Achieving maternal and child health gains in Afghanistan: a Countdown to 2015 country case study

Nadia Akseer, Ahmad S Salehi, S M Moazzem Hossain, M Taufiq Mashal, M Hafiz Rasooly, Zaid Bhatti, Arjumand Rizvi, Zulfiqar A Bhutta

Summary

Background After the fall of the Taliban in 2001, Afghanistan experienced a tumultuous period of democracy overshadowed by conflict, widespread insurgency, and an inflow of development assistance. Although there have been several cross-sectional assessments of health gains over the last decade, there has been no systematic analysis of progress and factors influencing maternal and child health in Afghanistan.

Methods We undertook a comprehensive, systematic assessment of reproductive, maternal, newborn, and child health in Afghanistan over the last decade. Given the paucity of high-quality data before 2001, we relied mainly on 11 nationally representative surveys conducted between 2003 and 2013. We estimated national and subnational time trends for key reproductive, maternal, and child health indicators, and used linear regression methods to determine predictors of change in health-care service use. All analyses were weighted for sampling and design effects. Additional information was collated and analysed about health system performance from third party surveys and about human resources from the Afghan Ministry of Public Health.

Findings Between 2003 and 2015, Afghanistan experienced a 29% decline in mortality of children younger than 5 years. Although definite reductions in maternal mortality remain uncertain, concurrent improvements in essential maternal health interventions suggest parallel survival gains in mothers. In a little over a decade (2003–13 inclusive), coverage of several maternal care interventions increased—eg, for antenatal care (16% to 53%), skilled birth attendance (14% to 46%), and births in a health facility (13% to 39%). Childhood vaccination coverage rates for the basic vaccines from the Expanded Programme of Immunisation (eg, BCG, measles, diphtheria-tetanus-pertussis, and three doses of polio) doubled over this period (about 40% to about 80%). Between 2005 and 2013, the number of deployed facility and community-based health-care professionals also increased, including for nurses (738 to 5766), midwives (211 to 3333), general physicians (403 to 5990), and community health workers (2682 to 28 837). Multivariable analysis of factors contributing to overall changes in skilled birth attendance and facility births suggests independent contributions of maternal literacy, deployment of community midwives, and proximity to a facility.

Interpretation Despite conflict and poverty, Afghanistan has made reasonable progress in its reproductive, maternal, newborn, and child health indicators over the last decade based on contributions of factors within and outside the health sector. However, equitable access to health care remains a challenge and present delivery models have high transactional costs, affecting sustainability. To maintain and further accelerate health and development gains, future strategies in Afghanistan will need to focus on investments in improving social determinants of health and targeted cost-effective interventions to address major causes of maternal and newborn mortality.

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Introduction

Few countries in the world have been at the epicentre of conflict, of population displacement, and of misery for as long as Afghanistan. One of the poorest countries of the world (panel 1),[1–18] Afghanistan has been ravaged by incessant conflict and war among various factions for well over three decades. With its strategic geopolitical location, Afghanistan has long been a hunting ground for conquerors ranging from Alexander the Great seeking a passage to India and the superpowers of Great Britain

and the Soviet Union, seeking access to warm waters, or playing the so-called Great Game.[9,10] The Soviet invasion of Afghanistan in 1979 led to mass displacement of over 4 million people to neighbouring countries, mainly in Pakistan, and subsequently to a series of events that continue to affect the entire region (panel 1).[11]

Despite much donor interest and presence of development agencies, little systematic information is available about progress in maternal and child health and survival in Afghanistan since the 2001 ousting of the

Evidence before this study

Afghanistan's basic infrastructures, particularly those for health, had been virtually destroyed by 2001. Health and survival indicators of the civilian population in this time were some of the worst seen globally. About 1700 mothers per 100 000 livebirths were dying giving birth or shortly after, and more than 257 children per 1000 livebirths would not reach their 5th birthday—both of these figures were amongst the highest in the world in 2003. Almost 60% of children younger than 5 years were chronically malnourished, and 50% of children aged 6–24 months were anaemic, while three of four school-aged children were iodine deficient; nutrition indicators in mothers were similar. Facilities providing access to life-saving maternal and child interventions were virtually non-existent and those available were minimally accessed. Progress has been made since 2001 and we attempted to collate all available evidence to generate a methodical and comprehensive picture of achieved gains. We undertook a systematic in-depth review of all available electronic published and unpublished reports pertaining to the situation analysis of reproductive, maternal, newborn, and child health (RMNCH) in Afghanistan from 2001–14, and relevant policies, programme strategies, and interventions, official reports about progress towards Millennium Development Goals, and socioeconomic development. We searched papers published in 1980–2014 using these broad search terms: "reproductive" or "sexual" or "maternal" or "mother*" or "child*" or "under-5" or "newborn*" or "neonate*" or "post-neonate*" AND "health" or "risk" or "survival" or "mortality" or "nutrition" or "health system*" or "health finance*" or "health inequit*" or "health inequality*". Documents on policy, financial, and health system environment were specifically acquired to explore underlying determinants of progress achieved.

Added value of this study

To our knowledge, this case study is the first comprehensive, systematic assessment of RMNCH, nutrition and survival

gains, and contextual determinants of RMNCH outcomes in Afghanistan. We synthesised evidence from all available sources to undertake a thorough and robust situational analysis of trends in the country in the post-2001 rebuilding era. Data sources accessed included national and province level data from the Ministry of Public Health and other sectors (eg, telecommunications and agriculture), primary datasets from national health and demographic surveys, health facility assessment datasets, and a systematic review of the literature, among other sources. Our analysis integrates data from the various sources to elucidate trends at the national level, to conduct an in-depth assessment of subnational interventions coverage and inequities, and also to assess determinants of improvements in health-care service use. From 2001 to 2014 covers a period of relative peace coupled with substantive international funding and rebuilding of the conflict-torn nation; explicating RMNCH gains in this era, as our analysis has attempted to do, is vital to determining success factors, challenges, and opportunities moving forward.

Implications of all the available evidence

Our study provides detailed and robust information on the various drivers of maternal and child survival in Afghanistan, including coverage of interventions, subnational inequities, health systems and policies, health financing, and the lives saved analysis. Evidence from this case study can be used for understanding what has worked and not worked for scaling up RMNCH in Afghanistan. Data from the various aspects of the case study can be analysed further and used for agenda setting, policies, and programming at the national level and for provinces in the country. Further research is needed to understand progress made and permeating challenges, specifically in regards to interventions coverage, malnutrition, and inequities.

Taliban Government; the large repertoire of existing survey reports is mostly limited to cross-sectional assessments at various timepoints or specific geographic regions.[19–22]

We conducted a comprehensive assessment of reproductive, maternal, newborn, and child health (RMNCH) and survival trends in Afghanistan, along with an analysis of health systems, policies, financial flows, and key determinants of health gains. The case study was supported by the Countdown to 2015 consortium and used standard Countdown methods.[23]

Methods

Data sources and statistical analysis

We systematically reviewed all available published information on RMNCH and analysed nationally representative datasets with information about health,

mortality, and nutrition in women and children in Afghanistan (appendix). [24–34]

Our analysis of maternal outcomes was restricted to women of reproductive age (15–49 years). We analysed data for children younger than 5 years, and where available, explored trends separately for neonates (<1 month) and post-neonates (1–59 months). National estimates of mortality in neonates and children younger than 5 years were obtained from the UN Inter-agency Group for Child Mortality Estimation for 2000–15.[35] Maternal mortality estimates were obtained from the UN Maternal Mortality Inter-agency Group, and were available for the years 2000, 2005, 2010, 2012, and 2013.[36] Maternal and child mortality estimates for Afghanistan published by the Institute for Health Metrics and Evaluation were also evaluated.[37,38] Our rationale for relying heavily on modelled mortality estimates from

Panel 1: Afghanistan's demographics and history

Devoid of recent census data, Afghanistan's best population estimate is approximately 30 million, including 3 million refugees residing in neighbouring Iran and Pakistan.[1-3] Because of the repatriation of refugees from bordering countries (appendix), the Afghan settled population is projected to grow steadily in coming years (current annual population growth rate is 3% per year).[4] Afghanistan boasts vibrant ethnic and lingual diversity across the 34 provinces.[1] The largest ethnic groups are the Pashtuns and Tajiks, followed by Hazaras, Uzbeks Aimaqs, Turkmen, Baluchs, and a smaller proportion of others. More than 99% of the Afghan civilian population is Muslim.

Despite steady urbanisation in the past decade (4% per year from 2003),[4] over 76% of the country remains rural.[1] About half of the population is younger than 15 years, reflective of the country's high fertility rates (average 5·3 children per woman), and average life expectancy of 61 years at birth.[5]

Afghanistan remains among the least developed countries globally. The country's human development index was 0·47 in 2013, ranking it 169th of 187 nations.[4] Although social and economic inequalities exist in Afghanistan, poverty pervades more than 50% of the population in most provinces (31 of 34 provinces), and food insecurity is highly prevalent in more than half the country (appendix p 18). Additional educational, economic, and social indicators for Afghanistan are displayed.[4-8]

- Literacy rate in 2013 (proportion who can read and write of population >15 years): 30% (population); 50% (male); 20% (female)
- Gross domestic product per capita (2001–14): US$115–667
- Gross national income per capita (2001–14): $210–680
- Net official development assistance received per capita (2001–13): $19–172
- Total health expenditure (% of GDP; 2002–13): 8·2–8·1%
- Private health expenditure (% of GDP; 2002–13): 7·6–6·4%
- Public health expenditure (% of GDP; 2002–13): 0·6–1·7%
- Out-of-pocket health expenditure from 2002–13 (% of total health expenditure): 87·7–73·8%
- Human development index in 2013 (rank): 0·47 (169/187)
- Gender inequality index in 2013 (rank): 0·71 (150/152)

Afghanistan's strategic geopolitical location, straddling the entry points to central Asia and the Indian subcontinent, has also subjected the nation to an exceedingly vibrant and turbulent history over the centuries (appendix).[9-14] After the country's Soviet invasion and occupation (1979–89) and civil war (1990–96), Afghanistan saw the introduction of a new military and political force called the Taliban in 1994, which emerged from religious seminaries bordering Pakistan. Espousing a hard line form of Sunni Islam, the Taliban promised stability, and by 1996, had overthrown existing warlords to establish the Islamic Emirate of Afghanistan. In their zenith, the Taliban amassed control of more than 90% of the country.[13]

Although the religious movement was initially welcomed by war weary Afghans who were seeking peace and security, the civic society was soon confronted with an extremely tribal and repressive fundamentalist government that governed by corporal punishment, torture, and public executions.[17] The Taliban implemented a policy of segregating men and women in separate hospitals.[18] In the capital, Kabul, this policy translated to the Ministry of Public Health suspending medical services to women at all but one hospital in Kabul. The Taliban's gender restrictions also prohibited women from travelling or seeking health care without a male companion, and restricted mixed-gender employment and educational opportunities. This group's tolerance and sanctuary to the extremist al-Qaeda forces and Osama Bin Laden formed the basis for the US-led invasion of Afghanistan, and the Taliban's subsequent ousting from power. A civilian government supported by national elections and the Loya Jirga (a national meeting of tribal and political elders) has been in place since 2002 but with substantial presence of US and the North Atlantic Treaty Organization troops. Although delineated a post-conflict zone, Afghanistan continues to suffer from widespread insurgency and insecurity. Since 2006, more than 60 000 civilians have been killed or maimed as a result of battle-related conflict—about 40% of them have been women and children (appendix).

global groups, which include coverage limitations of available survey data, is detailed in the appendix (pp 2–3).

Major causes of mortality in children younger than 5 years and of maternal mortality for Afghanistan were obtained from recent analyses by the Institute for Health Metrics and Evaluation,[39] Liu and colleagues,[40] and WHO.[41] We undertook additional analysis of causes of child death from the Afghanistan Mortality Survey 2010 using standard methods for evaluating verbal autopsies.[42,43]

Coverage trends for RMNCH interventions, morbidity patterns, and contextual and sociodemographic indicators were estimated from 11 national complex surveys conducted in Afghanistan from 2003 to 2013. Datasets included the Multiple Indicator Cluster Surveys 2003–04 and 2010–11;[44,45] National Risk and Vulnerability Assessments 2005,[46] 2007–08,[1] and 2011–12;[47] Afghanistan Health Surveys 2006 and 2012;[48,49] Afghanistan Mortality Survey 2010;[42] Expanded Programme on Immunisation Census 2013 (Hossain SMM, unpublished), and the National Nutritional Surveys 2004 and 2013.[50,51]

Panel 2: Multivariable analysis methods for change in skilled birth attendance and facility births

The difference in coverage rates of skilled birth attendance and facility births from 2003 to 2010 were used as a linear outcome regressed on a series of putative correlates. Estimates of differences were calculated for each province as the total change between the 2003–04 and the 2010–11 Multiple Indicator Cluster Surveys. Baseline (2003) estimates of various indicators for Panjsher and Daykundi provinces were held at the values of their formerly amalgamated provinces of Parwan and Urozgan, respectively. More than 30 potential correlates were examined including indicators of demographics, insecurity and casualties, mobile phone accessibility, provincial health-care resources, and health facility visit characteristics (appendix). Telecommunications access was assessed using a rate of mobile phone tower coverage (hereafter referred to as mobile tower, calculated as the tower frequency per 100 000 population),[58] and a measure of equitable mobile tower spread. This measurement of mobile tower spread was determined from geospatial tower coverage maps by Nadia Akseer and Ahmad S Salehi who independently evaluated and ranked tower spread relative to population distribution in each province; the intraclass correlation coefficient between scorers was 0·92, indicating high internal consistency. A composite ratio of the rate of mobile towers and inequitable spread was created (rate of mobile towers per 100 000 population and degree of inequitable spread) where higher values indicated more equitable mobile phone coverage across the province. The rate of war-related deaths and injuries, such as those due to weapons or unexploded ordinance (eg, rifles, pistols, knives, mines, bombs, grenades, rockets) regardless of whether the injury was intentional, and regardless of the body part injured, was estimated per 100 000 provincial population in 2010 (Salehi AS, Rasooly H, unpublished). The death dirty war index (civilian to total mortality) was calculated using standard methods. Covariate variables were extracted from various sources and incorporated as fixed 2010 estimates because there was insufficient baseline information to model predictor variables in 2003 or to calculate the covariate change between 2003 and 2010.

Univariate distributions were explored using frequencies and proportions, means and medians, and histograms, as appropriate. Bivariate associations between outcomes and potential predictors were examined using Pearson and Spearman correlation analysis, and variables with skewed distributions were transformed for regression analysis as required. We examined regional clustering of provinces using linear mixed models with random intercepts. The spatial effects were not statistically significant (p>0·05) and hence multiple linear regression using fixed effect covariates was conducted. Variables significant at a liberal p<0·2 in bivariate analysis were incorporated into a robust backward elimination model-building strategy to determine the best fitting multivariable model and retained if significant at p<0·15. As sensitivity analysis and to confirm model robustness, highest adjusted R model selection methods were also examined to determine the best fitting candidate models. Variance inflation factors were consulted to examine multicollinearity among independent variables. By the most stringent criteria, a variance inflation factor of more than two was considered suspect for multicollinearity. Model diagnostics included carefully examining leverage statistics greater than $(2k+2)/n$ and residuals greater than 2·5 or –2·5. The final model was selected on the basis of theoretical and statistical significance of predictors, model power, and fit. Type 1 error rate was held at 0·05, and statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA). For sensitivity, we also undertook hierarchical modelling and present key methods in the appendix (p 8).[62]

National prevalence was estimated for 2 year periods; where more than one survey was conducted within the same period, estimates from the most recent survey were used for analysis. Changes were considered statistically significant where the two-sample test of proportion p values were less than 0·05, and sequential estimates and corresponding 95% CI did not overlap; in all cases the two methods corroborated on statistical significance thus we present only the former in text to avoid redundancy. Because of the low coverage of the Afghanistan Mortality Survey (appendix pp 2–3), estimates of intervention coverage for the periods spanning 2010–11 were taken from Multiple Indicator Cluster Survey 2010 only. Similarly, the Afghanistan Health Surveys 2006 were not used in national trend analysis as they represented only rural Afghanistan. We analysed childhood vaccinations coverage from survey data and also compared with modelled estimates from WHO and UNICEF,[52] which additionally incorporate administrative data from other national sources.

Prevalence of stunting, wasting, and underweight were calculated from the National Nutrition Survey 2003–04[50] and 2013,[51] and Multiple Indicator Cluster Surveys 2010–11[45] datasets using WHO guidelines and software (WHO Anthro; version 3.2.2, January, 2011).[53] For consistency across years, we only compared data for children aged 6–59 months. Subnational estimates for the 34 provinces were obtained for food insecurity, multidimensional poverty index,[54] and coverage estimates for interventions across the continuum of care, from the Multiple Indicator Cluster Surveys 2003–04 and 2010–11, National Nutrition Survey 2013, and Expanded Programme on Immunisation Census 2013 datasets. All analyses were weighted to limit variability among enumeration blocks and provinces. High resolution subnational maps were generated using ArcGIS 10.2 (Environmental Systems Research Institute, Redlands, CA, USA, 2013) to visualise skilled birth attendance (SBA), multidimensional poverty index, and food insecurity estimates across provinces.

To assess the quality of health-care services, we also reviewed and analysed original data from the Afghanistan balance score card series of nationally and provincially representative facility-based surveys for the time period 2004–12.[55–57] Health system and service delivery covariates that were used in the multivariable analysis were re-estimated from the 2010 balance score card for women of reproductive ages only (15–49 years). Data for trained and deployed health worker cadres of the Ministry of Public Health of Afghanistan including medical doctors, medical doctor specialists, nurses, midwives, and community health workers, collected by the human resources department for those trained and community-based health-care programmes for those deployed, were obtained for the period 2005–13. Mobile phone tower frequency and distribution maps were obtained from the Afghan Telecommunications Regulatory Authority regulated within the Ministry of Communication and Information Technology of Afghanistan.[58] Data for civilian casualties were obtained from the Health Management Information System of the Ministry of Public Health, and other sources for coalition (security or armed forces personnel) fatalities and security incidents.[59,60]

To identify drivers of improvement in maternal and newborn health and survival in Afghanistan, we used correlation and regression methods to statistically evaluate a series of demographic, social, economic, environmental, and other contextual factors, including indicators of conflict. In view of the known clustering of maternal and newborn deaths around the period of childbirth and limitations in human resources for safe birth,[61] outcomes assessed were SBA as a marker for service delivery and facility births to assess community behaviours and care seeking for childbirth. More than 30 potential correlates of SBA and facility birth changes from 2003 to 2010 were explored in bivariate and multivariable analyses. Variable descriptions and estimation methods are presented in the appendix. Details on statistical modelling and analytical methods are presented in panel 2.[63,65]

To assess the potential impact of various existing or new interventions on maternal, newborn, and child health outcomes we evaluated the potential effect of scaling up key packaged evidence-based interventions (appendix pp 2, 3, 9) on deaths using the Lives Saved Tool.[64] We simulated the scaling up of key interventions from their most recent coverage estimates to three target coverage levels—ie, 50%, 75%, and 90% by the year 2025; if the most recent coverage of a particular intervention was at or more than the specified target level, it was kept constant.

Role of the funding source
The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results
Maternal mortality estimated by the UN group indicated a 64% decrease in maternal mortality ratio from 2000 to 2015 (ie, 1100 to 396 per 100 000 livebirths; figure 1A).[35–38] National maternal mortality reduction targets in Afghanistan were set to reduce maternal mortality to 50% of its 2003 levels by 2015 and to a further 25% by 2020;[65] according to UN estimates, Afghanistan has successfully reached its maternal mortality target for 2015. However, the Institute for Health Metrics and Evaluation reports maternal mortality of 716·3 deaths in 2003 and 885·0 deaths in 2013, implying a 24% increase over the last decade (figure 1A). These opposing and conflicting results could be attributed to the mortality estimation methods, which varied in statistical models, assumptions, and inclusion of covariates;[36,37] coupled with low-quality input data from the Afghanistan Mortality Survey, modelled estimates are unstable and have wide confidence intervals. Although representative national surveys quantifying maternal mortality status and change were scarce, potential gains are likely because of the dramatic improvements in the coverage of many maternal life-saving interventions since 2003 (as
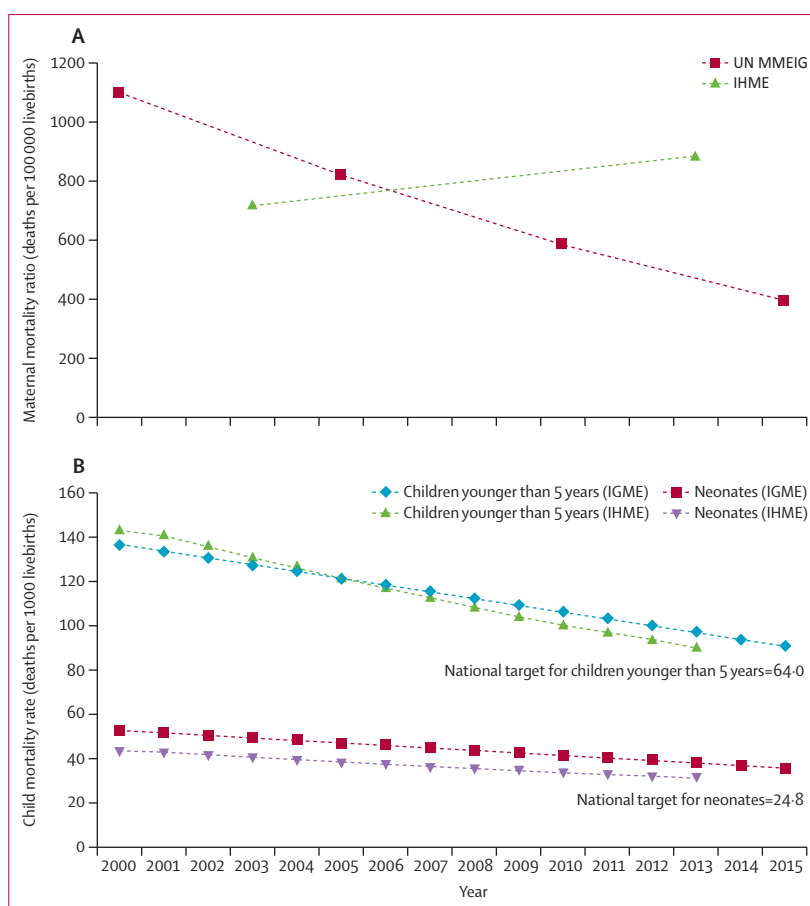

Figure 1: Mortality trends in Afghanistan from 2000 to 2015
(A) Maternal mortality trends in Afghanistan from 2000 to 2015.[36,37] Maternal mortality ratios in 1990 were 1340 per 100 000 livebirths (according to the UN Maternal Mortality Estimation Inter-agency Group) and 501 per 100 000 livebirths (according to the Institute for Health Metrics and Evaluation). (B) Mortality trends of neonates and children younger than 5 years in Afghanistan from 2000 to 2015.[35,38] UN MMEIG=UN Maternal Mortality Estimation Inter-agency Group. IHME=Institute for Health Metrics and Evaluation. IGME=UN Inter-agency Group for Child Mortality Estimation.

discussed later). These gains are also plausible given more recent subnational surveys providing further evidence of reduction in maternal mortality over time. For example, the RAMOS I set of subnational surveys[66] covering four districts in four provinces (Kabul City, Kabul; Ragh, Badakshan; Alisheng, Laghman; and Maywand, Kandahar) between 1999 and 2001 found a rate of 1600–2200 maternal deaths per 100 000 livebirths, a figure widely regarded as among the highest in the world. The RAMOS II, a repeat of this survey conducted in three of the four areas in 2011, indicated substantial reduction in maternal mortality from the previous survey (Linda Bartlett, Johns Hopkins University, personal communication).

A WHO analysis of causes of maternal deaths in Afghanistan in 2003–09 found haemorrhage (46%), hypertensive disorders (15%), and obstructed labour (12%) as the leading causes of preventable deaths in mothers (appendix p 19).[41] In more recent analyses by the

	2003–04 (95% CI)	2009–10 (95% CI)	2011–12 (95% CI)
Diarrhoea	29·7% (29·1–30·3%)	22·9% (22·2–23·6%)	25·8% (25·1–26·5%)
Oral rehydration solutions and fluid	54·0% (52·9–55·1%)	47·5% (45·8–49·2%)	..
Oral rehydration solutions	29·6% (28·6–30·6%)	53·3% (51·6–55·0%)	61·3% (59·8–62·9%)
Acute respiratory infection	18·8% (18·3–19·3%)	18·6% (18·0–19·2%)	14·6% (14·0–15·2%)
Care seeking for pneumonia*	46·0% (45·3–46·7%)	60·5% (58·7–62·3%)	77·0% (75·2–78·8%)
Antibiotic use for treatment of acute respiratory infection	..	63·9% (62·2–65·6%)	..

No data are available for the years 2005–06 and 2007–08.*By any appropriate provider. Where more than two datapoints were available for the same period, the most recent was shown.

Table 1: Trends in key illness and health-care seeking indicators in Afghanistan in children aged 0–59 months, 2003–12[1,42,44–47,49]

	2003–04 (95% CI)	2005–06 (95% CI)	2007–08 (95% CI)	2009–10 (95% CI)	2011–12 (95% CI)
Contraceptive prevalence (any method)*	10·3% (9·9–10·7)	11·8% (11·4–12·2)	30·3% (29·6–31·0)	21·2% (20·5–21·9)	21·8% (20·9–22·7)
Contraceptive prevalence (modern only)	8·5% (8·1–8·9)	8·0% (7·7–8·3)	20·3% (19·7–20·9)	19·5% (18·9–20·1)	13·8% (13·1–14·6)
Two or more antenatal care visits*	16·1% (15·4–16·8)	..	32·4% (31·6–33·2)	47·9% (46·5–49·3)	52·9% (51·6–54·2)
Four or more antenatal care visits	..	..	..	14·6% (13·6–15·6)	13·3% (12·4–14·2)
Skilled birth attendance*	14·3% (13·7–15·0)	16·0% (15·3–16·7)	24·0% (23·2–24·8)	38·6% (37·2–40·0)	46·1% (44·8–47·4)
Caesarean section	..	..	..	3·6% (3·1–4·1)	..
Facility births*	12·8% (12·2–13·4)	19·7% (19·0–20·5)	20·9% (20·2–21·6)	38·6% (37·2–40·0)	38·8% (37·5–40·1)

*p<0·001 from 2003–04 to 2011–12.

Table 2: Trends in intervention coverage in Afghanistan in women aged 15–49 years, 2003–12[1,42,44–47]

Institute for Health Metrics and Evaluation, the proportion of deaths from haemorrhage was found to be considerably lower in 2013 (reduced to 19%); however, this illness remained the biggest killer of mothers along with hypertensive conditions (14%), abortive outcomes (14%), and infections (9%; appendix p 19).[39]

Current best estimates by the UN Inter-agency Group for Child Mortality Estimation and Institute for Health Metrics and Evaluation yielded similar estimates and trends for mortality in children younger than 5 years and neonates in Afghanistan (figure 1B). Respectively, mortality in children younger than 5 years was 127·8 and 130·9 per 1000 livebirths in 2003, and corresponding neonatal mortality was 49·6 and 40·9 per 1000 livebirths (figure 1B).[35,38] According to UN Inter-agency Group for Child Mortality Estimation, between 2003 and 2015, mortality in children younger than 5 years decreased by 29% in Afghanistan (from 127·8 to 91·0 per 1000 livebirths) and neonatal mortality decreased 27% (from 49·6 to 36·0 per 1000 livebirths). According to these UN estimates, Afghanistan has not reached its 2015 national targets for mortality in children younger

than 5 years of 64·0 deaths per 1000 livebirths and in neonates of 24·8 deaths per 1000 livebirths. Given current trends, attainment of respective 2020 targets (mortality in children younger than 5 years goal of 32·0 deaths per 1000 livebirths and of neonatal mortality of 12·4 deaths per 1000 livebirths) also seems unlikely.

The major categories of deaths of children younger than 5 years are broadly similar between the two major global data sources,[39,40] and our analysis of verbal autopsy data from the Afghanistan Mortality Survey.[42] For simplicity, Child Health Epidemiology Reference Group estimates[40] are presented throughout while others are available in the appendix (p 18). According to best available estimates for 2013, pneumonia (20%), diarrhoea (13%), and other infections (eg, sepsis, meningitis, tetanus; 12%) were the leading causes of death of children younger than 5 years in Afghanistan, while preterm birth complications (10%) and intrapartum-related deaths (11%) contributed to neonatal deaths (appendix p 19).

Between 2001 and 2013, the major causes of neonatal (1–17 days) and post-neonatal (1–59 months) deaths scarcely shifted. Pneumonia (26% in 2001 vs 28% in 2013) and diarrhoea (24% vs 20%) persisted as the major killers of post-neonates in 2001 and 2013.[40] Among newborn babies, the proportions of deaths from preterm birth complications (29% in 2001 vs 28% in 2013), intrapartum related events (23% vs 29%), and infections, including sepsis, meningitis, and tetanus (20% vs 23%) have also remained fairly constant.[40]

We found few reliable morbidity estimates from representative surveys; available surveys provided some information from short-term recall suggesting that diarrhoea and acute respiratory infections are still widely prevalent (table 1). The reported prevalence of diarrhoea in the last 2 weeks in children in the survey sample was 26% in 2012. Similarly, acute respiratory infection in the preceding 2 weeks was prevalent in about 15% of those surveyed in 2012 (table 1).

Notwithstanding the relatively small size (925 children aged 6–59 months) of the national nutrition survey in 2004,[50] the more recent Multiple Indicator Cluster Survey 2010–11,[45] and the much larger National Nutrition Survey 2013[51] suggest that there has been significant improvement in stunting as this factor reduced by roughly a third from about 61% in 2004 to 43% in 2013 (p<0·0001). The prevalence of wasting remained relatively stable over this time period (p=0·84) and in 2013 was estimated at about 9%. Precise estimates and CIs for additional undernutrition data are presented in the appendix (p 20).

Overall coverage rates of key health interventions relevant to maternal and child survival have increased over time (table 2). Most notable changes relate to visits to skilled attendants for antenatal, SBA at birth, and facility-based births, which have more than tripled over the decade. The increasing trends in maternal interventions highlight and corroborate notable gains in co-coverage of

key interventions among mothers. Although the use of any method of contraception has increased, overall coverage remains very low. Data for caesarean sections were not available over time; however, estimates from 2010 suggest low overall coverage (4%; table 2).

Care-seeking patterns among children 0–59 months showed some improvement over time (table 1). Seeking health care for pneumonia by any provider increased significantly from 46% in 2003 to 77% in 2012 (p<0·0001), and use of antibiotics for treatment was noted to be 64% in 2010. Use of oral rehydration solution in combination with other home fluids (54%) was more common than use of oral rehydration solutions alone (30%) in 2003, but over time, a bit more than half of children used either intervention for diarrhoea treatment. No reliable data are available for the use of zinc for the treatment of diarrhoea.

Despite variations between surveys and no robust estimates at the provincial level (with the exception of the most recent Expanded Programme on Immunisation Census survey in 2013), the overall coverage of immunisations had shown some improvement. Best WHO and UNICEF modelled estimates suggest that vaccination rates for BCG, measles, diphtheria-tetanus-pertussis, and three doses of polio in children aged 12–23 months had more than doubled from about 25% in 2000 to 75% in 2014 (figure 2).[52] Representative survey estimates showed less impressive but similar gradual trends over time, with the more recent and robust 2013 Expanded Programme on Immunisation Census survey suggesting moderate national coverage of measles (61%), diphtheria-tetanus-pertussis (62%), and three doses of polio (61%). Present BCG coverage was estimated at about 80%. Afghanistan had managed to reduce polio cases over the years but remained one of the two countries with endemic cases of polio.[67] The proportion of mothers receiving two or more doses of tetanus toxoid vaccine had also increased gradually from around a quarter in the early 2000s to beyond 70% in 2013, according to the official national administrative estimates (figure 2). The gains in immunisations were largely achieved through the promotion of delivery through non-governmental organisations (NGOs) and other state supported vaccinators. Between 2004 and 2014, the number of fixed Expanded Programme of Immunisation vaccination centres (from 400 to 1575) and the number of vaccinators (from 800 to 2926) almost quadrupled (Sherin Varkey, UNICEF Afghanistan, personal communication).

The issue of disparities in relation to coverage of key interventions is important in Afghanistan. Intervention coverage varied greatly across wealth quintiles (figure 3A) and provinces (figure 3B) where some of the greatest disparities were seen in access to improved water and sanitation, antenatal care visits, and SBA coverage. Variation in intervention coverage by gender and across ethnic groups (eg, Pashto, Dari, Uzbek, and Turkmen) was minimal (appendix pp 51–52).
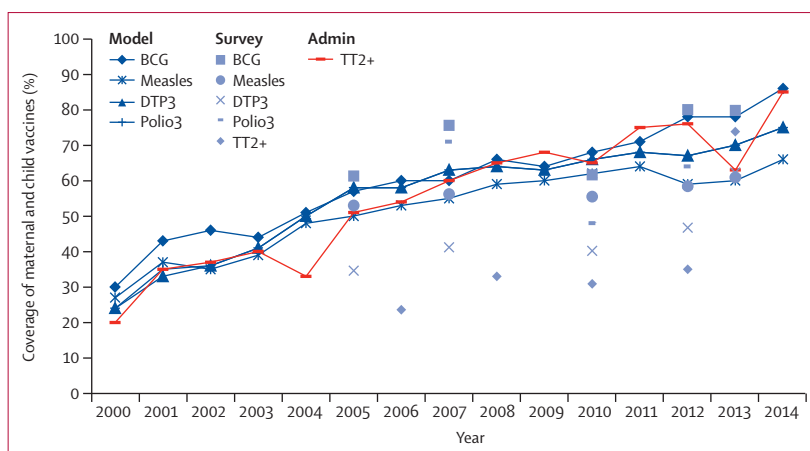

Figure 2: **Coverage of essential maternal and child vaccines in Afghanistan from 2000 to 2014**[1,45–47,49,52]
National survey versus WHO and UNICEF modelled estimates. Immunisation data from Multiple Indicator Cluster Surveys 2003–04 were excluded due to the known data quality issues. Childhood vaccine coverage (BCG, measles, DTP3, and polio3) was estimated for children 12–23 months in Afghanistan. TT2+ reflects the proportion of mothers receiving two or more doses of tetanus toxoid. DTP3=Diphtheria-tetanus-pertussis. Polio3=three doses of polio. TT2+=two or more doses of tetanus toxoid. *WHO and UNICEF modelled estimates were not available for TT2+ thus survey data are contrasted with official national administrative estimates. Hossain SMM, unpublished.

Despite inequalities, coverage rates of essential RMNCH interventions have improved notably over a relatively short time period. Emerging from decades of conflict in 2003, less than 20% of births were attended by a skilled professional in almost all provinces of Afghanistan; exceptions were provinces with urban hubs such as Herat, Kabul, and Nangarhar, where 20–46% of births were attended by a skilled provider (appendix p 22). Between 2003 and 2010, of the 34 provinces, 21 improved SBA coverage by 20·1% or more and 11 had gains in SBA of more than 30% (figure 4, appendix p 23). However, the gains were unequal and almost half the provinces had no increase or a small increase in SBA, with the lowest gains observed among provinces that were most multidimensionally poor with respect to severe deprivations in education, health, and living standards (Pearson correlation $r=-0·50$, $p=0·0028$; appendix p 18). This finding was especially noticeable in more remote and inaccessible provinces such as Nuristan, Wardak, Ghor, Badghis, and Zabul, which had less than 10% SBA use in 2010 (appendix pp 22–23).

To identify key determinants of coverage change, we evaluated putative correlates of change in SBA and facility births from 2003 to 2010 from available contextual and health systems information. Bivariate analysis results are displayed in table 3. Changes in SBA and facility births correlated with each other and with changes in antenatal care. Health-care resources that statistically correlated with SBA and facility birth changes included the rate of deployment of community midwives per 100 000 provincial population and the rate of active nurses. Both access and quality of care appear to be important. The average distance travelled to a health-care
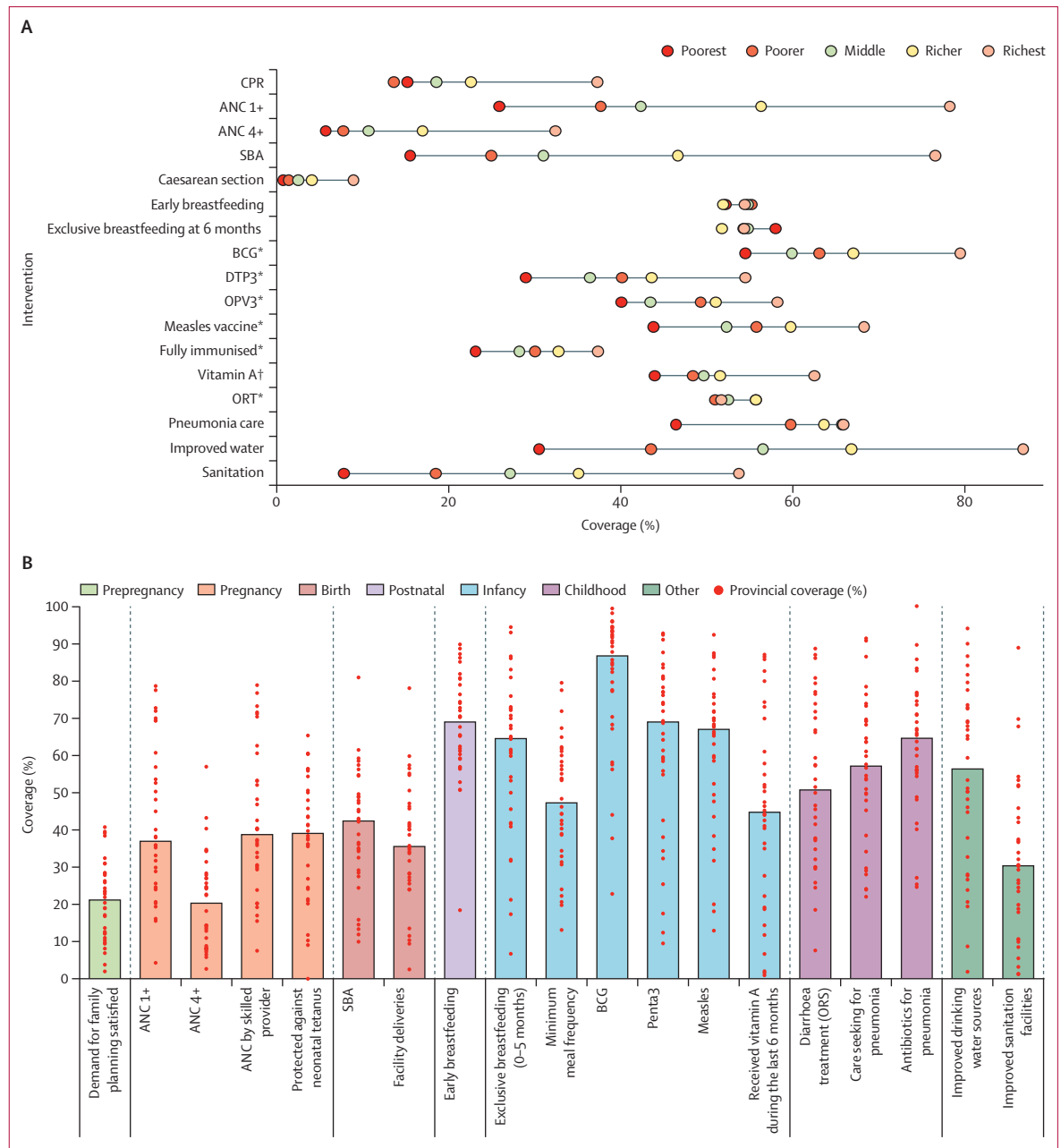
***Figure 3*: Essential interventions coverage across wealth quintiles and provinces**

(A) Disparities in coverage interventions across the continuum of care by wealth quintiles.[45] (B) Median national provincial coverage of interventions across the continuum of care. ANC 1+=women received at least one visit from skilled provider during pregnancy. ANC 4+=women received four or more visits during pregnancy. Pneumonia care=suspected pneumonia taken to an appropriate health provider. CPR=contraceptive prevalence rate. DTP3=three doses of diphtheria-tetanus-pertussis vaccine. Early breastfeeding=introduction of breastfeeding within 1 h of birth. Minimum meal frequency=proportion of children 6–23·9 months of age who receive solid, semi-solid, or soft foods or milk feeds the minimum number of times or more (two times for breastfed infants 6–8 months, three times for breastfed children 9–23 months, four times for non-breastfed children 6–23 months). Penta3=three doses of pentavalent vaccine. OPV3=three doses of oral polio vaccine. ORT=diarrhoea treated with oral rehydration. SBA=delivery by skilled birth attendance. Vitamin A=one dose of vitamin A during last 6 months. *Children aged 12–23 months. †Children aged 0–59 months. Hossain SMM, unpublished.[45,51]

facility correlated negatively with SBA, and the extent of privacy in the visit was statistically associated with both SBA and facility births. Overall patient satisfaction and quality of care during the health visit were positively related to change in both outcomes.

Maternal literacy correlated positively whereas low household income also had negative associations with both SBA and facility births, respectively. The less equitably mobile phone towers were spread across the province, the lower the change in SBA and facility births.
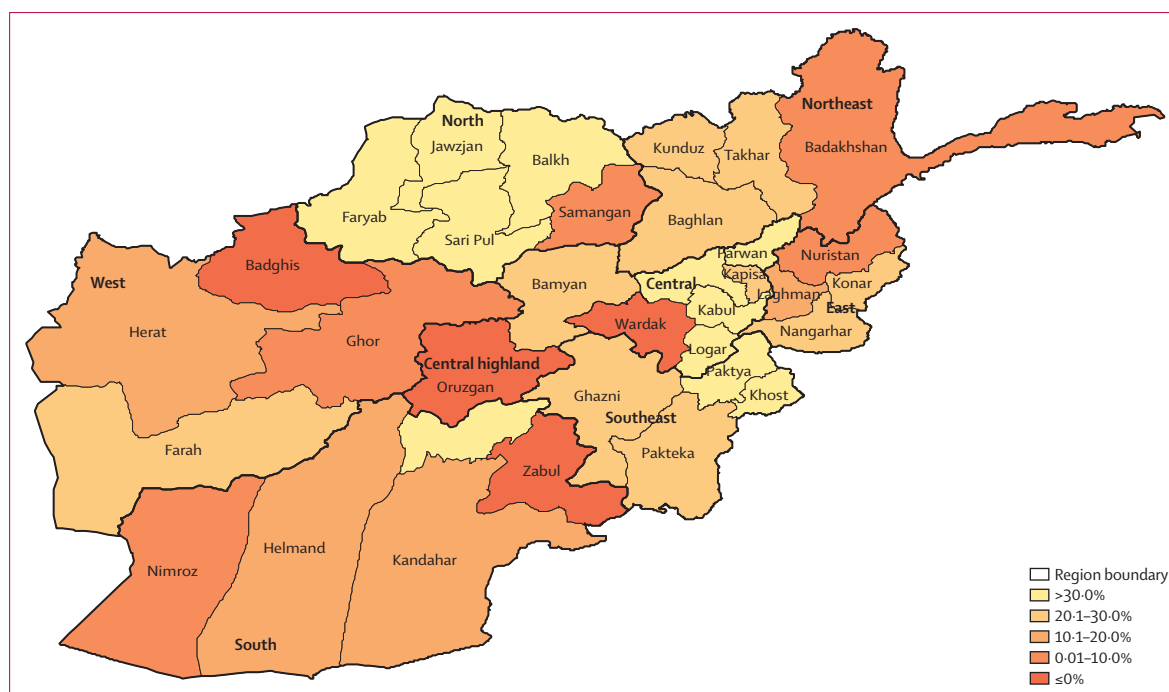
Figure 4: Percentage change in skilled birth attendance between 2003 and 2010[44,45]

The ratio of access to spread of telecommunications was positively associated with SBA change and marginally with facility births—indicating more change in provinces with accessible and equitable communication systems. Although change in SBA coverage was not associated with proxies of conflict, including civilian casualties, the death dirty war index, coalition fatalities, or security incidents, change in facility births correlated negatively with security incidents in the province and in the same direction but only marginally with coalition fatalities (table 3).

Table 4 summarises the final multivariable adjusted correlates of coverage outcomes. The main drivers of change in both outcomes were the rate of deployment of community midwives, proximity (measured in time or distance) to a facility, and maternal literacy, after adjusting for baseline SBA and facility births. Additionally, the availability of nurses and the quality of care received at health facilities were statistically important to change in SBA, whereas an indicator of conflict (coalition fatalities) was borderline negatively associated with changes in facility births, after adjusting for other covariates and baseline values (p=0·076). Results from the hierarchical multivariable model-building strategy were virtually identical, with additional indicators such as access to telecommunications showing up as pertinent to changes in SBA, and privacy during a facility visit was statistically important to facility births change (appendix p 12).

Altogether, the multivariable models predicted about 50% of the variation in change of both outcomes between 2003 and 2010 (table 4). The proportion of birthing facilities per 100 000 population had no association with SBA or facility birth change in either bivariate or multivariable analysis. We present interpretation of estimates for the SBA change model; however, analogous inferences can be made from the facility births model. For every ten additional midwives deployed per 100 000 population or ten or more nurses active in the province, SBA coverage change increased by approximately 11·6% and 31·0%, on average, after adjusting for baseline SBA (p=0·001) and other covariates (p=0·04). As the average distance to a health-care facility increased by 10 km, SBA change decreased by 16·6% on average (p=0·04), when controlling for other factors. Similarly, a 10 point increase in quality of care corresponded to a 6·8% increase in SBA change (p=0·05), and a 10% increase in the proportion of mothers with some form of formal education correlated to 6·4% (p=0·03) more change in SBA, after controlling for other covariates. Absolute standardised coefficients highlight proportion of deployed midwives as the intervention most important to SBA change (standardised β coefficient 0·56), followed by maternal illiteracy (0·36), active nurses (0·31), and finally, distance to facility, and quality of care (0·29; table 4).

Health sector reform has been substantiated by important health, economic, and social policies and strategies which were implemented nationally and subnationally soon after the fall of the Taliban Government. Given the huge challenges that development, UN bodies, and relief agencies faced in

	Change in SBA r (p value)	Change in facility births r (p value)
Health-care resources*		
Active birth facilities	–0·06 (0·744)	0·07 (0·693)
District hospitals	0·04 (0·802)	0·20 (0·259)
Comprehensive health centres	0·14 (0·444)	0·05 (0·767)
Basic health centres	0·03 (0·869)	0·14 (0·414)
Mobile clinics	0·06 (0·734)	0·07 (0·709)
Community midwives deployed†	0·38 (0·030)‡	0·41 (0·018)‡
Active midwives	0·02 (0·912)	0·17 (0·329)
Active nurses	0·28 (0·103)§	0·35 (0·046)‡
Active medical doctors	0·16 (0·352)	0·10 (0·572)
Active community health workers	0·14 (0·426)	0·18 (0·304)
Health facility physical capacity		
Equipment functionality	0·16 (0·369)	0·28 (0·114)§
Drug availability	–0·0098 (0·956)	–0·043 (0·809)
Laboratory functionality	0·20 (0·269)	0·089 (0·615)
Overall infrastructure	–0·18 (0·301)	–0·048 (0·789)
Health-care visit characteristics¶		
Convenient travel	0·21 (0·235)	–0·05 (0·786)
Distance to facility (km)	–0·47 (0·007)‡	–0·23 (0·197)§
Time to facility (min)	–0·27 (0·136)§	–0·16 (0·381)
Time to being seen (min)	0·09 (0·615)	0·19 (0·288)
Registration fee	0·11 (0·548)	–0·04 (0·838)
Overall fair cost	0·15 (0·397)	0·04 (0·815)
Privacy	0·35 (0·041)‡	0·39 (0·022)‡
Overall patient satisfaction	0·34 (0·054)§	0·30 (0·087)§
Quality of care	0·45 (0·007)‡	0·35 (0·042)‡
Staff adequate training	–0·099 (0·579)	–0·17 (0·343)
Client and community		
Community involvement/ decision making	0·21 (0·235)	–0·05 (0·786)
	(Table 3 continues in next column)	

	Change in SBA r (p value)	Change in facility births r (p value)
(Continued from previous column)		
Demographics and context		
Maternal age	–0·07 (0·662)	–0·19 (0·277)
Maternal literacy	0·33 (0·054)§	0·40 (0·018)‡
Low income	–0·51 (0·002)‡	–0·44 (0·009)‡
Rurality¶	–0·16 (0·363)	–0·11 (0·543)
Distance to paved road (km)¶	–0·24 (0·174)§	–0·14 (0·170)§
Change in ANC	0·61 (<0·0001)‡	0·71 (<0·0001)‡
Baseline (2003 SBA or facility birth rate)	–0·03 (0·863)	0·13 (0·479)
Change in SBA	..	0·79 (<0·0001)‡
Change in facility births	0·79 (<0·0001)‡	..
Mobile phone coverage‖		
MPT*	–0·14 (0·446)	–0·04 (0·826)
MPT inequitable spread	–0·49 (0·003)‡	–0·36 (0·034)‡
MPT/spread ratio	0·35 (0·041)‡	0·31 (0·074)§
Casualties and security		
Deaths*	–0·04 (0·826)	–0·17 (0·338)
Deaths and wound*	–0·04 (0·843)	0·11 (0·522)
Death dirty war index	–0·11 (0·538)	–0·22 (0·220)
Coalition fatalities‖	–0·12 (0·511)	–0·32 (0·076)§
Security incidents‖	–0·09 (0·608)	–0·36 (0·041)‡

Pearson correlation coefficients were estimated unless otherwise stated. ANC=antenatal care. SBA=skilled birth attendance. MPT=mobile phone towers. *Rates per 100 000 population. †Total community midwives trained and deployed in province from 2003 to 2010. ‡Statistically significant at p<0·05. §Considered statistically significant for model building at liberal p<0·20. ¶Respondents were women of reproductive age (15–44 years) seen at a health-care facility. ‖Spearman correlation coefficients estimated due to skewed distributions.

Table 3: Bivariate correlation analysis of demographic and contextual indicators (2010) and change in skilled birth attendance and facility birth rates from 2003 to 2010 (n=34)

2002 in rebuilding Afghanistan after decades of conflict and civil war, several immediate measures were taken to provide urgent services and to establish or rebuild key programmes. Of these measures, life-saving RMNCH initiatives were paramount. Between December, 2001, and May, 2002, Afghan authorities and national and international organisations targeted 1 748 829 children aged 6 months to 12 years in five provinces in central Afghanistan for measles vaccinations and achieved coverage rates exceeding 80%.[68] Similarly, the catch-up campaign in 2002 targeted nearly 12 million children aged between 6 months and 12 years; moreover, the follow-up campaign in 2003 targeted over 5 million children aged between 9 months and 59 months and achieved approximately 96% coverage, saving many lives in the aftermath of the war.[69] Further key details of key policies and programmes are highlighted in panel 3,[70–77] figure 5, and the appendix (pp 15–16).

Given the poor status of Afghanistan's public health infrastructure after the fall of the Taliban, and the need for scaling up provision of key interventions, essential health services were provided primarily through a large network of NGOs. To rapidly expand the provision of the Basic Package of Health Services to underserved areas and disadvantaged populations, a contracting-out strategy to national or international NGOs was adapted in 2003 with donor assistance, and formally implemented in 2004. Evaluations of the contracting-out mechanism in Afghanistan have shown promising increases in use in vulnerable populations, including poor people, women, and young children,[78] and reduced service use gaps between rich and poor people when compared with non-contracted and contracting-in mechanisms.[79] Of the various contracting strategies, the competitive bidding process, which allows contractors flexibility in how funds are allocated within fixed-sum budgets with explicit deliverables (known as CO-1 or contracting-out 1 mechanism), has been shown as the most effective and efficient.[76,78,79] However, despite some evidence of benefits on reaching poor people,[79] there are continued concerns about the potential cost-effectiveness of these

mechanisms and the impact on the public health system in the long term.[80]

In view of the decimation and exodus of trained health professionals during the period 1979–2001, a major focus of attention has been the production and deployment of trained human resources. The Ministry of Public Health with the financial assistance of three donors—European Union, US Agency for International Development, and the World Bank—focused on strengthening of the existing Institutes of Health Sciences programmes and initiation of community midwifery education programmes to train midwives in rural provinces and districts.[81] In 2006, the Ministry of Public Health adopted a human resource policy to ensure the appropriate production and equitable availability of qualified health workers for the provision of the Basic Package of Health Services, Essential Package of Hospital Services, and other health services. An assessment of Basic Package of Health Services facility-based health workers from 2005 to 2013 showed about an eight-fold increase in nurses (from 738 to 5766), and about 15 times more general physicians (403 to 5990), medical specialists (109 to 1592), and midwives (211 to 3333) deployed in Afghanistan (figure 6). However, this finding corresponds to a national density of only six skilled health-care workers per 10 000 population—still falling far short of the WHO recommended threshold of 23 skilled health workers (eg, nurses, doctors, and midwives) per 10 000 population. Hospital beds are scarce in Afghanistan, with best estimates suggesting an availability of only five inpatient beds per 10 000 population.[5]

Unlike many other countries, Afghanistan did not invest in community-based programmes (especially those involving community health workers) and strategies for creating and supporting community support groups. The engagement and deployment of community health workers in rural districts for task shifting and outreach services is relatively recent. The number of community health workers increased more than ten times from 2682 of these workers in 2005 to 28 837 in 2013 (figure 6). Reliable data for health professionals engaged in providing essential packages of hospital services and in the private sector are not available. What is recognised is that there is an unequal distribution of available skilled health professionals in Afghanistan, whom are mostly clustered in the cities among the more accessible urban populations.

Despite many of the challenges highlighted previously, several robust evaluations exist of Afghanistan's health system performance, especially facility-based services.[55–57] The balance score card assessments are a series of national and province level health facility report cards focused on measuring and managing performance in the delivery of Basic Package of Health Services and Essential Package of Hospital Services. Implemented by independent third party evaluators since 2004, the

	Unstandardised β coefficient	95% CI	p value	Standardised β coefficient
Change in skilled birth attendance (adjusted R^2=0·52, p=0·0004)				
Community midwives deployed*	1·16	0·51 to 1·81	0·001	0·56
Active nurses†	3·10	0·09 to 6·10	0·044	0·31
Distance to facility (km)	–1·66	–3·28 to –0·04	0·044	–0·29
Quality of care	0·68	0·0004 to 1·35	0·050	0·29
Maternal literacy	0·64	0·08 to 1·21	0·028	0·36
Skilled birth attendance (2003)	–0·60	–1·09 to –0·10	0·020	–0·39
Change in facility births (adjusted R^2=0·48, p=0·001)				
Community midwives deployed*	0·71	0·02 to 1·43	0·054	0·36
Time to facility (min)	–0·33	–0·59 to –0·68	0·016	–0·39
Coalition fatalities‡	–1·83	–3·95 to 0·30	0·088	–0·29
Maternal literacy	1·14	0·57 to 1·71	0·0004	0·67
Facility births (2003)	–0·66	–1·21 to –0·11	0·021	–0·48

Coefficients were standardised to remove dependent and independent variable units so that all means=0 and variances=1, permitting direct comparison across predictors. There was no statistically significant collinearity (variance inflation factors <2). Determinants were retained if p<0·10. *Rate of community midwives trained and deployed per 100 000 population in province from 2003 to 2010. †Rate of active nurses per 100 000 population in province in 2010. ‡Variable was log transformed due to skewed distribution.

Table 4: **Multivariable analysis of predictors of change in skilled birth attendance and facility births from 2003 to 2010 (n=34)**

balance score card recently completed its eighth annual cycle. The balance score cards were not specifically designed to evaluate comprehensive maternal and child health services and mother and child populations (although they do collect some relevant information), rather, the score cards provide robust and nationally and provincially representative estimates of broader health system performance. Data from the current 2011–12 assessment show that overall Basic Package of Health Services facility performance is moderate in Afghanistan (score 54 of 100),[82] with variable national performance across six domains: patient and community perception and involvement, human resources, physical capacity, quality of service provision, management systems, and equity. Strengths noted included high patient perceived satisfaction with services, active community involvement in decision making, high availability of equipment and vaccines and pharmaceuticals, regular use of health information systems, and minimal gaps between the rich and poor in terms of outpatient service use and level of satisfaction with services. Severe deficiencies were observed in staff training, health worker satisfaction, measures of quality care such as adequate client counselling and length of time spent with patients, the facility financial systems, and overall facility management.[82]

At the province level, there appeared to be moderate to good performance overall, with Nuristan (77%), Kunar (72%), and Nangarhar (70%) among the best performers whereas Zabul (43%), Kabul (48%), and Ghor (50%) lagged behind (appendix pp 13–14).[82] Factors affecting health facility and staff performance included facility remoteness, and accessibility, patient volume, costs to

Panel 3: Health policies and programmes

From the stagnation of the prolonged period of conflict after Soviet withdrawal and Taliban rule, the Ministry of Public Health of the Afghan Government adopted several policies and strategies to improve health, especially reproductive, maternal, newborn, and child health (RMNCH; figure 5).

Perhaps the most pivotal to large-scale improvement in RMNCH was the implementation of the Basic Package of Health Services. The package was designed in 2003 to address quality, cost-effectiveness, equity, and community involvement through seven components and has drawn consistent international assistance since 2003.[70–72] The components are: (1) maternal and newborn health (eg, antenatal care, delivery care, post-partum care, family planning, and care of newborn); (2) child health and immunisation (eg, Expanded Programme of Immunisation services including routing and outreach, integrated management of childhood illness); (3) public nutrition (eg, micronutrient supplementation and assessment of malnutrition); (4) communicable diseases (eg, control of tuberculosis and malaria and prevention of HIV/AIDS); (5) mental health (eg, mental health education and awareness; and case identification, diagnosis, and treatment); (6) disability and physical rehabilitation services (eg, disability awareness, prevention, and education; provision of physical rehabilitation services and case identification, referral, and follow-up); and (7) regular supply of essential drugs (eg, listing of all essential drugs needed).

The Essential Package of Hospital Services was introduced in 2005 as a complementary package to the Basic Package of Health Services to ensure the continuum of care and strengthen the referral mechanism. Apart from other clinical and diagnostic services (eg, inpatient, outpatient, surgical, medical, physiotherapy, emergency, pharmacy, basic laboratory, blood transfusion, basic x-ray, and ultrasound), obstetrics and gynaecology, and paediatric services are included in the package to address the serious condition of maternal, newborn, and child health in the country. Furthermore, national control programmes have been complementing the Basic Package of Health Services and the Essential Package of Hospital Services through offering preventive, curative, and promotive care services.[73]

Other key initiatives included a national salary policy, implemented in 2005, which standardised salaries of the contracting-out non-governmental organisations and the Ministry of Public Health contracting-in strengthening mechanism in an aim to motivate health-care workers to work in rural areas. Additionally, national programmes on Expanded Programme of Immunisation, malaria, tuberculosis, HIV/AIDS, community-based health insurance, and nutrition have been implemented since the year 2000, which accelerated progress in 2003, and have been sustained and scaled up to varying extents (figure 5). These, coupled with strong stewardship of the Ministry of Public Health, in terms of coordination and communication, regular monitoring, and the existence of a Health Management Information System, have had a crucial role in accelerating RMNCH gains.[74–77]

Detailed content on all Ministry of Public Health policies and strategies is included in the appendix (pp 28–25).

patients, and availability and training of health workers; these factors have been assessed individually for each province elsewhere and our detailed review of health facility performance over time in Afghanistan is presented in the appendix (pp 13–14).[82]

Much of the health budget and spending in Afghanistan is dependent on official development assistance. Over the last decade, the Afghan Government and development partners have channelled considerable resources to the nation's rapidly developing health system. The Afghanistan national health account report for 2011–12 indicated a total health expenditure budget of more than US$1·5 billion for the fiscal year—an increase in health expenditure of approximately 43·8% ($1 billion) from 2008–09.[8] Total government expenditure on health also rose 31·7 %, reaching $84 million; however, this increase represents only 4·2% of total government expenditures. Private sources, mainly out-of-pocket expenditures from households, were the primary financiers of the health system funding representing 73·6% of all health spending, while the central government contributed 5·6%, and official development assistance providing the remaining 20·8%. Approximately 16·4% of the total health expenditure ($246·7 million) was spent on RMNCH in 2011–12.[8]

Disaggregated financial allocations for RMNCH were only available for official development assistance through the Organisation for Economic Co-operation and Development databases (Countdown to 2015 team, personal communication). Of the approximate $226 million official development assistance allotted for RMNCH in Afghanistan in 2010, 11·5% was designated to reproductive health, 28·5% to maternal and neonatal health, and 60·0% to child health (appendix p 23). Although there were few disbursements mentioning newborn health before 2008, in 2010, these represented 35·8% of all RMNCH official development assistance (appendix p 23).

Our analysis of lives saved using the Lives Saved Tool indicates that, over 85% of all deaths (84% of neonatal, 92% postnatal death in children younger than 5 years, and 89% of maternal deaths) could be averted by scaling up all intervention packages to 90% coverage levels by 2025 (figure 7, appendix pp 36–37). In our simulation, the intervention that could have the greatest impact on saving neonatal and maternal lives in Afghanistan was maternal emergency obstetric care and immediate newborn care. Increasing coverage of these interventions to 50% from present levels could save the lives of approximately 9000 newborn babies and 1700 mothers each year, while further increasing coverage to 75% could avert almost 19 000 newborn and 2700 maternal deaths. Universal coverage (90%) of immunisation could avert approximately 30 700 child deaths annually. Water, sanitation, and hygiene interventions scaled up to 50% coverage could avert another 9600 child deaths, while increasing to 90% coverage could save about 19 600 post-neonatal child deaths annually. Scaling up the coverage of infant and young child feeding programmes to 75% and 90% by year 2025 has the potential to save additional 12 100 and 14 000 children every year in Afghanistan.

Discussion

Despite few high-quality data and disparate surveys, we were able to collate and analyse much of the available information from one of the poorest and most conflict-affected countries in the world. Although few
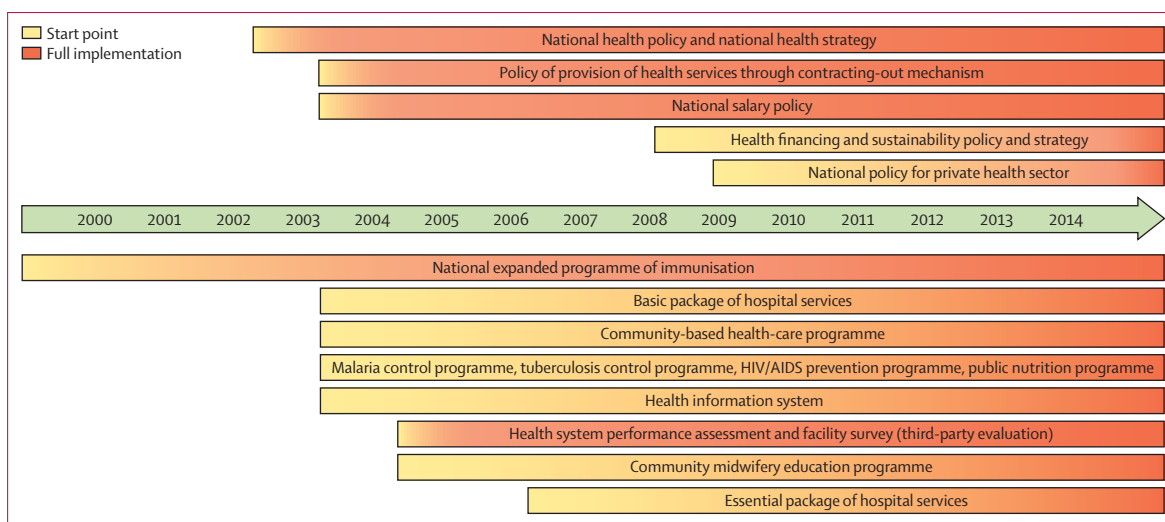
Figure 5: Health policies and programmes in Afghanistan from 2000 to 2014

surveys have had provincial-level specificity, Afghanistan does have a reasonable amount of aggregate information from surveys on health and nutrition trends that we used. Our analysis suggests that, notwithstanding the challenges and paucity of trained human resources, Afghanistan has made progress in improving coverage of maternal, newborn, and child health interventions and services to its population. Additonally, key results underscore that, although inequities remain, considerable health gains have been made in some rural areas and that there is much potential for further gains building on the existing scaffolding of programmes in provinces.

Afghanistan signed the Millenium Declaration in 2004, setting itself national targets for Millenium Development Goals 4 and 5 for 2015 and 2020, respectively, using 2003 as the base.[65] In 2004, these targets were defined on the basis of best national survey estimates available from Multiple Indicator Cluster Survey 2003–04 estimates, translating into a 50% mortality reduction in children younger than 5 years by 2015 (from 257 to 93 per 1000 livebirths) and a 75% reduction by 2020 (to 76 per 1000 livebirths).[44,65] However, tracking exact progress on mortality trends from national data is challenging, as available mortality estimates from Afghanistan are often inconsistent, with wide confidence intervals.[83,84] For example, an assessment in 2006 estimated unadjusted mortality in rural Afghanistan in infants of 129 deaths per 1000 livebirths and 191 deaths in children younger than 5 years per 1000 livebirths,[83] with strong evidence of under-reporting. The Afghan Mortality Survey in 2010 was non-representative as it did not capture information from several conflict-affected and insecure areas in the south of the country. We thus agree with the contention of Viswanathan and colleagues[83] that current estimates
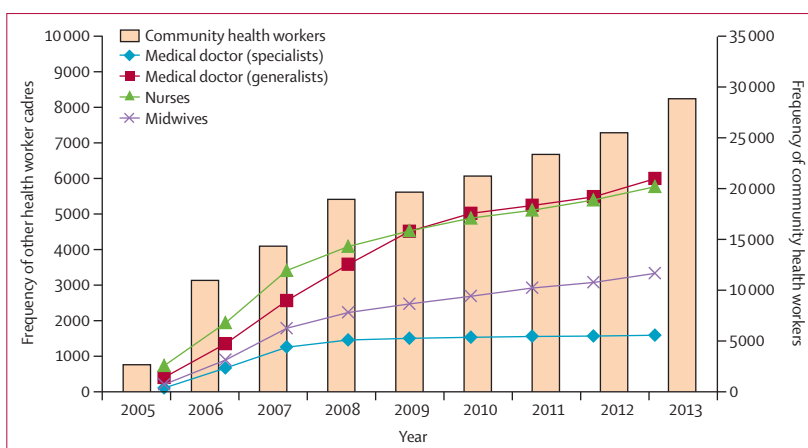

Figure 6: Trends in facility and community based human resources deployed from 2005 to 2013
Data for facility health workers reflect deployment for the Basic Package of Health Services only. Mashal T and Rasooly MH, unpublished.

of maternal and child mortality in Afghanistan need to be supplanted by more robust estimates, including adequate population coverage of all provinces. However, this occurrence will require peace to return to the country before effective representative surveys can be designed and executed. The Afghanistan Demographic and Health Survey 2015 is currently underway and might provide some of this data.

Given the absence of robust information from existing national surveys, we relied heavily on modelled estimates of mortality, which build on the available information. Our analysis used the present best estimates and estimated targets from UN Inter-agency Group for Child Mortality Estimation, which suggest that although Afghanistan has reduced mortality in children younger than 5 years by approximately 29% (currently 91·0 per 1000 livebirths) and neonatal
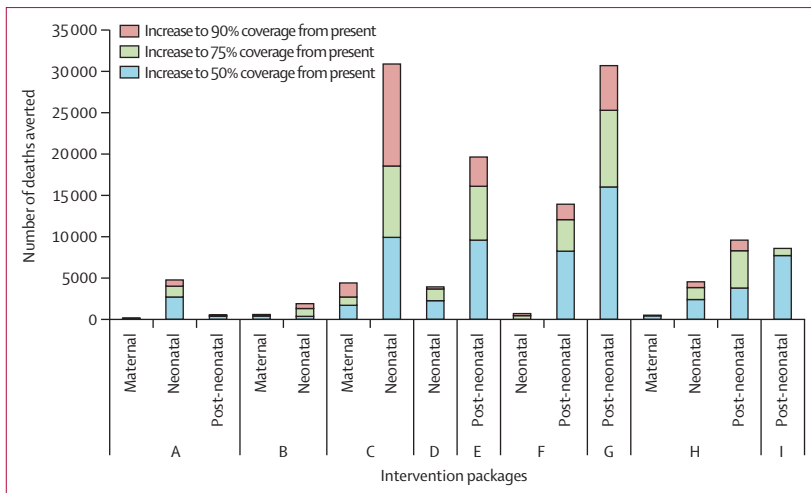
Figure 7: Maternal, neonatal, and post-neonatal deaths in children younger than 5 years averted by intervention packages
90%, 75%, and 50% coverage represent the number of deaths saved by increasing the present coverage of the intervention package to these respective amounts. A=optimisation of maternal nutrition and care preconception and during pregnancy. B=Expanded Antenatal Care Package. C=childbirth including maternal emergency obstetric care and immediate newborn care. D=postnatal care (including community newborn and child care). E=water, sanitation, and hygiene interventions. F=improving infant and young child feeding package. G=Expanded Immunization Package. H=case management. I=management of severe acute malnutrition.

mortality by 27% (currently 36·0 per 1000 livebirths) between 2003 and 2015, progress is still short of agreed national targets. Moreover, mortality in children younger than 5 years in Afghanistan continues to be among the highest in the world.[35,38] Similarly, despite the reductions in maternal mortality supported in this analysis, the fact remains that present maternal mortality estimates of 400–800 per 100 000 livebirths in Afghanistan remain extremely high, and put Afghanistan among the highest burden countries globally. These statistics underscore the need for continued focus on women's and children's health and acceleration of efforts in Afghanistan. For the forseeable future, strategies will need to be considered given the reality of ongoing conflict and of an economy that is largely dependent on external assistance.

Although Afghanistan did not meet the 2015 national targets, further acceleration in maternal and child health gains is possible but will require a focus on most cost-effective interventions across the continuum of care.[85] The observed aggregate gains in coverage of maternal care and facility births reflect investments in deploying community midwives as well as improving Basic Packages of Essential Services. However, further gains in maternal health care and outcomes will require specific attention to the quality of basic and emergency obstetric care in first and second level referral facilities, reducing the human resource gaps in remote and rural areas and development of transport systems. Additional measures will need to address the health and wellbeing of adolescent girls and the promotion of sexual and reproductive health and family planning. This

development will need investments in education and gender equality and empowerment across all regions of the country and not just the urban populations.[86] Similarly, to achieve further reductions in mortality for children younger than 5 years, Afghanistan needs to substantially invest in reducing inequities in coverage of childhood immunisations as well as strategies to reduce childhood diarrhoea and pneumonia mortality.[87] Eliminating preventable diarrhoea and pneumonia deaths might well be prioritised for implementation and is achievable in the near future.[88] Neonatal mortality rates have shown slower changes over time than have child mortality rates (figure 1B), and in 2015, accounted for almost 40% of all deaths in children younger than 5 years in Afghanistan.[35] Future gains must squarely address the quality, scope, and scale of newborn care. Since the repertoire of health interventions addressing neonatal survival are broader than those for survival of children younger than 5 years, key cost-effective and evidence-based health interventions targeting neonatal deaths should be prioritised for implementation and scale-up. The Every Newborn Action Plan[85,89,90] provides a template for considering key interventions that have the potential for reducing mortality such as newborn resuscitation, care of small (especially premature) and sick infants, and prevention and treatment of severe neonatal infections.

Many of these proposed solutions are also focused on improving quality of care in health facilities and will also affect maternal mortality.[85] Afghanistan has made huge progress in making midwifery services and skilled birth attendance available to its rural populations, and in view of the clear improvements in its health workforce, is now poised for improvements in the distribution of physicians and specialists to the provinces to improve facility-based care. The platform for assessing quality of facility-based services is already available, such as the proposed province-specific score cards, and could easily incorporate additional measures for maternal and newborn care, especially within the first 24–48 h of life.[90]

Other innovations for reaching marginalised populations are needed to complement the aforementioned approaches. Deploying a cadre of well trained community health workers might serve the purpose of reaching poor and marginalised populations in rural provinces and has been shown to be effective for community mobilisation and for promotion of appropriate household practices and care seeking.[91] These interventions can be complemented with community support groups, especially those targeting women, and can have benefits for maternal and newborn outcomes.[85,92,93] Afghanistan seems to have only tentatively moved in this direction and our analysis shows that numbers of community health workers have increased dramatically over a decade. Recent evaluations suggest that having ten or more of these workers employed at a health facility (compared to those with no

community health workers) significantly increased the odds of the health facility providing services to the poor.[79] Assessments of community health worker-based services in Afghanistan have shown that despite limited awareness of this group (only about a quarter of civilians are aware), of those who accessed the services, not only were their services generally accepted and used by community members, these workers were preferred over basic or comprehensive health centre use.[94,95]

A legitimate question can be asked about the transaction costs and cost-effectiveness for many initiatives undertaken in Afghanistan given the estimated $58 billion received in external development and relief assistance from 2001–14,[5] and the subsequent choices made. In view of the almost complete donor dependence for the financing of the health and social sectors, many of these programmatic choices were implemented with close donor coordination and oversight. The choice of contracting out represents one such mechanism which, although understandable in the early stages after the fall of the Taliban, should have been been replaced with more efficient and sustainable strategies. Although these contracting models have worked, use of NGOs for scaling up coverage does carry high transaction costs, is prone to risks of fiscal malfeasance, and might not be sustainable as development assistance slows down.[96] As Afghanistan develops a stable and well distributed public sector health workforce, these models should be phased out or restricted to special areas.

None of the aforementioned actions will yield the desired results without consistent and concerted investments to address the social determinants of health. Undernutrition, in all its forms, underlies 45% of deaths globally in children younger than 5 years.[40] Given the high rates of maternal and child undernutrition in Afghanistan, promotion of food security and investments in improving maternal and child nutrition are key. Although some progress has been made to reduce child stunting in Afghanistan, rates are still high and wasting rates have remained unaltered. Little information is available on time trends for maternal nutrition and micronutrient deficiencies, especially those that relate to adolescent girls and proportion of births that are small for gestational age—important determinants of stunting and child mortality.[97,98] To reduce stunting further, Afghanistan will need to invest in comprehensive nutrition-specific interventions for its women, and children, and also address environmental health and other nutrition-sensitive interventions.[99,100] These measures must be supplemented with additional safety nets, such as cash transfers, preferably conditioned on the uptake of best preventive and promotive RMNCH practices.

Our analysis of factors determining change in SBA use and facility births highlights the importance of investments in education, infrastructure such as communication and transport systems, and health system strengthening. These results corroborate previous analyses on SBA in Afghanistan and underscore the importance of community mobilisation as well as strengthening of the health system for provision of accessible, quality services.[101] Moving forward, Afghanistan should focus its attention on enhancing health and education services, as well as opportunities for full economic participation by its youth, both boys and girls. This is easier said than done given the widespread political polarisation, conflict, and economic stagnation. The fact that conflict does emerge as an important determinant of access and facility births in our analysis also points to the importance of securing peace and ensuring access for care in the country. It is imperative that the fragile gains of a new democracy and multi-ethnic government are maintained. None of the aforementioned strategies will work if the country were to regress to civil war.

Several limitations of our analysis should be recognised. We were substantially limited in the amount of reliable information available at population and province level. Although we used systematic and statistically robust regression methods to assess determinants of change in SBA and facility births subnationally, given the relatively small sample of provinces (n=34) and varying quality of data, our findings should be interpreted with caution. Approximately 50% of the variation in SBA and facility birth changes was not explained in the final model; this finding warrants a more powerful analysis on the basis of larger sample sizes and additional variables, but could also represent the contribution by factors outside of health that are not readily measurable. These limitations in analysis have also been the case in other countries of the region with rapid changes in maternal health and mortality outcomes.[102,103] Multivariable analysis, such as ours, could also be subject to ecological fallacy and potential over-interpretation of the aggregate provincial level results because the observed associations at the provincial level might not translate into average change at household level.[104] The little information on coverage and progress from the south of Afghanistan and relatively insecure provinces also underscores the importance of additional need for data collection. These issues are not unique to Afghanistan and are compounded by little access to key areas for planning and implementation.

What explains the resilience of its people and the notable, although limited, gains in several RMNCH indicators in Afghanistan over the last decade? Firstly, a sound and stable policy framework for RMNCH that led to consistent investments in primary care and to the introduction of a basic health package.[105] The contribution of this initiative to primary preventive care needs to be further evaluated and must be supplemented with additional strategies to improve quality of care in facilities and reduce out-of-pocket expenditures for care. Secondly, a decision to produce and deploy community midwives at broader scale in Afghanistan has led to

change in coverage of antenatal care, SBA, and facility births. However, the availability of specialists and medical officers with requisite skills in rural provinces and districts remains low and should now be prioritised for provision of emergency maternal and newborn care. The current models of implementation also need to focus on quality of care for RMNCH services at referral facilities with an eye on improving perinatal and newborn care and regionalisation of services. The recent call to action for maternal and child survival in Afghanistan and convening of stakeholders in Afghanistan in May, 2015, was a welcome step in developing national consensus. The subsequent steps towards consolidation and concrete actions in the concerned ministries, appointment of key individuals, and implementation has been slow and affected by the deterioration in the security environment.

With the shift in development assistance and global priorities away from Afghanistan, the country faces huge economic and security challenges. Despite progress, maternal and child mortality in this country are among the highest in the world and will need concerted action for change. This change will need continued focus by the new government and specific strategies to address social determinants and reach marginalised populations. Also needed is apportioning of adequate resources by the donor community to ensure that the gains made at great cost and effort over the last decade are not reversed by an upsurge in conflict, donor fatigue, and reductions in social sector spending. As we embark on an ambitious agenda for sustainable development, it is critical that fragile democracies and transitional societies such as Afghanistan are fully supported in their ambitions to improve the lives of women and children and to move from a mere survival agenda to one that encompasses health and human development.

References
1 Afghanistan Central Statistics Organization. National risk and vulnerability assessment 2007–08: a profile of Afghanistan. https://www.unodc.org/documents/afghanistan//EUGovtofAFG_NRVA_2007-8_report.pdf (accessed Sept 16, 2015).

2 Afghanistan Central Statistics Organization. Statistical indicators of Afghanistan 2012–13. http://cso.gov.af/Content/files/Statical%20Indicators%2012-13%20Country.pdf (accessed Sept 16, 2015).

3 United Nations Statistics Division. Population and vital statistics report 2014. Statistical papers 2014; Series A Vol LXVI. http://unstats.un.org/unsd/demographic/products/vitstats/Sets/Series_A_2014.pdf (accessed June 18, 2014).

4 United Nations Development Programme. Human development report 2014. Sustaining human progress: reducing vulnerabilities and building resilience. http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf (accessed Sept 16, 2015).

5 World Bank. Statistical indicators for Afghanistan. http://data.worldbank.org/country/afghanistan (accessed Sept 16, 2015).

6 United Nations Education, Scientific, Cultural Organization in Kabul. Afghanistan national literacy strategy: policies, targets and strategies, 2013. http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Kabul/pdf/NLSEnglishFinal.pdf (accessed June 18, 2014).

7 World Health Organization. National health account database: Afghanistan indicators. http://apps.who.int/nha/database (accessed Sept 16, 2015).

8 Afghanistan Ministry of Public Health. Afghanistan national health accounts with subaccounts for reproductive health 2011–2012. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2013.

9 Colorado State University. CENTCOM Historical/Cultural Advisory Group. Afghanistan: timeline of Afghan history and culture. http://www.cemml.colostate.edu/cultural/09476/afgh02-01enl.html (accessed Dec 4, 2014).

10 Akbar AS. Afghanistan: the great game revisited—a review article. *J Asian Stud* 1981; **41:** 73–80.

11 Bhutta ZA. Children of war: the real casualties of the Afghan conflict. *BMJ* 2002; **324:** 349–52.

12 Turnball S. Essential histories: Genghis Khan and the Mongol conquests 1190–1400. Oxford: Osprey Publishing, 2003.

13 Kakar MH. Afghanistan: the Soviet invasion and the Afghan response. 1979–1982. Berkeley: University of California Press, 1995: c11995.

14 Goodson L. Afghanistan's endless war; state failure, regional politics, and the rise of the Taliban. Seattle: University of Washington Press, 2001.

15 United Nations High Commission for Refugees. Afghanistan the unending crises. *Refugees* 1997; **108:** 3–9.

16   Gessner BD. Mortality rates, causes of death, and health status among displaced and resident populations of Kabul, Afghanistan. *JAMA* 1994; **272:** 382–85.

17   Rashid A. Taliban: militant Islam, oil, and fundamentalism in central Asia. New Haven, CT: Yale University Press, 2000.

18   United States Department of State. Country report on human rights practices. Washington, DC: US Department of State, 1998.

19   Dyson T. Infant, child and maternal mortality and associated conditions of health in the Greater Kabul region of Afghanistan. *World Health Stat Q* 1981; **34:** 14–43.

20   Singh M, Qureshi MA, Aram GN, et al. Morbidity and mortality in childhood in Afghanistan: a study of 40 492, consecutive admissions to the Institute of Child Health, Kabul. *Ann Trop Paediatr* 1983; **3:** 25–30.

21   Assefa F, Jabarkhil MZ, Salama P, Spiegel P. Malnutrition and mortality in Kohistan District, Afghanistan, April 2001. *JAMA* 2001; **286:** 2723–28.

22   Ahmed A, Edward A, Burnham G. Health indicators for mothers and children in rural Herat Province, Afghanistan. *Prehosp Disaster Med* 2004; **19:** 221–25.

23   WHO, UNICEF, Countdown to 2015. Fulfilling the health agenda for women and children: the 2014 report, 2014. Geneva: World Health Organization, UN Children's Fund.

24   Maurice J. WHO heads efforts to restore Afghanistan's shattered health. *Bull World Health Organ* 2001; **79:** 1174.

25   Ministry of Health. Afghanistan national health resource assessment. Prepared for the Ministry of Health by MSH, HANDS, and MSH/Europe, with support from USAID, EC, UNFPA, and JICA. https://www.ecoi.net/file_upload/farinpour1_ANHRA_2002_LITE.pdf (accessed June 18, 2014).

26   United Nation Population Fund. Afghanistan National Reproductive Health Assessment, summary findings and recommendations. March, 2003. http://www.hands.or.jp/pagesj/08_publicity_pdf/Afghan_RH.pdf (accessed June 18, 2014).

27   Ministry of Public Health Afghanistan. National Child and Adolescent Health Strategy 2009–2013. Kabul, Afghanistan: Child & Adolescent Health Department, Ministry of Public Health 2009.

28   Ministry of Public Health Afghanistan. Basic Package of Health Services 2009–2013. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2009.

29   Government of the Islamic Republic of Afghanistan. Afghan National Development Strategy 2008–2013. Kabul, Afghanistan: Government of the Islamic Republic of Afghanistan, 2008.

30   United Nations Development Programme, Government of the Islamic Republic of Afghanistan. Afghanistan Millennium Development Goals Report 2012. Kabul: Afghanistan, 2014. http://www.af.undp.org/content/afghanistan/en/home/library/mdg/MDGs-report-2012 (accessed April 5, 2015).

31   Zainullah P, Ansari N, Yari K, et al. Establishing midwifery in low-resource settings: guidance from a mixed-methods evaluation of the Afghanistan midwifery education program. *Midwifery* 2014; **30:** 1056–62.

32   Johns Hopkins University Bloomberg School of Public Health, Indian Institute of Health Management Research. Health Sector Balanced Scorecard 2006. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2009.

33   Ministry of Public Health Afghanistan. Health Management Information System. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan Health Information System Publication, 2011. http://moph.gov.af/Content/Media/Documents/HMISNEWSLETTERJUNE201219201293557514553325325.pdf (accessed June 18, 2014).

34   Ministry of Rural Rehabilitation and Development Afghanistan. National Solidarity Program. Afghanistan, 2011. http://mrrd.gov.af/Content/files/Brochure%20final%203.pdf (accessed June 18, 2014).

35   WHO, UNICEF, the World Bank, and the United Nations Population Division. Levels and trends in child mortality 2015. http://www.childmortality.org/files_v20/download/IGME%20Report%202015_9_3%20LR%20Web.pdf (accessed Dec 1, 2015).

36   WHO, UNICEF, UNFPA, the World Bank, and the United Nations Population Division. Trends in Maternal Mortality: 1990 to 2015. http://apps.who.int/iris/bitstream/10665/194254/1/9789241565141_eng.pdf?ua=1 (accessed Dec 1, 2015).

37   Kassebaum NJ, Bertozzi-Villa A, Coggeshall BA, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014; **384:** 980–1004.

38   Wang H, Liddell CA, Coates MM, et al. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014; **384:** 957–79.

39   GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; **385:** 117–71.

40   Liu L, Oza S, Hogan D, et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. *Lancet* 2015; **385:** 430–40.

41   Say L, Chou D, Gemmill A, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health* 2014; **2:** e323–33.

42   Afghan Public Health Institute, Ministry of Public Health Afghanistan, Central Statistics Organization, ICF Macro, Indian Institute of Health Management Research, WHO Regional Office for the Eastern Mediterranean. Afghanistan Mortality Survey 2010. http://measuredhs.com/pubs/pdf/FR248/FR248.pdf (accessed June 18, 2014).

43   Anker M, Black RE, Coldham C, et al. A standard verbal autopsy method for investigating causes of death in infants and children. Geneva: World Health Organization, 1999.

44   Central Statistics Organization, UNICEF. Moving beyond 2 decades of war: progress of provinces. Multiple indicator cluster survey 2003–04. http://www.childinfo.org/files/AfghanistanMICS2003.pdf (accessed June 18, 2014).

45   Central Statistics Organization UNICEF. 2012. Afghanistan multiple indicator cluster survey 2010–2011: final report. Kabul. http://cso.gov.af/en/page/6807 (accessed June 18, 2014).

46   Central Statistics Organization, Ministry of Rehabilitation and Development (Afghanistan). National risk and vulnerability assessment 2005–2006: Afghanistan. Germany: ASA Institut für Sektoranalyse und Politikberatung GmbH, 2007.

47   Central Statistics Organization, Ministry of Rehabilitation and Development (Afghanistan). National risk and vulnerability assessment 2011–2012: Afghanistan living conditions survey. http://www.af.undp.org/content/dam/afghanistan/docs/MDGs/NRVA%20REPORT-rev-5%202013.pdf (accessed June 18, 2014).

48   Johns Hopkins University Bloomberg School of Public Health, Indian Institute of Health Management Research. Afghanistan Health Survey 2006: estimates of priority health indicators. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2008.

49   Johns Hopkins University Bloomberg School of Public Health, Indian Institute of Health Management Research. Afghanistan Health Survey 2012. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2013.

50   Ministry of Public Health, United Nations Children's Fund, Center for Disease Control and Prevention, National Institute for Research on Food and Nutrition, Tufts University. Afghanistan National Nutrition Survey 2004. http://nutritionmoph.gov.af/attachments/article/93/NNS%20-%202004%20Report.pdf (accessed June 18, 2014).

51   Ministry of Public Health, UNICEF, Aga Khan University. National Nutrition Survey, Afghanistan (2013). http://reliefweb.int/sites/reliefweb.int/files/resources/Report%20NNS%20Afghanistan%202013%20(July%2026-14).pdf (accessed May 2, 2016).

52   WHO, UNICEF coverage estimates for 1983–2014. Nov 4, 2015. http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tswucoveragedtp3.html (accessed Dec 20, 2015).

53   WHO. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. Geneva: World Health Organization, 2006. http://www.who.int/childgrowth/standards/Technical_report.pdf?ua=1 (accessed Nov 8, 2014).

54   Alkire S, Foster J. Understandings and misunderstandings of multidimensional poverty measurement. *J Econ Inequal* 2011; **9:** 289–314.

55   Johns Hopkins University Bloomberg School of Public Health, Indian Institute of Health Management Research. Health sector balanced scorecard 2004–2012. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2013.

56   Peters DH, Noor AA, Singh LP, Kakar FK, Hansen PM, Burnham G. A balanced scorecard for health services in Afghanistan. *Bull World Health Organ* 2007; **85:** 146–51.

57   Edward A, Kumar B, Kakar F, et al. Configuring balanced scorecards for measuring health system performance: evidence from 5 years' evaluation in Afghanistan. *PLoS Med* 2011; **8:** e1001066.

58   Ministry of Communication and Information Technology of Afghanistan, Afghan Telecommunications Regulatory Authority. Mobile Network Operators Coverage Maps 2012. http://atra.gov.af/en/page/7000/7006/coverage-footpring-2012 (accessed May 3, 2016).

59   iCasualties. Operation enduring freedom: war in Afghanistan. http://icasualties.org/oef/ByProvince.aspx (accessed June 18, 2014).

60   The Afghanistan NGO safety office 2010 report. Jan 1–Dec 31, 2010. http://reliefweb.int/sites/reliefweb.int/files/resources/F7EE02609B7F7A0F4925782200200E4D-Full_Report.pdf (accessed June 18, 2014).

61   Lawn JE, Blencowe H, Oza S, et al. Every newborn: progress, priorities, and potential beyond survival? *Lancet* 2014; **384:** 189–205.

62   Victora CG, Huttly SR, Fuchs SC, Olinto MTA. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *Int J Epidemiol* 1997; **26:** 224–27.

63   Hicks MH-R, Spagat M. The dirty war index: a public health and human rights tool for examining and monitoring armed conflict outcomes. *PLoS Med* 2008; **5:** e243.

64   Johns Hopkins University Bloomberg School of Public Health. LiST: the lives saved tool software that predicts survival of mothers and children. http://livessavedtool.org (accessed Jan 30, 2016).

65   United Nations Development Programme, Government of the Islamic Republic of Afghanistan. Afghanistan Millennium Development Goals Report 2012. Kabul: Afghanistan, 2014. http://www.af.undp.org/content/dam/afghanistan/docs/MDGs/Afghanistan%20MDGs%202012%20Report.pdf (accessed April 30, 2014).

66   Barlett LA, Mawji S, Whitehead S, et al. Where giving birth is a forecast of death: maternal mortality in four districts of Afghanistan, 1999–2002. *Lancet* 2005; **365:** 864–70.

67   Afghanistan Ministry of Public Health. Afghanistan polio eradication initiative: surveillance update week 45. http://moph.gov.af/Content/Media/Documents/Surveillanceupdateweek45201418112014111440622553325325.pdf (accessed Jan 5, 2015).

68   Dadgar N, Ansari A, Naleo T, et al. Implementation of a mass measles campaign in central Afghanistan, December 2001 to May 2002. *J Infect Dis* 2003; **187** (suppl 1): S186–90.

69   Vijayaraghavan M, Lievano F, Cairns L, et al. Economic evaluation of measles catch-up and follow-up campaigns in Afghanistan in 2002 and 2003. *Disasters* 2006; **30:** 256–69.

70   Ministry of Public Health. A Basic Package OF Health Services 2003. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2003.

71   Ministry of Public Health. A Basic Package of Health Services 2005. Afghanistan: Ministry of Public Health, 2005.

72   Ministry of Public Health. A Basic Package of Health Services 2010. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2010.

73   Ministry of Public Health. Essential package of hospital services 2005. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2005.

74   Ministry of Public Health. Health Management Information System report 2013. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2013.

75   Waldman R, Strong L, Wali A. Afghanistan's health system since 2001: condition improved, prognosis cautiously optimistic. http://www.areu.org.af/Uploads/EditionPdfs/635E-Afghanistans%20Health%20System%20BP%202006%20web.pdf (accessed June 18, 2014).

76   Strong L, Wali A, Sondorp E. Health policy in Afghanistan: two years of rapid change from 2001 to 2003. London: London School of Hygiene & Tropical Medicine, 2005.

77   Loevinsohn B, Sayed GD. Lessons from the health sector in Afghanistan: how progress can be made in challenging circumstances. *JAMA* 2008; **300:** 724–26.

78   Arur A, Peters DH, Hansen PM, et al. Contracting for health and curative care use in Afghanistan between 2004 and 2005. *Health Policy Plan* 2010; **25:** 135–44.

79   Alonge O, Gupta S, Engineer C, Salehi AS, Peters DH. Assessing the pro-poor effect of different contracting schemes for health services on health facilities in rural Afghanistan. *Health Policy Plan* 2014; **29:** 1–14.

80   Michael M, Pavignani E, Hill PS. Too good to be true? An assessment of health system progress in Afghanistan, 2002–2012. *Med Confl Surviv* 2013; **29:** 322–45.

81   Health Services Support Project, Jhpiego, Johns Hopkins School of Public Health. Evaluation of the pre-service midwifery education program in Afghanistan. Kabul: Health Systems Strengthening (USAID), Jhpiego, JHSPH, 2011.

82   Johns Hopkins University Bloomberg School of Public Health, Indian Institute of Health Management Research. Afghanistan Basic Package of Health Services balanced scorecard national report 2011–12. Kabul: Ministry of Public Health of Islamic Republic of Afghanistan, 2013.

83   Viswanathan K, Becker S, Hansen PM, et al. Infant and under-five mortality in Afghanistan: current estimates and limitations. *Bull World Health Organ* 2010; **88:** 576–73.

84   Rasooly MH, Govindasamy P, Aqil A, et al. Success in reducing maternal and child mortality in Afghanistan. *Glob Public Health* 2014; **9** (suppl 1): S29–42.

85   Bhutta ZA, Das JK, Bahl R, et al, for the *Lancet* Every Newborn Study Group. Every Newborn: can currently available interventions end preventable deaths among mothers, newborns and stillbirths and at what cost? *Lancet* 2014; **384:** 347–70.

86   Grown C, Gupta GR, Pande R. Taking action to improve women's health through gender equality and women's empowerment. *Lancet* 2005; **365:** 541–43.

87   Bhutta ZA, Das JK, Walker N, et al, for the *Lancet* Diarrhoea and Pneumonia Interventions Study Group. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *Lancet* 2013; **381:** 1417–29.

88   Chopra M, Mason E, Borrazzo J, et al, for the Lancet Diarrhoea and Pneumonia Interventions Study Group. Ending of preventable deaths from pneumonia and diarrhoea: an achievable goal. *Lancet* 2013; **381:** 1430–41.

89   WHO. Every Woman Every Child. Every newborn: an action plan to end preventable deaths. World Health Organization, 2014. http://apps.who.int/iris/bitstream/10665/127938/1/9789241507448_eng.pdf?ua=1 (accessed Nov 28, 2014).

90   Das JK, Rizvi A, Bhatti Z, et al. State of neonatal health care in eight countries of the SAARC region, south Asia: how can we make a difference? *Paediatr Int Child Health* 2015; **35:** 174–86.

91   WHO, Global Health Workforce Alliance. Global experience of community health workers for delivery of health related millennium development goals: a systematic review, country case studies, and recommendations for integration into national health systems: alliance document, 2010. http://www.who.int/workforcealliance/knowledge/resources/chwreport/en (accessed Dec 31, 2014).

92   Lassi ZS, Das JK, Salam RA, Bhutta ZA. Evidence from community level inputs to improve quality of care for maternal and newborn health: interventions and findings. *Reprod Health* 2014; **11** (suppl 2): S2.

93   Lassi ZS, Cometto G, Huicho L, Bhutta ZA. Quality of care provided by mid-level health workers: systematic review and meta-analysis. *Bull World Health Organ* 2013; **91:** 824–33I.

94   Edward A, Branchini C, Aitken I, Roach M, Osei-Bonsu K, Arwal SH. Toward universal coverage in Afghanistan: a multi-stakeholder assessment of capacity investments in the community health worker system. *Soc Sci Med* 2010; **145:** 173–183.

95   Najafizada SA, Labonte R, Bourgeault IL. Community health workers of Afghanistan: a qualitative study of a national program. *Confl Health* 2014; **8:** 26.

96   Cockcroft A, Khan A, Md Ansari N, Omer K, Hamel C, Andersson N. Does contracting of health care in Afghanistan work? Public and service-users' perceptions and experience. *BMC Health Serv Res* 2011; **11** (suppl 2): S11.

97   Black RE, Victora CG, Walker SP, et al, for the Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013; **382:** 427–51.

98 Katz J, Lee AC, Kozuki N, et al, for CHERG. Small-for-Gestational-Age-Preterm Birth Working Group. Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: a pooled country analysis. *Lancet* 2013; **382:** 417–25.

99 Bhutta ZA, Das JK, Rizvi A, et al, for the *Lancet* Nutrition Interventions Review Group, the Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; **382:** 452–77.

100 Ruel MT, Alderman H, for the Maternal and Child Nutrition Study Group. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 2013; **382:** 536–51.

101 Mayhew M, Hansen PM, Peters DH, et al. Determinants of skilled birth attendant utilization in Afghanistan: a cross-sectional study. *Am J Public Health* 2008; **98:** 1849–56.

102 Chowdhury ME, Botlero R, Koblinsky M, Saha SK, Dieltiens G, Ronsmans C. Determinants of reduction in maternal mortality in Matlab, Bangladesh: a 30-year cohort study. *Lancet* 2007; **370:** 1320–28.

103 El Arifeen S, Hill K, Ahsan KZ, Jamil K, Nahar Q, Streatfield PK. Maternal mortality in Bangladesh: a Countdown to 2015 country case study. *Lancet* 2014; **384:** 1366–74.

104 Piantadosi S, Byar DP, Green SB. The ecological fallacy. *Am J Public Health* 1988; **127:** 893–904.

105 Newbrander W, Ickx P, Feroz F, Stanekzai H. Afghanistan's basic package of health services: its development and effects on rebuilding the health system. *Glob Public Health* 2014; **9** (suppl 1)**:** S6–28.