Published by Oxford University Press in association with The London School of Hygiene and Tropical Medicine *Health Policy and Planning* 2012;**27**:iii88–iii103

doi:10.1093/heapol/czs043

Newborn survival in Malawi: a decade of change and future implications

Evelyn Zimba,[1] Mary V Kinney,[2]* Fannie Kachale,[3] Karen Z Waltensperger,[4] Hannah Blencowe,[5] Tim Colbourn,[6,7,8] Joby George,[1] Charles Mwansambo,[9,10] Martias Joshua,[11] Harriet Chanza,[12] Dorothy Nyasulu,[13] Grace Mlava,[14] Nathalie Gamache,[15] Abigail Kazembe[16] and Joy E Lawn[2] for the Malawi Newborn Change and Future Analysis Group†

[1]Save the Children, Lilongwe, Malawi, [2]Save the Children, Cape Town, South Africa, [3]Reproductive Health Unit, Ministry of Health, Lilongwe, Malawi, [4]Save the Children, Pretoria, South Africa, [5]London School of Hygiene and Tropical Medicine, London, UK, [6]UCL Centre for International Health and Development, Institute of Child Health, London, UK, [7]MaiKhanda Trust, Malawi, [8]Parent and Child Health Initiative, Malawi, [9]Ministry of Health, Lilongwe, Malawi, [10]Kamuzu Central Hospital, Lilongwe, Malawi, [11]Zomba Central Hospital, Zomba, Malawi, [12]World Health Organization, Lilongwe, Malawi, [13]UNFPA, Lilongwe, Malawi, [14]UNICEF, Lilongwe, Malawi, [15]Save the Children, Washington, DC, USA and [16]Kamuzu College of Nursing, University of Malawi, Lilongwe, Malawi

*Corresponding author. Saving Newborn Lives/Save the Children. E-mail: mvkinney@gmail.com

†Group members are listed at the end of the article.

Accepted 29 March 2012

Malawi is one of two low-income sub-Saharan African countries on track to meet the Millennium Development Goal (MDG 4) for child survival despite high fertility and HIV and low health worker density. With neonatal deaths becoming an increasing proportion of under-five deaths, addressing newborn survival is critical for achieving MDG 4. We examine change for newborn survival in the decade 2000–10, analysing mortality and coverage indicators whilst considering other contextual factors. We assess national and donor funding, as well as policy and programme change for newborn survival using standard analyses and tools being applied as part of a multi-country analysis. Compared with the 1990s, progress towards MDG 4 and 5 accelerated considerably from 2000 to 2010. Malawi's neonatal mortality rate (NMR) reduced slower than annual reductions in mortality for children 1–59 months and maternal mortality (NMR reduced 3.5% annually). Yet, the NMR reduced at greater pace than the regional and global averages. A significant increase in facility births and other health system changes, including increased human resources, likely contributed to this decline. High level attention for maternal health and associated comprehensive policy change has provided a platform for a small group of technical and programme experts to link in high impact interventions for newborn survival. The initial entry point for newborn care in Malawi was mainly through facility initiatives, such as Kangaroo Mother Care. This transitioned to an integrated and comprehensive approach at community and facility level through the Community-Based Maternal and Newborn Care package, now being implemented in 17 of 28 districts. Addressing quality gaps, especially for care at birth in facilities, and including newborn interventions in child health programmes, will be critical to the future agenda of newborn survival in Malawi.

Keywords Malawi, newborn, neonatal mortality, maternal, newborn and child health, Millennium Development Goals, epidemiology, health systems research, implementation

KEY MESSAGES

- Malawi has made accelerated progress between 2000 and 2010 in reducing under-five mortality after the first month (7.1% per year) and maternal mortality (6.0% per year), but less progress in neonatal mortality reduction (3.5% per year); yet the latter is still faster than the regional average (1.5% per year).
- A comprehensive national health sector approach provided an evidence-based and consistent framework within which to integrate newborn survival programmes.
- The initial focus for newborn care in Malawi was at facility level. The recently launched Community-Based Maternal and Newborn Care package bridges community and facility level care as well as maternal, newborn and child health, HIV/AIDS and malaria, but coverage is still low. Gaps in quality care at birth must be addressed to maximize mortality reduction for mothers and babies.
- Consistent high level political commitment to maternal health provided a programmatic and policy platform for a small network of newborn survival technical experts to integrate high impact newborn care interventions, despite very limited newborn-specific funding.

Box 1 Malawi at a glance

Total population (2011)	**15 263 000**
Mothers, babies and children	
Annual live births (2010)	663 000
Maternal mortality ratio per 100 000 live births (2010)	460
Annual number of maternal deaths	3000
Stillbirth rate per 1000 total births (2009)	24
Annual number of stillbirths	15 000
Neonatal mortality rate per 1000 live births (2010)	27
Annual number of newborn deaths	18 000
Mortality rate per 1000 live births for children 1–59 months (2010)	58
Annual number of child deaths 1–59 months	38 000
Under-five mortality rate per 1000 live births (2010)	92
Annual number of under-five deaths	56 000
Health system	
Health worker density per 10 000 population (2008)	3.0
Percentage of births that take place in a facility (2010)	73%
Context	
One of the poorest countries in the world with very low gross national income (GNI) per capita (US$330)	
High HIV prevalence (11%)	
One of the lowest physician densities in the world	
High population growth rate (3.1) and high total fertility rate (6 births per woman)	

Data sources: Population estimates (UNFPA 2011b); maternal mortality estimates (WHO *et al.* 2012)); annual live births, neonatal and under-five mortality (UNICEF *et al.* 2011) with new analysis of mortality trends by age of death; stillbirth estimates (Cousens *et al.* 2011); health worker density (WHO 2011a); facility births (NSO Malawi and ICF Macro 2011); GNI per capita (US$ atlas method current USD), population growth and total fertility rate (World Bank 2011): HIV prevalence (UNAIDS 2010). Note that mortality rates and numbers are for most recent year in which data are available.

Introduction

More than 40% of under-five deaths globally occur in the first month of life, resulting in 3.1 million newborn deaths each year (UNICEF *et al.* 2011). Meeting the Millennium Development Goal (MDG) 4 for child survival is increasingly determined by success in reducing these deaths. Progress in reducing neonatal mortality is being made in all regions; however sub-Saharan Africa has seen one of the slowest reductions globally (1.5% per year from 2000–10) (Hill *et al.* 2012). Yet some countries have made more progress and an understanding of why and how this has occurred is critical to accelerating progress in this region and globally (Kinney *et al.* 2010; Lawn *et al.* 2012).

Malawi was one of two low-income countries in sub-Saharan Africa on track in 2011 to meet MDG 4 (UNICEF *et al.* 2011). The maternal mortality ratio, having apparently increased in the 1990s during the height of the HIV epidemic, is now reducing according to all national data and estimates, with the most recent World Health Organization (WHO) estimate at 460 per 100 000 live births (WHO *et al.* 2012) and the 2010 Demographic Health Survey (DHS) suggesting 675 per 100 000 live births. Malawi's efforts towards achieving the health MDGs are evident despite major challenges, including a high population growth rate, fertility rate and HIV prevalence and low health worker density (Box 1) (UNAIDS 2010; World Bank 2011; WHO 2011a). In a country with a population of over

15 million people, there are only eight paediatricians, 16 obstetricians (personal communication with Dr Queen Dube, Queen Elizabeth Central Hospital, Blantyre, Malawi, 2011) and approximately 2500 nurse-midwives in public practice (UNFPA 2011a).

Malawi implemented a five-year health sector development plan in 2004, initiating improvements in terms of service coverage and delivery, yet significant gaps remain for newborn care (Bowie and Mwase 2011). To date, there is neither a published evaluation of the reduction of neonatal deaths in Malawi, nor an in-depth analysis of the effect of increased attention for neonatal survival. What has changed for relevant programmes and policy in the last decade (2000–10)? What has been learnt about the process of taking newborn care to scale? What are the implications for future policy and programmes?

This paper is the sixth in a seven-paper supplement to evaluate change for newborn survival, focusing on the decade 2000–10. In this paper, we examine change for newborn survival in Malawi, applying a common results framework and standardized analyses and tools to understand better what has or has not progressed, and why, in terms of survival, coverage of care and context, as well as funding, health systems, policies and programmes. By examining these data and the linked narrative, we aim to identify accelerators and constraints for progress, as well as gaps, to inform a future agenda for further reduction of neonatal mortality. These findings may also be relevant for other countries aiming to accelerate progress in newborn survival or to scale up more comprehensive programmes.

Methods

Evaluation framework and overview

This evaluation is structured according to a standard results framework beginning at the goal level (reduction in neonatal mortality), moving to strategic objective level (use of healthy behaviours and coverage of key high-impact practices and services), while also considering changes in context and certain social determinants of health. At the intermediate results level, we examined policy change and events over time, considering benchmarks that are considered necessary, but not sufficient, to scale up newborn health interventions, as well as the access, quality and demand for newborn care services (Lawn *et al*. 2012; Moran *et al*. 2012).

Data collection methods

We conducted an extensive review of national reports and assessments, national guidelines and programme reviews as well as peer review literature. Standard methods and tools (Lawn *et al*. 2012) were used to collect and enter data into a database and to cross-check for quality. Definitions and sources are detailed in the first paper in this supplement (Lawn *et al*. 2012).

A national expert team of 22 members, the Malawi Newborn Change and Future Analysis Group, was convened to undertake these analyses and review the findings (see members of group under acknowledgements). Members included representatives from the Ministry of Health (MoH), professional organizations, non-governmental organizations, the academic community and United Nations (UN) agencies. This team met several times in 2010 and 2011, at meetings convened by the MoH, and also communicated by conference calls and email.

Data analysis methods

To analyse changes in the national neonatal mortality rate (NMR), causes of neonatal deaths and coverage of newborn-related behaviours and services between 2000 and 2010, we abstracted data from national household surveys (NSO Malawi and ORC Macro 2001, NSO Malawi and ORC Macro 2005, NSO Malawi and Macro International Inc. 1994, NSO Malawi and UNICEF 2008, NSO Malawi and ICF Macro 2011), UN estimates (UNICEF *et al.* 2012), Institute for Health Metrics and Evaluation (IHME) estimates (Lozano *et al*. 2011) and Child Health Epidemiology Reference Group neonatal cause of death estimates (Liu *et al*. 2012). To assess change over time, the average annual rate of reduction for NMR is compared with regional and global rates as well as with the under-five mortality rate, the mortality rate for children aged 1–59 months and the maternal mortality ratio (WHO *et al.* 2012; UNICEF *et al.* 2011; Hill *et al*. 2012). Definitions and sources of coverage indicators used are detailed in the first paper in this supplement (Lawn *et al*. 2012). Description of survey data and details on other estimates are given in Supplementary Data Web Annex A.

To evaluate quantitative factors that may have contributed to mortality change, we undertook two analyses. First, we examined the associations of inter-sectoral indicators with change in neonatal mortality, including gross national income (GNI) per capita, female literacy, HIV prevalence and total fertility rates. Second, the Lives Saved Tool (LiST) was used to estimate the mortality impact of maternal, newborn and child health (MNCH) interventions between 2000 and 2010 using the most recent available coverage, mortality rates and causes of neonatal deaths in Malawi (Johns Hopkins Bloomberg School of Public Health 2010). Details of these analyses are available in Supplementary Data Web Annexes B and C, respectively.

We applied two standard tools to assess change in national newborn policy and programmes (Lawn *et al*. 2012; Moran *et al*. 2012). First, a Policy and Programme Timeline identified critical events and changes for policies, programmes, advocacy and research that could have had an impact on newborn health programmes (Supplementary Data Web Annex D) (Lawn *et al*. 2012). Second, 27 selected Scale-up Readiness Benchmarks determined whether each marker was in place (achieved), not in place (not achieved) or partially achieved or in progress (partially achieved) for three time points (2000, 2005, 2010) (Supplementary Data Web Annex E). Both tools were completed by the national expert team and background documentation was verified by out-of-country reviewers. Policy and programme data were checked against an independent socio-political analysis of the priority of newborn health in Malawi (Shiffman and Kazembe 2009).

Availability and access to newborn care services was assessed using the density of physicians, nurses and midwives, and measured against WHO standards (Lawn *et al*. 2012). Additionally, an evaluation of the Emergency Human Resource Programme (DFID and Management Sciences for Health 2010) and the geographic reach of training for newborn health packages were reviewed. National assessments of emergency obstetric care

(EmOC) services in 2005 and in 2010 were considered for *quality of newborn care services* (MoH-RHU [Malawi] 2005; MoH [Malawi] *et al*. 2010), as well as sub-national health facility and quality improvement assessments and a qualitative research study of women's recall of delivery and newborn care (Rozario *et al*. 2010; Yoder *et al*. 2010). We reviewed findings from formative research (Maleta *et al*. 2008; Van Zyl 2010) and a community mobilization cluster randomized control trial (cRCT) (Rosato *et al*. 2006; Rosato *et al*. 2009) to examine *demand for care.* National and donor funding sources were analysed for changes in *financial resources for health*. Financing data were obtained from the WHO National Health Accounts from 2000 to 2009 (WHO 2011b) and previously published data on official development assistance (ODA) specifically for MNCH (Pitt *et al*. 2010), with a special analysis for newborn funding as described elsewhere (Lawn *et al*. 2012). A detailed assessment of health financing from 1998 to 2006 was also considered (Zere *et al*. 2010). All government and donor funding values are in constant 2008 USD.

Results and discussion

Neonatal mortality reduction (goal level)

Neonatal mortality has declined according to all available data sources for Malawi (Figure 1a and Figure 1b). From 1990 to 2010, neonatal mortality decreased from 44 to 27 deaths per 1000 live births, resulting in an annualized decline of 2.5% (UNICEF *et al.* 2011). From 2000 to 2010, the NMR decreased 3.5% annually, suggesting accelerated progress; however this remained below national annual reductions for under-fives (5.9%), children aged 1–59 months (7.1%) and for maternal mortality (6.0%) (UNICEF *et al.* 2011; WHO *et al.* 2012). Variations by socioeconomic characteristics—urban and rural, richest and poorest—were minimal and within uncertainty bounds (NSO Malawi and ICF Macro 2011).

In Malawi, three conditions—complications of preterm birth, severe infection and intrapartum-related (birth asphyxia)—account for 89% of all newborn mortality (Figure 2). The relative proportions of these causes have not significantly changed over the past decade with the exception of neonatal tetanus and a less marked change in diarrhoea deaths (Liu *et al*. 2012). Malawi was certified for elimination of maternal and neonatal tetanus in 2004 (WHO 2004).

Healthy behaviours and equitable use of effective health services (strategic objective level)

Between 2000 and 2010, national coverage data of many interventions relevant to newborn survival increased (Figure 3): skilled birth attendance (17 percentage points increase); tetanus toxoid immunization (8 percentage point increase); malaria prevention through increases of intermittent preventive treatment in pregnancy (26 percentage point increase); and exclusive breastfeeding in the first month (14 percentage point increase) (NSO Malawi and ORC Macro 2001; NSO Malawi and ICF Macro 2011). Antenatal care attendance was consistently high at 95% for at least one visit, but the percentage of women attending four visits dropped from 56% to 46%. Less than half of women reported using any modern form of contraception, and 36.2% of married women expressed unmet need for family planning. Postnatal care cannot be compared between surveys due to a change in the survey question. Many high-impact neonatal-specific interventions—for example, neonatal resuscitation—do not have national coverage data.

Gaps between the richest and poorest families exist; however, Countdown to 2015 reported Malawi among the most equitable countries for socio-economic variation in coverage (Barros *et al*. 2012). Other studies found improvements in reducing inequalities in health care use and in health-related attitudes and behaviour (Chapotera *et al*. 2009; Bryce and Requejo 2010).

Evaluation of associations with neonatal mortality reduction

Given the significant NMR reduction from 1990 to 2010, context and coverage indicators were analysed for possible associations. The total fertility rate reduced from 7 to 6 (World Bank 2011); HIV prevalence increased from 7% to 11% (UNAIDS 2010); and female literacy increased from 34% (in 1987) to 66% (in 2009) (World Bank 2011). The moderate overall increase in the GNI per capita ($180 to $330 in current USD) is small compared with many other countries in Africa. Unfortunately, given the limited number of data points and the lack of coverage data for many neonatal-specific interventions, a multivariate analysis was unable to quantify further the possible contribution of contextual and coverage factors to the observed change in NMR (see Supplementary Data Web Annex B for more details).

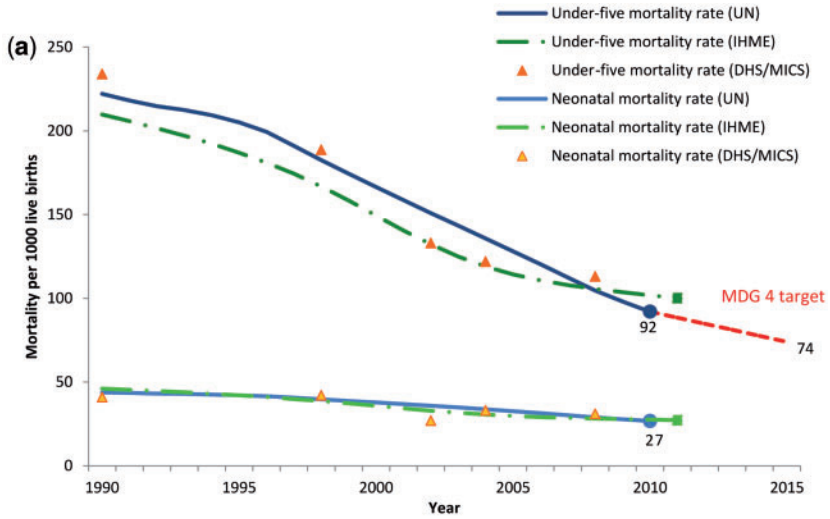
Using coverage data from national surveys, the LiST analysis results predicted an NMR reduction similar to the UN and IHME estimates and the 2010 DHS (Figure 4). This finding suggests that NMR reduction is consistent with estimated changes in neonatal interventions.

Programme change at scale in health systems (intermediate results level)

Policy and programme change at scale in health systems

Malawi's health services are delivered at district and central hospital level, health centre level and community outreach level through two primary health service provider systems: government and the Christian Health Association of Malawi (CHAM), which provides around 39% of facility-based health services. The MoH and CHAM entered into Service Level Agreements in 2002 subsidizing CHAM constituent institutions to deliver free services to the poorest families (DFID and Management Sciences for Health 2010), and this resulted in an increased use of health facility care in some settings (Kalungwe 2008). The extensive primary outreach system is a national, centrally recruited cadre of paid extension workers, Health Surveillance Assistants. The Health Surveillance Assistant system was first introduced in the 1960s as part of an initiative to eradicate smallpox (Kadzandira and Chilowa 2001). Currently, Health Surveillance Assistants deliver a wide portfolio of preventive and promotive services, and have begun to take on select curative tasks such as community case management of childhood pneumonia, malaria, diarrhoea, severe malnutrition and newborn sepsis (WHO 2010).

Since the 1990s, the health sector has focused on preventive care such as immunization, and since 2000, HIV prevention and



Average annual rate of reduction	1990-2010	2000-2010
Under-five mortality rate	4.4%	5.9%
Children 1-59 months mortality rate	5.4%	7.1%
Neonatal mortality rate	2.5%	3.5%

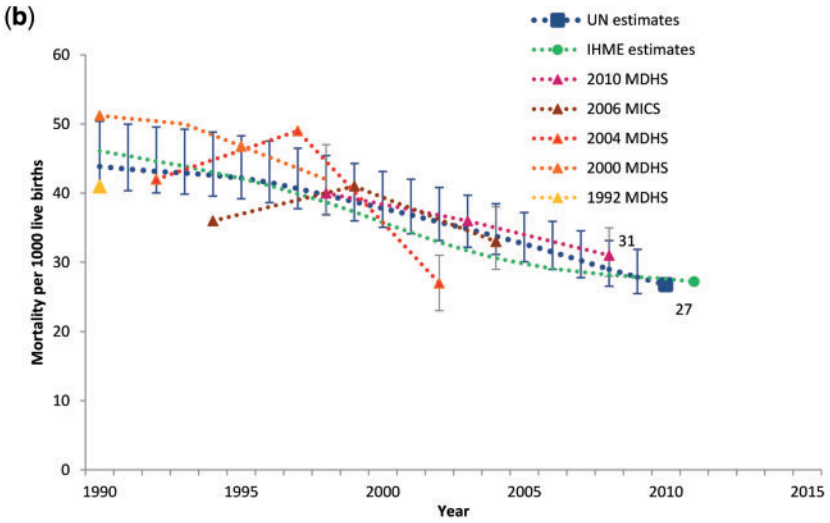


Figure 1 (**a**) National progress towards Millennium Development Goal 4 for newborn and child survival from 1990 *Data sources:* Malawi Demographic Health Surveys (DHS) (NSO Malawi and Macro International Inc. 1994; NSO Malawi and ORC Macro 2001; NSO Malawi and ORC Macro 2005; NSO Malawi and ICF Macro 2011). Malawi Multiple Indicator Cluster Survey (MICS) (NSO Malawi and UNICEF 2008). UN estimates of neonatal and under-five mortality (UNICEF *et al.* 2011) with new analysis of mortality trends by age of death. IHME estimates (Lozano *et al.* 2011). *Note:* Survey data are centred 2 years prior to survey date. MDG 4 target from Countdown to 2015, decade report: 2/3 reduction from 1990 U5MR. (**b**) Neonatal mortality trends from 1990 *Data sources:* Malawi Demographic Health Surveys (MDHS) (NSO Malawi and Macro International Inc. 1994; NSO Malawi and ORC Macro 2001; NSO Malawi and ORC Macro 2005; NSO Malawi and ICF Macro 2011). Malawi Multiple Indicator Cluster Survey (MICS) (NSO Malawi and UNICEF 2008). UN estimates (UNICEF *et al.* 2011). IHME estimates (Lozano *et al.* 2011). *Note:* Survey point estimates from household surveys are centred 2 years prior to survey date. Uncertainty bounds are provided for UN estimates and 95% confidence intervals for national household surveys, where available.

treatment has been given high priority (Harries *et al.* 2011). In 2004, the MoH initiated a health Sector Wide Approach (SWAp) 2004–10, a comprehensive framework to unify donor and government health policies and financing. The SWAp prioritized the Essential Health Package, a set of cost-effective interventions, including reproductive and neonatal interventions, to address the country's major causes of illness and mortality (Bowie and Mwase 2011). In order to operationalize the Essential Health Package in the face of limited human resources (Palmer 2006), a six-year Emergency Human Resource Programme was developed to substantially increase the number of health workers through trainings and incentives and strengthening the capacity of health training institutions (DFID and Management Sciences for Health 2010).

Few programmes specifically addressed newborn survival in the early part of the decade. In 2002, the national launch of Saving Newborn Lives, a programme of Save the Children, drew attention to this issue through the recruitment of staff dedicated to newborn survival, newborn-specific programme

activities and the publication of a national situation analysis of newborn health (Save the Children 2002). A Kangaroo Mother Care (KMC) training unit was opened in 2002 (Box 2), focusing on training to improve care for preterm babies in facilities around the country.

While most changes for newborn survival began within maternal health policy and programmes, some linked with child health programmes. The MoH adopted the Integrated Management of Childhood Illnesses (IMCI) strategy in 1998 and then a national IMCI policy for Accelerated Child Survival and Development in 2007. Neonatal content was included in IMCI clinical algorithms in 2007 and training finalized in 2010.

In 2005, the MoH, in association with partners, developed a multi-year (2005–15) national initiative, *The 'Road Map' for Accelerating Reduction of Maternal and Newborn Mortality and Morbidity in Malawi* ('Road Map'), which was linked to the SWAp with a costed implementation plan (MoH [Malawi] 2005). The original draft of the 'Road Map' template for Malawi, developed by the WHO Africa office (Lawn *et al*. 2006), focused mostly on maternal outcomes and increasing facility births, but more newborn content, especially regarding community approaches, was added after the publication of *The Lancet* Neonatal series (Lawn *et al*. 2005). Newborn survival technical experts also influenced the inclusion of essential newborn care and KMC with the maternal focus. As a result of the 'Road Map', development partners worked with government to harmonize multiple existing training materials into one training manual for facility-based health workers, *Integrated Maternal and Newborn Care,* which included maternal care and essential newborn care, basic EmOC and newborn care, KMC and postnatal care (Robb-McCord *et al*. 2009). The MoH adopted the Community-Based Maternal and Newborn Care (CBMNC) package in 2007, led by a specially-appointed taskforce, to address the remaining gaps in community demand and primary level service provision (Figure 5 and Box 3).

Based on to the Policy and Programme Timeline for Malawi (Supplementary Data Web Annex D), newborn survival was virtually unmentioned around the year 2000, with greater attention emerging in the early 2000s and intensifying after 2005. According to the Malawi Newborn Change and Future Group, the top ranked events or inputs of influence were the integration of newborn survival into the Essential Health Package linked to the SWAp, especially through the Malawi 'Road Map' and the associated CBMNC package (Box 3). The rollout of KMC was also ranked by stakeholders as one of the major inputs for newborn health programming (Box 2).

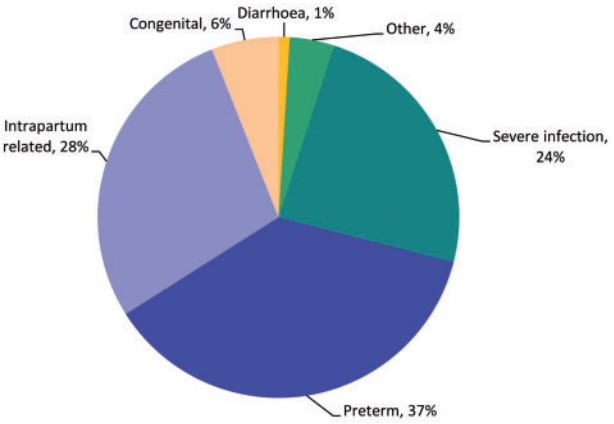


Figure 2 Estimated causes of mortality around the year 2010 for around 18 000 neonatal deaths *Data source:* Malawi-specific mortality estimates (Liu *et al*. 2012). *Note*: Severe infection includes sepsis, meningitis, pneumonia and tetanus.

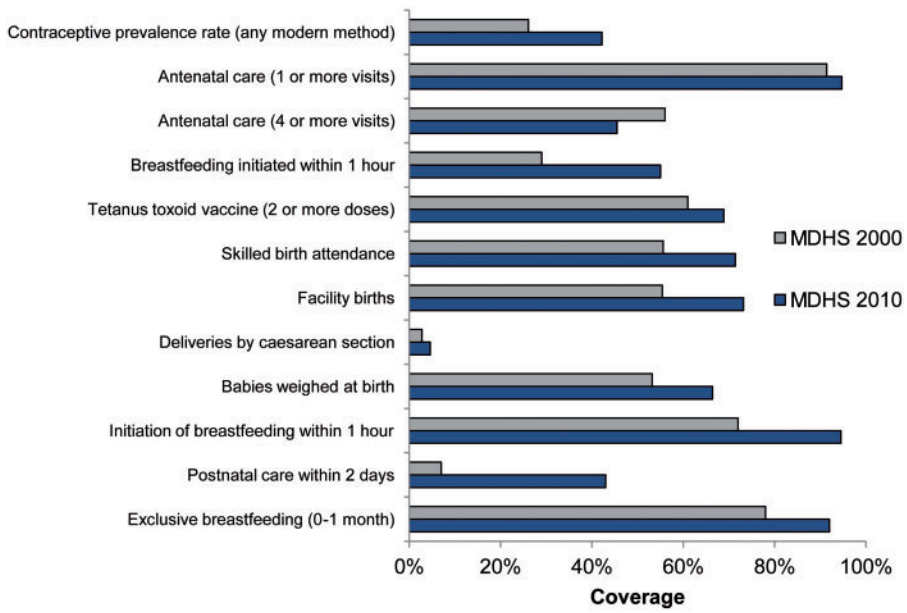


Figure 3 Trends in coverage data for newborn-related interventions and packages (2000–10) *Data sources:* Malawi Demographic Health Surveys (NSO Malawi and ORC Macro 2001; NSO Malawi and ICF Macro 2011). *Note:* Due to changes in the questionnaire and methodology, data for postnatal care across the surveys cannot be compared over time.

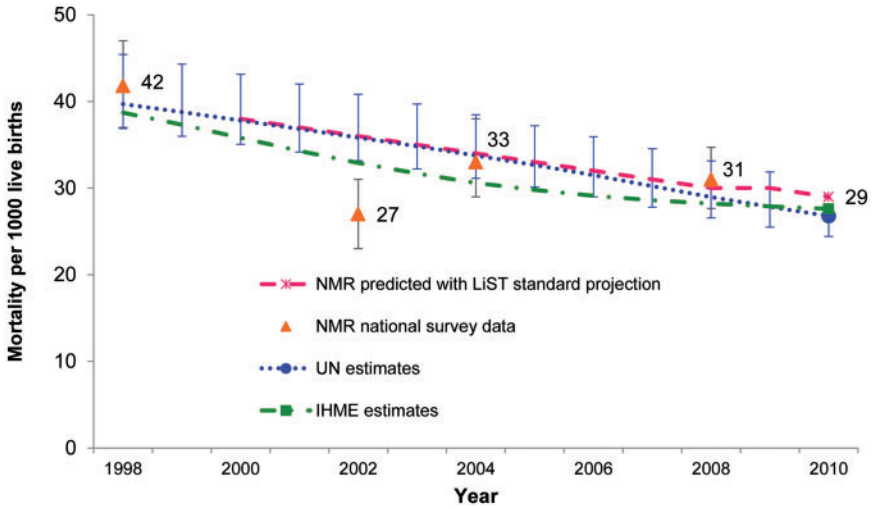


Figure 4 Results of predicted neonatal mortality reduction through changes in coverage (2000–10) *Data sources:* Malawi Demographic Health Surveys (MDHS) (NSO Malawi and Macro International Inc. 1994; NSO Malawi and ORC Macro 2001; NSO Malawi and ORC Macro 2005; NSO Malawi and ICF Macro 2011). Malawi Multiple Indicator Cluster Survey (MICS) (NSO Malawi and UNICEF 2008). UN estimates (UNICEF *et al.* 2011). IHME estimates (Lozano *et al*. 2011). *Note:* Survey point estimates are centred 2 years prior to survey date. Uncertainty bounds are provided for UN estimates and 95% confidence intervals for data from national household surveys. See Supplementary Data Web Annex C for details on the Lives Saved analysis and inputs.

Box 2 Systematic scaling up of Kangaroo Mother Care in Malawi's health facilities

Rationale: In Malawi, complications from preterm birth claim more than 5 800 lives each year, roughly a third of all newborn deaths. Conventional care for preterm babies is challenging in low-income settings; incubators are few and often broken or misused. Kangaroo Mother Care (KMC) involves tying the baby skin-to-skin with the mother to provide warmth, promote breastfeeding and reduce infections. KMC is associated with over 50% reduced risk of neonatal mortality for stable babies <2500g if started in the first week (Lawn *et al*. 2010) and also improves post-discharge mortality, breastfeeding, weight gain and maternal bonding (Conde-Agudelo *et al*. 2011).

Process: Until the late 1980s, a limited number of poorly maintained incubators were available to small and preterm babies in facilities. KMC was first introduced to Malawi in the 1990s at one hospital but discontinued when two neonatal deaths led to discomfort with the intervention (Bergh *et al*. 2007). In 1999, KMC was re-introduced at Zomba Central Hospital to address overcrowding and high neonatal mortality in the nursery. From 2002 to 2006, the Ministry of Health/Reproductive Health Unit (MoH/MoH-RHU), in collaboration with Save the Children and other partners, promoted the use of KMC, and it was included in the national 'Road Map' with specified funding. National guideline and training manuals were developed, and KMC was incorporated into pre-service education for nurse-midwives and doctors in 2005. A national community sensitization campaign, as well as counselling materials and job aids for mothers, promoted the intervention.

Results: By 2007, KMC units had been established in 10 facilities nationally with a total of 18 trainers (from district health offices) and 274 trained service providers. In addition, routine pre-service education of doctors and nurse-midwives include KMC (Bergh *et al*. 2007). Given the recommendation that KMC be implemented closer to homes and at wider scale in all district hospitals and health centres, in-service training for KMC was incorporated into the national in-service *Integrated Maternal and Newborn Care* training. As of 2011, more than 700 facility service providers and 15 tutors affiliated with nursing schools were trained and more than 1000 Health Surveillance Assistants (HSAs) had been sensitized to their role in supporting the intervention. At least 30 hospitals have active KMC units, including 26 of 28 government-run district hospitals.

Future agenda: Strengthened linkages between households and health workers are needed to support early discharge for stable newborns in KMC, with follow-up care provided by a HSA at home or through out-patient visits to the facility. Community initiation of KMC for babies born at home is an important research agenda. Staff shortages and high turnover among nurses have catalysed varying models of task shifting, for example to ward attendants, and more effective evaluation of these varying models would be valuable for Malawi and more widely. KMC service data are not part of existing national information systems and nationally agreed indicators. A critical move in tracking coverage of this high impact intervention would be to include a question on KMC in national household surveys.

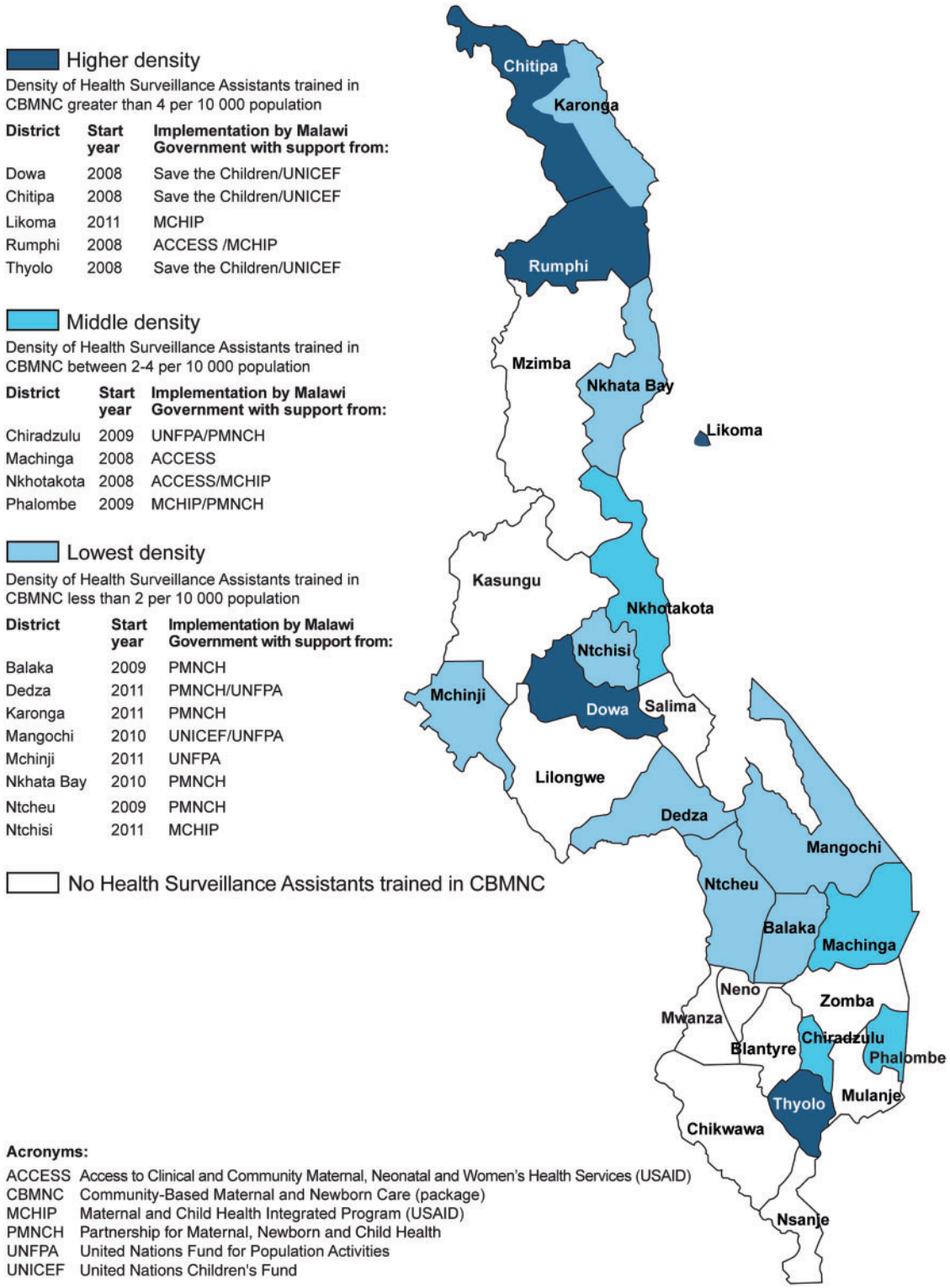


Figure 5 National scale up for Community-Based Maternal and Newborn Care (CBMNC) *Data sources:* Population data from Malawi National Statistics Office and Health Surveillance Assistants trained in CBMNC data from Save the Children training tracker 2011.

The 27 Scale-up Readiness Benchmarks (Moran *et al*. 2012) confirm a similar pattern of change, with little evidence of policy or programme attention to newborn survival in the early 2000s, then rapid comprehensive change towards readiness to scale up newborn health particularly between 2005 and 2010 (see Supplementary Data Web Annex E). By 2010, Malawi had achieved 16 of the 27 benchmarks, with nine additional benchmarks partially achieved, one not achieved and one

Box 3 Design and national scale up of a district-based package for maternal and newborn care for community and first-level facilities

Rationale: Malawi's Health Surveillance Assistants (HSA) have provided a range of services at the community level for over 40 years. There are approximately 11 000 of these predominately male workers, each serving a population around 1400 (DFID and Management Sciences for Health 2010). HSAs have a varied portfolio of tasks across health sectors, and the Ministry of Health (MoH) has added additional roles for HSAs with regard to maternal and newborn health during this past decade.

Process: Malawi was one of the first African countries to nationally adopt an integrated, community-based package for mothers and newborns. In 2006, UNICEF sponsored a study tour for Malawian MoH policy makers to a home-based newborn care project in Gadchiroli, India (Bang *et al*. 1999). Motivated to adapt this model, a national workshop was coordinated by the MoH's Reproductive Health Unit (MOH-RHU) with support from partners to design a Community-Based Maternal and Newborn Care package (CBMNC) for Malawi. A national taskforce was established in 2007 to design and oversee the rollout of the package. The initial idea was to address neonatal sepsis but the taskforce decided upon a phased approach whereby a platform of preventive community-based maternal and newborn services would be first designed and tested, emphasizing linkages to facilities for care at birth and for emergency care.

The CBMNC package trains HSAs to undertake three home visits during pregnancy and three postnatal visits within the first week after birth, as well as to engage in community mobilization activities to encourage careseeking throughout pregnancy, childbirth and the postnatal period. The focus of the home visits is on promotion of antenatal care, skilled birth attendance and early practices including hygiene, breastfeeding and identification of and careseeking for danger signs. Small babies receive extra visits and are referred for Kangaroo Mother Care (KMC). The HSAs link with facility-based health workers, who are oriented in CBMNC, enabling access to essential maternal and newborn care including care at birth, resuscitation and KMC. Maternity waiting home systems have been established in many of these facilities.

Results: By 2011, 17 of Malawi's 28 districts were implementing the standard CBMNC package (Figure 5); more than 1700 HSAs had been trained. A 2011 household survey of 900 women in three pilot districts (Dowa, Thyolo and Chitipa) found that coverage of HSA home visits during pregnancy was only 36% and less than 20% of mothers and newborns received a postnatal home visit within the first week after birth (Save the Children 2011). According to a review of HSA registers, only 66% of HSAs reported conducting at least one pregnancy home visit and only 51% reported at least one PNC home visit during the previous 3 months (Save the Children 2011).

Future agenda: While this model holds a lot of promise, strengthening implementation of CBMNC requires balancing the demands placed on HSAs. Achieving high coverage of an early postnatal visit is challenging for even a single-purpose community health worker (Baqui *et al*. 2009). The CBMNC package has been introduced to the HSA portfolio alongside other packages such as Community Case Management. Integrating CBMNC into the basic HSA (pre-service) training and exploring community-based treatment for neonatal sepsis are areas for future work.

missing (Figure 6). The uncompleted benchmark, authorization of community-based providers to resuscitate newborns, may not be appropriate for Malawi given the high level of facility-based deliveries and shifting roles of the traditional birth attendant.

Availability and access to newborn care services

Despite having one of the lowest densities of physicians in the world with less than 0.5 physicians per 10 000 people and an overall health worker density of 3.3 per 10 000 population, which is substantially lower than the WHO recommendation of 23 (Bryce and Requejo 2010), Malawi has the highest ratio of a non-physician clinician cadre—the Clinical Officer—in sub-Saharan Africa, at 2.2 per 10 000 population (Mullan and Frehywot 2007). Many donors invested in the Emergency Human Resource Programme, partly in response to the HIV/AIDS crisis (Harries *et al*. 2011). Between 2004 and 2009, professional health workers (including doctors, clinical officers and nurses) increased from 5500 to 8400 and Health Surveillance Assistants from 4900 to 10 500 (DFID and Management Sciences for Health 2010). Of the 17 districts that have implemented the CBMNC package, the density of Health Surveillance Assistants trained to deliver these services has varied between and within districts (Figure 5).

Since over half of the population lives farther than 5 km from a health facility and only 20% of the population live within 25 km of a hospital (MoH [Malawi] 2004), maternity waiting homes to prevent delays in accessing care are available in some facilities, although as yet there is not rigorous evidence of effect on pregnancy outcomes (Lee *et al*. 2009; van Lonkhuijzen *et al*. 2009). Initiatives such as provision of motorcycle ambulances and community transport schemes as well as radio communication systems may reduce delays in seeking care, but these are not yet widely available (Lungu and Ratsma 2007; Hofman *et al*. 2008).

Quality of newborn care services

Malawi achieved a major increase in facility births over the decade, yet a quality gap was evident. The majority of women and newborns with complications at birth continued to lack access to essential services, with estimated met need for EmOC

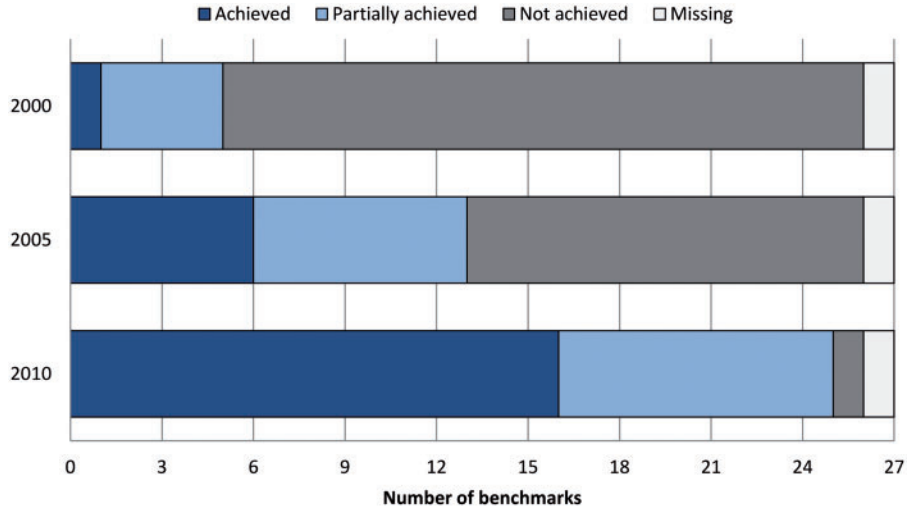


Figure 6 Progress towards Scale-up Readiness Benchmarks for newborn care *Note:* Details on this analysis can be found in the second paper of this supplement (Moran *et al*. 2012). Full results and documents reviewed can be found in Supplementary Data Web Annex E. The missing benchmarks relate to financial commitments and do not have data.

at 18.5% in 2005 and 22% in 2010. While there has been little improvement in the number of fully functioning EmOC facilities, with three-quarters of facilities lacking three or more signal functions and reporting shortages in staff and basic drugs and medical supplies, the majority of facilities (82%) reported that they had performed neonatal resuscitation (MoH-RHU [Malawi] 2005; MoH [Malawi] *et al*. 2010).

Multiple assessments of health care services found that the quality of newborn care services was lower than for other health services. In a sub-national Performance and Quality Improvement (PQI) evaluation, newborn survival interventions (care at birth and postnatal care) had fewer improvements in clinical standards than other interventions (antenatal care and family planning) (Rozario *et al*. 2010). Newborn complications and prevention of mother-to-child HIV transmission were among the lowest for met-need out of over 50 Essential Health Package interventions assessed in an evaluation of the Essential Health Package (Bowie and Mwase 2011).

Health facility deliveries were not always assisted by a skilled attendant due to position vacancies and frequent absenteeism (Mueller *et al*. 2011). A small qualitative research study conducted in Mchinji District reported that about a quarter of facility births were unassisted (Yoder *et al*. 2010).

Demand for newborn care

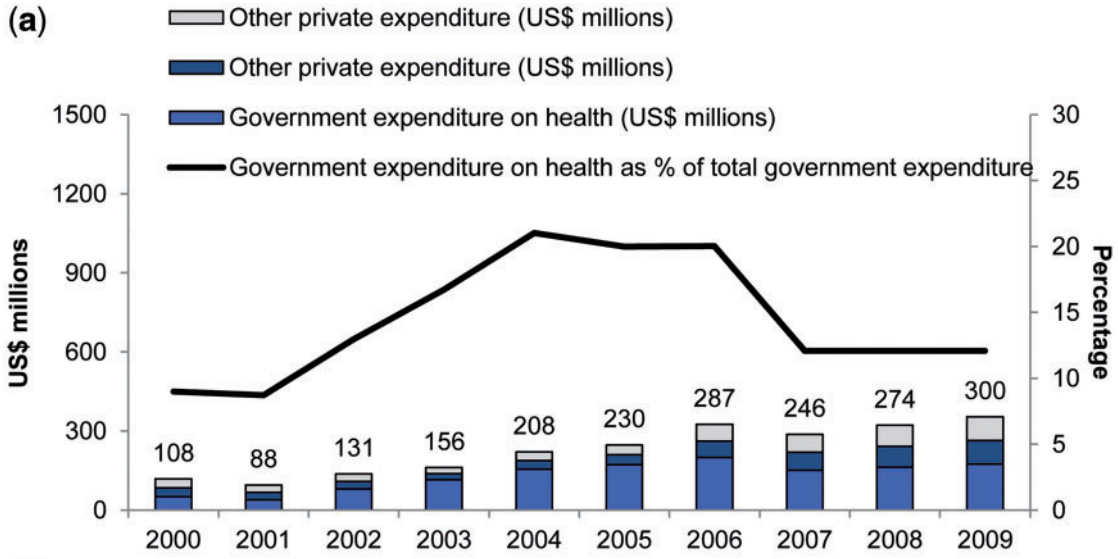
In 2006, the Government of Malawi officially shifted Traditional Birth Attendant (TBA) roles to promotion of skilled attendants at delivery (MoH [Malawi] and WHO Malawi 2006), and this likely contributed to the rapid increase in demand for facility births, especially as some communities instituted by-laws restricting TBA services during delivery.

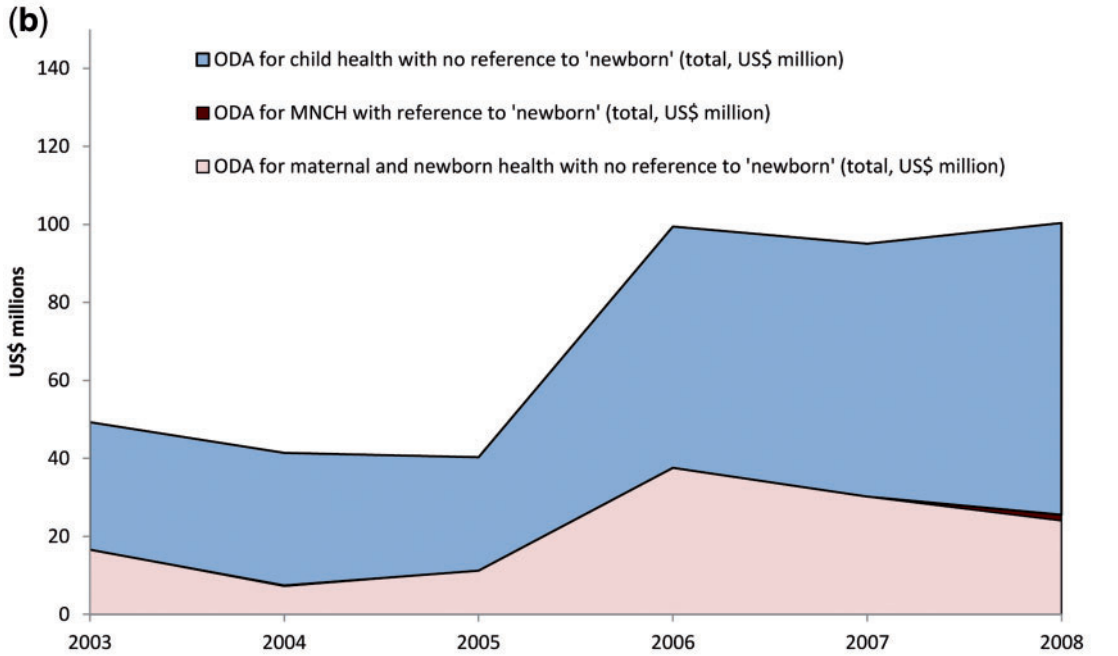
Positive demand promotion approaches were employed although most at small scale, such as Ekwendeni CCAP (Church of Central Africa Presbyterian) Mission Hospital's Agogo Approach in Mzimba District where grandparents were trained to encourage facility deliveries and healthy newborn care. The catchment area experienced a 21% increase in facility births from 2006 to 2008 (Van Zyl 2010). Preliminary results from a cRCT, started in 2003 and conducted by Mai Mwana project in Mchinji district, indicated community mobilization may assist in raising awareness of newborn health problems and promoting collective action to address these problems (Rosato *et al*. 2006; Rosato *et al*. 2009).

Financial resources for health

Total health expenditure in Malawi more than doubled between 2000 and 2009, from $108 million to $300 million (Figure 7a) (WHO 2011b). Per capita total health expenditure increased from $9 to $20 but fell below the Macroeconomics Commission's suggested minimum of $34 per capita ($53 in constant 2008 USD) annual cost needed for an essential package of health interventions (WHO 2001). Government health expenditure per capita nearly tripled from $4 to $11. By 2000, only 12% of total health expenditure was from direct costs to families, far less than the average among Countdown to 2015 countries at 41% (WHO 2011b; Lawn *et al*. 2012). Government spending on health, once as high as 20%, fell to 12% of total government spending in 2009 (Figure 7a) (WHO 2011b). The role of development partners as financing agents increased during the 2000s, particularly as a result of increased funding for HIV/AIDS (Zere *et al*. 2010).

Donor contributions for health overall and specifically for MNCH also increased rapidly, though funding for projects actually mentioning newborns remained low. Between 2003 and 2008, ODA for health nearly doubled from $115 million to $275 million. ODA for child health received the majority of the disbursement to MNCH (Figure 7b). Malawi received double the average ODA per target population compared to Countdown to 2015 countries. Donor disbursements for MNCH activities which mentioned newborns were only $1.6 million of the total $100 million in donor funding for MNCH in 2008, with very little funding activities mentioning newborns prior to 2008. This funding increased to $5.3 million in 2009, rising above the Countdown average in 2009 ($4.9 million).





Comparison with Countdown to 2015 (68 countries)	Malawi		Countdown country averages	
Comparison of MNCH donor funding	***2003***	***2008***	***2003***	***2008***
ODA for health per capita	$8.93	$18.50	$4.30	$9.50
ODA for child health per child	$13.79	$29.16	$5.80	$15.90
ODA for maternal and newborn health per live birth	$29.46	$41.19	$14.00	$31.00
Comparison of donor funding for newborn health	***2003***	***2008***	***2003***	***2008***
Value of ODA for MNCH which mentions 'newborn' health (US$ millions)	$0.00	$1.55	$0.38	$3.51
Value of ODA for MNCH that specifically benefits newborns (US$ millions)	$0.00	$0.01	$0.00	$0.07

Figure 7 (**a**) Health funding changes: total health expenditure by government, out-of-pocket and other private expenditure, and percentage of government expenditure on health as compared with total government expenditure (2000–09) *Data sources:* Analysis of World Health Organization National Health Accounts (WHO 2011b). *Note:* All values in constant 2008 USD. (**b**) Health funding changes: changes in official development assistance for maternal, newborn and child health (MNCH) in Malawi (20032008), showing the proportion 'mentioning' newborns and comparing with averages (unweighted) for Countdown to 2015 priority countries *Data source:* Pitt *et al*. (2010) with special analysis done by C. Pitt. *Note:* All values are in constant 2008 USD. MNCH donor projects with reference to newborn health include MNCH donor disbursements that mention the word newborn or relevant search terms in titles or project descriptions. The OECD database does not capture funding from emerging donor states, foundations, non-governmental organizations or faith-based groups.

Implications

This analysis of change for newborn survival, policy and programmes in Malawi is the first published examination of the rate of change as well as the accelerators and constraints for neonatal survival. Malawi has made more progress for MDG 4 than most sub-Saharan African countries. Yet, the annual rate of reduction for neonatal mortality was half that for child mortality after the first month of life and was also slower than under-five and maternal mortality (Figure 1). Nonetheless, from 2000 to 2010, the annual rate of reduction for NMR (3.5%) was more than double the sub-Saharan African regional average (1.5%) and higher than the global average (2.1%) (Hill *et al*. 2012). Given that our findings tease out a story of relatively recent attention to newborn survival, this reduction becomes more notable despite limited political priority or specific funding.

While the NMR decline is not fully explained by the available coverage and contextual data, there has been significant change in key newborn survival indicators such as skilled attendance at delivery, exclusive breastfeeding and tetanus toxoid immunization, and these have likely contributed to the decline. Coverage of facility births (73%) is much higher than the regional average (41%), and the rapid recent increase is considerably higher than virtually all other African countries (NSO Malawi and ICF Macro 2011; World Bank 2011). Possible reasons for this rapid increase include the comprehensive approach taken by the Malawi 'Road Map' and Health Sector plan, which increased the supply of services through rehabilitated facilities, more health workers and increased demand for care through the redefined role of TBAs, as well as initiatives encouraging communities to take an active role in maternal and newborn health. Service Level Agreements between the MoH and CHAM facilities could have also contributed to this increase as documented in the Nkhota-kota District (Kalungwe 2008).

Advocacy, partnerships and convening mechanisms

The Government of Malawi, especially the MoH Reproductive Health Unit (MoH-RHU), has worked effectively through partnerships, consistently supported by a few national champions with technical expertise in newborn survival. Several of these champions have also had influence beyond Malawi. These champions used the consistent high level of political commitment to maternal health to integrate newborn care interventions in the programmatic and policy platform. The majority of national activities for newborn care prior to 2005 were initiated or funded by Save the Children. After 2005, most activities involved a range of partners under the leadership of the MoH, resulting in greater synergy and co-ordinated efforts. The 'Road Map' cemented partnerships between government, development partners and civil society, and fostered consensus around maternal and newborn health, with a clear leadership role for the MoH-RHU.

Convening mechanisms have played an important role in building consensus, catalysing change and promoting co-ordination. The Sexual and Reproductive Health Technical Working Group, a governance structure under the health SWAp comprising of stakeholders and co-ordinated by the MoH-RHU, has met quarterly to share planned interventions. The CBMNC taskforce was critical for reaching consensus on the package, linking it to the existing Essential Health Package and training for Health Surveillance Assistants (Box 3). This carefully designed package was mandated by the MoH as the standard approach for community maternal and newborn care, promoting rapid national uptake. The taskforce was incorporated into the Safe Motherhood sub-committee in 2009; however, an informal working group still meets regularly and remains critical for progress and monitoring of CBMNC and newborn care more generally.

Increased attention to newborns by the MoH leadership, technical managers and policy makers at national level, and a widening circle of champions have been critical in advancing newborn survival. This political attention has not yet been matched with a shift in social norms that still accept newborn deaths as an inevitable fact of life. Community mobilization and information sharing are essential to address traditional beliefs preventing careseeking for sick newborns. For example, some communities believe a newborn is not a person until after the umbilical cord stump has dropped off even though this is the most critical time for the survival of a newborn (Rosato *et al*. 2009). The leadership role of guardians, grandparents and newborn health champions at community level may be a powerful entry point in Malawian culture (Van Zyl 2010).

Evidence and data to inform scale up

Research from other countries, especially from India's Society for Education, Action and Research in Community Health (SEARCH) project (Bang *et al*. 1999) and *The Lancet*'s neonatal series, influenced change in Malawi (Box 3) (Darmstadt *et al*. 2005; Lawn *et al*. 2005). Effectiveness results are not yet available from the Mai Mwana cRCT and from operational research from the Institute for Healthcare Improvement and Women and Children First's MaiKhanda programme (funded by The Health Foundation), which also works with women's groups to increase demand for care while improving quality of care at health facilities. However, these programmes may have influenced community messages for newborn care. Preliminary district level results from the CBMNC operational research, such as increasing skilled birth attendance, influenced policy makers to further prioritize scale up of this package (Save the Children 2011).

Ensuring reliable NMR estimates is critical for monitoring change and maintaining programmatic momentum and political will. For example, concerns about underreporting of neonatal deaths in the 2004 DHS resulted in UNICEF increasing the sample size of the 2006 Multiple Indicator Cluster Survey with financial support from a non-governmental organization, resulting in more reliable NMR estimates (Supplementary Data Web Annex A). Nonetheless, five-yearly data are not sufficient for planning and monitoring rapidly-changing programmes, and attention to data quality and use is needed. In 2011, the MoH-RHU recruited a newborn-specific monitoring and evaluation specialist to oversee programmes as they scale up nationally.

Seizing opportunities and addressing implementation realities

The initial focus on facility-based newborn survival policies and programmes transitioned into integration with other MNCH

programmes. The entry point for newborn survival through KMC (Box 2) followed by the introduction of community strategies is unlike the Asian country case studies in this multi-country analysis, many of which initiated activity for newborns at the community-level (Moran *et al*. 2012; Syed *et al*. 2012; Pradhan *et al*. 2012). The initial facility focus in Malawi was logical given that its facility birth coverage in the early 2000s was more than double that of the Asian countries examined in the supplement. Strong alliances with maternal health in the country may also have influenced this entry point; in contrast with the more commonly used pathway of child health through IMCI and neonatal sepsis. The comprehensive health sector approach in the middle of the decade further promoted integration of newborn survival, which especially gained traction in policy with the 'Road Map' (Supplementary Data Web Annex D).

The pathway to implementation has faced challenges yet there are signs of progress especially for KMC and CBMNC (Box 2 and 3). Despite notable increases in the number of physicians, nurses, clinical officers and Health Surveillance Assistants (DFID and Management Sciences for Health 2010), there is a severe shortage of health workers and supplies, especially in rural areas. The limits of task shifting responsibilities to Health Surveillance Assistants is being tested. Quality of care for maternal and newborn interventions requires priority attention, especially with more births occurring in facilities.

Institutionalization of newborn survival and the future agenda

Recognized as an example of progress for maternal and child health, Malawi has served as a learning environment for integrated newborn care and KMC in the region, hosting teams from neighbouring countries. Newborn survival benefited from high level attention to maternal health and was integrated into wider MNCH policies and programmes, yet progress for newborns remains vulnerable (Shiffman and Kazembe 2009). The three-fold increase between 2008 and 2009 in donor funding for MNCH projects with newborn terms points to an increase in overall attention, but none of this funding exclusively benefited newborns. Continued donor support and government investment is critical for sustaining and advancing the gains for MNCH, especially since ODA still contributes over 50% of all spending for health (Zere *et al*. 2010). There is also need for more robust and frequent data and inclusion of specific newborn health indicators in the Health and Management Information System.

Improving quality of care is essential to continued progress given the rapid increase in facility deliveries. If newborn survival interventions reached all families in Malawi, over 16 000 newborn lives could be saved in 2015 and 12 000 stillbirths prevented. An additional 9000 lives would be saved if quality gaps were addressed in health facilities and all facility births received access to quality emergency obstetric care, if needed, and outreach interventions increased 20 percentage points (Supplementary Data Web C).

Multiple programmes throughout the country seek to address these gaps though initiatives, such as the rapid scale up of community interventions through CBMNC; the integration of neonatal sepsis management into community case management; and the continued scale up of facility-based KMC. However, there is the risk of sacrificing quality of care in facilities through rapid scale up and also the concern of overstretching the already overloaded Health Surveillance Assistants (Box 3).

Several newer programmes have potential to accelerate change for newborn survival. The Helping Babies Breathe initiative to improve neonatal resuscitation practices was launched in 13 districts in 2011 with support from development partners and is being expanded to four more districts through 2012—starting in almost two-thirds of the country in just 2 years. Pneumonia and rotavirus vaccine rollouts may have an effect on neonatal as well as child mortality. The Calista Mutharika Safe Motherhood Foundation, founded by Malawi's former First Lady, is promoting training of community midwives to provide skilled attendance in communities and facilitate early referral to health facilities.

Conclusion

Malawi has made remarkable strides toward MDGs 4 and 5 over the past decade, especially considering the contextual challenges. Neonatal mortality reduction has been less dramatic but faster than most other African countries and the pace appears to be increasing. Consistent health sector and increasing human resource investments have been a good foundation for progress. Strong national commitment to maternal mortality reduction provided an entry point for an effective small group of technical partners working with the MoH to include specific newborn care interventions at facility (e.g. KMC) and community (e.g. CBMNC) levels. The initial focus for newborn care was mainly through facility entry points but has transitioned to comprehensive, integrated approaches also paying increased attention to the community level. While Malawi has implemented programmes at increasingly wide scale for newborn survival, it has been less strong on data collection and monitoring and evaluation.

Despite advances, such as increasing facility birth coverage, key future agendas exist including addressing the quality gap and increasing attention to newborn interventions in child health channels, especially neonatal sepsis. Even moderate increases in coverage and systematic attention to including high impact interventions and quality of care could optimize Malawi's chances of staying on track for and meeting MDG 4, a remarkable achievement for one of the world's poorest countries.

Acknowledgements

We acknowledge the contributions of the *Malawi Newborn Survival Analysis Change Group* and *Newborn Survival Decade of Change Analysis Core Group*. We thank Deborah Sitrin for reviewing and providing helpful insights on the manuscript. We appreciate support from Catherine Pitt and Meghna Ranganathan on the donor funding analysis.

The Malawi Newborn Change and Future Analysis Group (alphabetical): Semuh Banda (Zomba Central Hospital), Hannah Blencowe (London School of Hygiene and Tropical

Medicine), Agatha Bula (City University London and Mai Mwana Project), Harriet Chanza (World Health Organization), Gerald Chidzankufa (MaiKhanda Trust), Tim Colbourn (University College London Institute of Child Health and MaiKhanda Trust), Clifford Dedza (Ministry of Health, IMCI Community Case Management unit), Nathalie Gamache (Save the Children), Joby George (Save the Children), Edwin JDM Gondwe (Zomba Central Hospital), Tanya Guenther (Save the Children), Martias Joshua (Zomba Central Hospital), Fannie Kachale (Reproductive Health Unit, Ministry of Health Malawi), Abigail Kazembe (Kamuzu College of Nursing, University of Malawi), Kate Kerber (Save the Children), Mary Kinney (Save the Children), Sonia Lewycka (Mai Mwana Project and UCL Institute of Child Health), Reuben Ligowe (Save the Children), Charles Makwenda (MaiKhanda Trust), Florida Malamba (Mai Mwana Project), Bernard Mijoni (UNFPA), Grace Mlava (UNICEF), Allisyn Moran (Save the Children), Martin Msukwa (MaiKhanda Trust), Charles Mwansambo (Ministry of Health and Kamuzu Central Hospital), Bejoy Nambiar (UCL Institute of Child Health and MaiKhanda Trust), Dorothy Nyasulu (UNFPA), Tambosi Phiri (Mai Mwana Project), Tambudzai Rashidi (MCHIP/Jhpiego), Karen Z Waltensperger (Save the Children), Evelyn Zimba (Save the Children). They reviewed the findings and provided inputs to the manuscript.

Supplementary Data

Supplementary data are available at *Health Policy and Planning* Online.

Funding

This analysis and the supplement were funded by Save the Children's Saving Newborn Lives programme through a grant from The Bill & Melinda Gates Foundation. Tim Colbourn was funded by The Health Foundation. Joby George, Karen Waltensperger and Evelyn Zimba, affiliated with Save the Children, were supported in part by the United States Agency for International Development (USAID) under the terms of Cooperative Agreement No. GHS-A-00-06-00016. The opinions expressed are those of the authors and do not necessarily reflect the views of the funding partners.

Conflict of interest

None declared.

References

Bang AT, Bang RA, Baitule SB, Reddy MH, Deshmukh MD. 1999. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *The Lancet* **354**: 1955–61.

Baqui AH, Ahmed S, El Arifeen S *et al.* 2009. Effect of timing of first postnatal care home visit on neonatal mortality in Bangladesh: a observational cohort study. *British Medical Journal* **339**: b2826.

Barros A, Bertoldi G, Bryce J, Boerma T, Victora C. 2012. Descriptive article on magnitude and patterns of socioeconomic inequalities in Countdown to 2015 countries. *The Lancet* **379**: 1225–1233.

Bergh AM, van Rooyen E, Lawn J *et al.* 2007. Retrospective evaluation of Kangaroo Mother Care practices in Malawi hospitals. USAID, Save the Children, University of Pretoria, and Medical Research Council of South Africa.

Bowie C, Mwase T. 2011. Assessing the use of an essential health package in a sector wide approach in Malawi. *Health Research Policy and Systems* **9**: 4.

Bryce J, Requejo JH. 2010. *Countdown to 2015 Decade report (2000–2010): Taking stock of maternal, newborn and child survival*. New York: Countdown to 2015 for Maternal, Newborn and Child Health.

Chapotera G, Sabola B, Nkhoma D. 2009. Inequality and health in Malawi 2009 – an analytical study identifying trends over 17 years. Lilongwe, Malawi: Ministry of Health.

Conde-Agudelo A, Belizan JM, Diaz-Rossello J. 2011. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database of Systematic Reviews*(2):CD002771.

Cousens S, Blencowe H, Stanton C *et al.* 2011. National, regional, and worldwide estimates of stillbirth rates in 2009 with trends since 1995: a systematic analysis. *The Lancet* **377**: 1319–30.

Darmstadt GL, Bhutta ZA, Cousens S *et al.* 2005. Evidence-based, cost-effective interventions: how many newborn babies can we save? *The Lancet* **365**: 977–88.

DFID, Management Sciences for Health. 2010. *Evaluation of Malawi's Emergency Human Resource Progromme*. Cambridge, MA: Management Sciences for Helath.

Harries AD, Makombe SD, Libamba E, Schouten EJ. 2011. Why did the scale-up of HIV treatment work?: A case example from Malawi. *Journal of Acquired Immune Deficiency Syndromes* **57**(Suppl. 2):S64–7.

Hill K, You D, Inoue M, Oestergaard MZ. 2012. on behalf of the United Nations Inter-agency Group for Child Mortality Estimation and its Technical Advisory Group. Accelerating Progress in Reducing Global Child Mortality, 1990–2010. Forthcoming.

Hofman JJ, Dzimadzi C, Lungu K, Ratsma EY, Hussein J. 2008. Motorcycle ambulances for referral of obstetric emergencies in rural Malawi: do they reduce delay and what do they cost? *International Journal of Gynaecology and Obstetrics* **102**: 191–7.

Johns Hopkins Bloomberg School of Public Health. 2010. LiST: The Lives Saved Tool. An evidence-based tool for estimating intervention impact. Online at: http://www.jhsph.edu/dept/ih/IIP/list/index.html, accessed 10 September 2011.

Kadzandira JM, Chilowa WR. 2001. The Role of Health Surveillance Assistants (HSAs) in the Delivery of Health Services and Immunisation in Malawi. Lilongwe, Malawi: Malawi Ministry of Health, UNICEF.

Kalungwe P. 2008. Evaluating the impact of non user-fee maternal and neonatal health service programme in reducing Maternal and Neonatal Mortality in Nkhota-kota District, Malawi. Masters Degree in Public Health, University of Malawi.

Khan A, Kinney MV, Hazir T *et al.* 2012. Newborn survival in Pakistan: a decade of change and future implications. *Health Policy and Planning* **27**(Suppl. 3):iii72–iii87.

Kinney MV, Kerber KJ, Black RE *et al.* 2010. Sub-Saharan Africa's mothers, newborns, and children: where and why do they die? *PLoS Medicine* **7**: e1000294.

Lawn J, Kerber K (eds). 2006. *Opportunities for Africa's Newborns: Practical data, policy and programmatic support for newborn care in Africa*. Cape Town: PMNCH, Save the Children, UNFPA, UNICEF, USAID, WHO.

Lawn JE, Cousens S, Zupan J. 2005. 4 million neonatal deaths: When? Where? Why? *The Lancet* **365**: 891–900.

Lawn JE, Kinney MV, Black RE *et al.* 2012. Newborn survival: a multi-country analysis of a decade of change. *Health Policy and Planning* **27**(Suppl. 3):iii6–iii28.

Lawn JE, Mwansa-Kambafwile J, Horta BL, Barros FC, Cousens S. 2010. 'Kangaroo mother care' to prevent neonatal deaths due to preterm birth complications. *International Journal of Epidemiology* **39**(Suppl. 1):i144–54.

Lee AC, Lawn JE, Cousens S *et al.* 2009. Linking families and facilities for care at birth: what works to avert intrapartum-related deaths? *International Journal of Gynaecology & Obstetrics* **107**(Suppl. 1): S65–85S86–8.

Liu L, Johnson HL, Cousens S *et al.* 2012. Global, regional, and national causes of child mortality in 2000–10: an updated systematic analysis. *Lancet*. doi:10.1016/S0140-6736(12)60560-1.

Lozano R, Wang H, Foreman K *et al.* 2011. Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *The Lancet* **378**: 1139–65.

Lungu K, Ratsma Y. 2007. Does the upgrading of the radio communications network in health facilities reduce the delay in the referral of obstetric emergencies in Southern Malawi? *Malawi Medical Journal* **19**: 1–8.

Maleta K, Umar E, Mandalazi P. 2008. The Community-Based Maternal and Newborn Care Learning Programme: Baseline survey report. Lilongwe, Malawi: Ministry of Health [Malawi], Save the Children, UNICEF and partners.

MoH [Malawi]. 2004. Essential Health Package Document 2004: Access to Health Care in Malawi. Lilongwe, Malawi: Ministry of Health.

MoH [Malawi]. 2005. Road Map for Accelerating the Reduction of Maternal and Neonatal Mortality and Morbidity in Malawi. Lilongwe, Malawi: Ministry of Health Malawi.

MoH [Malawi], UNICEF, UNFPA, WHO, AMDD. 2010. Malawi 2010 EmONC needs assessment final report. Lilongwe: Ministry of Health Malawi.

MoH [Malawi], WHO Malawi. 2006. Assessment of Future Roles of Traditional Birth Attendants (TBAs) in Maternal and Neonatal Health in Malawi. Lilongwe, Malawi: Ministry of Health Malawi.

MoH-RHU [Malawi]. 2005. *Emergency obstetric care services in Malawi: report of a nationwide assessment*. Lilongwe: Ministry of Health Malawi, Reproductive Health Unit.

Moran AC, Kerber K, Pfitzer A *et al.* 2012. Benchmarks to measure readiness to integrate and scale up newborn survival interventions. *Health Policy and Planning* **27**(Suppl. 3):iii29–iii39.

Mueller DH, Lungu D, Acharya A, Palmer N. 2011. Constraints to implementing the Essential Health Package in Malawi. *PloS one* **6**: e20741.

Mullan F, Frehywot S. 2007. Non-physician clinicians in 47 sub-Saharan African countries. *The Lancet* **370**: 2158–63.

NSO Malawi, ICF Macro. 2011. *Malawi Demographic and Health Survey 2010*. Zomba, Malawi and Calverton, MD: National Statistical Office and ICF Macro.

NSO Malawi, Macro International Inc. 1994. *Malawi Demographic and Health Survey 1992*. Zomba, Malawi and Calverton, MD: National Statistical Office and Macro International Inc.

NSO Malawi, ORC Macro. 2001. *Malawi Demographic and Health Survey 2000*. Zomba, Malawi and Calverton, MD: National Statistical Office and ORC Macro.

NSO Malawi, ORC Macro. 2005. *Malawi Demographic and Health Survey 2004*. Zomba, Malawi and Calverton, MD: National Statistical Office and ORC Macro.

NSO Malawi, UNICEF. 2008. *Malawi Multiple Indicator Cluster Survey 2006, Final Report*. Lilongwe, Malawi: National Statistical Office and UNICEF.

Palmer D. 2006. Tackling Malawi's human resources crisis. *Reproductive Health Matters* **14**: 27–39.

Pitt C, Greco G, Powell-Jackson T, Mills A. 2010. Countdown to 2015: assessment of official development assistance to maternal, newborn, and child health, 2003–08. *The Lancet* **376**: 1485–96.

Pradhan YV, Upreti SR, KC NP *et al.* 2012. Newborn survival in Nepal: a decade of change and future implications. *Health Policy and Planning* **27**(Suppl. 3):iii57–iii71.

Robb-McCord J, Waltensperger KZ, Russell J *et al.* 2009. *Malawi Newborn Health Program Report of the Mid-term Evaluation*. Washington, DC: USAID and Save the Children.

Rosato M, Mwansambo CW, Kazembe PN *et al.* 2006. Women's groups' perceptions of maternal health issues in rural Malawi. *The Lancet* **368**: 1180–88.

Rosato M, Lewycka S, Mwansambo C, Kazembe P, Costello A. 2009. Women's groups' perceptions of neonatal and infant health problems in rural Malawi. *Malawi Medical Journal* **21**: 168–73.

Rozario A, Rawlins BJ, Kim Y *et al.* 2010. Evaluation of a national quality improvement initiative in infection prevention and reproductive health services in Malawi. American Public Health Association 138th Annual Meeting & Expo, 6–10 November 2010, Denver, CO, USA.

Save the Children. 2002. *State of the World's Newborns: Malawi*. Lilongwe, Malawi: Save the Children Federation.

Save the Children. 2011. *The Community-Based Maternal and Newborn Care Learning Programme: Endline Survey Report*. Lilongwe: Save the Children.

Shiffman J, Kazembe A. 2009. *Generating Political Priority for Newborn Survival in Malawi*. Syracuse, NY and Lilongwe, Malawi: Saving Newborn Lives, Save the Children.

Syed U, Rubayet S, Shahidullah M *et al.* 2012. Newborn survival in Bangladesh: a decade of change and future implications. *Health Policy and Planning* **27**(Suppl. 3):iii40–iii56.

UNAIDS. 2010. Global Report: UNAIDS Report on the Global AIDS Epidemic *2010*. Washington, DC: UNAIDS.

UNFPA. 2011a. *State of the World's Midwifery 2011: Delivering health, saving lives*. New York: UNFPA.

UNFPA. 2011b. *State of the World Population 2011: People and possibilities in a world of 7 billion*. New York: United Nations Population Fund. Online at: http://www.unfpa.org/swp/, accessed 24 April 2012.

UNICEF, WHO, The World Bank, the United Nations Population Division. 2011. *Levels and Trends in Child Mortality, Report 2011*. New York: UNICEF.

van Lonkhuijzen L, Stekelenburg J, van Roosmalen J. 2009. Maternity waiting facilities for improving maternal and neonatal outcome in low-resource countries. *Cochrane Database of Systematic Reviews*:CD006759.

Van Zyl M. 2010. The Ekwendeni Agogo Approach: Grandparents as agents of change for newborn survival. Lilongwe, Malawi: Save the Children and USAID.

WHO. 2001. *Macroeconomics and Health: Investing in Health for Economic Development*. Geneva: World Health Organization.

WHO. 2004. Assessment of neonatal tetanus elimination in Malawi. *Weekly Epidemiological Record* **79**: 2–6.

WHO. 2010. Caring for Newborns and Children in the Community: Manual for Health Surveillance Assistants. Lilongwe: Government of Malawi and World Health Organization.

WHO. 2011a. Global Atlas of the Health Workforce. Online at: http://apps.who.int/globalatlas/, accessed 24 April 2012.

WHO. 2011b. National Health Accounts. Online at: http://www.who.int/entity/nha/, accessed 30 September 2011.

WHO, UNICEF, UNFPA, and The World Bank. 2012. Trends in Maternal Mortality: 1990-2010. Geneva: World Health Organization.

World Bank. 2011. Health Nutrition and Population Statistics. Online at: databank.worldbank.org/ddp/home.do, accessed September 2011.

Yoder P, Rosato M, Mahmud R *et al.* 2010. *Women's Recall of Delivery and Neonatal Care in Bangladesh and Malawi: A Study of Terms, Concepts, and Survey Questions*. Calverton, MD: ICF Macro.

Zere E, Walker O, Kirigia J *et al.* 2010. Health financing in Malawi: Evidence from National Health Accounts. *BMC International Health and Human Rights* **10**: 27.