are scarce for impairment outcomes after SGA, but suggest a small increased risk of cognitive delay and behavioural disorders (such as ADHD) at all gestational ages compared with AGA peers. Babies born preterm and SGA have the highest risk of stunting in childhood (table 2). Prevalence of cardiovascular disease, obesity, and insulin resistance or type 2 diabetes are increasing, reaching epidemic levels in many countries. Developmental programming in-utero puts small babies, both preterm and SGA, at higher risk of NCDs.
than their term appropriately grown peers, especially if they rapidly gain weight. The high risk of SGA, especially in south Asia, is contributing to the NCD epidemic, but, compared with investment and innovation for treating NCDs, little focus is being put into improvement of birth outcomes.

The human capital consequences of unhealthy birth outcomes
A healthy start is central to the human life course, with birth holding the highest risk of death, disability, and loss of development potential, leading to major societal effects (figure 8, appendix p 76). If present mortality, stunting, and disability risk trends are maintained, allowing for demographic change, by 2035 adverse birth outcomes will result in 116 million deaths, 31 million disabled survivors, and 68 million survivors with lost development potential (through stunting). Additionally, millions of adults, especially in south Asia, will be at increased risk of NCDs after being born small. Thus, birth outcomes are crucial to reach a grand convergence for global health and human capital by 2035. The Lancet Global Investment Framework for Women’s and Children’s health22 suggests a nine-time return on investment, especially through family planning, quality of care at birth, and care of small and sick newborn babies. Today’s newborn babies are the workforce of the future, and their health is tomorrow’s wealth.

Counting every newborn baby
Child mortality estimates have improved and are converging; however, neonatal and maternal mortality are not yet converging. Improvements in the frequency and visibility of neonatal mortality and cause-of-death estimates have helped to attract attention, but data gaps in morbidity, and in coverage and quality of care are major constraints to planning of programmes and tracking of progress. Strengthening of national data systems is urgently needed, and requires phased strategies for context-specific data collection platforms, notably vital registration, routine, and facility-based health information systems and intermittent household surveys (appendix p 77). The data on NMR and causes of death have approximately doubled since 2005 (figure 4). However, much of this increase has been in middle-income countries transitioning to higher vital registration coverage. In 2012, 49% of births were reported as registered during the first year of life, with no data available for 16% of all births and 35% remaining unregistered (figure 9). Newborn babies are least likely to get birth certificates in South Asia (37%) and sub-Saharan Africa (38%), but substantial variation exists even in these regions. In Bangladesh only 9% of all births were registered in the first year of life, compared with 100% in Bhutan. In sub-Saharan Africa, high coverage has been achieved in Mauritius (99%) and South Africa (95%), whereas

Figure 9: Newborn babies born in 2012 whose birth was registered in the first year of life
Analysis based on livebirths for UNPopDiv 2012 and UNICEF analysis of birth registration coverage.
their invisibility; hence, most of the world’s newborn deaths and almost all stillbirths enter and leave the world without a piece of paper to record their existence. Low recording signifies acceptance and leads to inaction. Birth and death registration provide nationally-representative, timely data, and signify a shift in social norms by counting every newborn baby and stillbirth. To increase global momentum to improve civil and vital registration is important, and the human face of this are those who are counted the least—newborn babies and stillbirths.

Most high-burden countries are dependent on 5-yearly household surveys for mortality and coverage data. Unfortunately, the 5 year time lag impedes programmatic action and, furthermore, such surveys occur irregularly in most middle-income countries like China, India, and South Africa. Improvements in survey techniques, including a shift to pregnancy histories, are necessary to capture all birth outcomes, especially stillbirths.

Now that most births are in facilities, a crucial data improvement opportunity is through standardised facility-based perinatal dataset. In the 1970s, a minimum perinatal dataset developed by several collaborating European and North American countries was the cornerstone for improved perinatal surveillance, including stillbirths. The initial deliberately restricted dataset later expanded to hundreds of variables. EURO-PERISTAT, a multidisciplinary international collaborative network, grew from this effort and continues across Europe. The Vermont Oxford Network focuses on neonatal care quality improvement and now involves some LMIC partners, but wide-scale use will need simpler indicators and databases. Recent work has highlighted the necessity for metrics of neurodevelopmental impairment, especially in every country that is scaling up neonatal intensive care, and metrics will be increasingly important in the post-2015 world. The drive for innovation from initiatives such as Saving Lives at Birth and the Saving Brains Initiative has also drawn attention to the imperative for more consistency in measurement of quality of care at birth and development outcomes.

As an output from the Every Newborn Action Plan, we plan to work with Saving Lives at Birth and other partners to develop and test a minimum perinatal dataset, with a toolkit to promote comparability across the varying levels of data complexity. Consistent metrics will help address key data challenges, such as misclassification of neonatal deaths and fresh or intrapartum stillbirths, simplified birthweight, gestational age assessments, and improved cause of death attribution, including International Classification of Disease codes. Data gaps for programmatic implementation are absolutely crucial to inform and drive scale-up and will also be assessed and addressed.

Conclusion
In view of the delayed attention to neonatal survival and poor investment, especially for care of small and sick newborn babies, and in the highest mortality countries, that progress has been slow is unsurprising. Inputs, including donor funding, have increased since 2005, but not commensurate with a burden of almost 10% of disability-adjusted life-years worldwide, or with the potential for major (71%) effect with highly cost-effective interventions. We emphasise the importance of counting of all birth outcomes, including stillbirths, and looking beyond survival in the post-2015 world.

Governments, the global public health community, and especially civil society and parents are mobilising through the Every Newborn movement. In this Series paper, we have outlined mortality targets for every country to reach: neonatal mortality and stillbirth rates of fewer than or equal to 10 by 2035. Rapid progress in some countries shows that NMR can be halved within a decade, but the countries achieving most progress are mainly high-income and middle-income countries, with a few remarkable exceptions. The epidemiological data draw attention to priorities to maximise progress in countries, notably a focus around the time of birth, on the leading causes of neonatal deaths, and targeting of babies born too small or too soon (key messages panel). However, targets and data alone do not save lives—changes in health systems and coverage do. The third Every Newborn Series paper summarises the evidence base for interventions, estimates neonatal lives saved, and the effect on stillbirths, maternal deaths, and stunting.

A safe birth and healthy start in life are at the heart of human capital and economic progress. The post-2015 long-term focus on a grand convergence of health and development potential within a generation can only be realised with improvements in birth outcomes, and also with transformation of risk for adult NCDs. The longer-term timeline compared with the MDGs and the intersectoral emphasis enable an inter-generational shift to reduce low birthweight, and ensure girls’ nutrition, education, and family-planning access. Improvement of birth outcomes is also the lynchpin for short-term progress to reduce preventable child and maternal deaths and make stillbirths count.

Every newborn baby is vulnerable, but small and preterm babies are the most vulnerable citizens in any country. Their care, survival, and being counted is a sensitive test of health system responsiveness, the accountability of a nation’s leaders, and the key to every nation’s future development.

Contributors
JEL and HB coordinated the analyses and manuscript. SO did the analyses on NMR trends and target setting with JEL, DY, and the wider Every Newborn target setting team. MI, HB, and JEL did the SBR target setting analyses and the NMR country group analyses. SO, SC, JEL, and CM did the neonatal cause-of-death analyses, with CHERG. HB coordinated the neonatal morbidity and small baby analyses with JEL, ACCL, PC, and the CHERG SGA Working Group and neonatal morbidity estimation teams. SO did the NMR equity analyses, with JEL and SC. AJDB provided the urban–rural and socioeconomic status analysis of coverage data. PW provided data on social autopsy. All authors had input to the Series paper. The content of this Series paper does not necessarily indicate the views of the authors’ organisations.
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Every Newborn 3

Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost?

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Progress in newborn survival has been slow, and even more so for reductions in stillbirths. To meet Every Newborn targets of ten or fewer neonatal deaths and ten or fewer stillbirths per 1000 births in every country by 2035 will necessitate accelerated scale-up of the most effective care targeting major causes of newborn deaths. We have systematically reviewed interventions across the continuum of care and various delivery platforms, and then modelled the effect and cost of scale-up in the 75 high-burden Countdown countries. Closure of the quality gap through the provision of effective care for all women and newborn babies delivering in facilities could prevent an estimated 113 000 maternal deaths, 531 000 stillbirths, and 1·325 million neonatal deaths annually by 2020 at an estimated running cost of US$4·5 billion per year (US$0·9 per person). Increased coverage and quality of preconception, antenatal, intrapartum, and postnatal interventions by 2025 could avert 71% of neonatal deaths (1·9 million [range 1·6–2·1 million]), 33% of stillbirths (0·82 million [0·60–0·93 million]), and 54% of maternal deaths (0·16 million [0·14–0·17 million]) per year. These reductions can be achieved at an annual incremental running cost of US$5·65 billion (US$1·15 per person), which amounts to US$1928 for each life saved, including stillbirths, neonatal, and maternal deaths. Most (82%) of this effect is attributable to facility-based care which, although more expensive than community-based strategies, improves the likelihood of survival. Most of the running costs are also for facility-based care (US$3·66 billion or 64%), even without the cost of new hospitals and country-specific capital inputs being factored in. The maximum effect on neonatal deaths is through interventions delivered during labour and birth, including for obstetric complications (41%), followed by care of small and ill newborn babies (30%). To meet the unmet need for family planning with modern contraceptives would be synergistic, and would contribute to a halving of a third of deaths and therefore deaths. Our analysis also indicates that available interventions can reduce the three most common cause of neonatal mortality—preterm, intrapartum, and infection-related deaths—by 58%, 79%, and 84%, respectively.

Introduction

This Lancet Every Newborn Series shows that despite a halving of under-5 child deaths in the past two decades, progress in reducing newborn deaths has been slower, with about 3 million neonates still dying every year. 1 Reductions in neonatal mortality have averaged 2-0% annually since the Millennium Development Goals (MDG) baseline in 1990, which is much slower than corresponding reductions in maternal mortality (2-6%) or mortality in children 1–59 months of age (3-4%). Additionally, 2-6 million stillbirths (≥28 weeks or ≥1000 g) occur every year, including 1·2 million during labour. 1 These stillbirths were not counted in the MDGs and progress has been substantially slower than even that for reductions in newborn mortality. 1 Achievement of the proposed Every Newborn targets of ten or fewer neonatal deaths and stillbirths per 1000 births in every country 2 would need a doubling of present rates of change at a global average, and more in some high-burden countries. Such progress needs focus on the most effective interventions and intentional implementation and implementation, which has been insufficient so far. 1 In this third paper of the Series, we provide an update of the evidence base for interventions since the Lancet 2005 Neonatal Series and 2011 Stillbirth Series, and other relevant reviews. 4,7 We estimate the potential lives saved and the running costs of implementation, and make recommendations for prioritisation linked to the Every Newborn Action Plan.

Review of interventions and delivery platforms

We identified specific interventions across the continuum of care (preconception, antenatal, intrapartum, immediate postnatal period, and thereafter), building on previous evidence reviews 4-7 (appendix pp 3–4), which could affect stillbirths and newborn outcomes (figure 1). We also reviewed delivery platforms that could augment the uptake of these interventions and methods to improve quality of care. We searched all major databases to identify available quality systematic reviews in various domains using standardised methodology. When we could not identify relevant syntheses, we did de-novo reviews (appendix pp 5–6). When we could not identify interventions from low-income and middle-income countries, we considered evidence from other contexts. Table 1 and appendix pp 8–22 summarise the evidence of interventions across the continuum of care that affect stillbirths and neonatal outcomes.
Key messages

1) Evidence is high, but coverage is low
New evidence-based interventions exist to address the main causes of newborn deaths, including:
- Innovations such as chlorhexidine cord cleansing.
- Increasing evidence of care of small and ill newborn infants in first and second level facilities.
- Increasing feasibility because of adaptation and innovation of preventive measures such as antenatal corticosteroids and care for preterm infants using training tools for resuscitation and low-cost equipment such as continuous positive airway pressure.

These interventions can be delivered within existing service delivery packages, but almost all have very low coverage at present, with less than a third of mothers and neonates in need receiving them. Major acceleration is needed to be able to meet targets for Every Newborn, linked to A Promise Renewed, and the post-Millennium Development Goal targets.

2) Impact is high and cost is quite low
High coverage of care by 2025 would prevent 71% of neonatal deaths, saving 1·90 million newborn babies, preventing 0·82 million stillbirths, and averting more than 0·16 million maternal deaths per year, with ongoing effects on child health beyond the first month of life. Hence, care provides a quadruple return for an investment of US$5·65 billion ($1·15 per person) and $1928 for each life saved.

Together, the most effective packages can save 87% of preventable maternal and newborn deaths:
- Care during labour and birth, plus immediate newborn care, can avert 1·49 million maternal and newborn deaths and stillbirths per year by 2025, of which almost 0·8 million are newborn lives.
- Care of the small and ill newborn can avert more than 580 000 newborn deaths per year.
- Preventive care of the healthy neonate could save more than 230 000 neonatal lives, whereas immediate care of the neonate at birth alone could avert almost 190 000 deaths.

3) Quality of care gap
- Quality of care at birth: an immediately feasible opportunity is to address the quality gap for births already occurring in facilities by 2020, resulting in an estimated 1·325 million neonates saved, 531 000 stillbirths prevented, and 113 000 women saved.
- Care of small and ill neonates: our estimates suggest the greatest effect would come from a focus on the care of small and ill neonates, which has been neglected to date and would prevent almost 600 000 newborn deaths per year by 2025. Much of this effect is potentially achievable through newborn care services in subdistrict and district level hospitals.

4) Equity gap
The 24 countries with the highest mortality (neonatal mortality rate >30) have the greatest potential for lives saved, both proportionately and in actual numbers (1·3 million or two-thirds of all newborn lives saved by 2025). Within countries, specific unmet needs for family planning, optimisation of inter-pregnancy intervals, and enhancement of pre-pregnancy nutritional status; these approaches can be delivered across a range of possible platforms (panel 1).

Antenatal: interventions during pregnancy
The antenatal interventions reviewed included maternal immunisation, screening and management of infections (notably HIV, syphilis, other sexually transmitted infections, and malaria), interventions addressing pre-existing chronic diseases (notably diabetes and hypertension) and pregnancy-induced disorders, detection and management of significant in-utero growth retardation, prevention of rhesus (Rh) D allo-immunisation, and interventions to improve nutrition and psychosocial health and combat drug misuse during pregnancy. Some of the salient interventions are summarised in the following paragraphs and are detailed in appendix pp 8–14.

Although the importance of tetanus immunisation in pregnancy is well established, the evidence to support other vaccines in pregnancy such as pneumococcal, haemophilus influenzae type B, and viral influenza vaccines is less robust, partly because of persistent challenges in the undertaking of immunisation trials during pregnancy. Despite reductions in maternal and infant respiratory illnesses with maternal influenza vaccination, no consistent benefits were noted on rates of preterm delivery and low birthweight (appendix p 23).

Intermittent preventive treatment of malaria in pregnancy reduces antenatal parasitemia and placental malaria, and is associated with reductions in low birthweight (by 29%) and neonatal mortality (31%) (appendix pp 24–25). The use of insecticide-treated bednets in pregnancy can reduce blood and placental parasitaemia (by 24%), low birthweight (20%), and stillbirths (32%) (appendix pp 24–25). Although the combined use of intermittent preventive treatment of malaria and insecticide-treated bednets in pregnancy can reduce the occurrence of low birthweight in the first or second pregnancy by 35% in areas of stable Plasmodium falciparum transmission, data for rates of prematurity and stillbirths are scarce.

In syphilis-endemic countries, antenatal syphilis screening combined with penicillin treatment can reduce syphilis-specific stillbirths (by 82%), preterm births (64%), and syphilis-related neonatal mortality (80%). A small amount of evidence suggests that screening for other genital tract infections and treatment programmes can also reduce respective preterm births (by 45%) and low birthweight (52%). Work is underway to establish the effectiveness of these approaches in primary care health systems.

Although treatment of bacterial vaginosis with antibiotics shows no clear benefits on preterm births or neonatal infections, intrapartum antibiotic prophylaxis for known group B streptococcus colonisation can reduce

Preconception: interventions before and between pregnancy
The importance of preconception interventions for improved maternal, perinatal, and neonatal health outcomes is increasingly being recognised. These interventions include delaying of age at first pregnancy, meeting of unmet needs for family planning, optimisation of inter-pregnancy intervals, and enhancement of pre-pregnancy nutritional status; these approaches can be delivered across a range of possible platforms (panel 1).
Insecticide-treated bednets
Intermittent preventive treatment for malaria in pregnancy

Interventions before, during, and between pregnancies

<table>
<thead>
<tr>
<th>Risk</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girl and adolescent health</td>
<td>Nutrition, especially for girls younger than 7 years; prevention of female genital mutilation, education and empowerment</td>
</tr>
<tr>
<td>Family planning</td>
<td>Reduce unintended pregnancies, delay age at first pregnancy, contraception services, safe abortion</td>
</tr>
<tr>
<td>Maternal immunisation</td>
<td>Tetanus, pneumococcal, Haemophilus influenzae type b, influenza</td>
</tr>
<tr>
<td>Maternal infection prevention, screening and management</td>
<td>Malaria (IPTp, ITN), syphilis, lower genital tract infections, group B streptococcus, bacterial vaginosis, urinary tract infection, chlamydia, gonorrhoea, HIV, toxoplasmosis</td>
</tr>
<tr>
<td>Address chronic diseases and pregnancy-induced disorders</td>
<td>Pregnancy-induced hypertension, pre-eclampsia, eclampsia, gestational diabetes, diabetes, hypertension</td>
</tr>
<tr>
<td>Maternal nutrition enrichment</td>
<td>Iron, folate, calcium, multiple micronutrient, balanced protein energy</td>
</tr>
<tr>
<td>Detection and management of significant IUGR</td>
<td>Doppler velocimetry for early antenatal detection of IUGR and appropriate treatment and timely delivery</td>
</tr>
<tr>
<td>Maternal interventions to improve psychosocial health and substance abuse</td>
<td>Antenatal assessment and interventions for anxiety, antenatal and postnatal psychosis, and depression. Prevention of smoking, alcohol use, and illicit drug use</td>
</tr>
<tr>
<td>Prevention of Rhesus disease</td>
<td></td>
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</tbody>
</table>

Interventions during labour and birth

<table>
<thead>
<tr>
<th>Risk</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled birth attendance</td>
<td>Use of clean birth kits, hand washing with soap and, if appropriate, chlorhexidine</td>
</tr>
<tr>
<td>Hygienic care at birth</td>
<td>Induction of labour after 41 weeks of pregnancy, Management of preterm labour: Treatment with antenatal steroids</td>
</tr>
<tr>
<td>Antibiotics for preterm premature rupture of membranes</td>
<td></td>
</tr>
</tbody>
</table>

Interventions for immediate care and for small and ill newborn babies

<table>
<thead>
<tr>
<th>Risk</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate care for every neonate</td>
<td></td>
</tr>
<tr>
<td>Cord care and clamping</td>
<td>Delayed cord clamping and cord cleansing with antiseptics</td>
</tr>
<tr>
<td>Interventions to prevent hypothermia</td>
<td>Drying, head covering, skin-to-skin care, and delayed bathing for every newborn baby</td>
</tr>
<tr>
<td>Nutrition in neonates</td>
<td>Early initiation and exclusive breastfeeding</td>
</tr>
<tr>
<td>Vitamin K administration</td>
<td></td>
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<tr>
<td>Small and ill neonates</td>
<td></td>
</tr>
<tr>
<td>Resuscitation of neonate for perinatal depression and care for babies with neonatal encephalopathy</td>
<td></td>
</tr>
<tr>
<td>Care for small (preterm and/or small for gestational age) infants</td>
<td>Extra thermal care including plastic wraps for transfer, kangaroo mother care, topical emollient therapy, secondary level care, tertiary level care, management of respiratory distress syndrome</td>
</tr>
<tr>
<td>Recognition and management of neonatal infections: Antibiotics for neonatal pneumonia/sepsis/meningitis. Facility-based supportive care with intravenous fluids and intensive care</td>
<td></td>
</tr>
<tr>
<td>Hyperbilirubinaemia prevention and management: Phototherapy to prevent complications</td>
<td></td>
</tr>
</tbody>
</table>

Risks for morbidity and mortality

General | Poverty, absence of education and empowerment, low access to care, household air pollution |
Maternal | Maternal malnutrition, maternal age, interpregnancy interval, maternal infections, chronic diseases, pregnancy-induced disorders, substance misuse |
Intrapartum | Absence of obstetric care, breech delivery, post-term pregnancy, preterm premature rupture of membranes, preterm labour, unskilled delivery |
Neonatal | Prematurity, IUGR, perinatal depression, meconium aspiration syndrome, kernicterus, hypothermia, congenital malformations, neonatal infections |

Figure 1: Conceptual framework for risks and interventions to improve health for every newborn and other birth and maternal outcomes

IPTp=intermittent preventative treatment in pregnancy. ITN=insecticide-treated bednets. IUGR=intraterine growth restriction.

Table 1 continues on next page
## Table 1: Overview of interventions showing effect on selected outcomes

<table>
<thead>
<tr>
<th>Stillbirth</th>
<th>Preterm birth</th>
<th>Perinatal mortality</th>
<th>Small for gestational age</th>
<th>Neonatal mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Continued from previous page)</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Lower genital infection screening and management</td>
<td>–</td>
<td>0.55 (0.41–0.75)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Prophylactic antibiotics</td>
<td>–</td>
<td>0.96 (0.70–1.33)</td>
<td>0.80 (0.31–2.06)</td>
<td>1.29 (0.42–3.96)</td>
</tr>
<tr>
<td>Antibiotic prophylaxis for group b streptococcus colonisation</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Antibiotics for bacterial vaginosis</td>
<td>–</td>
<td>0.88 (0.71–1.09)</td>
<td>0.71 (0.36–1.39)</td>
<td>–</td>
</tr>
<tr>
<td>Asymptomatic bacteriuria treatment</td>
<td>–</td>
<td>0.37 (0.10–1.36)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Periodontal disease management</td>
<td>0.49 (0.26–0.94)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Antihypertensive for mild-to-moderate hypertension</td>
<td>1.14 (0.60–2.17)</td>
<td>1.02 (0.89–1.16)</td>
<td>0.96 (0.60–1.54)</td>
<td>0.84 (0.54–1.37)</td>
</tr>
<tr>
<td>Magnesium sulphate for prevention of pre-eclampsia</td>
<td>0.89 (0.87–1.21)</td>
<td>–</td>
<td>0.98 (0.88–1.10)</td>
<td>–</td>
</tr>
<tr>
<td>Calcium supplementation for hypertension</td>
<td>0.90 (0.74–1.09)</td>
<td>0.76 (0.60–0.97)</td>
<td>0.86 (0.70–1.07)</td>
<td>1.05 (0.86–1.29)</td>
</tr>
<tr>
<td>Antiplatelets for pre-eclampsia</td>
<td>1.15 (0.88–1.49)</td>
<td>0.92 (0.88–0.97)</td>
<td>0.89 (0.74–1.08)</td>
<td>0.90 (0.83–0.98)</td>
</tr>
<tr>
<td>Preconception diabetes education</td>
<td>–</td>
<td>0.83 (0.62–1.12)</td>
<td>0.51 (0.19–0.53)</td>
<td>–</td>
</tr>
<tr>
<td>Optimum vs suboptimum glucose control</td>
<td>0.51 (0.14–1.88)</td>
<td>–</td>
<td>0.40 (0.25–0.63)</td>
<td>–</td>
</tr>
<tr>
<td>Education/psychotherapy to quit smoking</td>
<td>–</td>
<td>0.79 (0.52–1.21)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nicotine replacement therapy</td>
<td>–</td>
<td>0.77 (0.61–0.97)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Incentives to quit smoking</td>
<td>–</td>
<td>0.49 (0.22–0.86)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Prenatal antidepresants</td>
<td>–</td>
<td>1.55 (1.38–1.74)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Doppler velocimetry</td>
<td>–</td>
<td>–</td>
<td>0.71 (0.52–0.98)</td>
<td>–</td>
</tr>
<tr>
<td>Fetal movement monitoring</td>
<td>0.65 (0.41–1.04)</td>
<td>1.12 (0.72–1.75)</td>
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</tr>
<tr>
<td>Caesarean section for breech</td>
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<td>–</td>
<td>0.33 (0.19–0.56)</td>
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<tr>
<td>Post-term labour induction</td>
<td>0.28 (0.05–1.67)</td>
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<td>0.30 (0.09–0.99)</td>
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<tr>
<td>Antibiotics for preterm premature rupture of membrane</td>
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<td>–</td>
<td>–</td>
<td>0.88 (0.80–0.97)</td>
</tr>
<tr>
<td>Steroids for preterm labour</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.96 (0.63–1.44)</td>
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<tr>
<td>Basic emergency obstetric care</td>
<td>–</td>
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<tr>
<td>Comprehensive emergency obstetric care</td>
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<tr>
<td>Skilled birth care</td>
<td>–</td>
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<tr>
<td>Clean birth practices at home</td>
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<tr>
<td>Clean birth practices at facility</td>
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<tr>
<td><strong>Newborn and neonatal interventions</strong></td>
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<tr>
<td>Delayed cord clamping in full-term neonates</td>
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<td>Umbilical cord antiseptics</td>
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<td>Neonatal resuscitation at home</td>
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<tr>
<td>Neonatal resuscitation at facility</td>
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<tr>
<td>Anticonvulsants for asphyxia</td>
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<tr>
<td>Hypothermia for hypoxic ischaemic encephalopathy</td>
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<tr>
<td>Continuous positive airway pressure for respiratory distress syndrome</td>
<td>–</td>
<td>–</td>
<td>0.52 (0.32–0.87)</td>
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<tr>
<td>Surfactant therapy for respiratory distress syndrome</td>
<td>–</td>
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<tr>
<td>Preventive surfactant therapy for preterm neonates</td>
<td>–</td>
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<tr>
<td>Antibiotics for meconium aspiration syndrome</td>
<td>–</td>
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<tr>
<td>Systemic steroids for meconium aspiration syndrome</td>
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<tr>
<td>Inhaled steroids for meconium aspiration syndrome</td>
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<tr>
<td>Surfactant lung lavage for meconium aspiration syndrome</td>
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<td>Bolus surfactant for meconium aspiration syndrome</td>
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<td>Topical emollient therapy</td>
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<td>Hypothermia prevention for preterm infants</td>
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<td>Oral antibiotics for pneumonia</td>
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<td>Injectable antibiotics for pneumonia</td>
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<td>Antibiotics for sepsis</td>
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Data are RR (95% CI). Numbers in bold indicate a significant effect, whereas non-bold data indicate no significant effect. ·· Indicates no evidence.
early infection. The potential overall effect in low-income and middle-income countries is uncertain. Antibiotic treatment for asymptomatic bacteriuria in pregnancy is effective in clearing asymptomatic bacteriuria (by 75%), and in reducing the incidence of pyelonephritis (77%) and low birthweight (44%).

Despite wide prevalence, the evidence to support interventions to prevent the transmission and complications of cytomegalovirus, herpes, or toxoplasmosis is inconclusive.

Antiretroviral drugs reduce viral replication and can decrease mother-to-child transmission of HIV. Recent studies suggest that extended duration of treatment, especially highly active antiretroviral therapy during pregnancy, might be associated with an increased
cidence of preterm delivery, small for gestational age infants, and pregnancy complications, including hypertension. These areas merit further research and development.

Hypertensive diseases of pregnancy, including pregnancy-induced hypertension, pre-eclampsia, and eclampsia, can complicate 5–8% of pregnancies and are the second most common cause of maternal deaths worldwide. Treatment of mild-to-moderate hypertension during pregnancy does not substantially affect maternal and birth outcomes, although the use of magnesium sulphate can reduce the risk of eclampsia by 59%. Studies of antiplatelet drugs for women at risk of developing pre-eclampsia show that these drugs reduced
risks of pre-eclampsia (by 17%), preterm birth (8%), and small for gestational age infants (10%). These drugs might be beneficial to prevent pre-eclampsia and improve maternal care in health systems.

An estimated 60 million women of reproductive age have type 2 diabetes, and gestational diabetes affects up to 15% of pregnant women worldwide. Gestational diabetes creates an excess risk of adverse birth outcomes. Preconception dietary advice and counselling can reduce the mean concentration of glyated haemoglobin (HbA1c) during the first trimester of pregnancy, and can also reduce congenital malformations (by 70%) and perinatal mortality (69%).

Intensified management including dietary advice, monitoring, or pharmacotherapy for women with gestational diabetes results in a 54% reduction in birth outcomes. Although most of the evidence is from high-income countries, these interventions can also improve maternal and newborn outcomes in low-income and middle-income countries.

Maternal undernutrition is a risk factor for infants being small for gestational age. General nutrition interventions include dietary advice to pregnant women, specific micronutrients and balanced protein energy supplements to malnourished women, and prescription of low-energy diets to overweight pregnant women or those with excessive weight gain in early pregnancy.

Iron deficiency is the most common cause of anaemia in pregnancy and iron and folic acid supplements are recommended for prevention. However, in view of the widespread multiple micronutrient deficiencies in women of reproductive age worldwide, replacement of iron folate supplements with multiple micronutrient supplements has been recommended and could have additional benefits on reducing small for gestational age births. Calcium supplementation during pregnancy in populations with low calcium intake can lower the risk of gestational hypertension and pre-eclampsia, reduce the risk of preterm births, and improve birthweight.

The causes and risk factors overlap for stillbirth and intrauterine growth restriction. Early antenatal detection of intrauterine growth restriction and then appropriate treatment and timely delivery could minimise the risks of adverse outcomes and has been shown to be cost effective for middle-income countries according to a modelling exercise. One possible treatment is low-dose heparin, although this therapy is yet to be tested in low-income and middle-income countries.

Detection based on low maternal body-mass index, symphysial fundal height measurement, and targeted doppler ultrasonography could help in the identification of fetuses at risk of intrauterine growth restriction who should be delivered early, which could potentially reduce stillbirths by 20% according to a Delphi consensus panel. However, this strategy needs further assessment in low-income and middle-income countries because of its high cost and the potential associated risks regarding increased preterm birth in the absence of high-quality neonatal intensive care.

The risk of RhD alloimmunisation during or immediately after a first pregnancy is about 1% and administration of 100 µg (500 IU) anti-D to women in their first pregnancy can reduce this risk to about 0·2%. Antibiotic prophylaxis is also recommended to be given post-abortion, although the evidence to support this treatment approach is not clear. Recent estimates show a substantial burden of both death and disability caused by this preventable disorder, and new focus is needed to reduce the cost of anti-D so that it can be made universally available.

Maternal mental health disorders can significantly affect the health of both the mother and the newborn baby. Although the benefit of maternal mental health interventions, especially cognitive behavioural therapy, is well recognised, reviews about antidepressants for treatment of antenatal depression show conflicting reports about the benefits and risks.

 Substance misuse during pregnancy consists of the use of illicit drugs, alcohol, or smoking, and can affect maternal and fetal health and development. Although neonatal withdrawal syndrome can be managed, few proven interventions can reduce maternal drug misuse and its effects on newborn outcomes. By contrast, promising evidence suggests that a decrease in the prevalence of smoking could reduce preterm births and low birthweight in some countries (appendix pp 26–27).

Interventions during labour and birth

Interventions during and close to labour include obstetric care (monitoring of labour and assisted vaginal delivery or caesarean section), skilled delivery, and management of preterm labour and post-term pregnancy (appendix pp 15–17).

In obstetric care, the potential benefits of partogram use and cardiotocography with intermittent auscultation of the fetal heart rate on neonatal outcomes in low-risk pregnant women are uncertain. The presence of skilled birth attendants and provision of emergency obstetric care as needed are the cornerstone of modern obstetrics. A Delphi process among experts suggested that basic emergency obstetric care could reduce intrapartum-related neonatal deaths by 40% and comprehensive emergency obstetric care could do so by 40%, whereas skilled birth care alone without access to the emergency component was judged to have a smaller effect at 25%.

Education and promotion of clean birth behaviours results in a 29% increase in the use of sterile cord cutting and reductions in perinatal and neonatal mortality
Hand washing with soap and water by traditional birth attendants, infants' caregivers or both reduces the risk of omphalitis (by 31%) and neonatal tetanus (42%) (appendix pp 30–31). A Delphi-based expert panel suggested that clean birth practices could reduce neonatal sepsis deaths by 15% at home, by 27% in facilities, and by 40% with clean postnatal care practices. The panel also estimated that clean birth practices reduce neonatal tetanus mortality by 30% in home births, by 38% in facility births, and by 40% through clean postnatal care practices.64

The effect of antenatal steroids to manage preterm labour is mediated through overall acceleration of fetal maturity, and has shown to reduce respiratory distress syndrome by 34%, cerebroventricular haemorrhage by 46%, and the risk of neonatal deaths by 31%.65–72 This intervention is also associated with reduced need for ventilation so will probably have a greater effect in settings without intensive care, and a subgroup analysis of evidence from low-income and middle-income countries suggests that the effect on neonatal mortality effect is indeed bigger than in high-income countries at 53%.65 Antibiotics administered for preterm, premature rupture of membranes reduces the risk of respiratory distress syndrome by 12% and early-onset postnatal infection by 39%.73

A policy of labour induction at term or post-term (at 41 weeks or more), when compared with spontaneous labour or later induction, was associated with 69% fewer perinatal deaths and 50% reduction in risk of meconium aspiration syndrome.74 However, the costs and increased risk associated with the detection and induction of labour for post-term pregnancies do not yet support implementation of this approach in low-income and middle-income countries.4

Interventions for immediate care for every newborn baby
Interventions at birth for every newborn baby include immediate drying and stimulation, provision of warmth, hygienic care, support for immediate breastfeeding, and administration of vitamin K. For babies who do not breathe at birth, neonatal resuscitation is crucial, and might also include prevention and management of meconium aspiration syndrome (appendix pp 18–20).

Cleansing of the umbilical cord with antiseptics can reduce risk of infection, and application of chlorhexidine to the cord stump in community settings is associated with a 27% reduction in the incidence of omphalitis and 23% reduction in risk of neonatal mortality.75–77 Delayed cord clamping in preterm newborns is associated with a 39% reduction in the need for blood transfusion, a 41% reduction in the risk of intraventricular haemorrhage, and a 38% reduction in risk of necrotising enterocolitis.78

In view of the raised risk of neonatal mortality with hypothermia, thermal care is important for every newborn baby. Plastic wraps, when combined with other environmental heat sources, are effective in reducing hypothermia in preterm babies during stabilisation and transfer within the hospital. Some evidence supports a beneficial effect of delayed bathing and head covering on hypothermia in term and preterm babies. However, only a few small, underpowered studies have sought to quantify the effect of common thermal care interventions on neonatal mortality in low-income and middle-income countries (appendix p 32). A Delphi-based expert panel provided estimates for the effect of three thermal care practices (delayed bathing, head covering, and skin-to-skin care) and suggested that these methods could avert 20% of neonatal deaths caused by preterm birth complications and 10% of deaths in full-term or moderately preterm babies caused by infection (appendix p 32).

Initiation of breastfeeding within 1 h of birth, exclusive breastfeeding of infants until 6 months of age, and continuation of breastfeeding until 2 years of age are strongly recommended.79 Although descriptive analyses suggest that early initiation of breastfeeding can reduce neonatal mortality by 44%,76 in exclusively breastfed infants the risk of all-cause neonatal mortality did not differ between early and late initiators. Education and counselling interventions have been shown to improve exclusive breastfeeding rates by 43% at day 1 and by up to 30% by 1 month of age, and this can be included in maternal and newborn home visit programmes that are presently being scaled up.80

When given to infants of very low birthweight, oral or intramuscular vitamin A supplementation is associated with slightly reduced neonatal mortality.81 Asian studies have shown that neonatal vitamin A reduces the risk of mortality at 6 months of age by 14%, with evidence of benefit in populations at risk of maternal vitamin A deficiency, although results from Africa are awaited.82 Vitamin K is given prophylactically after birth to prevent vitamin K deficiency bleeding and is especially important for babies who are exclusively breastfed. In the absence of vitamin K prophylaxis, the risk of such bleeding is 0.4–1.7% and one dose of intramuscular vitamin K can reduce this risk on days 1–7 after birth and improve coagulation indices.83

Interventions for small and ill newborn babies
Interventions for small and ill newborn babies include prevention of hypothermia; management of respiratory distress syndrome, neonatal pneumonia, sepsis and hyperbilirubinaemia; and innovations for skin care including emollient and massage therapy (appendix pp 21–22).

Kangaroo mother care involves a package of early and continuous skin-to-skin contact, breastfeeding support, early discharge from hospital, and supportive care in stable neonates. This care package in preterm neonates (<2000 g birthweight) in hospitals is associated with reduced risk of neonatal mortality (by 51%),84 nosocomial infection or sepsis (by 58%), hypothermia
(by 77%), and shorter length of hospital stay. Kangaroo mother care also leads to a 27% increase in breastfeeding rates at 1–4 months after birth and increased breastfeeding duration. So far, insufficient evidence exists to recommend community initiation of kangaroo mother care, but strong evidence supports the use of this care approach post-discharge to reduce both later mortality and also improve breastfeeding rates. High-income countries are taking up kangaroo mother care because of its long-term developmental benefits.

Perinatal respiratory depression caused by intrapartum hypoxia events or preterm birth increases the risks of mortality, neonatal encephalopathy, and long-term disability. Resuscitation training in facilities reduces intrapartum-related neonatal deaths by 30% and early neonatal deaths by 38%. Although some community-based studies of resuscitation have shown benefit, further evidence is needed from large-scale implementation efforts, especially regarding cost-effectiveness and sustainability (appendix p 33).

The use of anticonvulsants in encephalopathic asphyxiated newborns has no additional benefit (appendix pp 34–35). Evidence, mostly from high-income settings, suggests that therapeutic hypothermia could reduce neonatal mortality by 25% and major neurodevelopmental disabilities by 23%. A more recent review from low-income and middle-income countries suggests similar benefit, although concerns persist about scale-up in low-income and middle-income countries because of the high underlying rates of infection. Meconium aspiration syndrome can accompany intrapartum complications, although evidence for effective, feasible interventions is scarce (appendix pp 36–39).

Continuous positive airway pressure in spontaneously breathing preterm infants with respiratory distress syndrome reduces both intensive care admissions (by 53%) and mortality (48%). Most trials of this procedure analyse specifics in the context of wide use of ventilation, such as reduced time to extubation with continuous positive airway pressure. A few more recent but small studies have assessed the use of continuous positive airway pressure versus no ventilation in South Africa and Malawi with encouraging results. Further research is needed before wide-scale implementation in low-income and middle-income countries.

Prophylactic intratracheal administration of animal-derived surfactant reduces the risks of pneumothorax (by 60%), pulmonary interstitial emphysema (54%), and neonatal mortality (40%). Similarly, the use of animal-derived surfactant in preterm infants with established respiratory distress syndrome is associated with substantial decreases in risks of pneumothorax (by 58%), pulmonary interstitial emphysema (55%), and neonatal mortality (32%). Further research efforts are needed to develop a low-cost surfactant.

In developed countries, facility-based neonatal care is usual practice and historical trends clearly show the effect on reducing neonatal mortality. Hospital-based care of neonates has become increasingly sophisticated with improving understanding of physiology and disease, and the development of new technologies (eg, ventilators, monitoring devices, and laboratory investigations) and treatments (eg, surfactant, parenteral nutrition, indomethacin, and caffeine). Low-income and middle-income countries have followed this trend with the establishment of neonatal care units, often in the private sector or in referral hospitals in urban settings.

Specific evidence for the effectiveness of the package of hospital-based care for ill and preterm infants is scarce in both high-income countries and in low-income and middle-income countries since trials tend to focus on the incremental gains of single interventions. We undertook a Delphi consultation on the effectiveness of two hospital-based supportive care packages: secondary level care (including kangaroo mother care, provision of warmth, feeding support/intravenous fluids, infection management, oxygen, and management of neonatal jaundice) and tertiary level care (including additional surfactant and/or nasal continuous positive airway pressure or intermittent positive pressure ventilation as needed). The consultation suggested that secondary and tertiary level care could prevent 70% and 90% of deaths in preterm infants, respectively (appendix pp 40–45).

The rapid detection and optimum treatment of suspected neonatal bacterial infections, such as pneumonia and sepsis, is essential. Oral antibiotics administered in community settings can reduce all-cause neonatal mortality by 25% and pneumonia-specific mortality by 42%. Although the evidence for the use of injectable antibiotics in community settings shows significant reductions in mortality in infected newborn babies, implementation at scale has not yet been reported. Recent findings from studies of simplified antibiotic regimens in Asia and Africa suggest that newborn infants with potentially serious bacterial infections can be identified by community health workers and can be successfully given injectable antibiotics in first-level facilities (Bahl R [WHO, Geneva, Switzerland], personal communication).

Premature and small for gestational age infants are at high risk of pathological hyperbilirubinaemia that can lead to bilirubin encephalopathy. Phototherapy is the most common treatment for neonatal hyperbilirubinaemia and is effective in preventing the sequelae of the disorder.

Topical emollient therapy can reduce the risk of hospital-acquired infections (by 50%), improve weight gain (by 98 g), and reduce neonatal mortality (by 27%). Massage therapy with or without emollients might have several benefits in preterm infants in low-income and middle-income countries but this approach needs to be assessed further (appendix p 46).
Delivery platforms and strategies to reach mothers and neonates in the greatest need

Although we have a reasonable repertoire of evidence-based interventions, the effect on the population depends on the achievement of high coverage and on reaching unreached groups. The introduction of mHealth also opens the door to efficiently reaching households and health workers (appendix p 47). Several approaches could be instrumental in the scale-up of evidence-based interventions.

First, community-based delivery platforms, especially when linked to local health facilities, can not only increase the coverage of essential interventions but also reduce inequities (appendix pp 48–49). A recent review assessing the effectiveness of community-based intervention packages shows benefits on reducing maternal morbidity (by 25%), stillbirths (19%), perinatal mortality (23%), and neonatal mortality (26%). Many of these effects operate through changes in household behaviours and practices, such as improved tetanus immunisation rates, use of clean birth kits, facility births, early initiation of breastfeeding, and seeking of health care for neonatal illnesses.

Community mobilisation and antenatal and postnatal home visits by community health workers should complement facility-based care and promote family contact with the health system at crucial times, with consequent reductions in neonatal mortality (by 40%). Concomitant gains are provided by newborn care practices such as early initiation of breastfeeding, exclusive breastfeeding, delayed bathing, and clean cord care. When referral is not possible, home-based care of ill neonates is feasible and has been shown to be effective in India, Bangladesh, and Zambia.

An important aspect of such community platforms is the creation of demand for services and changes in household practices. A recent review on women’s groups facilitated by workers to discuss and solve related problems showed a significant effect on reducing neonatal mortality by 20%. These approaches can have a huge effect on empowering communities, improving household practices, and promoting demand for better maternal and newborn care.

Notwithstanding good-quality maternal and newborn care in facilities, sufficient evidence supports scale-up of community-based packages of preventive and basic care, which can be promoted through a range of outreach workers and women’s groups. A combination of these approaches, empowerment of women through community mobilisation and support groups, outreach community health workers, and promotion of transport to referral facilities are needed as a logical step to scale-up coverage.

Child health days have been introduced in some contexts as a strategy to rapidly scale-up essential child survival interventions, including vitamin A supplements, immunisations, insecticide-treated bednets, and deworming, among others. Several new elements can be included within such approaches, for example, maternal antenatal care, micronutrient supplements, birth registration, and behavioural change communication to support early initiation of breastfeeding and exclusive breastfeeding. Although integrated management of childhood illness initially excluded the first week of life, the strategy was explicitly modified in some countries to include this period. This new approach has now been shown to have good sensitivity for the diagnosis and referral of young infants with severe illnesses and for improving the quality and cost-effectiveness of ambulatory care.

Although information about newborn outcomes and effects is scarce, integrated management of neonatal and childhood illnesses has been shown to reduce neonatal mortality when implemented at scale.

Financial incentives are used widely as policy strategies to ameliorate poverty, reduce financial barriers, and improve health outcomes in poor populations. A review of financial platforms to improve basic and emergency obstetric care showed that maternal voucher schemes improved the use of a range of maternal and newborn health services and outcomes, including increased institutional births with voucher schemes, community-based health insurance, and exemptions from user fees. Voucher schemes led to increased use of antenatal care and higher skilled birth attendance. Evidence exists for the benefits of conditional cash transfers on maternal care seeking and improved rates of institutional deliveries. India’s conditional cash transfer scheme (the Janani Suraksha Yojana) had an impressive effect on increasing the number of births in facilities, but was only associated with a modest reduction in perinatal and neonatal mortality, possibly because the quality of facility care provided was low. Conditional and unconditional cash transfers have also improved birth registration and hold promise in reducing inequities.

Improvement of quality of maternal and newborn care

Despite existing evidence-based interventions to prevent and successfully manage major causes of maternal and newborn morbidity and mortality, the delivery and distribution of these services is often inadequate. The quality of care received by women and newborn babies in poor and marginalised populations is insufficient and could contribute to low use of services and high rates of morbidity and mortality. Although evidence from formal trials is scarce, improvement of the quality of care at all tiers of the health system could offer a major opportunity for change (panel 2).

Modelling of the cost and effect on stillbirths and maternal and neonatal mortality

Methods

We selected interventions from those reviewed, based on evidence of benefits as described here and extensively in previous publications. The cause-specific effects of
A review showed that audits and feedback mechanisms led to an absolute increase in health-care professionals’ compliance with desired practice. The median adjusted percentage change compared with control was 1.3% (IQR 1.3–28.9), and feedback mechanisms also positively affected various patient outcomes, with a median percentage change of 17% (IQR 1.5–17). Multivariate meta-regression indicated that these mechanisms might be more effective when repetitive, with low baseline performance, and when feedback is provided by a supervisor or colleague and is given in both verbal and written formats, including both explicit targets and an action plan.

A review found two randomised controlled trials, the first of which showed that newborn resuscitation training was associated with a significant improvement in performance of adequate initial resuscitation steps (relative risk [RR] 2.45, 95% CI 1.75–3.42) and a reduction in the frequency of inappropriate and potentially harmful practices (mean difference 0.40, 95% CI 0.13–0.66). In the second trial included in the review, assessment of breathing and newborn care practices in the delivery room improved following implementation of essential newborn care training. Implementation of the Helping Babies Breathe programme in eight health facilities in Tanzania was associated with a significant reduction in neonatal deaths (RR 0.53, 95% CI 0.43–0.65) and rates of fresh stillbirths (RR 0.76, 95% CI 0.64–0.90).

A review of interventions including target payments linked to coverage and quality of care or conditional cash transfers without quality measures showed that these approaches have some benefits. Most of the interventions used a wide range of targets covering inpatient, outpatient, and preventive care, including a strong focus on services for women and children. Almost all dimensions of potential effect remain understudied, including intended and unintended effects on health outcomes, equity, organisational change, user payments and satisfaction, resource use, and staff satisfaction.

These interventions are presented in table 2 and appendix pp 50–64. We used the Lives Saved Tool (LiST) to model the effect of these interventions within the health systems of 75 Countdown countries that together account for more than 95% of maternal, neonatal, and child deaths worldwide. LiST works by estimating the country-by-country cause-specific effects of increasing coverage of individual interventions from baseline levels of 2012 on stillbirth and neonatal and maternal mortality (panel 3) (appendix pp 65–67).

To calculate the costs of these packages of care we used an ingredient-based approach for each of the 75 Countdown countries to estimate the incremental running cost of the higher coverage for selected interventions in terms of people time, commodities, amortised facility costs, and other inputs as detailed in panel 3 and appendix pp 68–80. This calculation does not include specific infrastructure investments that might be needed since these are more specific to context. These methods are broadly consistent with other recent multi-country costing work, except for one recent model in which general health system strengthening costs were included for a wide range of interventions and scenarios (table 3 and appendix pp 68–80).

Panel 2: Quality of care

Audits and feedback mechanisms

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Training of care providers

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Paying health workers for performance

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Safe childbirth checklist

This approach tries to emulate the success of aviation industry in improving quality and reducing the risk of accidents through the use of checklists. A safe childbirth checklist is being assessed in a large trial in India.

Information systems

Information technology has been used to educate mothers and families, send reminders to health providers or mothers and families, support health providers in clinical management, and to improve supervision and monitoring, all of which have the potential to improve quality of care. Several assessments of this approach are underway.

Social support during pregnancy and labour

Standardised or individualised programmes of additional social support throughout pregnancy and during labour, including emotional support and provision of information about labour and coping techniques, can reduce the risk of antenatal hospital admission (RR 0.79; 95% CI 0.68–0.92), caesarean birth (0.87; 0.78–0.97), intrapartum analgesia (0.90; 0.84–0.97), dissatisfaction (0.69; 0.59–0.79), labour duration (mean difference –2.45 hours; 95% CI –0.86 to –0.30), instrumental vaginal birth (RR 0.90; 95% CI 0.84–0.96) with an increase in spontaneous vaginal birth (1.08; 1.04–1.12) although it did not show any effect on preterm birth, low birthweight, or perinatal mortality.

Breastfeeding support interventions

These interventions, including reassurance, praise, information, and staff training to improve the supportive care, have been shown to increase the duration and exclusivity of breastfeeding (RR for stopping any breast feeding before 6 months 0.91; 95% CI 0.88–0.96). However, the effectiveness is reportedly higher in settings with high initiation rates; hence, strategies to increase the uptake of breastfeeding should be in place.

Training of traditional birth attendants might lead to improved referrals and early breastfeeding with reductions in perinatal and neonatal mortality but are not yet integrated with other health systems interventions.
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<th>Stillbirths</th>
<th>2020 coverage target (%)</th>
<th>2025 coverage target (%)</th>
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<td>CEmOC facility births</td>
<td>Intrapartum-related† and prematurity†</td>
<td>Intrapartum-related: 0.85; prematurity: 0.10</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Antenatal corticosteroids for preterm labour in facility births (clinic, BEmOC, or CEmOC level)</td>
<td>Prematurity†</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Antibiotics for PPROM in facility births (clinic, BEmOC, or CEmOC level)</td>
<td>Prematurity† and sepsis†</td>
<td>Prematurity: 0.12; sepsis: 0.08</td>
<td>0.3 (proportion of PPROM among preterm infants)</td>
<td>--</td>
</tr>
</tbody>
</table>

(Table 2 continues on next page)
Results for estimates of lives saved

On the basis of the coverage listed in figure 2 and the interventions’ effects and targets (table 2), we estimate that with high coverage by 2025, 71% (range 56–76%) of neonatal mortality, 33% (23–38%) of stillbirths, and 51% (44–53%) of maternal deaths could be averted. A breakup of the analysis in the modelled countries according to neonatal mortality rates shows that the largest effects of
Panel 3: Methods for modelling and costing

Modelling methods
We modelled the potential effect of introducing these interventions within health systems of the 75 high-burden Countdown countries. We used a standard sequential introduction of the interventions using the Lives Saved Tool (LiST), which estimates the effect of increased coverage of interventions on deaths from one or more causes, or in reduction of the prevalence of a risk factor (appendix p 65). For each of the 75 Countdown countries, baseline scenarios were created that represent the most up-to-date details about health status, including mortality rates,1 stunting and wasting rates,2 and median coverage of interventions and other maternal and child health indicators based on the most recent data from the United Nations (figure 2). We estimated the effects of scale-up of a set of interventions that fall into six packages along the continuum of care:

- Preconception nutrition care (balanced energy protein supplementation, folic acid supplementation/fortification, and micronutrient supplementation [multiple micronutrients, including iron and folic acid])
- Antenatal care (calcium supplementation in at-risk populations, intermittent preventive treatment in pregnancy, syphilis detection and treatment, and tetanus toxoid vaccination). We also modelled an additional set of more complex antenatal care interventions (diabetes case management, fetal growth restriction detection and hypertensive disease prevention and case management, induction of labour for pregnancies lasting longer than 41 weeks) for possible effect on stillbirths in only a few countries with neonatal mortality rates lower than 30 per 1000 livebirths
- Care during labour and childbirth (active management of the third stage of labour, clean birth practices, labour and delivery management, antenatal corticosteroids for preterm labour, antibiotics for preterm premature rupture of membranes, and magnesium sulphate for pre-eclampsia)
- Immediate newborn care (immediate assessment and stimulation, and neonatal resuscitation)
- Care of the healthy neonate (breastfeeding, chlorhexidine cord application, and clean postnatal practices)
- Care of the small and ill neonate (thermal care, hospital care of preterm babies including kangaroo mother care, case management of severe neonatal infections, oral antibiotics for neonatal infections, and oral rehydration solution for diarrhoea)

Table 2 shows the intervention packages and modelled coverage targets for 2020 and 2025. For the period before birth, the coverage targets for the seven core intervention packages were set at 70% for 2020 and 90% for 2025. For interventions at birth, we had a more complex scale-up that addressed the quality of service provided and the overall coverage of births occurring in a facility. We systematically scaled up the quality of services by scaling up assumptions of coverage of the component services that could be provided at a low level facility, at a higher level secondary care facility, and at a hospital able to provide a full range of tertiary care services. Finally, we also scaled up preventive and curative interventions after birth. Here, as was the case with birth care, we increased the coverage of quality of care at an appropriate level of care. For example, for a premature baby we have three options of care that could be provided at different levels of facilities—ie, basic thermal care in lower level facilities, followed by kangaroo mother care alone in some of the primary care facilities, and then quality secondary and tertiary care at higher level facilities in both rural and urban settings. We also ascertained the effect by levels of care at various time points. Sensitivity analyses to produce different scenarios were done for the results estimating effect (eg, deaths averted and number of deaths). The specific scale-up functions are shown in appendix pp 66–67.

Sensitivity analyses to produce different scenarios were done for the results estimating effect (eg, deaths averted and number of deaths). The sensitivity analyses were based upon varying the assumptions of efficacy for the modelled interventions. Three different scenarios were created using the same levels of baseline coverage, scale-up patterns, and achieved targets but the effectiveness of the interventions to reduce cause-specific maternal, neonatal, or stillbirth deaths varied according to the ranges reported for specific interventions. These ranges represent the lowest, intermediate, and highest estimates of efficacy or effect for the interventions. For estimates of intervention effectiveness derived from meta-analyses, the 95% CIs were used to define the upper and lower bounds. For interventions in which efficacy was estimated with a Delphi approach, the interquartile range (IQR) was used to define the low and high estimates.

Costing methods
We used the LiST costing sub-module to assess the running costs of the interventions for which we used an ingredients-based approach. The costing sub-module draws its assumptions about staffing, drugs, and need for services from the the United Nation’s OneHealth Tool database—another module within the overall Spectrum software package.127 As with OneHealth, the costing module adjusts personnel costs based on regional variation in costs and costs by location and type of service provider. This approach has been used in previous studies building on others to analyse costs for interventions to address interventions for stillbirths,13 childhood pneumonia and diarrhoea,14 and maternal and childhood malnutrition. A similar approach that used the OneHealth Tool was published recently in a report that developed a global investment case for maternal and child health and survival.128 More details about the costing approach and inputs are available in appendix pp 68–80. The cost estimates reported incremental costs for increasing coverage to the target levels in 2020 and 2025 from the levels of coverage in 2012. All the costs are reported in US$.

Clear limitations exist to the estimated effect and costs of scaling up of the package of interventions to reduce neonatal mortality. Although we believe that the levels of coverage are achievable, they are not rapidly achievable in all countries. To reach the levels of coverage in 2025, many countries will need to scale-up coverage at a rate many times higher than they have done in the past. This goal is challenging since hospital-based services such as comprehensive emergency obstetric care, and inpatient care of preterm newborns and neonatal sepsis need more investment in reliable referral system and in infrastructure and especially human resources if they are to reach the coverage levels used in these analyses. Illustrative financing for these costs at various amounts of coverage have recently been published129 and, similar to other recent reports,14,128 the main focus of our paper is on running costs.
Our analysis suggests that India, Nigeria, and Pakistan would benefit the most in terms of absolute lives saved, and the top five countries account for 57% of the total reduction in mortality. An important aspirational goal relates to the scale-up of quality secondary and tertiary newborn care in facility settings (appendix p 83) and the missed opportunity and quality gap around maternal and newborn care. If 90% of all women giving birth in facilities in 2020 were recipients of the highly effective interventions that they and their babies should receive, this would contribute to the prevention of an estimated 113000 maternal deaths (84% of the total deaths averted by 2020), 531000 stillbirths (76%), and 1·325 million neonatal deaths (77%), including 300000 preterm deaths (table 4).

<table>
<thead>
<tr>
<th>Countries</th>
<th>Interventions</th>
<th>Year of baseline coverage (endline year)</th>
<th>Target coverage (%)</th>
<th>Costing methods</th>
<th>Total additional annual cost</th>
<th>Cost per person (total population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal series (2005)</td>
<td>16 neonatal interventions (7 of the 8 neonatal in the child survival series)</td>
<td>2000 (2015)</td>
<td>99%</td>
<td>Ingredients-based running costs with human resource time based on normative delivery schedule and and amortised facility costs, plus additional training supervision, M&amp;E time</td>
<td>$4·1 billion (2004 US$)</td>
<td>$0·96</td>
</tr>
<tr>
<td>Countdown to 2015 (2005)</td>
<td>32 maternal, neonatal, and child interventions</td>
<td>2005 (2015)</td>
<td>99%</td>
<td>Ingredients-based running costs with human resource time based on normative delivery schedule and amortised facility costs, plus additional training supervision, M&amp;E time</td>
<td>$7 billion (range $4·6 billion–10·7 billion) (2004 US$)</td>
<td>$1·62</td>
</tr>
<tr>
<td>Guttmacher Institute (2009, revised in 2010)</td>
<td>26 reproductive, maternal, and newborn interventions</td>
<td>2008 (2015)</td>
<td>Universal coverage (100% met need for family planning interventions)</td>
<td>Direct costs based on the United Nation Population Fund’s Reproductive Health Costing Tool. Indirect costs include overhead costs for programme management, supervision, health education, monitoring and assessment, advocacy, human resources training, information systems, commodity supply systems, and capital costs for maintenance and expansion of the physical capacity of health facilities</td>
<td>$12·8 billion ($3·6 billion for family planning, $9·2 billion for maternal and neonatal care) (2008 US$)</td>
<td>$2·23</td>
</tr>
<tr>
<td>Taskforce for Innovative International Financing for Health Systems (2010)</td>
<td>135 maternal, newborn, child, and infectious disease interventions</td>
<td>2008 (2015)</td>
<td>No specified target</td>
<td>WHO normative approach and MBB tool. Ingredients-based approaches are for health systems strengthening (eg, new facilities) and demand-side financing (eg, incentives). These costs include costs for health systems strengthening (74% of WHO normative and 62% of MBB estimated costs)</td>
<td>$18·6–36·5 billion (MBB)</td>
<td>$24 (MBB)</td>
</tr>
<tr>
<td>Commission of Macroeconomics and Health (2010)</td>
<td>All low-income countries</td>
<td>2002 (2015)</td>
<td>No specified target</td>
<td>-</td>
<td>$9·4 billion additional ($38 billion from donors) (US$, year not clear)</td>
<td>-</td>
</tr>
<tr>
<td>Stillbirth series (2011)</td>
<td>15 maternal and perinatal interventions (10 with effects on stillbirths)</td>
<td>2008 (2015)</td>
<td>99%</td>
<td>Ingredients-based running costs with human resource time based on normative delivery schedule and amortised facility costs, plus additional training supervision, M&amp;E time</td>
<td>$10·9 billion (2008 US$)</td>
<td>$2·32</td>
</tr>
<tr>
<td>Diarrhoea and Pneumonia Series (2013)</td>
<td>15 child interventions</td>
<td>2011 (2025)</td>
<td>80% for all interventions except vitamin A supplementation and vaccines, for which 90% target coverage was used</td>
<td>The costs were based on four components: personnel and labour, drugs and supplies, other direct costs, and indirect costs. Assumptions were obtained for time needed for an intervention and costs for drugs and supplies from the One Health Model developed by the UN</td>
<td>$6·75 billion (2011 US$)</td>
<td>NA</td>
</tr>
</tbody>
</table>

(Table 3 continues on next page)
In a comparison of the effects across the continuum of care, about half of the effect on neonatal mortality is from interventions delivered to the mother (48%) and the remainder from interventions delivered to the newborn infant (52%). The maximum gains (41% of all neonatal deaths averted) occurred with interventions delivered during labour and childbirth, followed by care of the small and ill neonate (30%), care of the healthy neonate (12%), and immediate newborn care (10%), which emphasises the importance of interventions during the period around birth (figure 4). Similarly, for stillbirths, the maximum benefit was noted from appropriate care during labour and childbirth including complications (70% of all stillbirths averted), followed by enhanced antenatal care focused on the detection of complications (21%).

In terms of the effect of intervention scale-up by 2025 on major causes of neonatal mortality, deaths caused by prematurity could be reduced by 58%, intrapartum-related deaths by 79%, and those related to serious infections by 84% (appendix p 82). Assessment of
specific interventions affecting these three major causes of neonatal mortality shows that appropriate care at birth (70%) and neonatal resuscitation (22%) are responsible for most intrapartum-related deaths averted, whereas hospital care of preterm babies including kangaroo mother care (50%) and scale-up of antenatal steroids (31%) are responsible for most preterm-related deaths averted. Appropriate case management of serious infections (24%) and clean postnatal care practices (24%) were responsible for most of the reduction in infection-related deaths (figure 5).

The effect of provision of these additional elements of quality care for ill newborn infants beyond basic preventive strategies and care in community settings is huge and supports the importance of such approaches. Our analysis also supports immediate scaling up of various community-based and primary care interventions because they have the potential to avert almost a third of all neonatal deaths by 2017, along with better secondary and tertiary facility-based care. Although scaling up of quality and secondary and tertiary care to 90% coverage by 2025 would prevent around 80% of all neonatal deaths averted, community-based strategies would still account for 20% of deaths prevented (appendix p 84).

Costing results
The incremental annual costs of providing our recommended packages of care would be close to US$4·5 billion (US$0·91 per person) by 2020, rising to US$5·65 billion (US$1·15 per person) in 2025. This amount represents a cost of about US$1928 for each maternal and neonatal life saved, including stillbirths averted. Table 5 shows the breakdown of these costs by intervention packages and suggests that scale-up of appropriate care during labour and child birth by 2025 would cost US$2·29 billion, followed by food and micronutrient supplements for pregnant women at US$1·88 billion. Of the various components of the respective costs, the bulk is related to human resources and commodities including drugs.

When costs per newborn life saved are considered, immediate care of the newborn infant and care of the healthy neonate have the best return on investment, followed by care of the small and ill neonate and labour and delivery management. However, when a wider range of benefits to maternal, fetal, and newborn deaths are considered, labour and delivery management and antenatal care are as good as neonatal interventions in terms of returns on investment (figure 4).

We recognise that these calculations underestimate the full economic cost, especially when existing facilities and
human resources need major replanning and scale-up investment. Table 3 and appendix pp 68–80 compare this costing with other exercises during the past decade, most of which are also based on incremental running costs. Our estimate is consistent with others that have taken a similar approach, noting that the various exercises have had narrower or wider remits. For example, the Investment Framework for Women’s and Children’s Health estimated costs per person to be US$5 per annum by 2035, and this analysis covered the whole range of reproductive, maternal, and child health interventions, including family planning, additional interventions for water and sanitation, and additional infrastructure costs for general health systems strengthening at scale.

Discussion

Our review is the first comprehensive analysis of the evidence base and strategies to address global newborn health and survival and delivery strategies since our analyses in 2005, and has the additional strength of considering maternal and stillbirth outcomes. During the past decade, notable advances have been made in the breadth and depth of the evidence base for newborn interventions, especially in the context of essential interventions and packages of care. Some highlights include new interventions such as cord cleaning with chlorhexidine, additional evidence of the potential benefits of known interventions such as kangaroo mother care and antenatal steroids, expansion of access to treatment of neonatal infections, and the improved feasibility of more advanced care such as neonatal resuscitation and continuous positive airway pressure devices because of adaptation and innovation of equipment and training methods. We now have more experience with large-scale community-based projects to scale-up care in Asia and Africa and strategies to improve access to universal care. Despite this enhanced evidence, overall coverage of interventions remains low, reductions in neonatal mortality very poor, and progress for stillbirths even more inadequate.

High coverage of available interventions by 2025 could prevent almost three-quarters of neonatal deaths, saving around 2 million lives per year, at a running cost of $1.15 per person, and would put countries on track to achieve the “Every Newborn” and “A Promise Renewed” targets for neonatal mortality reduction by 2030 and 2035, respectively. Packages for care during labour and childbirth (including complications and immediate care of the neonate) and for the care of small and ill neonates have the potential to save 1-9 million newborn infants (almost 92% of all newborn deaths). These two packages are the main focus of the call for action in the Every Newborn Action Plan.

Indeed, even if by 2020 every woman delivering a newborn in a facility received recommended care, our estimates suggest that 1-325 million newborn infants, 0-531 million stillbirths, and 0-112 million women could be saved every year at annual running costs of $1-4.5 billion, or less than a dollar per person in the 75 highest burden countries. This closure of the quality gap for facility births must become imperative for every country and is surely one of the best investments in health and also human rights.

According to the Lancet Global Investment Framework, an even greater effect is possible with universal coverage in 2035. Especially important is to address unmet need for family planning, which would reduce births, further reduce deaths and also reduce the load on the health-care system. This framework suggests that an investment of US$5 per person per year up to 2035 in 74 high-burden countries could yield up to nine-times that value in economic and social benefits, and
would prevent the needless deaths of 147 million children, 32 million stillbirths, and 5 million women by 2035. The analysis also suggested that scaling up of family planning could lead to a 47% reduction in child deaths and a 64% reduction in stillbirths. Their estimate for running costs—excluding those for health system strengthening, new human resources, programme management, and conditional cash transfers—was US$2·1 per person, which suggests that our estimated running costs of US$1·15 per person for maternal and newborn interventions are plausible.

The high proportionate reduction in neonatal mortality suggests that the major killers of newborn babies in low-income and middle-income countries can be addressed—a notion supported by the dramatic reduction in these deaths in high-income countries. New trend data suggest that in some low-income and middle-income countries, deaths caused by neonatal infections have fallen during the past decade at a rate faster than have deaths due to intrapartum complications and substantially more than preterm deaths.1 This finding might be indicative of inadequate attention to care of small babies in facilities in low-income and middle-income countries. Importantly, since many of these interventions are delivered in the antenatal period and around childbirth, they have the potential to reduce stillbirths by a third and reduce maternal deaths by 50%—a triple return on investment with additional benefits on later child survival, improved growth, reduced disability, and non-communicable diseases. The effect on stillbirths is smaller and more work is needed to increase the scope and scaleability of interventions, especially for antepartum stillbirths.

Figure 4: Estimated effect of the intervention packages on numbers of neonatal lives saved and costs according to levels of care by the year 2025
Error bars represent ranges. NMR=neonatal mortality rate. NA=not applicable.
effect on maternal mortality would be higher with the inclusion of some other postnatal interventions to address maternal mortality, such as the prevention and management of maternal haemorrhage and infections.

Our scale-up scenarios for the care of the small and ill neonates are deliberately ambitious but not unrealistic. Our analysis also challenges the view that newborn care is prohibitively expensive once intensive care is added.143 With the scaling up of secondary and tertiary care for 90% of newborn infants in need by 2025, the model suggests that although the costs are substantial, the effect is huge. These benefits do not yet take into account potential long-term gains for human capital by lower disability.1

The rapid increase in facility births in many settings in recent years gives credence to opportunities for impact with more focus on facility care140 but also emphasises the crucial need to match the supply-side interventions to provide quality maternal and newborn care in health systems with ongoing promotion of demand for care. Our analysis here, consistent with the 2005 Lancet Neonatal Series, estimated that community and primary care approaches will save about a third of newborn lives over the next 5–6 years. Even when facility-based care coverage exceeds 90%, community interventions will still continue to contribute to reducing a fifth of all newborn deaths. The maximum benefits would be accrued through a focus on integrated delivery and scale-up of both community-based and primary care strategies while clinical care in facilities and transport systems are strengthened (figure 6). We continue to support the importance of community-based strategies, including women’s groups and the key role that community health workers have in preventive and promotive care and in delivering basic care in primary care settings.149 However, in view of the effect at community level, especially for intrapartum-associated complications and preterm infants, improvement of the quality of care in referral facilities through evidence-based interventions should also be prioritised.

A key programme challenge is to reduce the equity gap, to reach those women and newborn infants in the greatest need. Although classic equity analysis relies largely on tracking differentials using income or asset quintiles,140 many of these differentials relate to issues of ethnicity, geography, and other forms of social marginalisation. We limited our repertoire of interventions to those that address the distal pathways within the health sector while fully recognising the importance of social determinants. We should emphasise that these technological advancements and interventions have to be layered on approaches to address social determinants, education and empowerment of women in society, and human rights, especially the health and wellbeing of girls.

Strategies to overcome these obstacles include addressing of financial barriers149 and deliberate targeting of patient groups through community outreach programmes.140 The evidence from the role of women’s groups from various settings also underscores the need for continued community engagement, demand creation, and empowerment of communities—especially women—as a continued adjunct to interventions within the health sector. The transition

![Figure 5: Estimated effect of interventions on the three largest causes of neonatal deaths](image-url)
PPROM = preterm premature rupture of membranes. IPTp = intermittent preventive treatment in pregnancy. IMCI = integrated management of childhood illnesses.

**Figure 6:**

**Table 5:** Incremental cost of the scale-up plan by intervention package for the years 2020 and 2025

<table>
<thead>
<tr>
<th>Intervention Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconception nutrition care</td>
</tr>
<tr>
<td>Antenatal care</td>
</tr>
<tr>
<td>Advanced antenatal care</td>
</tr>
<tr>
<td>Care during labour and childbirth, including complications</td>
</tr>
<tr>
<td>Immediate neonatal care</td>
</tr>
<tr>
<td>Care of the healthy neonate</td>
</tr>
<tr>
<td>Care of the small and ill neonate</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Capital costs Drug and supply costs Labour costs Other recurrent costs Annual costs in 2020 (US$)**

<table>
<thead>
<tr>
<th>Item</th>
<th>2020</th>
<th>2020</th>
<th>2020</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconception nutrition care</td>
<td>231,093,000</td>
<td>1,031,430,000</td>
<td>99,201,000</td>
<td>66,645,000</td>
</tr>
<tr>
<td>Antenatal care</td>
<td>60,508,000</td>
<td>38,413,000</td>
<td>417,911,000</td>
<td>17,450,000</td>
</tr>
<tr>
<td>Advanced antenatal care</td>
<td>67,518,000</td>
<td>31,883,000</td>
<td>104,064,000</td>
<td>21,061,000</td>
</tr>
<tr>
<td>Care during labour and childbirth, including complications</td>
<td>267,028,000</td>
<td>382,064,000</td>
<td>1,020,568,000</td>
<td>88,051,000</td>
</tr>
<tr>
<td>Immediate neonatal care</td>
<td>187,770,000</td>
<td>300,000</td>
<td>1,570,000</td>
<td>601,000</td>
</tr>
<tr>
<td>Care of the healthy neonate</td>
<td>25,125,000</td>
<td>80,291,000</td>
<td>101,376,000</td>
<td>423,789,000</td>
</tr>
<tr>
<td>Care of the small and ill neonate</td>
<td>77,991,000</td>
<td>283,164,000</td>
<td>101,376,000</td>
<td>231,093,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,008,849,000</td>
<td>1,570,000</td>
<td>1,570,000</td>
<td>601,000</td>
</tr>
</tbody>
</table>

**Capital costs Drug and supply costs Labour costs Other recurrent costs Annual costs in 2025 (US$)**

<table>
<thead>
<tr>
<th>Item</th>
<th>2025</th>
<th>2025</th>
<th>2025</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconception nutrition care</td>
<td>302,619,000</td>
<td>1,356,250,000</td>
<td>122,059,000</td>
<td>87,272,000</td>
</tr>
<tr>
<td>Antenatal care</td>
<td>58,279,000</td>
<td>50,952,000</td>
<td>57,102,000</td>
<td>16,807,000</td>
</tr>
<tr>
<td>Advanced antenatal care</td>
<td>64,848,000</td>
<td>31,571,000</td>
<td>103,539,000</td>
<td>20,227,000</td>
</tr>
<tr>
<td>Care during labour and childbirth, including complications</td>
<td>335,856,000</td>
<td>555,408,000</td>
<td>1,286,525,000</td>
<td>110,648,000</td>
</tr>
<tr>
<td>Immediate neonatal care</td>
<td>1,869,000</td>
<td>100,000</td>
<td>1,017,000</td>
<td>598,000</td>
</tr>
<tr>
<td>Care of the healthy neonate</td>
<td>32,586,000</td>
<td>79,956,000</td>
<td>335,126,000</td>
<td>111,749,000</td>
</tr>
<tr>
<td>Care of the small and ill neonate</td>
<td>79,956,000</td>
<td>335,126,000</td>
<td>111,749,000</td>
<td>347,301,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,286,525,000</td>
<td>1,286,525,000</td>
<td>1,286,525,000</td>
<td>1,286,525,000</td>
</tr>
</tbody>
</table>

**Referral and tertiary level facility**

- Family planning
- Prevention and management of sexually transmitted infections, HIV, and malaria
- Tetanus immunisation
- Nutritional counselling/supplementation
- Fetal growth restriction management
- Chronic disease management
- Prevention and management of preterm labour including antenatal steroids, antibiotics for PPROM
- Skilled birth attendants
- Clean birth practices
- Emergency obstetric care if needed
- Induction of labour at >41 weeks
- Prevention of mother-to-child transmission of HIV
- Immediate newborn care (stimulation, warmth, breastfeeding)
- Extra care of ill/preterm neonate: warmth, kangaroo mother care, feeding/fluids, oxygen, management of neonatal jaundice
- Emergency care: continuous positive airway pressure/intermittent positive pressure ventilation and surfactant for respiratory distress syndrome
- Management of severe neonatal infections
- Hospital care of childhood illness including HIV

**First and secondary care**

- Family planning
- Prevention and management of sexually transmitted infections, HIV and malaria
- Tetanus immunisation
- Nutritional counselling/supplementation
- Diagnosis and treatment of chronic maternal disorders
- Antenatal care visits
- Prevention and management of sexually transmitted infections, HIV and malaria
- Tetanus immunisation
- Nutritional counselling/supplementation
- Diagnosis and treatment of chronic maternal disorders
- Skilled birth attendants
- Clean birth practices
- Emergency obstetric care if needed
- Referral and transport
- Promotion of healthy behaviours (e.g., hygiene, breastfeeding, warmth)
- Extra care of at-risk babies: kangaroo mother care, warmth, feeding support/intravenous fluids, oxygen provision
- Management of neonatal jaundice
- Infection prevention/management
- Early detection and referral for severe illness
- Immunisations, nutrition
- Malaria (IPTp and bednets)
- Care of children with HIV
- First level care of childhood illness (IMCI)
- Diagnosis and treatment of disability
- Infection prevention/management
- Early detection and referral for serious illness

**Community care**

- Adolescent and pre-pregnancy health and nutrition
- Prevention of sexually transmitted infections, HIV, and malaria
- Prevention of female genital mutilation and gender violence
- Nutritional counselling/supplementation
- Counselling and preparation for safe birth and newborn care
- Prevention and management of sexually transmitted infections, HIV and malaria
- Prevention of gender violence
- Nutritional counselling/supplementation
- Counselling and preparation for safe birth and newborn care
- Prevention and management of sexually transmitted infections, HIV and malaria
- Prevention of gender violence
- Nutritional counselling/supplementation
- Counselling and preparation for safe birth and newborn care
- Emergency preparedness including transport
- Skilled birth attendants
- When skilled care is not available, consider clean birth practices
- Promoting healthy homes
- Early initiation and exclusive breastfeeding
- Seek curative services for infections and other illnesses
- Referrals when needed

**Intersectoral: Improved living and working conditions including housing, water and sanitation, and nutrition; education and empowerment (especially of girls); folic acid fortification; safe and healthy work environments for women and pregnant women**

**Figure 6:** Intervention packages by level of care

PPROM = preterm premature rupture of membranes. IPTp = intermittent preventive treatment in pregnancy. IMCI = integrated management of childhood illnesses.

from home deliveries to facility births can be accelerated through incentives that increase coverage of skilled care in facility settings. The latter also necessitates consideration of strategies to move beyond community care and task shifting to appropriate quality care in district and referral health facilities. So far, this approach has not received sufficient
attention and is crucially important, especially in view of the longer time frame post-MDGs to 2035. Given the burden of preterm births in low-income and middle-income countries, low-cost strategies to manage preterm infants with respiratory distress syndrome as an adjunct to preventive strategies, such as the use of antenatal steroids and management of complications in pregnancy, could potentially save many lives. The mortality reduction targets of the Every Newborn strategy would not be achievable without the rational development of high-quality facility-based newborn care. An urgent need therefore exists to develop acceptable standards, norms, and protocols for facility-based newborn care, and enhance capacity in this crucial area of newborn health care. The vital role of health care professionals, especially well-trained midwives, in achieving these goals must be recognised.

Our findings have several limitations that should be recognised. We still struggle with the level and quality of evidence for many of the interventions considered here, with relatively few effectiveness assessments of packages of care. We have used LiST to estimate effect and have provided uncertainty ranges that do draw attention to the wide uncertainty, more so for partial estimates. Our cost estimates are also consistent with those in several recent studies (table 3 and appendix pp 68–80) and are based on estimated annual running costs. Contextual factors and assessment of specific health systems gaps are essential for planning, and further analysis of the full costs should be based on actual country-specific planning for human resources and infrastructure gaps. The incremental running cost approach is also more comparable across countries and does provide a basis for more detailed national and subnational planning for additional specific investments.

Integration and further scale-up of these interventions in health systems will benefit women, babies, development outcomes, and economic capital—a quadruple return on investment. The key is to prioritise implementation to overcome context-specific bottlenecks. Universal health coverage, which entitles every citizen and every family to a package of health care services guaranteed by the state is the lens through which equitable provision of maternal and newborn care should be viewed. No country can afford to ignore this investment case to change survival and health for every newborn baby and future generations.

Contributors
ZAB was responsible for overall coordination and oversight of the review and writing process; JKD for coordination of reviews and substantial contribution to the writing process; RAS for reviews of maternal vaccination, enrolling and massage therapy; adolescent interventions, and quality of care reviews; ZL for community delivery platforms, management of gestational diabetes mellitus; VRP, RA, and JMS for respiratory distress syndrome, meconium aspiration syndrome, and continuous positive airway pressure reviews; HB and JEL for folate supplementation or fortification, syphilis, tetanus vaccine, hypothyroidism management, kangaroo mother care, obstetric care, and neonatal resuscitation; AI for maternal calcium and balanced energy protein supplementation, cord care and intrauterine growth restriction; SA and AL for contributing the section on mHealth; JEL, VBC, and AR for working on the LiST and cost analysis; and NW for overseeing the modelling and costing process. All named authors contributed to the conceptualisation, writing, and finalisation of the paper. ZAB is the overall guarantor.

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Declaration of interests
We declare no competing interests.

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Universal coverage of essential interventions would reduce neonatal deaths by an estimated 71%, benefit women and children after the first month, and reduce stillbirths. However, the packages with the greatest effect (care around birth, care of small and ill newborn babies), have low and inequitable coverage and are the most sensitive markers of health system function. In eight of the 13 countries with the most neonatal deaths (55% worldwide), we undertook a systematic assessment of bottlenecks to essential maternal and newborn health care, involving more than 600 experts. Of 2465 bottlenecks identified, common constraints were found in all high-burden countries, notably regarding the health workforce, financing, and service delivery. However, bottlenecks for specific interventions might differ across similar health systems. For example, the implementation of kangaroo mother care was noted as challenging in the four Asian country workshops, but was regarded as a feasible aspect of preterm care by respondents in the four African countries. If all high-burden countries achieved the neonatal mortality rates of their region’s fastest progressing countries, then the mortality goal of ten or fewer per 1000 livebirths by 2035 recommended in this Series and the Every Newborn Action Plan would be exceeded. We therefore examined fast progressing countries to identify strategies to reduce neonatal mortality. We identified several key factors: (1) workforce planning to increase numbers and upgrade specific skills for care at birth and of small and ill newborn babies, task sharing, incentives for rural health workers; (2) financial protection measures, such as expansion of health insurance, conditional cash transfers, and performance-based financing; and (3) dynamic leadership including innovation and community empowerment. Adapting from the 2005 *Lancet* Series on neonatal survival and drawing on this Every Newborn Series, we propose a country-led, data-driven process to sharpen national health plans, seize opportunities to address the quality gap for care at birth and care of small and ill newborn babies, and systematically scale up care to reach every mother and newborn baby, particularly the poorest.

**Introduction**

Reduction of the neonatal mortality rate (NMR; deaths within the first 28 days of life), has lagged substantially behind progress in child mortality, with almost 3 million deaths in 2012 being a major unfinished agenda at the end of the Millennium Development Goal era. Globally, the average annual rate of reduction in neonatal mortality has been around half that for children after the first month of life and half that for maternal deaths, and progress is even slower for the world’s 2·6 million stillbirths. Although some countries have made substantial advances in newborn survival, progress varies between neighbouring countries and within countries. African countries have made the least progress in reducing the risk of neonatal deaths (28%) compared with countries in east Asia (65%).

The first paper in this Series reviews changes and challenges since the first call to action for newborn survival in 2005. Although striking progress has been made in agenda setting and the generation and use of evidence in policy formulation, there is little investment, limited large-scale implementation, and major gaps in data for both coverage and process. Hence, it might not be surprising that progress in newborn survival has been slower than in the reduction of child mortality. However, we have now much clearer epidemiological evidence describing the size of the problem and the action priorities—where, when, and whom to focus on. The time of greatest risk for both women and babies is around birth. Small babies—either preterm or small for gestational age or both—are especially vulnerable, accounting for more than 80% of neonatal deaths in south Asia and sub-Saharan Africa. Targeting of small babies has been crucial to acceleration of neonatal mortality reduction in high-income and middle-income countries.

Additionally, the evidence for effective and affordable interventions is clearer than ever: universal coverage of maternal and newborn care would avert 54% of maternal deaths, 71% of newborn deaths, and 33% of stillbirths as well as provide ongoing benefits throughout the lifecycle. Table 1 shows the most effective intervention packages to save mothers’ lives and address the three main causes of newborn mortality including basic care for neonates at birth. Full scale-up of these intervention packages could substantially reduce deaths due to prematurity (38%), intrapartum-related deaths (79%), and deaths related to infections (84%).

Wide and equitable coverage of care is needed to realise a new vision of grand convergence for the richest and poorest countries of the world, including achieving the Every Newborn goals for newborn babies and stillbirths. Of the indicators tracked as a follow-on for the Commission for Information and Accountability, only immunisation is higher than 60% coverage.
fact, coverage is the lowest—and the equity gap the highest—for care around the time of birth, when mortality risk is highest. More than three-quarters of newborn deaths occur in high-mortality settings (NMR higher than 15 deaths per 1000 livebirths) characterised by struggling health systems with low numbers of health workers and facility births (table 2). The interventions that have the greatest effect are especially dependent on health-system infrastructure, capacity, and resources; strengthening of clinical care in facilities is essential because it provides the backbone of services that save the lives of women and children, particularly newborn babies.\(^7,16\)

In 2005, Knippenberg and colleagues\(^7\) noted that the strengths and weaknesses of a health system are crucial but are often not assessed in health programme design,\(^9\) and proposed a four-step systematic approach to assess the context and scale-up of newborn care in communities and facilities. Clinical and community services are inextricably linked, and health-systems strengthening involves addressing of both.\(^7,10\) Neonatal deaths and stillbirths could be the most sensitive marker of linkages between community and facility care. The big challenge remains how to put health-systems strengthening into practice to achieve high, equitable, and effective coverage of care. We suggest that faster progress needs systematic, context-specific identification of the health systems barriers or bottlenecks, to plan and implement strategies to accelerate progress.\(^7,20\)

### Objectives

Every Newborn is a multipartner process initiated in response to country demand for more guidance and action from the global community on newborn survival and health. In the February, 2014, online consultation, which was initiated to allow stakeholders to review the Every Newborn plan, more than 300 comments were received including comments from more than 40 country governments, indicating interest and need for the plan.

In this paper, the fourth of The Lancet Every Newborn Series,\(^1,5,7,21\) we present the results of two analyses: first, multicountry analyses of health-system bottlenecks for scaling up intervention packages to reduce neonatal deaths and improve health; and second, analyses of specific enabling factors that have facilitated progress in reducing neonatal mortality in selected countries. On the basis of this information, we propose strategies to accelerate the scale-up of high-effect interventions, with a particular focus on closing the quality gap for care at birth.

To assess the bottlenecks, we selected key high-burden countries and undertook a series of collaborative workshops to assess the bottlenecks to scale-up (panel 1). We also selected fast progressing countries for NMR reduction in three regions, Africa, Asia, and Latin America and the Caribbean, to analyse the factors that might have accelerated progress (panel 1).

### Key messages

#### Status for scaling up

The interventions with the most effect are mainly clinical and usually facility-based, but have the widest equity gap and the greatest health system challenges. Care around birth and the care of small and ill newborn babies have the greatest gaps in coverage, equity, and quality of care in health facilities in low-income and middle-income countries.

#### Health-systems bottlenecks impeding scale-up

- Interventions with the greatest bottlenecks are the prevention and management of preterm births, inpatient supportive care of ill and small newborn babies, the management of severe infections, and kangaroo mother care.
- Common constraints to scale-up of high-effect intervention packages are found in all high-burden countries and include, most importantly, bottlenecks related to the health workforce, finance, and service delivery.
- Context-specific constraints, where, despite similar health systems, an intervention such as kangaroo mother care can be scaled up in some settings or countries but faces substantial challenges to scale-up in others, despite similar health-systems bottlenecks.

#### Learning from fast progressing countries

Some low-income and middle-income countries have made remarkable progress in reducing neonatal deaths, and if their regional neighbours achieved the same rates, then the Every Newborn Series and action plan mortality goals would be exceeded. Lessons from fast progressing countries draw attention to specific strategies that can be implemented to overcome bottlenecks and improve access to and quality of care, such as addressing health workforce shortages, removal of financial barriers, and improvement of access to care through innovative delivery strategies such as task shifting.

#### Systematic scale-up in countries by overcoming bottlenecks

Adapting from Lancet 2005 Series on neonatal survival and on the basis of the analyses in the Every Newborn Series, we propose four steps for countries to phase in strategies to increase financing, improve the availability and skills of providers, and close the quality gap. Context-specific strategies are needed; countries with low mortality need to focus on quality and equity, whereas those with higher mortality need to improve supply and demand as well as equity and quality.

### Barriers to scale-up of care

We categorised the most frequently mentioned bottlenecks and innovative solutions for each health-system building block into 17 thematic areas (table 3); the specific country teams that drew attention to these bottlenecks are also shown in table 3. Figure 1 summarises the grading across the nine intervention packages overall across all the countries, as well as grouped by NMR and by region.

Figure 1A shows that for all countries, the bottlenecks most frequently identified (affecting more than five interventions) as very major or significant were health financing (six interventions), health workforce (six interventions), health service delivery (five interventions), and essential medical products and technologies (five interventions). When countries were categorised according to their mortality context (figure 1B, 1C), health service delivery and the health workforce were frequently mentioned in workshops in both mortality contexts.

The country teams in the two regions perceived bottlenecks somewhat differently (figure 1D, 1E). For the country teams from Africa, all the health-system building blocks except for leadership and governance (three
interventions) were frequently cited as having very major or significant bottlenecks across interventions, dominated by health finance issues (nine interventions) and health service delivery (eight interventions). In Asia workshops, health financing seemed to be an issue for only three interventions and the dominant issue was the health workforce (seven interventions) followed by community ownership and partnership (six interventions). Health service delivery (five interventions) was also notably mentioned.

The health workforce and health service delivery therefore emerged as the health-system building blocks that were consistently rated by country participants as having very major or significant bottlenecks irrespective of mortality context or geographical region. Lack of skills, low competency of health-care providers, and poor quality of care were specifically mentioned as common bottlenecks in all the workshops (table 3).

The results from the grading patterns of intervention-specific bottlenecks suggested that, overall, for all eight countries, the prevention and management of preterm births, kangaroo mother care (KMC), the management of severe infections, and inpatient supportive care of ill and small newborn babies had most frequently very major or significant bottlenecks across more than 50% (more than four) of the health-system building blocks (figure 1A).

In reviewing the intervention bottlenecks according to mortality level (figure 1B, 1C), we noted that workshop participants in most countries in the higher NMR category (≥30 deaths per 1000 livebirths) reported very major or significant bottlenecks across all seven health-systems building blocks for the prevention and management of preterm births and inpatient supportive care for ill and small newborn babies. The management of severe infections was also reported to face bottlenecks (across six building blocks). Fewer intervention bottlenecks were identified by participants in countries with NMR between 15 and 30 deaths per 1000 livebirths, with only KMC meeting the greater than 50% criterion we had set.

Perhaps the most interesting findings are those related to the context-specific differences for the intervention packages. When we separated out the bottlenecks according to region (figure 1D, 1E), workshop participants in Africa reported more very major or significant bottlenecks across all seven health-systems building blocks for the prevention and management of preterm births and inpatient supportive care for ill and small newborn babies. However, the African country teams seemed to feel that implementation of KMC was feasible because this practice had the fewest very major or significant bottlenecks across the building blocks, mostly related to the absence of champions or political commitment and financial investment by governments for scale-up (table 4).
contrast, the Asian country workshop participants consistently reported major bottlenecks for scale-up of KMC across all seven health-system building blocks. In both Africa and Asia, prevention and management of preterm births, inpatient supportive care of ill and small newborn babies, and the management of severe infections were the three intervention packages still graded by most country teams as having a large number of bottlenecks. Table 4 shows specific examples of bottlenecks reported for the four most frequently cited intervention packages.

Progress is possible

Accelerating factors in fast progressing countries

Between 2000 and 2010, at least 77 countries including 13 low-income countries showed that rapid progress could be made in neonatal survival by reducing their NMR by more than 25%. All the fast progressing countries we reviewed have shown improvements in the coverage of the key intervention packages for maternal and newborn health (appendix). Of these countries, the greatest rates of reduction in newborn mortality have been in Latin American countries. In Africa, Rwanda has shown a remarkable turnaround from a country ridden by mass violence and high mortality rates to one that has reduced mortality in all age groups and is now the fastest progressing country for NMR in Africa. Although further progress still needs to be made, these fast progressing countries have also narrowed the equity gaps for specific intervention packages for maternal and newborn health (appendix).

The literature review found important accelerating factors affecting reductions in neonatal mortality, including socioeconomic factors such as economic growth, anti-poverty programmes, and increased female literacy. Sociocultural factors including women’s autonomy and gender equality have been emphasised for Sri Lanka. Specific health-related accelerating factors include health policy reforms and initiatives to expand basic services to all, particularly to poor groups, increased government expenditures on health, and the development of specific programmes for mothers and newborn babies were also identified as accelerating factors. In Malawi and Peru, dynamic government leadership with effective donor coordination generated high-level commitment to newborn health, which has led to policy development and programmatic change during the past decade (panel 2, 3).

Higher burden, greater challenges

The highest burden of mortality and morbidity is often seen where health-system gaps are the greatest. Countries with higher mortality have higher out-of-pocket...
Selection of countries for analyses
We selected countries from the 193 UN member states on the basis of the most recent mortality data available in early 2013 when the Every Newborn analyses process started. For analysis 1, the health-system bottleneck analysis, we selected the 13 countries with the highest numbers of newborn deaths in 2011 (appendix). We expanded beyond the highest ten countries to ensure that we would get data from a minimum set of high-burden countries, recognising the challenges of getting data from multiple countries through this intensive process within a short timeframe. For analysis 2, we selected three of the top fast progressing countries for reduction of neonatal mortality rate (NMR) in each of the Africa and south Asia regions, and two countries in the Latin America and Caribbean region excluding all countries with less than 10 000 births per year since the annual rate of reduction is less stable statistically in these countries (appendix).

Analysis 1: Systematic analysis of bottlenecks to scale-up of newborn care in high-burden countries
Maternal-newborn bottleneck analysis tool
To assist countries in analysis of their health-system bottlenecks and challenges that prevent the scale-up of high-effect, cost-effective intervention packages for newborn babies, and to identify potential solutions, the Every Newborn Steering Group (appendix) developed the maternal-newborn bottleneck analysis tool to assist data collection, compilation, analysis, and comparison across countries. The tool is in two sections: section 1 on newborn care, and section 2 with subsections on nine maternal and newborn health facility-based intervention packages (table 1). We focused on facility-based interventions at the time of birth—labour, childbirth, and immediate postnatal care—because they have the potential for the greatest effect on mortality reduction for both babies and mothers. So-called tracer interventions and commodities were selected for each package—eg, those most likely to reflect common challenges for that particular package or for interventions delivered at the same time period through a similar platform.

Sections 1 and 2 of the questionnaire were organised according to the six WHO health-systems building blocks. The seventh building block, community ownership and partnership, was included on the basis of the recommendations of the Ouagadougou declaration on primary health care.

Participants and process for country consultations
The maternal and newborn health bottleneck analysis tool was used in a series of national workshops held between July 1, and Sept 30, 2013, in eight of the selected high-burden countries (appendix). The number of workshop participants varied by country and included members of national or provincial maternal and newborn health technical working groups that consisted of Ministry of Health programme managers, UN agencies, the private sector, non-governmental organisations, professional bodies, academia, bilateral agencies, and other stakeholders at both national and subnational levels (appendix). The working groups’ members are experts from diverse fields nominated by government to provide advice on maternal and newborn health issues on a regular basis, although the regularity of their meetings depends on how functional the working group is. The Every Newborn country consultations brought the working group members together to focus on the particular issue of identifying bottlenecks and solutions to newborn scale-up. The working groups’ mandate also includes follow-up of implementation of solutions. More than 500 individuals participated in these workshops, which were led by the Ministry of Health in each country with support from different facilitating partners. Two regional workshops (appendix) were also held with more than 100 participants: one in Dakar, Senegal, in July, 2013, to test the tool with country participants from selected African countries and orientate facilitators; and the second in Kathmandu, Nepal, in August, 2013, to share findings from completed Asian country workshops.

The workshops followed a predefined agenda coordinated by facilitators who had been orientated on the tool. Participants examined each of the seven health-system building blocks—on the basis of data and experience—to identify the key bottlenecks to the scale-up of newborn care in general (section 1) and for each of the nine interventions (section 2). The groups then came to a consensus on whether the bottlenecks to the health-system area should be graded as good (not a bottleneck), needs some improvements (minor bottleneck), needs major improvements (significant bottleneck), or inadequate (very major bottleneck). Finally, participants proposed potential strategies and solutions to address the priority bottlenecks identified. The Ministry of Health programme managers and working group members were responsible for the collation of all responses and submission of the final data; they also served as points of contact for clarification of any issues.

The multicountry bottleneck analyses workshops, as part of the Every Newborn process, provided an opportunity to engage country teams in identifying and prioritising their context-specific health-systems barriers to the scale-up of crucial maternal and newborn health interventions. These government-led stakeholder consultations, supported by global partners, have generated a renewed national-level focus on newborn care as well as south-to-south exchange of experiences. Coordination between national and global actors has previously been identified as an important element for bringing attention to newborn issues. The workshops have played a key part in drawing further political attention to newborn care as part of the Every Newborn process. The limitations of the tool or the process should therefore not distract from the main conclusions of this analysis.

(Continues on next page)
Data analysis and grading of bottlenecks

We received complete national-level data from six countries, and subnational data from India (from two states) and Pakistan (five provinces), with 2465 bottlenecks identified. We reviewed all the bottlenecks for each maternal and newborn health intervention per health-system building block and all solutions presented by country participants to identify common bottlenecks and innovative solutions. Bottlenecks and solutions were classified by health-system building block into thematic areas, and defined as common if reported by at least three countries.

We then extracted only the bottlenecks that workshop participants categorised as significant or very major, to establish whether there were health-system areas and specific interventions that could be prioritised for action. We defined a health-system building block to be a priority if more than 75% of the reporting country teams graded at least five interventions (ie, >50% of the nine interventions examined) as significant or very major bottlenecks. We graded an intervention as a priority if country teams reported at least four of seven health-system building blocks to have significant or very major bottlenecks for the same intervention. For more context-specific subanalysis, we categorised the eight countries into the two geographical regions of Africa and Asia and also considered two NMR settings: NMR ≥30 and NMR between 15 and less than 30 per 1000 livebirths. For the two countries with subnational data, the national-level grade was represented by the average of the subnational data (appendix). We recognise that by combining the data into one national input, nuances might be lost and that in large countries data from selected areas might not reflect the whole country. However, in Pakistan, we received data from all provinces except Sindh (from which the data were incomplete); only the tribal areas were not represented. In India, we received data from only two of the 28 states, but these two states are among the most marginalised; thus, this subnational data could represent a worst case scenario.

We recognise that the data collection process was mainly qualitative and subjective; however, the results are in line with district health systems assessment coverage data gathered by most of these countries between 2010 and 2012 (Malawi, Democratic Republic of the Congo, Nigeria, India, Nepal, and Bangladesh) using a quantitative bottleneck analysis tool developed by UNICEF and the World Bank with other partners to systematically assess bottlenecks on the basis of influential work by Tanahashi and Piot.

Analysis 2: Review of accelerating factors in fast progressing countries

To identify factors or strategies that might have assisted the national acceleration of newborn survival, we searched PubMed, Google Scholar, and the Cochrane Database for all articles published in English since 2000. Our search terms included the eight selected fast progressing countries, and terms related to effective strategies to address health-system bottlenecks for each building block. The search terms, references, coverage data, equity profiles, a complete list of identified accelerating factors for countries, and strategies for each health-systems building block are available in the appendix.

In-depth reviews of three countries were done to further assess accelerating factors and provide context-specific examples of strategies implemented to address common health-systems building block challenges (panels 2, 3, 4). For Malawi and Nepal, the case studies were based on previously published work using methods described by Lawn and colleagues and also considered national political analyses by Smith and colleagues. A de-novo, in-depth analysis was done for Peru, using comparable analytical and epidemiological approaches, as well as key informant interviews, as part of the Countdown to 2015 country case study process.

Overcoming bottlenecks

We categorised bottlenecks by health-systems building blocks to allow the identification of issues and
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<th>Common bottlenecks</th>
<th>Selected solutions</th>
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<tr>
<td><strong>Leadership and governance</strong></td>
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| Policy or strategy implementation | Lack of or outdated national policy, strategy, guidelines, or protocols on newborn interventions (AFG, BGD, COD, IND, KEN, NGA, PAK)  
Policy and programme implementation is weak at lower levels of health care (AFG, COD, IND, KEN, PAK, UGA)  
Lack of situation analysis or no newborn targets defined in country operational plans (IND, KEN, PAK) | Develop and regularly update policies, guidelines, and protocols on specific newborn interventions (AFG, BGD, COD, IND, KEN, NGA, PAK)  
Ensure effective distribution of policies, norms, and guidelines to all health facilities and establish a system to monitor their implementation (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Gather baseline data for situation analysis and use to improve newborn health (IND, PAK) |
| Political support and coordination | Newborn health and survival not prioritised (AFG, COD, IND, KEN, PAK)  
Poor leadership and lack of champions for newborn babies (BGA, COD, IND, NGA, PAK)  
Ineffective coordination systems at national and subnational levels leading to lack of engagement of partners in newborn health (AFG, COD, PAK, UGA)  
Lack of public-private partnerships; private sector using different protocols and guidelines (IND, KEN, PAK) | Strengthen advocacy: promote an integrated approach—link newborn messages to other initiatives such as HIV/AIDS (UGA)  
Develop champions for newborn health—use existing maternal health champions to promote newborn health (NGA)  
Strengthen coordination mechanisms: assign a focal person at the Ministry of Health (BGD) and at state and district levels (IND)  
At subnational level, strengthen hospital management committees to make them fully functional (NGA) |
| **Health financing** | |
| Coverage of financing schemes | Low coverage of health financing schemes—mainly only pilot projects established for specific interventions (BGD, NGA, PAK, UGA) | Expand health insurance schemes to address out-of-pocket payments, with an emphasis on community-based health insurance (NGA, COD); advocate for the inclusion of newborn interventions as part of the free MNCH policy and national health insurance for pregnancy care (NGA); advocate for universal health care and social protection policies (KEN); establish subsidies for newborn care at subnational level (eg, voucher system for provision of transport and emergency referrals) (NGA, KEN); implement income-generating activities (UGA) |
| Funding or budget allocation | Inadequate funds allocated to maternal and newborn health interventions including commodities (AFG, BGD, COD, IND, KEN, PAK, UGA)  
No budget line allocated to newborn interventions in national accounts (BGD, IND, PAK)  
High out-of-pocket payments and no standardised costs for services (AFG, BGD, COD, IND, KEN, NGA, PAK) | Create a budget line for newborn health in national accounts—increase funds and allocate resources for newborn health interventions and commodities (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA); undertake investment cases for MNCH (KEN); ensure timely flow of funds from districts to health facilities (IND)  
Establish accountability mechanisms and curb under the table payments to service providers (PAK, AFG); establish pool donor funds (UGA) |
| **Health workforce** | |
| Human resource planning | Shortages of staff, poor deployment, and maldistribution between urban and rural areas (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Inadequate or lack of job descriptions (BGD, COD, IND, PAK, UGA)  
Only restricted categories of higher-level health care providers authorised to provide some interventions and to prescribe specific newborn drugs (COD, IND, PAK, UGA) | Develop or review and ensure implementation of policies for staff deployment and recruitment including increasing the number of staff (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA); regularisation of contractual staff and increase in retirement age of health professionals (IND)  
Clearly define roles and responsibilities of health workers for the provision of newborn care in their job descriptions; midwives and nurses to be authorised to provide more interventions and prescribe some essential maternal and newborn drugs (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Establish functional logistic and supply chain management (NGA) and implement essential medicines policy (NGA) to ensure availability of essential commodities at the district and health facility levels |
| Motivation of staff | Lack of motivation of staff due to poor remuneration or absence of capacity building plans and opportunities (BGD, COD, IND, KEN, NGA, PAK, UGA) | Institutionalise incentives to improve retention of skilled providers in remote and security challenged areas such as improved welfare packages or wages, scholarships, club housing, hardship allowances, pay for performance, and career growth (BGD, NGA, IND, UGA) |
| Competency or training of staff | No retention initiatives for skilled staff especially to encourage them to work in rural areas (AFG, BGD, IND, KEN, PAK, UGA)  
Poor skills and low competency of service providers (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Lack of competency-based training including preservice and in-service training (AFG, COD, IND, KEN, PAK, UGA) | Develop and test a new bonus payment for midwives based on number of deliveries and with documented postnatal visits (KEN)  
Review preservice and in-service training curricula to ensure that priority newborn health interventions are included at all levels of care for all workers involved in maternal and newborn health (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA) |
| **Essential medical products and technologies** | |
| Drug policy or registration | Some essential newborn drugs are not registered or included on the national essential medicines list (BGD, IND, PAK, UGA) | Include all essential newborn commodities with their appropriate indications in the national essential medicines list (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA) |
| Availability of commodities | Essential drugs and supplies not available in health facilities (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Commodities frequently out of stock due to poor coordination between national and subnational levels (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA) | Strengthen the national drug supply system (COD, NGA)  
Work with the UN Commission on Commodities to strengthen logistics and supply chain management (UGA) and implement essential medicines policy (NGA) to ensure availability of essential commodities at the district and health facility levels |
| Logistics management information systems | Inadequate drug forecasting, quantification, procurement, and tracking systems (AFG, BGD, COD, IND, KEN, PAK, UGA) | Establish functional logistic and supply chain management and procurement systems, including capacity building of health workers (AFG, BGD, COD, IND, KEN, NGA, PAK, UGA)  
Streamline procurement procedures and implement penalty clauses in case of delay (IND)  
Strengthen Logistics Management Information Systems (LMIS) through web-based stock register system (BGD) |

(Table 3 continues on next page)
Table 3: Common bottlenecks and solutions to scale-up of newborn care

<table>
<thead>
<tr>
<th>Common bottlenecks</th>
<th>Selected solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health service delivery</strong></td>
<td>**Build health facilities and ensure provision of materials and equipment, staff</td>
</tr>
<tr>
<td>Service availability</td>
<td>accommodation, water, and power (COD, UGA, IND, AFG)</td>
</tr>
<tr>
<td>Poor availability of clinical services due to lack of infrastructure or lack of</td>
<td>**Institutionalise effective referral system between facilities and communities by</td>
</tr>
<tr>
<td>or poor implementation of clinical guidelines and protocols in health facilities</td>
<td>involving national union of road transport and telecommunication (NGA), establishing</td>
</tr>
<tr>
<td>(BGD, COD, IND, KEN, PAK, UGA)</td>
<td>referral facilitators at the facility level (BGD, IND), use technology for movement</td>
</tr>
<tr>
<td>Poor distribution of newborn services with rural areas being underserved (AFG,</td>
<td>of vehicles and GPS connectivity (IND), involve the private sector (PAK), use</td>
</tr>
<tr>
<td>BGD, IND, KEN, PK)</td>
<td>alternative methods such as private motorcycles to carry mothers (UGA); fund</td>
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<tr>
<td>Weak referral systems and linkages between levels (community, primary, and referral</td>
<td>generation by community and support groups to help cover transport costs of the</td>
</tr>
<tr>
<td>care) (AFG, COD, IND, KEN, PAK)</td>
<td>poorest groups (IND)</td>
</tr>
<tr>
<td>Demand for care</td>
<td>**Strengthen or implement community-based maternal and newborn health outreach</td>
</tr>
<tr>
<td>Little knowledge and awareness of newborn care issues, entitlements, and availability</td>
<td>services (NGA); establish maternity waiting homes and offer domiciliary care to bring</td>
</tr>
<tr>
<td>of maternal and newborn health services (AFG, BGD, IND, KEN, PK, UGA)</td>
<td>services closer to communities (KEN)</td>
</tr>
<tr>
<td>Use existing community systems, structures, and initiatives to discuss newborn</td>
<td>**Institute and follow standard protocols and guidelines for maternal and newborn</td>
</tr>
<tr>
<td>health issues (village health committees, community health committees, traditional</td>
<td>care (AFG, BGD, COD, IND, KEN, NG, PAK, UGA); train and encourage the use of</td>
</tr>
<tr>
<td>leaders) (BGD)</td>
<td>checklists and standard operating procedures (NGA); improve availability of job aids</td>
</tr>
<tr>
<td>In addition to solutions provided under health financing and service delivery (referral) to</td>
<td>in all health facilities (NGA, KEN); involve private sector in adherence to standard</td>
</tr>
<tr>
<td>Referral of care</td>
<td>standards (AFG, BGD, IND, KEN, PAK)</td>
</tr>
<tr>
<td>Establish or strengthen integrated supportive supervision and mentorship at all</td>
<td>**Institutionalise regular capacity-building effort for health managers and</td>
</tr>
<tr>
<td>levels of care (NGA, COD); extend supportive supervision and oversight to private</td>
<td>statisticians for analysis of health management information system and interpretation</td>
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<tr>
<td>sector providers (NGA)</td>
<td>of programmatic action (BGD)</td>
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<tr>
<td>Support accreditation of maternal and newborn health services and private health</td>
<td>**Strengthen national health management information system including adoption of</td>
</tr>
<tr>
<td>facilities as per government approved criteria or norms (IND), establish centres of</td>
<td>technology for better data management (NGA); Ensure routine data review and feedback</td>
</tr>
<tr>
<td>excellence based on practice benchmarks (IND); establish or reinforce maternal and</td>
<td>(AFG, BGD, COD, IND, KEN, NG, PAK, UGA)</td>
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<tr>
<td>perinatal death audits (AFG, BGD, COD, IND, KEN, NG, PAK)</td>
<td>**Institutionalise effective referral system between facilities and communities by</td>
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<tr>
<td>Involvement of male in community-based maternal and newborn health outreach</td>
<td>involving national union of road transport and telecommunication (NGA), establishing</td>
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<td>services (AFG, BGD, IND, KEN, PK, UGA)</td>
<td>referral facilitators at the facility level (BGD, IND), use technology for movement</td>
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<td><strong>Health information system</strong></td>
<td>of vehicles and GPS connectivity (IND), involve the private sector (PAK), use</td>
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<tr>
<td>Data collection and reporting</td>
<td>alternative methods such as private motorcycles to carry mothers (UGA); fund</td>
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<tr>
<td>Data from private sector not routinely collected and reported (BGD, COD, IND,</td>
<td>generation by community and support groups to help cover transport costs of the</td>
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<tr>
<td>Data quality of data collected—data either incomplete or inaccurate (AFG, COD,</td>
<td>poorest groups (IND)</td>
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<tr>
<td>Community-based data not reported in health management information system (AFG,</td>
<td>Involving private sector in sharing data for key indicators (PAK, NG, IND)</td>
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<tr>
<td>Data monitoring and use</td>
<td>Develop an e-health system using mobile phones to track and follow up postnatal care</td>
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<tr>
<td>Weak staff capacity for data management and use (interpretation, analysis, and</td>
<td>visits at the community level (UGA); establish a real-time data-capturing mechanism</td>
</tr>
<tr>
<td>No systems for regular review of data (AFG, BGD, IND, KEN, PK, UGA)</td>
<td>(IND)</td>
</tr>
<tr>
<td><strong>Community ownership and partnership</strong></td>
<td>**Institutionalise effective referral system between facilities and communities by</td>
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<tr>
<td>Lack of community mobilisation; materials for information, education, and</td>
<td>involving national union of road transport and telecommunication (NGA), establishing</td>
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<td>Suboptimum or lack of involvement of existing community structures in maternal and</td>
<td>referral facilitators at the facility level (BGD, IND), use technology for movement</td>
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<td>poorest groups (IND)</td>
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<td>Engagement</td>
<td>**Establish or strengthen behaviour change communication initiatives including the</td>
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<td>Involvement of male in community-based maternal and newborn health outreach</td>
<td>availability of key messages in local languages (AFG, BGD, COD, IND, KEN, NG, PAK,</td>
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<tr>
<td>Lacks awareness of newborn care issues, entitlements, and availability of maternal</td>
<td>UGA); Use media and other outreach tools to communicate messages around newborn</td>
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<td>Lacks awareness of newborn care issues, entitlements, and availability of maternal</td>
<td>health and improving participation (eg, community radio and mobile applications)</td>
</tr>
<tr>
<td>Lacks awareness of newborn care issues, entitlements, and availability of maternal</td>
<td>(NGA), discussion in community forums (IND)</td>
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<tr>
<td>Demand for care</td>
<td>**Engage communities and leaders in sensitisation meetings such as town hall</td>
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<tr>
<td>little knowledge and awareness of newborn care issues (AFG, BGD, IND, KEN, PK,</td>
<td>meetings or focus group discussions (AFG, BGD, COD, IND, KEN, NG, PAK, UGA)</td>
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<td>Delays in care seeking due to sociocultural barriers (AFG, BGD, IND, KEN, PK,</td>
<td>**Establish or strengthen behaviour change communication initiatives including the</td>
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<td>Service use is limited by financial barriers including user fees, high out-of-</td>
<td>availability of key messages in local languages (AFG, BGD, COD, IND, KEN, NG, PAK,</td>
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<tr>
<td>pocket expenditure, and high costs of medicine (AFG, IND, KEN, PK, UGA)</td>
<td>UGA); Use media and other outreach tools to communicate messages around newborn</td>
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<tr>
<td><strong>AFG</strong>—Afghanistan; <strong>BGD</strong>—Bangladesh; <strong>COD</strong>—Democratic Republic of the Congo;</td>
<td>health and improving participation (eg, community radio and mobile applications)</td>
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<tr>
<td><strong>IND</strong>—India; <strong>KEN</strong>—Kenya; <strong>NGA</strong>—Nigeria; <strong>PAK</strong>—Pakistan; <strong>UGA</strong>—Uganda;</td>
<td>(NGA), discussion in community forums (IND)</td>
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<tr>
<td><strong>MNCH</strong>—maternal, newborn, and child health.</td>
<td>**In addition to solutions provided under health financing and service delivery</td>
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<tr>
<td><strong>Series</strong></td>
<td>(referral) to increase access to care: empower women through improved health</td>
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<tr>
<td><strong>Table 3:</strong> Common bottlenecks and solutions to scale-up of newborn care</td>
<td>education and information sharing among women and their community members (NGA,</td>
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<tr>
<td><strong>Continued from previous page</strong></td>
<td>PAK); Enforce positive attitudes of health workers (NGA)</td>
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### A

**Health-system building blocks**

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<tr>
<th>Prevention and management of preventable birth</th>
<th>Skilled birth attendance</th>
<th>IMiOC</th>
<th>CEmOC</th>
<th>Basic newborn care</th>
<th>Neonatal resuscitation</th>
<th>Kangaroo mother care</th>
<th>Management of severe infections</th>
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### B

**Countries with NMR ≥30 to <30 deaths per 1000 livebirths**

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### C

**Countries with NMR ≥30 deaths per 1000 livebirths**

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### D

**Countries in Africa**

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**Countries in Asia**

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<tr>
<td>Health workforce</td>
<td>COD, NGA, PAK</td>
<td>COD, NGA, PAK</td>
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<td>Essential medical products and technologies</td>
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<td>COD, NGA, PAK</td>
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<td>Health service delivery</td>
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<td>Health information system</td>
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<td>Community ownership and partnership</td>
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</tbody>
</table>
implementation of solutions. However, we recognise that barriers to care are interrelated and their solutions cut across several building blocks.21 For instance, low demand for care could be due to current non-availability of services (health service delivery and health workforce),14,15 poor quality of care (health service delivery),21 affordability (health financing),23 or lack of community awareness (community ownership and partnership).24,25

Our analysis of the health-systems bottlenecks also shows that the prevention and management of preterm births, inpatient supportive care of ill and small newborn babies, the management of severe infections, and KMC need immediate and deliberate attention in most countries. The third paper in the Series shows that scale-up of these intervention packages could avert most preterm and infection-related deaths.7 Increasing intervention coverage and institutionalisation of services will need an increased number of skilled providers, changes in the infrastructure, procurement, and supplies of life-saving commodities, and establishment of functional referral mechanisms. Research is ongoing into innovative approaches for management of newborn infections in the community26 and expansion of KMC;27 however, a strong health-system infrastructure will still be needed to support the community management of care. Advancement of newborn health also needs additional formative research to improve understanding of the context-specific differences in the perception of bottlenecks preventing the scale-up of crucial intervention packages such as KMC.

Since neonatal mortality can be regarded as a tracer for the health system,7 countries are split into categories by NMR (table 2) to provide a framework for prioritisation and phasing in of strategies to scale up the key intervention packages (table 1).1,17,26 The categorisation of strategies according to the mortality context provides a

### Table 4: Bottlenecks for specific intervention packages

<table>
<thead>
<tr>
<th>Health financing</th>
<th>KMC</th>
<th>Management of severe infections</th>
<th>Inpatient supportive care for ill and small newborn babies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage of financing schemes; funding or budget allocation</td>
<td>ACS are not part of the free MNCH policy (BGD, IND, NGA, PAK); ACS are not budgeted for by health facilities (COD, IND, KEN, PAK, UGA)</td>
<td>No investment plan for scale-up of KMC (AFG, BGD, COD, KEN, NGA, PAK, UGA); no funds allocated to KMC implementation so high dependency on external funding (AFG, BGD, COD, NGA, PAK)</td>
<td>Insufficient state subsidies and limited funds allocated to specialised care (AFG, BGD, NGA, PAK, UGA); lack of funds for the organisation of the services for ill newborn babies including procurement and distribution of essential drugs (intravenous fluids, oxygen) (AFG, BGD, COD, KEN, NGA, PAK)</td>
</tr>
</tbody>
</table>

| Human resource planning; motivation of staff; competency or training of staff | Only physicians are authorised to prescribe ACS (BGD, COD, IND, KEN, PAK, UGA); limited number of health-care providers can recognise preterm labour and use ACS (NGA, PAK, UGA); no competency training on management of preterm labour and the use of ACS (NGA, PAK, UGA) | No details regarding KMC in health provider job descriptions; shortage of health-care workers able to provide KMC (AFG, BGD, COD, KEN, NGA, PAK, UGA); inadequate training on KMC and feeding of low birthweight babies including nasogastric tube feeding, and support milk banking (AFG, BGD, COD, NGA, UGA) | No human resources strategy in place to expand in-patient care services to all newborn babies, especially those living in remote areas (BGD, COD); no skilled-based pre-service or in-service training package for the management of small and ill newborn babies (AFG, COD, NGA) |

| Service availability; quality of care | ACS administration is limited and only provided in tertiary hospitals (IND, KEN, NGA, UGA); ACS use not included in perinatal death audits (BGD, COD, IND, NGA) | KMC is not institutionalised—it is project-based in some areas (BGD, KEN, NGA, PAK, UGA); health facilities do not have space for KMC and milk banks; lack of community postnatal follow-up for KMC (AFG, BGD, COD, KEN, NGA, PAK, UGA); limited number of private hospitals provide KMC services (AFG, BGD, COD, NGA, PAK, UGA) | Limited availability of services providing extra care for small, low birthweight, or ill newborn babies (AFG, KEN); lack of dissemination of therapeutic protocols on in-patient care for newborn babies in health facilities (COD, NGA, PAK); perinatal audits done or taking place in some districts (COD, NGA, PAK, UGA) |
A pivotal moment for policy change occurred in 2005 with the integration of newborn health into national policies, programmes, agendas, and implementation guidelines. A generation of high-level commitment for newborn health has been formalised to strengthen the coordination across reproductive, maternal, newborn, and child health systems and improve intervention coverage particularly those interventions facing the most bottlenecks to scale-up (the prevention and management of preterm births, inpatient supportive care of ill and small newborn babies, the management of severe infections, and KMC).

Countries in mortality groups 1 and 2 already have high coverage of services; the number of providers and government funding for health is reasonable. Therefore, the priority is to reach the last 1%, to achieve universal health coverage and strengthen quality of care for all. Countries in higher mortality contexts (groups 3 and 4) face chronic shortages of health workers; hence, they need to focus on improving supply, and introducing strategies to reduce delays in case-seeking to improve demand as well as improving the quality of care while striving for equity in access to services. We also provide specific suggestions based on available evidence from our review of strategies that can be prioritised for each mortality context to strengthen the health-systems building blocks with the most bottlenecks to scale-up—health financing, the health workforce, and service delivery in particular. We emphasise that the strengthening of the supply chain of essential medical products and technologies, as well as health information systems (including the monitoring of coverage, measuring of effect and cost, and improving data gaps) is needed across all mortality contexts. Communities are crucial drivers for health-system efforts to scale up and improve care and need to be involved in all scale-up steps and mortality contexts.

**Increase funding for newborn babies (health financing)**

Increased domestic funding and spending on health are key to long-term sustainability, also essential is to ensure specific budget allocations are made for maternal and newborn care. Government funding is not yet systematically tracked for reproductive, maternal, newborn, and child health; lack of funding allocation and budget lines for newborn care were reported as major bottlenecks by country teams in all of the high-burden countries surveyed. Only 10% of official development assistance for maternal, newborn, and child health in 2010 mentioned “newborn” and only about 4% of the major child health investments actually went to newborn health.

To improve access for the poorest and most vulnerable populations, national and local strategies to reduce out-of-pocket spending on health need to be developed and tracked. Promising strategies that show an effect on improving health outcomes in general (there is no evidence yet on newborn-specific outcomes), include the development and expansion of community-based insurance schemes, voucher schemes, and conditional cash transfers. Panels 2, 3, and 4 present examples such as the expansion of social insurance schemes to the poor (Peru) and a stepwise approach to establish free health care with incentives and cash payments (Nepal). Performance-based financing of maternal and newborn care through cash transfers directed at health providers or families or both has been used in several countries including Brazil. In other countries, such as Rwanda, cash incentives are directed mainly at health facilities. Although whether cash transfers have universal applicability is not yet clear, experience shows that
alleviation of the financial burden of seeking care does have an effect on care-seeking and use of maternal and child health services. Irrespective of the strategy chosen to reduce out-of-pocket and catastrophic expenditures on health, important elements include clear guidelines for implementation, efficient and transparent operational management, and the implementation of plans for sustainability. Additionally, specific efforts must be made to increase public awareness about the schemes and develop innovative enrolment strategies to reach out to the poorest groups.

**Which health workers are responsible for newborn babies? (health workforce)**

The most crucial bottleneck identified is around the availability and distribution of health-care providers with specific skills. In many high-burden countries, which health worker is responsible for the newborn baby is not clear. Even for attended births, the focus of a midwife or obstetrician is most often on the woman and the placenta delivery. For almost all facility births, no attendant is available with the skills to provide essential care for the newborn baby. Previous assumptions that a health worker trained in maternal or child care could automatically take care of a newborn baby, especially one who is ill or preterm, have proven false and might well have held back progress in reduction of neonatal mortality. Specific skills and equipment are needed such as the use and availability of ambubags for neonatal resuscitation. Important, instilling a sense of urgency is crucial because babies die in minutes. This notion also links to wider social norms regarding the acceptance of newborn deaths, with potential applicability to communities and facilities.

There is an underlying shortage of skilled health workers in many high-burden countries (table 2), with countries in NMR group 4 having only 6-4 physicians, midwives, and nurses per 10,000 population. Currently, less than one in six countries with the highest burden of maternal and newborn mortality reach the minimum benchmark of 23 doctors, midwives, and nurses per 10,000 population necessary to provide a basic package of care. Severe shortages of midwives exist in at least 38 countries. To achieve universal health coverage, health workers will have to reach every community, including the poorest and hardest to access. Community health worker programmes have been expanded in countries in an attempt to address this gap; however, they have also faced considerable challenges. During the past decade, in an effort to address the chronic shortage of health workers, some countries (Brazil, Ghana, and Mexico) have implemented progressive policies and programmes to increase the numbers and distribution of skilled providers, including Malawi (panel 2). Delegation of tasks from one cadre to another is a strategy that has been successfully adopted in several countries to increase access to life-saving care including caesarean sections and KMC. More consistent efforts were made to increase public awareness about the schemes and develop innovative enrolment strategies to reach out to the poorest groups.

**Panel 3: Country case study—Peru**

### Expansion of health insurance to poor groups

In 2002 the Peruvian Government introduced the Comprehensive Health Insurance Scheme (SIS), which includes free access to basic health care for children younger than 5 years as well as for pregnant women while giving priority to vulnerable populations living in extreme poverty. The proportion of SIS insured people in rural areas progressed from 24.7% in 2004 to 73% in 2011. Efforts to reduce the equity gap were remarkable, with an increase in coverage of maternal and newborn health interventions among the poorest populations and those living in rural areas. Peru has integrated various social inclusion programmes such as conditional cash transfers (JUNTOS), emphasising their cross-cutting nature, and thus the need to ensure the participation of multiple public and private sectors in their implementation. Accordingly, health financing is focused on implementation of interventions related to public health problems identified through wide consultation processes, and it follows a results-based budgeting, which emphasises monitoring of progress in coverage and effect indicators related to reproductive, maternal, newborn, and child health.

### Implementation of comprehensive policies to improve service delivery

Peru implemented actions aimed at strengthening the quality of public sector management so as to explicitly link financial investments with results for priority health interventions increasing efficiency and equity. Universal health coverage (AUS) in Peru emphasises primary health care as well as health-system strengthening. An important approach that could have contributed to improved child and neonatal survival was the shift from vertical programmes (acute respiratory infections, acute diarrhoeal disease, immunisations) to integrated programmes such as the Integrated Management of Childhood Illnesses. A later adaptation included a neonatal care component, and more recently (2008 onward) a cross-cutting Articulated Child Nutrition Programme, with particular emphasis on children younger than 3 years, and Strategic Maternal-Neonatal Health Programme, which focuses on increasing coverage of emergency obstetric and comprehensive neonatal care at the national level. This programme has incorporated components such as combination of training, supportive supervision, team work (skills mix), adherence to evidence-based guidelines, and rights-based and culturally adapted care of pregnancy and delivery. Evidence shows that, during the past decade, there has been a continuous decrease in NMR that correlates significantly with increased coverage of priority packages of care (p<0.001): four antenatal care visits (–0.95), skilled birth attendance (–0.94), and caesarean section (–0.88) as well as neonatal health interventions (p<0.001), early initiation of breastfeeding (–0.99) and postnatal care for newborns (–0.80) and hospital-based newborn care.
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Panel 4: Country case study—Nepal

Dynamic leadership
High-level political leadership together with effective partner coordination have been drivers of change for newborn health in Nepal. In 2002, the Prime Minister launched the first national newborn situation analysis consequently generating widespread media and public attention for the issue. 2 years later, in 2004, the Family and Child Health Divisions of the Ministry of Health and Population developed a national newborn-specific strategy. Active technical working groups formed by the Ministry of Health and Population with participation from professional societies advanced the newborn agenda through national-level forums and policy changes. A long history of community research for maternal, newborn, and child health in Nepal has fostered strong relationships between researchers, government officials, and medical professionals and tendencies for research to be translated to policy and practice, allowing the rapid uptake of innovations and new technologies for reproductive, maternal, newborn, and child health in the community.

Expansion of social insurance schemes
The Maternity Incentive Scheme (later called the Safe Delivery Incentive Programme) was initiated in 2005 and included fee exemptions at facilities in poorer districts only and incentive payments to women and health workers in other areas. The programme has been successful in shifting behaviour and increasing skilled care at birth (13% increase). The next major shift introduced incrementally since 2006, was a more general move towards free essential health care; starting from free emergency and inpatient care for specific disadvantaged populations in district hospitals and primary health-care centres in 2006 to free care to all at health posts and primary health-care centres in 2007, and at all district hospitals in 2009.

In Nepal, the free delivery policy (called Aama Surakshya Karyakram) includes universal free delivery services, launched in 2009, and a continuation of the Safe Delivery Incentive Programme, providing cash payments to women who deliver in facilities and incentive payments for health workers who undertake home deliveries. Monitoring results 1 year after the Aama policy was launched show an increase in institutional deliveries (19% increase).

Improving skills of community-based health-care workers
A comprehensive community-based package for newborn health including the Birth Preparedness Package and Community-Based Newborn Care Programme (CB-NCP), developed in 2007, was integrated into maternal and child health programmes. The role of female community health volunteers was expanded to include components of newborn care and referrals of ill newborn babies provision and of the CB-NCP package. Training and behaviour change materials were developed in 2008 and implementation of CB-NCP began in ten pilot districts in 2009. The CB-NCP programme trains health-care workers at all levels of care and female community health visitors in programme districts to improve their skills in integrated case management of newborn babies. Mothers’ groups and community leaders are mobilised to improve newborn care practices at the same time health-care facilities are made capable to provide improved newborn care.

Results from the 2011 Nepal Demographic and Health Survey (NDHS) data show a positive effect of CB-NCP on neonatal mortality rate in the ten pilot districts.

Close the quality gap (health service delivery)
Health service delivery solutions need to focus on improving efficiency and quality in delivery of services, since increasing coverage alone will not necessarily lead to the desired outcomes or effect. Achievement of equity in the provision of care is imperative; the high rates of mortality and morbidity in women and newborn babies in poor and marginalised populations are due to poor quality of care. Perinatal audits have proven to be a useful mechanism to improve the quality of care and to decrease perinatal mortality, particularly in high-income countries but also in low-income and middle-income countries. This strategy was proposed as a solution to improve quality of service delivery by all our country workshop teams (table 3). However, the effect of audits are needed across countries to train additional health-care professionals and put strategies in place to retain them.

Motivational factors for health workers might be country-specific, but financial incentives, career development, and management issues are universal. Achievement of universal health care will depend not only on the availability of adequate numbers of health workers, but also on the distribution, skill mix, quality, and performance of the available health workforce.

These skilled providers need adequate supplies of essential medicines and commodities to provide quality services. In 2013, the UN Commission on Life-Saving Commodities for Women’s and Children’s Health identified an initial list of 13 overlooked life-saving commodities, which included maternal and newborn commodities integral to the delivery of the high-effect intervention packages. These commodities, if more widely accessed and properly used, could save the lives of more than 6 million women and children by 2015.

The Commission also made ten recommendations that focus on the need for improved global and local markets, innovative financing, quality strengthening, regulatory efficiency, improved national delivery of commodities, and better integration of private sector and consumer needs.

Figure 2: Phasing of strategies to address identified bottlenecks
Adapted from Knippenberg and colleagues and Lawn and colleagues. NMR=neonatal mortality rate. RMNCH=reproductive, maternal, newborn, and child health. CME=continuing medical education. KMC=kangaroo mother care. HR=human resources. EmOC=emergency obstetric care. IMNCI=integrated management of neonatal and childhood illnesses. MNH=maternal and newborn health. ANC=antenatal care. IMCI=integrated management of childhood illness. CEmOC=comprehensive emergency obstetric care. NICU=neonatal intensive-care unit. iCCM/C-IMCI=community-based integrated management of childhood illness.
# Focus of strategies for scaling up

<table>
<thead>
<tr>
<th>Steps to scale-up</th>
<th>Health-systems building block</th>
<th>Group 1, NMR &lt;5 deaths per 1000 livebirths</th>
<th>Group 2, NMR 5 to &lt;15 deaths per 1000 livebirths</th>
<th>Group 3, NMR 15 to &lt;30 deaths per 1000 livebirths</th>
<th>Group 4, NMR ≥30 deaths per 1000 livebirths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1: Assess the situation, determine priorities based on analyses, develop leadership</strong></td>
<td>Leadership and governance</td>
<td>• Increase the visibility of newborn issues in the context of RMNCH, engage stakeholders at all levels of care to raise awareness, ensure a coordinated convening group linked to Ministry of Health, cultivate champions</td>
<td>• Increase government spending for health, allocate budget lines for newborn care, and seize opportunities to leverage additional resources from existing RMNCH initiatives</td>
<td>• Implement and expand pro-poor legislation and strategies (eg, vouchers, community-based health insurance schemes, reimbursement of transport costs) and remove user fees</td>
<td>• Strengthen the role of community providers and families to implement clean birth practices, appropriate hygiene, and basic newborn care</td>
</tr>
<tr>
<td><strong>Step 2: Seize opportunities within the constraints of the existing health situation</strong></td>
<td>Health financing</td>
<td>• Increase investment in family-friendly care including infrastructure and technology in tertiary or specialised care centres</td>
<td>• Ensure financial protection for women and newborn babies needing emergency care</td>
<td>• Increase availability of nursing and midwifery skills and competencies for obstetric and newborn interventions (neonatal resuscitation, KMC, safe oxygen management and breastfeeding support) through preservice and in-service training, attraction and retention schemes, skill mix and task-shifting strategies, especially in rural and remote areas</td>
<td>• Strengthen and support community providers through regular supervisory visits and strengthen linkages with health facilities</td>
</tr>
<tr>
<td><strong>Step 3: Systematically scale up care</strong></td>
<td>Health workforce</td>
<td>• Increase efficiency and maintain skills and competencies (CME, workshops, in-service supervision, distance learning, reward system) of qualified health-care providers at all levels of care</td>
<td>• Expand and maintain nursing and midwifery skills and competencies for maternal newborn care and ensure long-term availability of skilled health workers, especially in remote and rural areas</td>
<td>• Establish learning centres at regional hospitals (eg, for KMC) to improve quality and efficiency</td>
<td>• Implement national HR strategies that provide incentives to increase availability, attract and retain skilled providers (continuous training, task shifting, compulsory service in rural areas, pay increase, etc)</td>
</tr>
<tr>
<td><strong>Step 4: Monitor coverage, measure effect and cost, improve data gaps</strong></td>
<td>Health service delivery</td>
<td>• Reach universal coverage of high-quality care for all newborn babies including those who are preterm or ill, or both—use innovative approaches to reach the most marginalised groups</td>
<td>• Improve follow-up mechanisms for newborn babies in need of long-term quality care</td>
<td>• Address missed opportunities for facilities births—improve EmOC and resuscitation</td>
<td>• Sustain long-term care and follow-up of premature babies with complications and early identification of impairment and disabilities</td>
</tr>
<tr>
<td><strong>Equity and quality</strong></td>
<td><strong>Quality</strong></td>
<td>improve quality of facility services for all mothers and newborn babies, reduce medicalisation of childbirth, improve the follow-up to support disabilities, and monitor long-term outcomes</td>
<td>Equity: identify the most marginalised and vulnerable groups and set specific plans to reach them</td>
<td>• Focus on quality ANC services to increase identification and treatment of women with pre-eclampsia and appropriate prevention of preterm labour</td>
<td>• Improve quality of care through perinatal audits</td>
</tr>
<tr>
<td><strong>Equity, quality, and supply</strong></td>
<td><strong>Supply</strong></td>
<td>increase number and competency of skilled providers, improve infrastructure and number of health facilities, strengthen outreach services, strengthen commodities supply chains, identify and address missed opportunities for facility births, and strengthen home facility linkages (plus group 1 and 2 strategies)</td>
<td></td>
<td>• Increase coverage of CEmOC and emergency neonatal care at least in district hospitals</td>
<td>• Improve data collection, reporting, and use to improve service delivery</td>
</tr>
<tr>
<td><strong>Equity, quality, supply, and demand</strong></td>
<td><strong>Demand</strong></td>
<td>mobilise communities to seek and use skilled care, strengthen community-based service delivery, improve referral between the community and facility (plus group 1, 2, and 3 strategies)</td>
<td></td>
<td>• Increase MMN outreach services including ANC, coverage of tetanus toxoid, IMCI, routine postnatal care (including extra care for small babies), and family planning</td>
<td>• Improve data collection, reporting, and use to improve service delivery</td>
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<tr>
<td><strong>Community ownership and partnership</strong></td>
<td><strong>Strengthening procurement and supply chain for essential commodities</strong></td>
<td></td>
<td></td>
<td>• Adapt KMC to the local context</td>
<td>• Increase coverage of CEmOC and emergency neonatal care at least at referral level</td>
</tr>
<tr>
<td><strong>Community ownership and partnership</strong></td>
<td><strong>Strengthening procurement and supply chain for essential commodities</strong></td>
<td></td>
<td></td>
<td>• Address unhealthy birth practices, consider social marketing of clean birth kits</td>
<td>• Establish NICUs to increase extra care for small and ill babies</td>
</tr>
<tr>
<td><strong>Community ownership and partnership</strong></td>
<td><strong>Strengthening procurement and supply chain for essential commodities</strong></td>
<td></td>
<td></td>
<td></td>
<td>• Strengthen newborn component within ICIMOC to scale up community-care management of neonatal sepsis in hard-to-reach areas with restricted access to health facilities</td>
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</tbody>
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depends on the ability to close the audit loop by identifying and implementing appropriate solutions to the problems identified, as well as continuously evaluating and refining the audit review process. In high NMR settings, where many births still occur at home, it is also important to ensure that community audits and social autopsies are integrally linked with facility-based audits and social mobilisation efforts. The more widespread experience of implementing maternal death audits at scale can provide useful lessons for the establishment and scale-up of perinatal audits. Supervision, audit feedback, and motivation of health-care providers can also improve service quality and provider performance. There is no magic bullet to improving the quality of health-care services; interventions to improve quality depend on the identification of underlying reasons for the problems and definition of improvements based on set benchmarks.

The Every Newborn Action Plan proposes a mother-baby friendly initiative that will combine effective quality improvement methodology into a package and establish a set of global standards as a key strategy to reach every mother and newborn baby with high-quality care. The Baby Friendly Hospital Initiative was successful in raising awareness and improving breastfeeding practices and rates. Lessons learned need to be applied to ensure that the new global mother-baby friendly initiative will integrate service delivery for mothers and newborn babies, cut across programmes (including HIV, nutrition, water and sanitation, communication for development) and initiatives (including A Promise Renewed, Scaling Up Nutrition, and the Global Strategy for the Elimination of Mother to Child Transmission of HIV, among others). The mother-baby friendly initiative will mobilise countries and partners to close the quality gap by improving facility-based care for women and babies while strengthening the linkages with communities. The focus will be on the delivery of high-effect interventions during the crucial periods of labour, childbirth, and the first week of life. Improvement of the quality of facility-based intervention packages for women around the time of childbirth as well as for newborn babies by ensuring that 90% of facility births receive the evidence-based intervention packages by 2020 could prevent around 113,000 maternal deaths, 531,000 stillbirths, and 1.325 million neonatal deaths.

Conclusion

Improvement of birth outcomes is fundamental to the post-2015 agenda for both economic and health system development, with care for the small baby being the most sensitive test of universal health coverage and quality of care. The Every Newborn Series and action plan goals for the reduction of stillbirths and neonatal mortality and A Promise Renewed goals for child survival cannot be met without increased focus on neonatal outcomes. Achievement of these goals will need a country-led, data-driven process to assess and sharpen national health plans. Countries must seize opportunities to systematically scale up care to reach every woman and newborn baby, particularly addressing the equity and quality gaps for care around the time of birth. Equitable access to high-quality, respectful care is a human right. To achieve the basic human right to survival, especially for small and ill babies, and a woman’s right to survival for both herself and her baby, needs a shift in norms to the universal resolve that no woman or baby should die needlessly. To translate this shift into reality needs more investment, more medicines, and more health workers, including midwives and nurses with the skills and autonomy to provide the right care for every woman and every newborn baby.

Contributors

KED was responsible for overall coordination of the country consultation process, bottleneck analysis tool development, the analysis, and writing group. AS-K was responsible for the tool development, substantial contributions to the data analysis, and writing process. MVK, LH, Jv, EL, and JEL contributed to the analysis, writing, and reviews of the paper drafts. JdG, SvX, and BD contributed to development of the tool and reviews of the paper. MS, NR, and CM contributed to coordination of regional and country consultations and reviews of the paper. All named authors contributed to the writing process and finalisation of the paper. All authors supported the facilitation of the regional and country consultation workshops.

The Lancet Every Newborn Study Group


Declaration of interests

KED, AS-K, NR, and MS are employed by UNICEF. LV is a consultant to UNICEF supported by funding from a grant from the Bill & Melinda Gates Foundation. MVK is employed by Save the Children’s SNL programme, which is funded by a grant from the Bill & Melinda Gates Foundation. EL is employed by the Global Alliance for Prevention of Prematurity and Stillbirths. LH received a grant from the Bill & Melinda Gates Foundation to do a case study that is captured in this paper. JdG is with MCHIP, which is funded through a grant from USAID. SvX and BD are employed by WHO. JEL is based at the London School of Hygiene and Tropical Medicine. Views expressed by the authors are their own and do not necessarily represent the views of their employing organisations.

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Series
Remarkable progress has been made towards halving of maternal deaths and deaths of children aged 1–59 months, although the task is incomplete. Newborn deaths and stillbirths were largely invisible in the Millennium Development Goals, and have continued to fall between maternal and child health efforts, with much slower reduction. This Series and the Every Newborn Action Plan outline mortality goals for newborn babies (ten or fewer per 1000 livebirths) and stillbirths (ten or fewer per 1000 total births) by 2035, aligning with A Promise Renewed goals for children and the vision of Every Woman Every Child. To focus political attention and improve performance, goals for newborn babies and stillbirths must be recognised in the post-2015 framework, with corresponding accountability mechanisms. The four previous papers in this Every Newborn Series show the potential for a triple return on investment around the time of birth: averting maternal and newborn deaths and preventing stillbirths. Beyond survival, being counted and optimum nutrition and development is a human right for all children, including those with disabilities. Improved human capital brings economic productivity. Efforts to reach every woman and every newborn baby, close gaps in coverage, and improve equity and quality for antenatal, intrapartum, and postnatal care, especially in the poorest countries and for underserved populations, need urgent attention. We have prioritised what needs to be done differently on the basis of learning from the past decade about what has worked, and what has not. Needed now are four most important shifts: (1) intensification of political attention and leadership; (2) promotion of parent voice, supporting women, families, and communities to speak up for their newborn babies and to challenge social norms that accept these deaths as inevitable; (3) investment for effect on mortality outcome as well as harmonisation of funding; (4) implementation at scale, with particular attention to increasing of health worker numbers and skills with attention to high-quality childbirth care for newborn babies as well as mothers and children; and (5) evaluation, tracking coverage of priority interventions and packages of care with clear accountability to accelerate progress and reach the poorest groups. The Every Newborn Action Plan provides an evidence-based roadmap towards care for every woman, and a healthy start for every newborn baby, with a right to be counted, survive, and thrive wherever they are born.

Introduction

The Millennium Development Goals (MDGs) showed that a few outcome-focused targets with accountability can unify many players around a common agenda to deliver results. The average annual rate of reduction in child mortality, for example, has more than doubled in the past 10 years compared with the previous decade, and both child and maternal mortality have halved since the 1990 baseline associated with increased intervention coverage of care and technical advances supported by political commitment and investment. By contrast, newborn mortality and stillbirth reduction did not feature in the MDGs, and receiving scant policy attention. As the chance of newborn survival becomes more certain, families are more likely to decide on fewer children by using contraception. These deaths account for 44% of under-5 child deaths globally. In most regions of the world, more than half of all deaths in children younger than 5 years occur in the newborn period. Additionally, more than 2.6 million third trimester stillbirths occur globally each year, with 45% taking place during childbirth. A key principle guiding the development of the post-2015 framework is “no-one left behind.” The data show that newborn babies were left behind—invisible in the MDG framework, and receiving scant policy attention and investment. Stillbirths were entirely missed and still do not appear in UN reporting for women’s and children’s health. Also missing in the current health goals is the clear link beyond survival to development outcomes, increasingly affected by insults around the time of birth and care of the baby, especially early nutrition.
Stillbirths and neonatal deaths matter not only to the families and communities that lose them, but to societies and economies, which fail to benefit from their contributions to labour and intellectual capital. Birth is the moment in the human lifecycle with the greatest risk of death, disability, and lost development potential. The generation born today is a workforce of 2030—a time when many countries, particularly those in Africa, hope to reap the so-called demographic dividend that comes from having an employed, healthy, and optimally productive working-age population caring for a smaller dependent population. This dividend, and the potential for accelerated economic growth, cannot be fully realised without addressing newborn survival and health. This is why a healthy start to life must be at the heart of the post-2015 agenda.

In the final paper in The Lancet Every Newborn Series, we summarise findings from the first four papers leading to an action plan to reduce newborn and maternal deaths and prevent stillbirths.

Assessment of progress and definition of priorities for action

In their Series paper, Lawn and colleagues' spotlight newborn survival and small babies as the heart of the unfinished MDG child survival agenda and argue that explicit targets with accountability are needed to drive ongoing progress. If neonatal mortality continues to fall at a much slower pace than mortality after the first month of life, targets for under-5 mortality will be unachievable. A Promise Renewed (2012) targets for ending of preventable child deaths by 2035 have attracted national commitments from more than 190 countries, and country data assessments have sharpened the focus on the imperative to address newborn survival. As presented by Lawn and colleagues, this Every Newborn Lancet Series proposes a global goal of ten or fewer deaths per 1000 livebirths for newborn babies and ten or fewer per 1000 total births for stillbirths by 2035 and an interim target of 12 or fewer deaths per 1000 livebirths for newborn babies and 12 or fewer per 1000 total births for stillbirths by 2030, aligning with other post-2015 targets for ending of preventable maternal and child mortality. These targets are ambitious for some higher burden countries, but are achievable even with existing interventions. Through a consultative process on targets and content in the plan, more than 50 governments, hundreds of partners, and more than 2000 individuals have been part of the Every Newborn Action Plan process and development (panel 1).

New epidemiological data underline the priorities for action in terms of where (which countries), when (around birth, when more than 40% of maternal and newborn deaths and stillbirths occur), what (the three leading causes of neonatal death: preterm, intrapartum complications, and infections, which also overlap with causes of stillbirths and maternal deaths), and who (small babies). More than 80% of all neonatal deaths are in low birthweight babies: two-thirds preterm and one-third term but small for gestational age. Additionally around a third of stunting starts as small for gestational age and preterm babies, explaining some of the slow progress in reduction of stunting by failure to effectively target the starting point. Strategic investment in birth outcomes and care of small and ill newborn babies would be transformational for human capital and economic development, especially in low-income and middle-income countries. Lawn and colleagues' also present the global burden of deaths and disability after neonatal insults and especially for babies born too small and too soon. Neonatal conditions account for almost 10% of all disability-adjusted life-years worldwide, even without stillbirths being counted.

In their paper, Bhutta and colleagues' estimate that high coverage (90%) of currently available interventions could save 3 million lives per year by 2025, including 162000 women, 816000 stillbirths, and 1.95 million...
newborn babies—a triple return on investment. These evidence-based interventions fall into four groups: (1) integrated antenatal care; (2) quality care at birth, with access to basic and comprehensive emergency obstetric care, and the management of preterm labour, including the appropriate use of antenatal corticosteroids; (3) essential newborn care and, if needed, prompt resuscitation, plus routine postnatal care for all women and babies; and (4) care of small and ill newborn babies, including the prevention and management of neonatal infections, kangaroo mother care, and supportive care for preterm babies. This approach builds on promotive and preventive care in community settings to better quality care in appropriately staffed and equipped facilities. Community care, especially with curative services, can prevent around 25% of neonatal deaths and is a feasible and important approach, especially in hard-to-serve populations, such as those that are rural or post-conflict. The greatest effect on newborn survival as well as maternal health and prevention of stillbirths is through facility-based care during labour, childbirth, and the first week of life, including care for small and ill newborn babies (figure 2). High coverage of these interventions is estimated to need an additional annual running cost of US$5-65 billion for the 75 highest burden countries, amounting to $1928 for each life saved, including stillbirths, newborn babies, and maternal

Panel 1: The Every Newborn Action Plan and movement

**What is Every Newborn?**
The Every Newborn Action Plan provides an evidence-based roadmap to reduce preventable newborn deaths and stillbirths, and to increase human capital through a healthy start in life. Women’s health is closely linked and counting the effect on both makes the investment case much stronger. The evidence gives clear principles for action, but for each country context-specific adaptation linked to national strategies and accountability mechanisms is crucial.

**How has the action plan been developed?**
The plan content is based on The Lancet Every Newborn Series with data and evidence shaped by the input of 17 national consultation workshops in 2013, as well as two multicountry regional consultations, a global stakeholders’ meeting, and consultations with health-care professional organisations.13 An official WHO online consultation in 2014 gathered inputs from about 300 stakeholders, including more than 50 national governments, as well as donors and foundations, civil society groups, and the private sector to refine the mortality targets. The Every Newborn process is coordinated by UNICEF and WHO, with representation from a wide range of stakeholder groups (see names at end of paper), and is in support of the UN Secretary-General’s Every Woman Every Child to implement the Global Strategy for Women’s and Children’s Health. Every Newborn is a movement of parent groups and more than 60 partner organisations responding to increasing demand from countries to accelerate action on newborn survival and health.

**What does the action plan include?**

- **Vision:** A world in which there are no preventable deaths of newborn babies or stillbirths, where every pregnancy is wanted, every birth celebrated, and mothers, babies, and children thrive and reach their social and economic potential.
- **Goals for 2035, linked to the post-2015 development framework:** For all countries to have a neonatal mortality rate of ten or fewer deaths per 1000 livebirths by 2035, and a stillbirth rate (death after 28 weeks’ gestation) of ten or fewer per total births by 2035, with interim targets every 5 years to enable monitoring.1 These goals have been developed on the basis of extensive consultation and the full wording includes an explicit focus on equity and on child development outcomes. Analyses underline that these goals can be reached by achieving universal coverage with existing interventions.1314
- **Guiding principles:** Country leadership, human rights, integration, equity, accountability, and innovation.
- **Actions:** The plan outlines the latest evidence on costs and expected effect of interventions on mortality outcome, and calls for implementation by all stakeholder groups. An expected output in countries is an integrated reproductive, maternal, neonatal, and child health plan, not a separate newborn plan, which is sharpened to include the highest effect interventions for care at birth and care of small and ill newborn babies in that country context. This emphasis lies at the heart of universal health coverage, and a functional health system that works for the poorest groups, as well as wider coverage along the continuum of care—notably also for family planning services, pregnancy care, and child health care.

The plan has five strategic objectives to achieve the targets (figure 1):

1. Strengthen and invest in care during the crucial period of labour, childbirth, and the first days of life.
2. Improve quality of maternal and newborn care.
3. Reach every woman and every newborn baby and reduce inequities.
4. Harness the power of families, families, and communities for change.
5. Count every newborn baby: improve measurement and accountability, including birth and death registration.

**How does Every Newborn build on other plans and efforts?**
Every Newborn builds deliberately on the targets, interventions, strategies, and processes proposed by other efforts to promote women’s and children’s health. These efforts include Committing to Child Survival: A Promise Renewed,1 with its emphasis on elimination of preventable child deaths by 2035, and the maternal mortality post-2015 targets, as well as Family Planning 2020. Every Newborn emphasises approaches consistent with the UN Commission on Lifesaving Commodities for Women’s and Children’s Health, which includes four life-saving commodities specific to newborn survival, the Scaling Up Nutrition framework for action, the Global Immunization and Vaccine Strategy, the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea, and Countdown to Zero for eliminating Mother-to-Child Transmission of HIV and improving the health of women with HIV. Wider environmental change is also needed notably for WASH (water, sanitation, and hygiene) for all. Plans are an important step towards action; however, their proliferation can also promote issue-specific tensions and pull national stakeholders into multiple meetings, even distracting from implementation. Our key message is context-specific attention to ensure newborn babies no longer fall between the gaps in the continuum of care and between multiple plans. In view of the core value of a healthy start in life and the vulnerability of newborn babies, they deserve special attention within many issue-specific plans.
The five strategic objectives of the Every Newborn Action Plan

- Effective care at time around labour, childbirth, and the first days after birth has the highest effect on stillbirth, newborn, and maternal mortality
- Quality care along the continuum of care, delivered by skilled health-care workers with access to essential commodities, including family planning
- Universal coverage to expand access to and use of interventions for the most vulnerable and hardest to reach populations
- Data for action and to achieve equity, including birth and death registration, health service performance data, and mortality audits with response
- Parents, families, and communities that are empowered and engaged to demand quality care and not accept preventable newborn and maternal deaths

Principles: Country leadership, human rights, integration, equity, accountability, innovation

Figure 1: The five strategic objectives of the Every Newborn Action Plan

The biggest failures have been lack of investment in the highest-burden countries, incomplete or partial implementation, and major gaps in programmatic coverage data. Behind this situation lies a lack of leadership and lack of public voice and accountability on newborn babies and stillbirths, in view of predominant global attention on disease-specific issues. In practice, responsibility for newborn babies has fallen between reproductive, maternal, and child health and nutrition efforts, and neither maternal nor newborn health programmes managed to access major global funding streams. Despite this overall disappointing effect, some issues such as neonatal tetanus have made major progress, reducing deaths ten-fold in the two decades of the MDG era. In the same timeframe, some middle-income countries have halved neonatal mortality; for example, China, Estonia, Turkey, and several Latin American nations, notably Peru and Brazil. In many cases, this progress has been linked to national government investment and deliberate pro-poor financing. So the picture is mixed, and the gap has widened between countries, especially for the poorest countries, and especially Africa. At current rates of progress, more than a century will pass before a child born in Africa has the same chance of survival as one born in an Organisation for Economic Co-operation and Development country.

Dichotomies, debates, and myths

Several debates recurred in both the Series analyses and in the consultations for the Every Newborn Action Plan. First, there is an apparent dichotomy of focus on the women or on her baby. Although this plan has a newborn title, its main message is to urge greater collective action to support women and babies together at the time of birth and consistently throughout the days and months after childbirth, so that the time of birth becomes the celebration that it should be. Whereas there is a clear recognition of the synergies of actions on saving mothers and newborn babies through integrated interventions, the term Every Newborn was chosen to underscore the importance of newborn outcomes and visibility in the UN
Secretary General’s Every Woman Every Child effort supporting the Global Strategy for Women’s and Children’s Health. Babies and their mothers must be considered together—they are distinct yet interdependent. The baby is held by the mother and this should guide the integrated design of services, the responsibilities of health workers, and flow of funding. Separation of women and babies is a false dichotomy, and Every Newborn calls on advocates for reproductive and maternal health and nutrition to also stand for babies, and vice versa.

A second (false) dichotomy is between a continuum of care approach—i.e., addressing of RMNCH and nutrition as an integrated whole—compared with focusing on where or when effect will be highest and the poorest families will gain the most. This dichotomy is akin to the debate of horizontal versus vertical approaches. On the basis of evidence on burden, effect, coverage, and equity gaps, the Every Newborn Action Plan is firmly focused on the time around birth, with the highest priority on quality of care at birth for every woman and every newborn baby—this gives a triple return on investment, with facility births and midwives at the heart of required efforts (figure 2). During the analyses of epidemiology and lives saved, as well as what has and has not worked in countries, we have recognised that the previous focus underemphasised care of the small and ill baby. More than 80% of neonatal deaths, and many stillbirths, are in low birthweight babies, especially those that are preterm. Preterm newborn babies also have a high risk of disability (although most babies born after 28 weeks’ gestation who survive are without significant disability). Both preterm and term infants who are small for gestational age have an increased risk of stunting and of adult-onset non-communicable diseases.

Some dichotomies that were a previous source of tension have shifted; for example, between community empowerment and care versus facility care. Both are clearly important, and linking of the two enables more progress. No country has achieved a neonatal mortality rate of less than 15 per 1000 livebirths without targeting small babies for care, including simple care at home as well as moving to more complex facility care. Indeed the basis for essential newborn care (“dry, warm, clean, feed”), started a century ago by the French obstetrician Pierre Budin, was the drive to care for “weaklings” or preterm babies. While recognising the value of community empowerment and engagement, we are calling for intentional scale-up of quality maternal and newborn care in facility settings, especially in district hospitals.

The child health community is also shifting to recognition of the need for more work to strengthen hospital-based quality of care for children with pneumonia, malaria, HIV, and severe malnutrition, complementing successful prevention and primary care management. With a future-casting agenda to 2030 and 2035, every country will be moving along a spectrum towards neonatal special care. This changing reality will
reduce deaths, but must urgently be linked to improved tracking of disability and specific quality improvement around safe oxygen use, eye care, and community follow-up and support to ensure child development is maximised. For example, India’s national programme includes both community and facility-based strategies, and specifically links small and ill newborn babies with home-based follow-up care (panel 2).

**Action for Every Newborn**

**Overview**

Building on the findings of this *Lancet* Every Newborn Series, we propose an action agenda to change the survival curve for stillbirths and newborn babies and to move beyond survival to improved health and development. Underpinning this agenda is a greater understanding of what must be done differently. The Every Newborn Action Plan (panel 1) has had an 18 month gestation, building on the epidemiological and intervention evidence and analyses presented in this Series, and particularly on the recommendations from Darmstadt and colleagues on what needs to change to accelerate progress, as well as the health system analysis presented by Dickson and colleagues. Throughout this time, the action plan content has been shaped by extensive consultations with countries and other stakeholders (appendix).

The core of the plan involves five strategic objectives (panel 1). The focus is on improved quality of care at

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**Panel 2: Taking integrated action with newborn babies at the start: the example of India**

Since 1990, India’s maternal mortality ratio has decreased by around 70%. However, newborn deaths have decreased more slowly, with still roughly 760 000 deaths annually. To address this challenge, India is implementing the Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH-A) strategy of the National Health Mission. The newborn component of the RMNCH-A strategy is built on five pillars:

1. **Essential newborn care**: Promoting institutional deliveries is a key focus, and the Janani Suraksha Yojana (JSY; conditional cash transfer scheme) provides financial incentives for institutional deliveries both to pregnant women and to the ASHA (Accredited Social Health Activists), who serve as a link between the community and the health system. Building on the success of JSY and to mitigate out-of-pocket expenses, a key barrier for accessing of timely care and services, in 2011 India moved towards an entitlement-based approach through Janani Shishu Suraksha Karyakram (JSSK). JSSK guarantees every woman delivering in a public health institution to absolutely free and cashless services that include free drugs, diagnostics, diet, and transport. The introduction of JSY has resulted in the proportion of institutional births increasing from 40-7% in 2005-06 to 83% in 2012-13. Additionally, a recent initiative has empowered assistant nurse midwives to give a pre-referral injection of gentamicin for management of sepsis in young infants (<2 months of age) and mandatory prophylactic vitamin K injection. This initiative has been supported by substantial efforts to increase quality and availability of emergency obstetric and essential newborn care at health facilities.

2. **Home-based newborn care**: India launched a home-based newborn care scheme in 2011 and is one of the first countries to have trained 600 000 ASHAs with specific skills to provide home-based newborn care during the first 42 days of life; they manage simple problems and refer to special newborn care facilities for advanced care.

3. **Ill and small newborn care**: At district level, sick newborn care units (SNCUs) have been established for newborn babies needing specialised health care. SNCUs have been rapidly scaled up, with 507 units established in 3 years—an increase of 176% over a baseline of 184 in 2005-2008. These units provide simple and effective care for newborn babies with severe illness and birth complications. Newborn survival rates in SNCUs are around 90%. Key success factors for these SNCUs are appropriately trained doctors and nurses, adherence to evidence-based protocols, and monitoring of all SNCU personnel’s performance.

4. **Enhanced focus on adolescent health and reproductive health**: Recognising that maternal mortality and child survival cannot be addressed in isolation, India has adopted a lifecycle approach situating newborn and maternal health at the centre of continuum of care—establishing clear linkages across services and care during crucial life stages. ASHAs provide reproductive health services including counselling for birth spacing and age-appropriate contraception methods to beneficiaries at home. The enhanced focus on spacing methods, including insertion of intrauterine contraceptive devices (IUCDs) and postpartum IUCDs has resulted in almost 17 million women being protected from unwanted and unplanned pregnancies during the past 36 months. Rashtriya Kishor Swasthya Karyakram (2014), India’s new adolescent health programme, reaches out to 253 million adolescents with information and counselling on delaying of marriage and early pregnancies.

5. **Strengthening the health system and evidence-based, strategic management**: A crucial component of India’s strategy to reduce preventable maternal and newborn deaths is strengthening the health system. To this end India has invested more than US$19 billion, trained more than 336 000 health workers including 8129 doctors, 2007 specialists, 11 925 Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) doctors, 251 738 assistant nurse midwives, 34 605 staff nurses, 13 725 paramedical staff, 10 080 programme management staff, and 20 000 ambulances or patient transport vehicles have been added to the public health system.
birth, but the plan requires change for health systems and social determinants, and especially parent voices to lead this movement (figure 1). The plan details these elements, but here we focus on what needs to be done differently and why, based on the top five issues identified by Darmstadt and colleagues: leadership and more coordinated partnerships, parent voice, investment, implementation, and indicators with effective data collection and accountability for use in continual programme improvement. Here we start with leadership, because this has been a fundamental gap.

(1) Intentional maximisation of leadership and partnership

Leadership is essential for progress in relation to policy change, legislation, investment, implementation, advocacy, and popular representation. For newborn survival, much of the change to date has been promoted by the technical community, and several assessments show that this remains a small group. Unlike for HIV and malaria, the case for change for newborn babies has so far failed to connect to a political voice on the global stage. Apart from a few countries, these voices remain primarily technical. Parliamentarians play a crucial part in voicing the needs of women and children in their constituencies. The 2011 Pan African Parliament prioritised policy and budget action for maternal and child health and the 2012 resolution on maternal and child health by the Inter-Parliamentary Union have been landmark moments in parliamentary action. Champions support these efforts—whether tribal or religious leaders, or from sports or popular entertainment. Such leaders amplify the voices of ordinary citizens and communicate key messages to wide audiences, driving a sense of collective intolerance about the status quo and broadening social movements, bringing policy and investment needs to the attention of decision makers, timed to moments in policy and funding cycles. Advocacy networks for women’s health have intentionally developed champions; for example, at the African Union and linked to the Campaign for the Accelerated Reduction of Maternal Mortality in Africa (CARMMA). Recent years have seen growing public intolerance about women dying while giving birth. Among African leaders there are now more frequent mentions of maternal deaths than for AIDS. The next step is for campaigners and the media to connect the protection of mothers with the protection of babies, especially in Africa where rates are highest and newborn deaths are frequently considered a norm.

As well as political leadership and champions, a wider community of technical leaders is crucial for change. Such leaders do not appear by accident—especially in high-burden countries, where there must be more intentional investment in technical and public health leadership skills, including opportunities for formal qualifications, since these bring credibility as well as capacity. Institutional and mentoring networks have been essential for HIV and malaria and vaccines, but are lacking for RMNCH and need to be built for those wanting to develop leadership skills to address newborn health, including clinical, public health planning, research, and political voice.

Partnerships and alliances are critical. The community of newborn advocates is small and most effective when undertaken in the context of the wider RMNCH continuum of care—notably, together with maternal or child health champions, or for champions of specific other conditions such as HIV, including prevention of mother to child transmission. There is no one health-care professional group active worldwide that stands for the baby, since most low-income and middle-income countries have few if any neonatologists or neonatal nurses. Hence multidisciplinary alliances across health-care professional teams and with others are important for programmatic and political change.

(2) Parent voices for action as a means to wider accountability

At least as important as political leadership and widening of capacities of health-care professionals is the empowerment of communities. Parents can be highly effective voices for change, shifting social norms around the acceptance of newborn deaths, as well as holding health workers and the government accountable for quality care and mobilising communities to support pregnant women and families with newborn babies. Emotional devastation associated with a newborn death or stillbirth occurs every day all around the world. Yet in some settings, women are stigmatised for the deaths of their babies, especially stillbirths. Cultural practices also play a part and some reflect the acceptance of newborn deaths, such as delayed naming of the baby. Since the voices of those who bear the burden are rarely heard, this invisibility promotes the concept that newborn deaths and stillbirths are inevitable. Greater attention and investment is needed in support of community-level networks and platforms from which ordinary voices can be heard, whether women’s group meetings or via the proliferation of new media channels, including radio, mobile phone, and internet platforms. For those who have access, social media can provide ways to share experiences and connect with others, as shown by massive participation in World Prematurity Day in 2012 and 2013, including national events led primarily by parent advocacy groups. Demand for action from women and communities is fundamental for accelerated progress.

At the community level, rising demand for facility-based maternal and newborn services has led to increases in the percentage of women accessing skilled care at childbirth, although disparities remain within and between countries. More information and support for better choices could help to build demand for quality services by encouraging better care-seeking practices in pregnancy and childbirth as well as healthier practices during pregnancy and postnatally (eg, through early...
home visits to new mothers by community health workers). Crucially, behavioural change interventions are not only for women, but also (or perhaps more so) for grandmothers, mothers-in-law, fathers, brothers, and other decision makers in the household, as well as frontline health-care workers. Community programmes can provide education and empowerment, improving knowledge and shifting social norms.

Participatory women’s groups target women of reproductive age, particularly newly married and newly pregnant women, and follow a participatory learning and action cycle to identify and prioritise problems in pregnancy, childbirth, and the postnatal period. Peers support new mothers and empower women to negotiate for change. Problems are addressed; for example, creating awareness, collecting funds to use for maternal and neonatal emergencies and arranging emergency transport, implementing their chosen strategies, and evaluating their activities. A systematic review and meta-analysis of the effect of women’s groups reported 37% reduction in maternal and 23% reduction in neonatal mortality. A WHO review concluded that evidence of beneficial effect of such groups on neonatal mortality was clearer than the evidence of its effect on other outcomes, and recommended implementation in rural settings with low access to health services, in tandem with efforts to improve the quality of health services. These investments in women’s empowerment and engagement will be most effective if they are linked to high-quality care within the health system, as shown in the first randomised controlled trial of women’s groups where this was an important input.

(3) Investment for effect and increased harmonisation in funding

This Series reports that an estimated 73% of newborn deaths, 35% of stillbirths, and 59% of maternal deaths can be averted at an additional annual running cost of just US$5-65 billion or $1-15 per head in the 75 highest burden countries—for a total of 3 million lives saved every year by 2025, with the biggest numbers in the poorest countries. The Global Investment Framework for Women’s and Children’s Health, supported by the Lancet Commission on Investing in Health, estimated that for every $1 spent on health, including health system strengthening and the provision of quality care at birth, economies would gain almost $9 in economic and social benefits as a result of lower mortality and morbidity by 2035.

To achieve this goal, we need increased funding through all channels (domestic, bilateral, and global), improved alignment with national contexts and plans, and promotion of sustainable, transparent funding channels. Within this funding, increased accountability for spending on the interventions with the highest effect on mortality outcome and reaching the poorest groups is needed. Official development assistance (ODA) can be tracked; currently, the share of ODA funding for RMNCH that refers to “newborn” (mainly through the phrase “MNCH”) is pitiful at less than 10%, especially in view of the large share of the disease burden and the demonstrated potential for lives saved. Furthermore, there is almost no mention of “stillbirths” in more than an quarter of a million donor disbursements.

Domestic funding accounts for most national health spending (ie, more than 70% in sub-Saharan Africa, and more in Asia, including out-of-pocket spending), and a steadily increasing domestic share of funding is necessary for ensuring sufficient funds are available for sustainable health systems building, which is key for success. Specific funding for RMNCH is also needed. However, 3 years after the report of the Commission on Information and Accountability for Women’s and Children’s Health in 2011, the one recommended financial indicator on national spending for RMNCH is available for only a handful of countries.

If the ambitions of “grand convergence” of life expectancy and health outcomes by 2035 are to be reached, as in the vision of the Lancet Commission on Investing in Health’ and Every Newborn goals for neonatal deaths and stillbirths, funding for newborn babies represents an important frontier for change. Funding for targeted newborn interventions is almost entirely missing, such as ensuring specific skills for health workers or specific commodities or key community aspects, either to reach women and babies at home or in women’s groups, or to bring curative care closer to home.

To address this gap and see results in their investments, global funding initiatives will need to make three important changes in the way they operate. More could be achieved with existing funds if coordination and harmonisation among global funding platforms were strengthened and services were better integrated, and the highest effect care prioritised. Platforms such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, the Health Results Innovation Trust Fund, the GAVI Alliance, and others represent huge funding streams. First, each global health funding platform should explicitly state how it will contribute to reducing newborn deaths and stillbirths through its work. For example, the new funding model of the Global Fund will support countries to strengthen their health systems for the provision of integrated service delivery that could support maternal, newborn, and child health services beyond the three diseases. Also investments in support of the FP2020 effort will contribute to improved outcomes for babies as well as girls and women. Second, integrated service delivery promotes increased efficiency for all services by, for example, taking opportunities to improve newborn outcomes by adding care with high effect on mortality outcome to other interventions—eg, antibiotic treatment of neonatal sepsis being added to artemisinin-based combination therapy for malaria. Likewise, birth and the early postnatal period are crucial for optimum breastfeeding and the most important time
window for antiretroviral therapy for prevention of mother to child transmission of HIV, with more than 1 million children globally in need of effective treatment.59 Growing cooperation between these major funding platforms promises to improve financial and technical support for integrated service delivery. Third, strengthened coordination among donors and funding platforms is crucial to identification of overlooked parts of the RMNCH continuum of care and to improvement of efficiency, in response to changing needs and defined gaps identified through robust monitoring and accountability.

(4) Implementation: increase health worker numbers and skills with attention to quality
Despite strong evidence and relatively low cost, many of the highest effect interventions targeting neonatal mortality have very low coverage and do not have appropriate data tracking mechanisms.60 Assessment of health-system bottlenecks are important to strengthen implementation.61 In every context, the major challenge is building and maintaining a health workforce with the skills to provide quality care during birth and to look after small and ill newborn babies. Health workers need evidence-based skills derived from pre-service and in-service training, including training in the care of small and ill newborn babies (WHO guidelines and training materials shown in appendix). To address the shortage in human resources, countries need specific human resource plans to increase the numbers and autonomy of midwives,62 as well as to include nurses with specific neonatal care skills, and to ensure that all health workers are competent and confident in newborn care. Scaling up of home visits to mothers and newborn babies will help to close the coverage and equity gap of essential interventions necessary in the first fragile days after birth.63 South-to-south learning through study tours can help uptake of innovations. For example, policy makers applied a national adaptation of community case management of neonatal sepsis in the Health Extension Worker package in Ethiopia, after a learning visit to Nepal.64

The responsibility for planning implementation lies within Ministries of Health, and accountability is enhanced when managers allocate responsibility for newborn survival to one or more programme managers who are tasked with the coordination of planned activities within integrated RMNCH programmes. Several tools are available for evidence-based planning such as the Lives Saved Tool (LiST)65 and national processes, such as Countdown to 2015 events,66 to support national evaluation and accountability.

Implementation must also be linked to programme learning and evaluation. More upstream research is also crucial to accelerate progress, particularly for prevention of preterm and small for gestational age births, for which there are currently very few high effect interventions.67

(5) Indicators: counting every newborn baby, monitoring with local action and accountability
Core indicators to track progress on newborn outcomes have been prioritised in the Every Newborn Action Plan on the basis of a ranking process for those that are most central to tracking of effect and coverage and inputs for Every Newborn, prioritising ten indicators (ie, three effect on mortality outcome, three contact point coverage)—also tracked by Commission on Information and Accountability and Countdown—and four neonatal-specific interventions) and counting births (figure 3).

Counting of births and deaths will eventually improve the data. In the 21st century, no child should be born and die without a single piece of paper left behind to mark their life. Likewise, no maternal death should go uncounted.68 Improvement of civic and vital registration systems is a fundamental step in improvement of the capacity of countries to plan and monitor health investments and to respect the right of all citizens to be counted.1

Urgent work is planned and must be executed to improve the metrics, both for these and other supporting indicators and to increase the number of countries routinely tracking them. This Every Newborn monitoring framework is the first milestone in the action plan (figures 3 and 4). Some indicators cannot be tracked through household surveys; for example, asking a woman if her baby needed resuscitation or was resuscitated. Hence, health facility data collection and routine health management information systems will be essential to measurement of further progress. Few indicators with

<table>
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<th>Core indicators</th>
<th>Additional indicators</th>
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<tr>
<td>Effect on mortality outcome</td>
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<tr>
<td>(1) Maternal mortality ratio</td>
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<tr>
<td>(2) Stillbirth rate</td>
<td>Intrapartum stillbirth rate</td>
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<td>(3) Neonatal mortality rate</td>
<td>Low birthweight rate</td>
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<td>Coverage: Care for all mothers and newborn babies</td>
<td>Preterm birth rate</td>
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<td>(4) Skilled attendant at birth</td>
<td>Small for gestational age</td>
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<td>(5) Early postnatal care for mothers and babies</td>
<td>Neonatal morbidity rates—eg, infection rates of long-term disability after neonatal conditions</td>
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<td>(6) Exclusive breastfeeding to 6 months</td>
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<td>Coverage: Complications and extra care</td>
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<td>(7) Antenatal corticosteroid use</td>
<td>Caesarean section rate</td>
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<td>(8) Newborn resuscitation</td>
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<td>(9) KMC and feeding support</td>
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<td>(10) Treatment of neonatal sepsis</td>
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<tr>
<td>Counting</td>
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<td>Birth registration</td>
<td>Death registration including cause of death</td>
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<td>Process indicators and norms and standards for service delivery packages</td>
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<td>Every Mother Every Newborn Quality Initiative</td>
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<td>Care of small and ill newborn babies</td>
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Figure 3: Indicators for tracking progress for Every Newborn
Blue—not currently routinely tracked. Bold—indicator needing further work to ensure availability of consistent data in routine information systems. Red—service delivery package for which norms and standards will be defined and tracked. All coverage indicators to be tracked in such a way that they can be broken down to assess equity—eg, urban or rural, regional, wealth quintile. KMC—kangaroo mother care.
relevance to newborn babies are in national routine tracking systems, and these need to be included, especially those outlined in figure 3 that are interventions with a high effect on mortality outcome that are not yet routinely tracked (eg, antenatal corticosteroids, neonatal resuscitation, kangaroo mother care).

Globally, accountability for RMNCH will be linked to the post-2015 accountability mechanism (figure 4) and it is expected that at global level some indicators will continue to be tracked through Countdown to 2015 country profiles and reports. These Every Newborn indicators should be included. Importantly, these data need to be used in-country to monitor progress and adjust programme implementation; for example, as part of health sector and district management reviews (figure 4). Some countries, including India, Nigeria, Ethiopia, and Tanzania, have started to use subnational scorecards, in association with the African Malaria Leaders Alliance, CARMMA, Evidence4Action, and Promise Renewed, and Countdown to 2015.

**Action for the next generation**

The time around birth and the first week of life is a crucial lifecycle moment that can provide a triple return on investment. New analysis in this Series shows how intimately linked childbirth and adolescence are, and how attention to both can accelerate change and maximise the opportunity of a demographic dividend and a healthy, stable population.

As the post-2015 world emerges, this vision of healthy societies, in which women and adolescent girls, newborns and children all thrive, must be at the heart of
Panel 3: Every Newborn call for action

Building on evidence from The Lancet Every Newborn Series and the Every Newborn Action Plan, we call for a renewed commitment to dramatically improve the health and survival of newborn babies and women in the next two decades.

National and global goals in the post-2015 development framework

Newborn babies and stillbirths should have explicit national and global goals. These targets align with A Promise Renewed target for children and are in support of targets for ending of preventable maternal mortality:

1. By 2030, reduce national neonatal mortality to 12 or fewer deaths per 1000 livebirths and stillbirth rates to 12 or fewer per 1000 total births, resulting in global averages of nine and nine, respectively.
2. By 2035, reduce national neonatal mortality to ten or fewer deaths per 1000 livebirths and stillbirth rates to ten or fewer per 1000 total births, resulting in global averages of seven and eight, respectively.
3. Specific subnational equity targets should be set to reach families left behind, and to maximise development outcomes and minimise disability.

Milestones to track progress

To achieve these mortality goals, we commit to working with partners and national governments to develop and deliver the following milestones:

1. An Every Mother Every Newborn Quality Initiative with evidence-based norms and standards for quality care for every mother and newborn around birth. This package will be developed in close partnership with maternal health and midwifery organisations, building from proven tools with an aim to ensure half of high-burden countries are using this package by 2020.
2. Definition of a comprehensive, evidence-based package to reduce stillbirths. Additional research and innovation to address antenatal (during pregnancy) stillbirths is crucial. In the meantime, immediate progress can and must be made to reduce the 1·2 million annual intrapartum (during delivery) stillbirths.
3. Definitions and measurement for the ten core Every Newborn indicators, along with an agenda for countries and partners to increase the frequency and quality of relevant data and link this to programmatic action.
4. Universal birth and death registration, to provide crucial data and make a first step towards shifting social norms to guarantee every newborn baby the right to care, nutrition, and education. We call for a worldwide campaign starting in 2015, the last year of the Millennium Development Goals, to “Count Every Newborn” with a birth certificate for every baby.
5. An accountability framework that links to the post-2015 architecture, with strong ownership by national governments, as well as tools to ensure that parents and communities can hold their leaders accountable for progress.

Implementation and national action

Countries should update their national health strategies to include the Every Newborn mortality goals, coverage targets, and milestones. National strategies should link to existing processes, such as health sector planning and A Promise Renewed, and include actionable and measurable changes to meet the five Every Newborn Action Plan objectives:

1. Focus on care at birth for women and their babies, and care of small and ill newborn babies;
2. Address quality of care, including through adoption and scaling up of the Every Mother Every Newborn package; this will necessitate targeting of health system main bottlenecks particularly the shortage of skilled health workers, including midwives and neonatal nurses, requiring strategies in multiyear health sector plans, newborn survival commodities, and context-specific, robust, lower-cost devices;
3. Ensure equitable care that targets the poorest groups and ensures financial protection;
4. Empower parents and elevate their voices, especially those of women; and
5. Establish a monitoring and accountability framework to ensure that every newborn baby is counted at birth and that programmatic coverage data for interventions with high effect on mortality outcome are collected and used, including in national health information systems and perinatal audit.

Investment

Investments in care at birth and care of small and ill newborn babies will yield the highest effect. Stillbirths are an important component of the newborn investment case, and should also be included in programming and counted alongside women and babies.

- Increased investments from governments and donors and more intentional targeting from existing global funds are crucial for reversal of the slow progress for newborn survival. The investment should be commensurate to the burden and targeted to specific care with a high effect on mortality outcome at birth and for small and ill newborn babies, not merely adding the word “newborn” to a title.
- Stillbirths are an important part of the investment case, and should also be included in programming and counted alongside women and babies.
- Implementation research and upstream research investments are crucial to acceleration of progress.

Intentional development of capacity, leadership, and champions

We all have a responsibility to newborn babies, and stillbirths. Hence we call on all organisations that work for women and children to consider their role and mandate in acceleration of change for babies.

- Particular investment and attention is urgently needed to develop high-capacity leadership in high-burden countries that includes building both clinical and public health skills. By 2020 the ten highest burden countries should have pre-service specialist training for neonatal nurse skills and opportunities for higher-level clinical and public health skills for newborn programme design, evaluation, and research.
- Parents’ or women’s groups and community champions should be enabled to empower women and ensure that parent voices are heard by policy makers.

Specific milestones by year from 2014 to 2025 are detailed in the appendix.
countries to intensify action and ensure that women—often themselves still children—are not left alone to care for their newborn babies.

Contributors
The paper was planned, drafted, and coordinated by EM and LM with JEL and MKV. The India panel was prepared by AG. The financing section was drafted by MC, CP, and AB. The indicators and milestones section and graphics were coordinated by JEL. All the named authors and the Every Newborn Study Team and Steering Committee contributed to the text and the call for action.

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Declaration of interests
We declare no competing interests.

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