

Health in South Africa 2



Saving the lives of South Africa's mothers, babies, and children: can the health system deliver?

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South Africa is one of only 12 countries in which mortality rates for children have increased since the baseline for the Millennium Development Goals (MDGs) in 1990. Continuing poverty and the HIV/AIDS epidemic are important factors. Additionally, suboptimum implementation of high-impact interventions limits programme effectiveness; between a quarter and half of maternal, neonatal, and child deaths in national audits have an avoidable health-system factor contributing to the death. Using the LiST model, we estimate that 11 500 infants' lives could be saved by effective implementation of basic neonatal care at 95% coverage. Similar coverage of dual-therapy prevention of mother-to-child transmission with appropriate feeding choices could save 37 200 children's lives in South Africa per year in 2015 compared with 2008. These interventions would also avert many maternal deaths and stillbirths. The total cost of such a target package is US\$1.5 billion per year, 24% of the public-sector health expenditure; the incremental cost is \$220 million per year. Such progress would put South Africa squarely on track to meet MDG 4 and probably also MDG 5. The costs are affordable and the key gap is leadership and effective implementation at every level of the health system, including national and local accountability for service provision.

Introduction

The enormity of the HIV/AIDS epidemic and the politics surrounding this issue in South Africa have obscured the other health challenges facing the country, yet they are closely linked. There are several colliding epidemics: HIV/AIDS and tuberculosis,¹ the increasing burden of chronic diseases including obesity linked to the demographic transition,² and staggeringly high rates of interpersonal violence.³ However, behind these headline issues is a more silent epidemic of continuing excessive mortality for mothers, babies, and children, which still primarily affects the poorest families.

Apartheid was particularly harsh to black South African women and children, mostly in peripheral and extremely

poorly resourced rural homelands. Under-resourced health services, environmental risks, and precarious food security characterised the lives of many during this period. By the time the government led by the African National Congress came to power in 1994, infant mortality was ten times higher in the black population than in the white population (infant mortality rate 130 vs 13 per 1000 livebirths), rates of stunting were much higher in black children than in white children (28.4% vs 1.1%), more than 19 000 cases of measles were reported each year, and large and mostly uncounted numbers of maternal deaths were occurring from septic abortions; these examples indicate some of the ways in which women and children bore the brunt of the effects of apartheid on health.^{4,5}

Key messages

- At the present trajectory, South Africa will fall well short of achieving Millennium Development Goals (MDGs) 4 and 5, related to reducing child and maternal mortality.
- HIV/AIDS and poor implementation of existing packages of care are the main reasons for the lack of progress towards the MDGs.
- Full coverage of key packages of interventions such as treatment and prevention of HIV infection and provision of comprehensive maternal and neonatal care would put South Africa on track to achieve MDG 4 and make substantial progress towards MDG 5.
- To achieve high coverage of priority care for mothers, neonates, and children is financially feasible, requiring a 2.4% increase in expenditure, but this money must be spent strategically.
- Strengthening of leadership, accountability mechanisms, and high quality of care interventions are also required.

Paradox of apparent progress yet worsening health outcomes

Maternal and child health was an early priority of the new government indicated by the construction of more than 1300 new primary health-care clinics and removal of user fees for maternal and child health services at the levels of primary health care and district hospital. New legislation and policies such as the Choice on Termination of Pregnancy Act had an almost immediate effect on women's health.⁶ After initial cutbacks, public-sector expenditure on social welfare and health expenditure for women and children has increased significantly in real terms especially in the past 5 years.⁷ Child support, care dependency, and foster-care grants have been introduced and are reaching 84% of target families;⁸ they are some of the most successful examples of cash transfer systems globally with demonstrated positive impact on the health of children and young women.⁹ Immunisation coverage has steadily increased with only six reported cases of

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measles in 2008,¹⁰ and South Africa has included new vaccines against pneumococcus and rotavirus into its routine vaccination schedule.

Yet South Africa is one of only 12 countries in which the mortality rate for children is higher than the baseline of 1990.¹¹ Data to track maternal mortality ratio and measure progress towards Millennium Development Goal (MDG) 5 are more complex, but they do show no measurable improvement and maternal mortality ratio has probably also risen. Each year an estimated 2500 mothers die, 20000 babies are stillborn, another 21900 die before they reach 1 month of age, and an additional 52600 children die before their 5th birthday, most from preventable and treatable causes and with no measurable progress being made in mortality reduction (table 1).¹² Infections including HIV/AIDS are a leading cause of death for both mothers and children younger than 5 years.^{13,14} Rates of malnutrition are persistently high: one in three women and children are anaemic; one in three children and one in four women have subclinical vitamin A deficiency; and 45% of children have inadequate zinc status.¹⁵

The challenge facing South Africa is to understand the paradox of a supportive policy and funding environment, high rates of use of maternal and child health services, and yet poor and in many cases worsening health outcomes. To unravel this paradox, we briefly review the status of maternal, neonatal, and child health in South Africa, drawing on a recent national report and linked paper in *The Lancet*.¹¹ We estimate the effect that improvements in coverage could have on reducing

neonatal and child mortality and the incremental human-resource requirements needed for improvements in coverage to be achieved.

Health system for maternal, neonatal, and child health—current structure and status

There is now a well-defined set of prevention and clinical packages, which include evidence-based interventions and are in line with WHO recommendations (figure 1). Four levels of care within the health system have been established. First, community level services, which focus on promotion of healthy behaviours and appropriate care-seeking, are regarded as important, but have not yet been resourced in a systematic or large-scale way.

Primary level services, such as reproductive health services, antenatal care (HIV testing and interventions for prevention of mother-to-child transmission [PMTCT]), limited postnatal care, and preventive and basic curative child health services (including early identification and supportive treatment for HIV/AIDS), are provided by a network of predominantly nurse-run clinics. Some of these facilities also supervise deliveries and provide treatment for HIV infection, but in many areas these functions fall to district hospitals. Primary health-care facilities generally have high rates of use, with 94% of women attending at least one antenatal visit and 83% of children being fully immunised at age 1 year.¹¹

The third level is district hospitals, which are staffed by generalist doctors and provide inpatient care for mothers, neonates, and children; this care includes the capacity to undertake caesarean sections.

	Mothers	Neonates (to 28 days)	Children (29 days to 5 years)
Mortality rate or ratio	Maternal mortality ratio, 152 (NCCEMD), 400 (UN estimate)	Neonatal mortality rate, 21 per 1000 livebirths (UN estimate)	Mortality rate 68 per 1000 livebirths (WHO estimate) with 47 per 1000 after 28 days and before 5 years
Number of deaths each year (with 2009 estimated birth cohort)	1660 (from NCCEMD), 4300 (from UN estimates)	23 000 (20 000 stillbirths)	51 300
Leading causes of death (updated for 2008)	Direct obstetric causes (46%) Non-pregnancy-related infections including HIV (44%)	Preterm birth complications (40%) Birth asphyxia (23%) Infections (19%) Congenital (10%)	HIV/AIDS (57% of all child deaths and more than 80% of deaths after 28 days and before 5 years) Pneumonia and sepsis* Diarrhoea* Malnutrition* Injuries (5%) Other (1%)
Avoidable factors in the health systems (based on national audit reports)	30% of maternal deaths had a modifiable factor related to administrator action—eg, lack of blood for transfusion, lack of transport between health institutions 58% of maternal deaths had a modifiable factor related to health-care provider action at the primary facility level; 49% at secondary level; and 30% at tertiary level—eg, not adhering to standard protocols	8% of stillbirths and early neonatal deaths had an avoidable factor directly related to administrator action—eg, personnel not available or not sufficiently trained response to maternal hypertension 13% of stillbirths and early neonatal deaths had an avoidable factor directly related to health-care provider action—eg, fetal distress not identified in labour, poor response to maternal hypertension	22% of all modifiable factors in child deaths were related to administrator action—eg, lack of senior doctors and nurses, and insufficient paediatric beds 53% of all modifiable factors in child deaths were related to health-care provider action, eg IMCI not used in clinics, and poor assessment and management in hospitals
Avoidable factors in the community (based on national audit reports)	46% of maternal deaths had a modifiable factor related to family/community action—eg, inadequate or no antenatal care	24% of stillbirths and early neonatal deaths had an avoidable factor directly related to family/community action—eg, delay in seeking care during labour	25% of all modifiable factors in child deaths were related to family/community action—eg, carer did not recognise severity of illness

NCCEMD=National Committee on Confidential Enquiries into Maternal Deaths. IMCI=Integrated Management of Childhood Illness. *The majority are in children with HIV/AIDS.

Table 1: Annual maternal, neonatal, and child deaths in South Africa with direct causes and avoidable factors identified

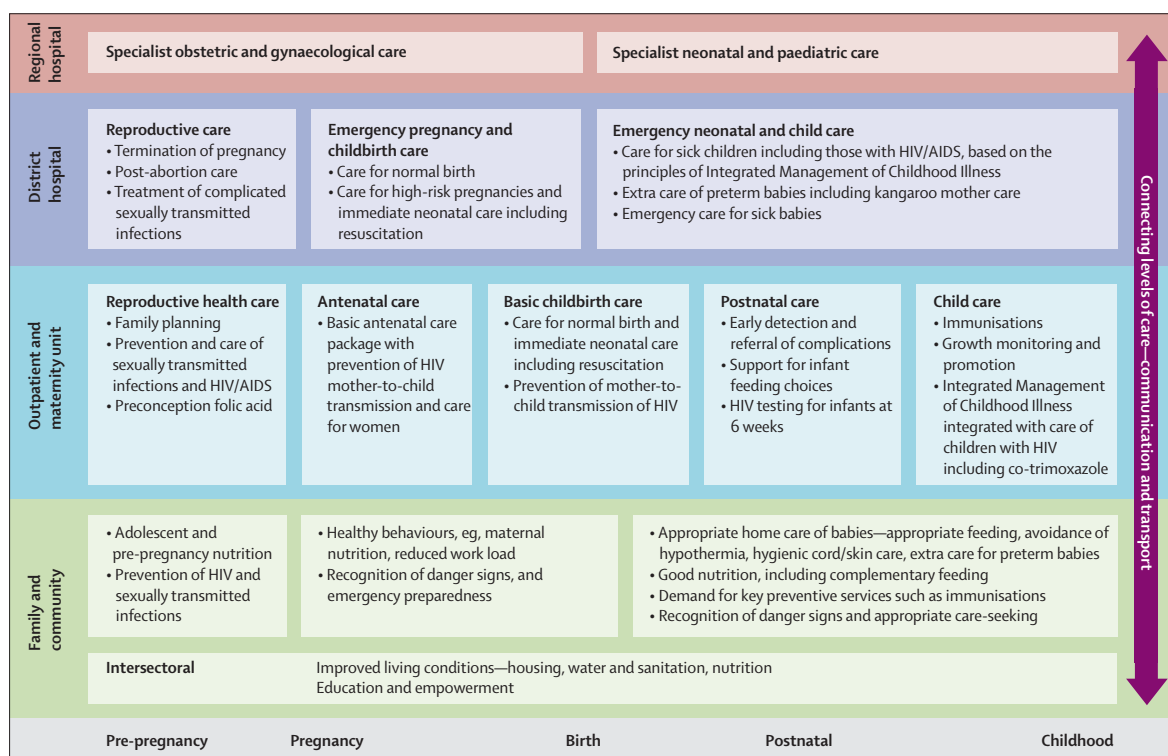


Figure 1: Integrated health-care packages for maternal, neonatal, and child health according to level of the health system in South Africa

The highest tier is regional hospitals, which have specialists, and tertiary hospitals, which have sub-specialists; these provide comprehensive obstetric and paediatric services. Referral systems are mostly suboptimum, and many patients bypass lower levels and access higher levels of care. Thus, regional and tertiary services provide a high proportion of care that could be more appropriately provided by district hospitals.

Overall access to basic packages of care is good: 84% of women give birth in a health facility: 17% of these births are at clinics, 42% at district hospitals, 30% at regional hospitals, and 11% at tertiary hospitals. In all levels of facilities there is an acute shortage of beds, and women are routinely discharged 6 h after delivery if they are assessed as being well; after caesarean section, women are routinely discharged on the third day.

Avoidable maternal, neonatal and child deaths in South Africa

The perpetuation of poverty and poor environmental conditions especially in rural areas and sprawling periurban townships partly explains the poor progress in reducing mortality rates. HIV/AIDS and its rapid spread is another obvious factor in the increase in maternal and infant mortality.¹ South African life expectancy would be in line with that of other countries with similar economic development if the excess mortality attributed to HIV/AIDS was removed.¹⁶ The maternal mortality rate for HIV-negative women is 34 per 100 000 livebirths, similar

to middle-income countries such as Brazil, Argentina, and Thailand. The maternal mortality rate for HIV-infected women is almost ten times higher.¹⁴ However, the spread of HIV was predicted for many years before its arrival in South Africa.¹ The almost unabated spread can be largely attributed to weak political leadership, underlying social dislocation and inequality, and an uneven and fragmented health system. These are the same underlying reasons for the persistently high proportions of maternal, neonatal, and child deaths with avoidable causes.

Information on the direct causes of mortality as well as the underlying and avoidable factors is crucial in reducing numbers of deaths. For mothers, although direct obstetric causes account for almost half of all deaths, about 44% are attributed to non-pregnancy-related infections, primarily HIV/AIDS (table 1). Hence to decrease the numbers of maternal deaths, the top priorities are HIV prevention and care and improvement of obstetric care. Given the overwhelming effect of HIV on child deaths, the top priority for child survival is clearly the prevention of HIV in children. The second priority is to address neonatal deaths, which account for a third of child deaths.

Nationally, the introduction of mortality audit processes that use routine health data in South Africa has been crucial for elucidation of the gap between health-service inputs and outcomes. These audits now cover the majority of maternal deaths and an increasing proportion of

neonatal and infant deaths.¹¹ Across the national reports, there are three broad sets of modifiable causes of mortality—poor-quality clinical care, administrative shortcomings, and avoidable factors within the community (table 1).

In the latest *Saving Mothers Report*,¹⁷ the assessors stated that 38% of the maternal deaths that occurred

within the health-care system were clearly avoidable. Most were direct failures in obstetric care, such as management of postpartum haemorrhage, complications of hypertension, and sepsis. In the latest *Saving Babies Report*,¹⁸ which now covers 39·5% of all deliveries in institutions, 44% of neonatal deaths due to intrapartum asphyxia were classed as probably avoidable,

Panel 1: Inputs and basis for modelling lives saved with increasing coverage of interventions

Basis of the modelling

The Lives Saved Tool (LiST) gives a menu of interventions loaded with current national coverage estimates. The user then sets coverage targets for each intervention by year up to 2015. The increases in coverage are linked to specific cause-specific mortality effect estimates resulting in estimates of lives saved by intervention and cause of death per year for that country.

LiST is a new module in the Spectrum software. Many of the interventions to reduce maternal mortality and stillbirths are already included, but the output estimates for maternal lives saved and stillbirths averted are not yet available because modules for cause of death and intervention reviews of cause-specific mortality effect size have not been completed. A linked cost module is also being developed. The tool has been designed for use at country and district level by policy makers, planners, and managers in low-income and middle-income countries, and by partner organisations (non-governmental organisations, multilateral and bilateral). The current format is in English, but the final version and training materials will be available in French, English, and Spanish.

Spectrum is a widely used, free demographic software package based on a demographic projection model called DemProj, developed and refined over the past 20 years and projecting the population by age and sex based on United Nations estimates. The software was originally designed to model the effect of family-planning interventions and works on a country by country dataset. Several years ago a module was developed with UNAIDS and added to include lives saved and cost of AIDS interventions and teams have been trained in over 150 countries.²⁶

Mortality inputs

We used numbers based on South Africa's current national estimates of births and most recent mortality rate estimates (table 1). Causes of death were based on the current estimated causes of death for neonates and children under 5 years (table 1), noting that almost a third of deaths before the age of 5 years are neonatal and that after the neonatal period, more than 80% of deaths after the first month are in children with HIV.

Mortality effect size due to each intervention

LiST displays a wide range of maternal, neonatal, and child health interventions, included on the basis of the strength of recommendation from application of the GRADE criteria. The mortality effect estimates are based on a consistent review process that uses an adapted version of GRADE²⁷ to review the level of evidence. In some cases there are many high-quality studies (eg, antenatal steroids). For others (eg, caesarean section) the evidence is of low quality because randomisation to placebo would be considered unethical, but these standard interventions receive a strong recommendation on the basis of GRADE and are included.

Current coverage of interventions

Coverage data are available for many interventions for most populous low-income and middle-income countries through Demographic and Health Surveys. However, for some interventions, comparable data are lacking (eg, caesarean section coverage, or neonatal resuscitation). Where possible for these estimates the latest South African coverage data were used (eg, for kangaroo mother care).

Combination of interventions, estimates of overall effect size

The estimates of lives saved are modelled such that lives cannot be saved twice. For example, pneumonia could be prevented by pneumococcal vaccine or by case management with antibiotics and the lives saved for each cannot simply be added. The details of these methods have been published previously.²³⁻²⁵

In addition a cohort-based approach is used so that if a death is averted in the neonatal period, that baby is then at risk of dying in infancy from other causes of death. The software allows output to be displayed as tables or graphically, and can be by mortality rate change over time (eg, to 2015), or by numbers of deaths averted (eg, by intervention or by cause of death).

Limitations

All modelled estimates have uncertainty. There are uncertainties around all the data inputs in LiST—the numbers of deaths, causes of death, mortality effect estimates, and the coverage data. Certain interventions for which coverage is already high will not result in many lives saved and this discrepancy may be misunderstood: for example, immunisation coverage is high in South Africa so very few lives would be saved by increasing from over 90% to our target of 95% coverage. However, if investment stopped and coverage fell, mortality would rise. This effect can also be modelled in LiST to ensure that misunderstandings do not arise.

For the LiST users' manual see <http://www.policyproject.com/softwareDownload.cfm?name=Spectrum&file=CSManual.pdf&site=Policy>

For the Spectrum software see <http://www.policyproject.com/software.cfm>

with the most common management errors related to poor monitoring or interpretation of the fetal heart rate and management of the second stage of labour. The avoidable perinatal mortality rate related to health-care providers was calculated as 7.04 per 1000 births in district hospitals, compared with 0.69 per 1000 births in community health centres, 5.69 per 1000 births in regional hospitals, and 4.5 per 1000 births in tertiary hospitals. Deaths due to intrapartum asphyxia and birth trauma were the most common probably avoidable perinatal deaths with an estimated 1180 per year being regarded as clearly avoidable had the health-care provider acted differently at district hospitals. The probable avoidable mortality rate due to administrative problems was again highest in district hospitals (4.29 per 1000 births compared with 0.3 per 1000 births in community health centres, 2.55 per 1000 births in regional hospitals, and 2.1 per 1000 births in tertiary hospitals).

Despite the pivotal role of district hospitals, they receive very limited outreach support from the regional hospitals, mainly because the latter are overstretched by their clinical work load. Although guidelines have been developed and training packages are available, their implementation is not monitored.

About a quarter of deaths were attributed to avoidable factors at family levels, such as delays in recognising danger signs and in seeking care.¹⁹ This finding has led to calls for greater education of mothers and families. Although this approach might be important, more detailed community follow-up of deaths shows a more nuanced situation. For example, recent community assessments of maternal and child deaths found that although the immediate cause of many deaths was related to delays in seeking care or in finding transport for the acute episode, carers had made visits to the formal health sector seeking care before the terminal event. A combination of suboptimum clinical care, lack of appropriate advice, perceived rudeness from the health-care provider, and the lack of authority of many young mothers to make direct decisions resulted in delayed care seeking as the illness progressed.^{20–22}

Potential for lives saved with existing care

Better coverage and quality of existing packages of care would translate into substantial reductions in mortality, yet no analysis to date has quantified this effect. We used the Lives Saved Tool (LiST) to estimate the number of neonatal and child lives that could be saved. The detailed technological basis (panel 1) has been described previously.^{23–25} More details are provided in the webappendix (pp 1–2). Table 2 shows that 11 500 neonatal deaths could be prevented each year if existing interventions were effectively and consistently implemented to cover 95% of mothers and newborn babies. This estimate does not even include moderately advanced interventions, such as continuous positive airways

	Lives saved
Neonatal	
Antenatal care plus periconceptional folic acid supplementation or fortification*	700
Childbirth care including full obstetric package (eg, pre-eclampsia treatment, intrapartum care) plus antenatal steroids for preterm labour and neonatal resuscitation	4300
Postnatal care and support for appropriate feeding, early care-seeking for illness	2600
Care for sick babies and kangaroo mother care for preterm babies†	3900
Total	11 500
Children	
PMTCT of HIV by dual therapy at 95% coverage, exclusive breastfeeding at 50%, exclusive replacement feeding at 40%, and mixed feeding at 10%	37 200
Total	48 700

Neonatal=day 0 to 28. Child here means from day 28 to 5 years. Estimates generated by LiST modelling; packages reducing neonatal mortality in many cases also reduce maternal deaths and stillbirths but the output for these lives saved is not yet available in this model. *Not including effect on HIV prevention, although same service delivery mechanism. †Not including continuous positive airways pressure, only basic neonatal care with oxygen, antibiotics, and so on.

Table 2: Estimated neonatal and children's lives saved in 2015 if all existing packages and interventions achieved linear increases in coverage from 2008 to 2015 and reached 95% coverage

pressure ventilation for preterm babies with respiratory distress, that are already used in South Africa. The interventions with highest impact are intrapartum care, including the full obstetric care package, as well as antenatal steroids for preterm birth, care of sick newborn babies, kangaroo mother care, and routine postnatal care. Scale-up of PMTCT along with improved infant feeding would save around 37 200 children's lives each year. The only intervention for which we did not set a target of 95% was appropriate exclusive feeding in the context of HIV infection, because it is particularly challenging to achieve. Preventive child care and case management of other childhood illness are important, but in this case the analysis of lives saved shows lower impact because coverage of preventive care is already high. The incremental lives saved, for example, in going from 83% coverage for measles immunisation to 95% is low, although the public-health importance is still high. Additionally, most deaths of children are during the neonatal period or are HIV related, and less than 10% are due directly to diarrhoea or pneumonia. However, sustained high levels of effective coverage of preventive care and case management will be essential as the HIV interventions are scaled up.

The lives of almost 50 000 newborn babies and children could be saved in 2015 if South Africa reached high, effective coverage especially of PMTCT and neonatal care. This achievement would put South Africa right on target to meet MDG 4. Interventions also included will have a major effect on maternal deaths and also stillbirths; on the basis of global estimates, at least two-thirds of direct obstetric deaths could be prevented by high coverage of the same obstetric care packages that are included in the estimates of neonatal lives saved.²⁸ Other interventions, such as providing antiretroviral treatment for eligible pregnant women, will also have a substantial

See Online for webappendix

effect on maternal mortality. Interventions for women with HIV infection should be aimed at improving the woman's own health, not just the childhood outcomes.²⁹

What will it cost to improve coverage?

The cost of increasing the coverage and quality of existing packages for care of mothers, babies, and children has never been calculated for South Africa. We estimated the total cost of achieving 95% population coverage for the essential packages of care and prevention (see webappendix pp 3–4). The packages cover the majority of causes of mortality and morbidity for women, neonates, and children. The incremental cost of implementing the packages at primary-care level was calculated. Data for actual use at the hospital level were not available, so we could not calculate incremental cost for hospitals. Since primary health care accounts for 96% of total contacts (defined as consultations and admissions), this level of care is pivotal to the influence of the packages.

Methods for economic modelling

For each component of each package, clinical assumptions and protocols were identified. This process set the following variables: prevalence or incidence of each condition, proportion of patients treated at each level of care, number of ambulatory visits per case per level of care, proportion of patients admitted and length of stay at each level of care, categories of clinical staff, and drugs and laboratory tests required. Staff time requirement consisted of time per consultation, immediate management (eg, delivery, surgery, haemorrhage), and inpatient-day. A top-up of 10% on clinical staff cost was agreed to reflect greater training and supervision needs. We calculated the cost of non-clinical staff (support staff as well as management and administrative staff) by applying the ratio of cost other staff to clinical staff observed in the province of the Western Cape; we used this province as a reference since it has the highest spending per head on health, hence is likely to be closer to target resource amounts. The total time required was translated into full-time equivalent after time off for holidays, sick leave, meetings, and non-contact time had been included. Actual public-sector salary scales were applied. Drugs and laboratory prices reflected actual national tender prices. Beyond these variables, information for other categories of cost (medical supplies, equipment, overheads ratios) was extrapolated from actual cost data of the Western Cape. To avoid double counting, we calculated consultations and inpatient days in addition to those covered in other parts of the package. We did not include initial investments such as building of new facilities because in most cases for South Africa this is not the major gap.

To calculate incremental cost at primary health-care level, we calculated the cost of filling the gap between current and target coverage by comparing the actual

number of visits to primary health care for children younger than 5 years and for maternal and reproductive health with the target number estimated to be needed for each condition. Since some visits for children under 5 years old are for conditions not defined as high priority (eg, minor upper respiratory tract infections) in the selected health packages, the number of visits was reduced by 10%. Utilisation data for hospitals are of very poor quality, so we were unable to calculate the incremental costs at the hospital levels. An Excel-based model was constructed to conduct the analysis.

Results for economic modelling

We estimate the total cost of the target package would amount to R15.7 billion (US\$1.57 billion) or 24% of the public-sector health expenditure. To calculate the extra or incremental cost to what is already provided, we estimated that an extra 9.4 million visits would be needed to move from the present coverage to the target 95% coverage. To cover this gap at the primary-care level will cost an extra R1.6 billion (\$160 million) or 2.4% of total public-sector health expenditure. To this must be added R722 million (\$72 million) planned in the next budget for the addition of the pneumococcal and rotavirus vaccines. About 61% of the additional cost (with new vaccines excluded) is required for staff, 22% for drugs, 5% for laboratory tests, and 12% for overheads. Our costing does not include community-based services, the cost of redistributing staff to under-served rural areas, and the costs of improving quality of care. It is therefore likely to underestimate the true cost.

We estimate that with the present scope of practice 189 additional medical officers, 2445 professional nurses, 250 enrolled nurses, and 134 enrolled nurse assistants are needed. Most of the shortfall is in primary care followed by district hospitals (figure 2). The shortage of medical officers and professional nurses in particular dictates an incremental approach towards scaling up, perhaps with priority for certain key packages. It also suggests the need to accelerate introduction of mid-level workers who can take on some of the tasks of doctors and nurses. Mozambique, Tanzania, and Malawi have all benefited from delegation of caesarean sections to trained and supervised midwives or medical assistants; the cost is lower and retention is much higher.^{30,31}

Improving effective coverage

Even where the use of maternal, neonatal, and child health packages is generally high in South Africa, evaluations have consistently shown that within each package the high-impact interventions are not being applied or are used suboptimally. For example, even though more than 90% of women complete at least one antenatal visit, only about 11% received the full set of interventions required in a recent survey.³² The quality gap between contact with the client and provision of effective care is especially important in diluting the effectiveness of more complex

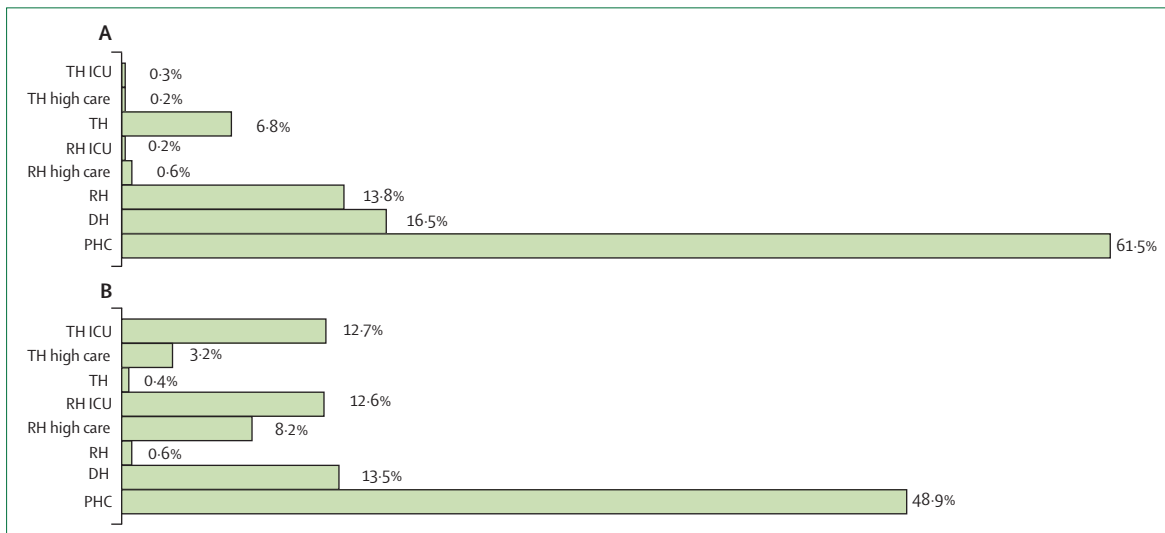


Figure 2: Estimated share of cost of reaching 95% of the uninsured population in South Africa with essential maternal, neonatal, and child health services per level of care per group of patients

(A) Distribution of costs for women. (B) Distribution of costs for infants and children under 5 years. TH=tertiary hospital. ICU=intensive care unit. RH=regional hospital. DH=district hospital. PHC=primary health care.

interventions such as PMTCT.³³ Large-scale investment in the employment of thousands of HIV counsellors in antenatal clinics has increased the coverage of HIV testing to almost 70% of pregnant women, but only about 60% of the women identified as HIV infected and 45% of their babies received nevirapine.¹⁰

The situation for babies and children shows a similar cascade of decreasing care with time. Despite the high coverage of institutional delivery and immunisation, there are important missed opportunities in relation to some important child survival interventions. Coverage of postnatal care is not routinely measured but is estimated to be less than 10%.¹¹ This postnatal care gap must be filled, particularly in the first few days after birth because this period is the time of highest mortality for mothers³⁴ and babies,³⁵ and it is also the key moment for effective support for feeding choices related to PMTCT of HIV. Women are discharged rapidly from the place they give birth with the expectation that they will be seen in 3 days. The clinics to which this responsibility has been devolved do not have the staff to do home visits, nor is there a communication system that lets them know a woman from their clinic has given birth. An apparently simple measure of keeping the woman at the delivery site would entail substantial health system changes. In the clinics, new provisions for feeding would be needed. In hospitals, the extra time would have the effect of more women being referred away because the facilities are full or result in over-full facilities with more women cared for in makeshift conditions such as floor beds. Extending the stay of women after delivery is an option but will need to be carefully evaluated in light of these constraints. Another option currently being assessed is to make use of community health workers to visit women and their babies postnatally, provided an effective

communication method can be found between the delivery site and the clinics.

The rate of exclusive breastfeeding until 6 months of age remains below 10%, which is the third lowest in Africa after Djibouti and Chad.³⁶ This low rate partly reflects the domino effect of messages about HIV and breastfeeding, but it is also due to lost ground on breastfeeding promotion—for example, several South African hospitals have recently lost their Baby Friendly Hospital status—and to inadequate controls on the baby milk industry. South Africa has not legally applied a marketing code for breastmilk substitutes. Additionally, despite high rates of subclinical vitamin A deficiency, only 40% of infants have received vitamin A supplementation in the previous 6 months.¹⁵ Furthermore, the proportion of HIV-exposed babies receiving extremely cost-effective interventions such as co-trimoxazole prophylaxis or being screened for HIV infection remains very low.³⁷

Lessons from HIV/AIDS and PMTCT

South Africa has the potential to save a substantial number of mothers' and children's lives and, although there are some critical shortages of staff and resources especially in the poorest rural areas—the challenge is to improve the quality and productivity of existing resources. HIV/AIDS is the most important cause of the excess maternal and infant deaths in South Africa, and scaling up HIV interventions for women and children is a priority. The rapid scale-up of the HIV treatment programme has shown that substantial improvements in coverage can be achieved with high quality care.¹ Table 3 compares some of the features required for an effective health system, showing the status of these for HIV/AIDS and for maternal, neonatal, and child health.

	Maternal, neonatal, and child health care	HIV/AIDS care
Status and progress		
Current coverage and quality	High apart from postnatal care, specific interventions not being delivered within each package (eg, syphilis in antenatal care), and low quality of care (eg, use of partograph, inadequate fetal monitoring) Falling coverage along the continuum of care (eg, antenatal to intrapartum to postnatal)	Increasing rapidly for adult antiretroviral treatment and PMTCT, but PMTCT affected by lack of postnatal care package Falling coverage along the continuum of care (eg, antenatal to intrapartum to postnatal)
Components of a functional health-system response		
Policies	Comprehensive package of services now articulated	National Strategic Plan has widespread support and is very comprehensive Policy of free care for the poorest
Funding	Policy not fully costed and no ring-fenced funding available	More systematic costing data and ring-fenced funding available for HIV treatment
Access	Policy of free care for the poorest, but no specific strategies to reach them	Policy of free care for the poorest, but no specific strategies to reach them
Drugs and equipment	Essential Drugs List developed for MNCH Sporadic monitoring of availability Equipment lists developed, but poor support for correct use and maintenance of equipment	Unified national drug protocol Separate tendering and procurement systems Better monitoring of supply systems
Human resource management	No formal assessment of human resources needs to improve coverage Well-developed pre-service training and formal in-service courses, but ad hoc implementation of in-service training	Better planning and recruitment including new cadres of workers Large backlog of training but specific resources allocated for training and accreditation
Supervision and accountability	Integrated into wider primary care supervisory systems Poor operational planning Specific supervisory tools but little training or motivation for use Performance not often reported widely	Multiple separate supervisory systems for HIV Stronger operational planning Wider reporting of performance and coverage progress
Implementation management and use for data for decision making	Weak management capacity and coordination Poor information systems and lack of clear M&E system Poor-quality data in DHIS, and no tracking at all of some key packages (eg, postnatal care)	Relatively strong management capacity Multitude of M&E systems and large amounts of data collection, but not always coordinated, sometimes conflicting results in different data systems
Community and civil society involvement	Good community linkages to provide access for child support grants No systematic process for behaviour change messages for priority MNCH issues (eg, appropriate feeding, recognition of danger signs) Limited civil society advocacy to date	Very active in advocating and monitoring service delivery especially HIV treatment Prevention messages more patchy and less systematic than access to care messages
MNCH=maternal, neonatal, and child health. M&E=monitoring and evaluation. DHIS=District Health Information System.		

Table 3: Components for health-system functioning comparing maternal, neonatal, and child-health care and HIV/AIDS care

In summary, the mobilisation and involvement of civil society has raised the profile of the coverage gap for HIV treatment and made managers and politicians accountable for the pace of delivery. The result has been substantial resources, much of which is ring-fenced, the employment of new cadres of specific workers, and widespread adoption of effective drug regimens. By contrast, the introduction and implementation of the PMTCT programme exemplifies the challenges for improving maternal, neonatal, and child health services. South Africa bears the greatest burden of mother-to-child transmission of any country.³⁸ About 300 000 HIV-infected mothers give birth to infants each year in South Africa and, despite a national programme launched in 2000 to provide single-dose nevirapine to HIV-infected women in labour and to their infants postnatally, in the largest province 7·2% of all 6-week-old infants attending for their first immunisation were already HIV infected.³⁹ The lack of a comprehensive policy framework that included PMTCT resulted in delays in extending the programme to all clinics and hospitals even though sites

were asking for the drugs and counsellors to enable implementation. The appointment of thousands of non-professional HIV counsellors facilitated acceleration of the coverage of PMTCT but the lack of integration into other maternal, neonatal, and child health activities continued to undermine the effectiveness of the programme.^{37,40}

The programme has also suffered from a lack of leadership. Despite a Constitutional Court ruling that the Minister of Health must make PMTCT available everywhere, the processes necessary to make this possible were delayed. PMTCT has begun to change from a vertical programme to an integrated service within maternal, neonatal, and child health. However, as with other countries in the region, the legacy of a vertical response has created many conflicts that will be difficult to resolve. Strategic decisions on protocols, budgets, and monitoring are taken largely within the national HIV department but implemented through maternal, child, and women's health directorate. At provincial and district level PMTCT coordinators do not have dedicated staff at

Panel 2: Improving quality of care through mentor teams and motivational strategies—South African examples for maternal, neonatal, and child health care

Health Workers for Change: an application for maternal health care

Health Workers for Change, a change management tool, is effective in identifying health-system inefficiencies, building empathy between provider and client, and improving motivation of health workers, and when in the hands of competent district management teams to improve health-systems performance.⁵² This intervention involves a series of workshops with providers that identify barriers to high-quality care and the actions required to resolve the barriers. The application has been used in several primary-care services across Africa, and in tertiary maternal-health services it has improved responsiveness of providers and availability of drugs and reduced bribery. It also improved teamwork, implementation of action plans staff had proposed, and frequency of staff meetings, and led to more rational drug ordering.^{53,54} One district in South Africa used Health Workers for Change and improved supervision to address low quality of maternal care. Measured improvements included the proportion of antenatal cards being correctly and completely completed (syphilis testing improved from 74% to 92% of charts reviewed; $p=0.007$) and improvement in partograph use (recording of dilatation of the cervix improved from 35% to 55%; $p=0.005$). Improvements in staff attitudes and behaviours were also documented.⁵⁵

A mentor team approach to improve PMTCT in Western Cape province

The Western Cape province was the first to achieve the target of all its antenatal clinics offering PMTCT services. Coverage of HIV testing has reached 93%, and around 75% of eligible women are receiving dual antiretroviral therapy.¹⁰ Routine data and independent research report transmission rates well below 10% 6 weeks postnatally.⁵⁶ The rapid scale-up of the programme has been driven by the development, dissemination, and training around a set of integrated clinical guidelines accompanied by supervisory tools, simplified management preparation checklist, and specific budget line items for specific inputs. The process was actively pushed and monitored by a senior management committee established at provincial level that met regularly to solve problems and provide specific technical support and mentoring to the district coordinators. Four regional HIV coordinators are given control of the budget, and they convene separate regional meetings to monitor implementation. This approach has accelerated the development of functional district health management teams that are now taking increasing responsibility and accountability for service delivery.

Limpopo Integrated Newborn Care

The Limpopo Initiative for Newborn Care was established in 2002 with the aim of improving neonatal care in the province. Norms and standards for hospital neonatal facilities and equipment were developed and used to guide renovations and procurement. Clinical guidelines and policies, a standard clinical record and tools for audit and monitoring were developed. A training programme was developed to address the knowledge and skills gaps of doctors, midwives, and enrolled nurses. For a week of each month a clinician and midwife visit hospitals in Limpopo providing guidance to the neonatal teams on site, checking facilities and equipment and neonatal care, and giving in-service training and mentoring. They also supervise continuous mortality audit. Hospitals are inspected intermittently and accredited for their achievements in improving neonatal care. Simultaneously the initiative has worked with the four regional hospitals to provide referral care.

There has been a sustained improvement in neonatal care standards in the province. Routine data for 2003–05 from 27 facilities for which complete data are available showed a 17% reduction in early neonatal deaths from 12 to 10 per 1000 births and a 15% reduction in deaths among babies weighing less than 2 kg. 12 hospitals have achieved accreditation for good neonatal care. Important key success strategies have been involvement of management and administrative staff as well as clinicians; developing problem-based training and involving enrolled nurses in daily care; and providing midwives with skill to provide good basic care when a doctor is not immediately available. To improve neonatal outcomes further, maternal care, especially during labour, needs attention.

clinics and hospitals but are reliant on maternal and child health supervisors and clinic teams to implement PMTCT-specific protocols. Messages to promote primary prevention and services that support pregnant women to remain negative are virtually non-existent and family-planning services remain generally inadequate and separate from other maternal, child, and women's health services. The processes to identify women and infants eligible for lifelong antiretroviral therapy and start treatment remain dysfunctional and represent huge missed opportunities to decrease maternal and infant deaths.

The history of PMTCT research in South Africa has been similarly chequered. Major studies on antiretroviral drug interventions^{41–43} and programme implementation have been conducted by South African investigators and contributed knowledge that has informed international guidelines. However, government responses for research have been ambiguous and on occasions

hostile. The Medicines Control Council has several times cast doubt on the safety of nevirapine.

What needs to be done to improve maternal, neonatal, and child health services?

Stronger leadership and greater local accountability will be crucial for improvements in coverage and quality especially in primary care and district hospitals. A strategy that re-energises and motivates health workers is a priority. The physical expansion of primary-care facilities and the removal of user fees was accompanied by an increase in the number and sophistication of services that a diminishing number of health workers were expected to deliver.⁴⁴ Until very recently most of these new interventions, even within maternal, child health, and nutrition services, were not introduced in an integrated way. As a result, neither primary-care nurses nor their supervisors have an understanding of how to deliver comprehensive services.⁴⁵ Reports and obser-

	Policy makers	Health managers	Health-care providers	Training institutions
Invest	Invest in a cohesive HIV/AIDS and MNCH strategy benchmarked on high-quality coverage and reduced mortality	Invest in conducting situational assessment of current MNCH programme implementation	Invest time in maintaining competency in correct assessment and treatment of high risk conditions for mothers, babies, and children	Review pre-service and in service training to prioritise high-impact care and consider delegation of tasks where appropriate
Implement	Provide financial resources for full coverage; encourage production and employment of mid-level workers	Ensure full implementation of HIV/AIDS and MNCH strategy	Take every opportunity to encourage all patients to test for HIV infection and follow through with appropriate care	Ensure that licensed health-care providers are competent in key life-saving practices and also in respect for clients
Improve quality	Systematically promote supportive supervision and mentor teams and accreditation systems in all provinces with linkages between key service delivery packages (MNCH, HIV)	Ensure quality improvement interventions at all levels of the system; encourage sharing of good practices and implement systems of performance appraisal, and mentor schemes	Institute and sustain effective supervision systems, and promote and practice accountability for health outcomes	Update curriculum to include IMCI and HIV as well as evidence-based maternal and neonatal care; provide health-care staff with training in use of and response to audit as a quality improvement tool
Reduce inequity	Start with the districts with highest mortality and the periurban poor	Monitor access and quality of programmes across different populations	Promote a welcoming atmosphere for all women, babies and children using services	Investigate effectiveness of strategies to increase retention of graduates in public sector and to serve in rural settings
Increase data for action	Encourage data management, monitoring and evaluation, and programme directorates to collaborate more closely	Encourage use of data to monitor and improve performance of health facilities and districts and make data publicly available, such as through accreditation programmes	Undertake regular mortality audit and standards based audit and use the data for local quality improvement	Improve monitoring of human resources distribution and performance post-training
Intersectoral action and empower families	Establish high-level MNCH intersectoral action teams; outline coherent community-based intervention strategy; develop and promote an agreed set of family health messages particularly recognition of danger signs, and information regarding the care that every family has a right to receive	Ensure families can access the right care at the right time by improving referral protocols and transport systems, linking to community empowerment programmes to increase demand for care	Collaborate with community non-governmental organisations and community health worker programmes to ensure that the agreed family health messages are consistently promoted	Ensure health-care providers are able to counsel, maintain confidentiality, and be respectful of their patients

MNCH=maternal, neonatal, and child health. IMCI=Integrated Management of Childhood Illness. Adapted from Every Death Counts Report, 2008.¹³

Table 4: Actions to take to save the lives of mothers, neonates, and children in South Africa

vations of rude and sometimes abusive behaviour by health workers, especially in the maternal setting, are widespread,^{46–48} and this behaviour is probably linked to the reported findings from health workers of lack of motivation and demoralisation.⁴⁹ However, there is little rigorous evidence as to what is required to change such attitudes and behaviours.^{50,51} Examples of three large-scale improvements in service delivery for maternal, neonatal, and child health in South Africa are shown in panel 2.

The challenge for these programmes is now to sustain the mentor teams and build a culture of using data to improve care.⁴⁰ Health service reviews of maternal, neonatal, and child health services have consistently found separate data collection registers, separate cadres of staff, different service days, and patient-held records for maternal and child health services and even for interventions within these groups.⁵⁷ In the long term, the training curriculum for all health personnel graduates must include monitoring and evaluation skills. Problem-based learning and use of simulation as teaching tools have already been tested locally and internationally⁵⁸ and the South African health professional councils must take responsibility to ensure that curriculum reform geared to improving health outcomes is implemented.

Finally, the scaling up of HIV treatment programmes has highlighted the crucial role of civil society in increasing demand for quality services. The adoption of

similar strategies such as mobilising communities to identify and demand appropriate services; increase the capacity of clients to monitor services and highlight shortcomings; and judicious use of legal redress to uphold the rights of women and children is also recommended for maternal, neonatal, and child health. The broader challenges of shifting from vertical to integrated programmes and developing the district health system are taken up in the final paper of this Series.⁵⁹

Conclusion

Poor women and children bore the brunt of the injustices of the apartheid regime. Our analysis shows that maternal, neonatal, and child health services still fail them and that an estimated total of 76 600 women, neonates, and children die unnecessarily every year. This report has identified key gaps in quality and coverage, drawn up an agreed set of known intervention packages to cover the gaps, calculated the impact of that on lives saved, and calculated how much the packages would cost to scale up. There are limitations to our analysis: the lack of models for effect of maternal interventions has not allowed us to estimate the number of maternal deaths saved; the poor quality of data has limited the costing to conditions seen in primary care. However, even with the existing analysis we have found that not only can many lives be saved but also at relatively little cost.

The first 14 years has seen the building of primary health-care infrastructure and the establishment of a unitary district-based health system. Leadership and advocacy to make the health of women and children a priority and strengthening the capacity of health workers by instilling simple but effective quality improvement approaches as routine practice have the potential to get South Africa on track to achieve the MDGs. Some of the actions to be taken by key groups were defined in a report compiled by the three maternal, neonatal, and child health mortality audit groups and the national Department of Health. These actions have been updated now to crosslink further with HIV/AIDS, chronic disease, and the overall gain from integrated action (table 4).

The actions required are affordable, possible, and sustainable for South Africa. Since our future lies in healthy women and children, can we afford not to undertake them?

Contributors

The economic modelling was undertaken by ED with review of assumptions by all the team. The LiST modelling was undertaken by JL. The first draft of this paper was prepared by MC and JL with review and inputs by all the other authors.

Conflicts of interest

We declare that we have no conflicts of interest.

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