Setting Priorities for Safe Motherhood Interventions in Resource Scarce Settings

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Abstract

This study aims to guide policy-makers in prioritizing the different components of safe motherhood programs. We compile existing data on effectiveness of safe motherhood interventions and cost these interventions using the WHO's Mother Baby Package (MBP) Costing Spreadsheet. First we compare the cost-effectiveness of the 18 interventions included in the MBP as well as safe abortion in a low, medium, and high infrastructure setting in sub-Saharan Africa. Second, we perform a budgetary simulation of the three model settings assuming per capita maternal health expenditures of $0.50, $1.00, and $1.50 respectively. Finally, we conduct a multivariate sensitivity analysis to assess the contribution to variance of different interventions. Results show that family planning and safe abortion, antenatal care, postpartum hemorrhage and sepsis, are more cost effective that safe delivery and eclampsia interventions. Safe motherhood interventions save a significant amount of newborn lives. A dollar spent on resource scarce settings saves more lives than in higher resource settings.

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Introduction

The Safe Motherhood Initiative, jointly launched by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank, and other organizations, brought maternal and child health to the forefront of public health concerns. Among other goals, this initiative aims to reduce maternal mortality by 75% between 1990 and 2015. However, it has been widely documented that desired improvements in maternal health have not been achieved despite this increased attention and commitment to safe motherhood. Countries in sub-Saharan Africa, in particular, experienced on average no change in the percentage of deliveries assisted by a skilled attendant between 1989 and 1999 (AbouZahr and Wardlaw 2001) and show no signs of achieving the scheduled reductions in maternal mortality (Koblinsky 2003).

There are several reasons for this lack of success in improving maternal health, but three stand out. First, there is a lack of evidence on the relative effectiveness of safe motherhood interventions in terms of their impact on maternal and neonatal mortality, particularly for those interventions that prevent and treat common causes of these deaths in developing countries. For example, important questions regarding the primary prevention, detection, and treatment of anemia and hypertensive disorders of pregnancy remain unanswered (Carroli, Rooney et al. 2001). Second, we have failed to implement known effective practices and subsequently improve coverage and quality of maternal health services (Villar, Carroli et al. 2001). Although complications of incomplete and unsafe abortions are a major cause of maternal death, a recent survey reported that less than 50% of health centers in 49 developing countries had the capacity to perform manual vacuum aspiration (Bulatao 2000). Finally, although the burden of mortality in developing countries accounts for the great majority of maternal and neonatal deaths worldwide, developing countries have scarce resources to attend to these problems and lack the information required to mobilize commitment to improving maternal health and effect policy making for this goal.

The Mother Baby Package (MBP) prescribes a set of interventions that are technically and economically feasible in developing countries. Devised by the WHO, the MBP consists of 18 basic interventions considered essential for decreasing maternal and neonatal mortality in resource poor settings (WHO 1994). The package describes simple, effective interventions needed before and during pregnancy, during delivery, and after delivery for the mother and the newborn.[2] It outlines what can be done to prevent and manage the major obstetric complications at different health care facility levels, and describes the most efficient use of available resources for these interventions. The MBP Costing Spreadsheet estimates the cost of implementing these interventions given local setting parameters and coverage goals. However, these tools do not adequately equip developing countries to maximize their investments in maternal health. A recent study estimated that it would cost $1.80 per capita to implement the Mother Baby Package standards in Uganda, compared to the $0.50 per capita spent at the time on maternal and newborn care (Weissman, Sentumbwe-Mugisa et al. 1999). Unless Uganda can apportion an additional $1.30 per capita for maternal health, it will need to prioritize the most cost-effective and high impact interventions.

Very little is known about the relative cost-effectiveness of maternal health interventions in developing countries. Jowett (2000) reviewed the evidence on cost-effectiveness of safe motherhood interventions, but due to incompatibility of outcome measures, was unable to compare the cost-effectiveness of various antenatal, obstetric, and abortion services.

This study attempts to guide policy-decision makers in prioritising the different components of safe motherhood programs in resource scarce settings. Here we bring together existing data on effectiveness of safe motherhood interventions and cost these interventions using the WHO's Mother Baby Package Costing Spreadsheet. First, we compare the cost-effectiveness (in terms of cost per death averted) of the basic interventions included in the WHO's Mother Baby Package as well as safe abortion in three model settings (low, medium, and high infrastructure settings) in

[2] Antenatal care according to standard WHO Mother-Baby Package consists of: at least 4 visits of at least 20 minutes each starting before the last trimester of pregnancy. Diagnostic tests include: hemoglobin, blood group, urine analysis and RPR syphilis test. Treatment entails: iron and folate supplements (60mg 3 time a day for 90 days; 2 tetanus vaccinations; treatment of malaria and hookworm. Normal delivery under the standard practice includes: hemoglobin, blood group and urine test before delivery; active management of third stage of labor; tetracycline eye ointment for the newborn; iron supplements 3x/ day for 14 days after delivery; and a routine postpartum check-up.

sub-Saharan Africa. Second, we perform a budgetary simulation for the three model settings, assuming per capita maternal health expenditures of $.50, $1.00, and $1.50 respectively. Finally, we perform a multivariate sensitivity analysis to assess the contribution to variance of the different interventions.

Data

Socio-demographic data and maternal health indicators were used from the latest available Demographic and Health Surveys (indicated where appropriate). Economic data used for each country was based on World Bank's World Development Indicators (World Bank 2004). Maternal health program effectiveness range was set according to two sources: from existing published estimates (Prendiville, Elbourne et al. 2000; Abalos, Duley et al. 2001; Magee and Duley 2003; McDonald, Brocklehurst et al. 2003; Mousa and Alfirevic 2003) and from the WHO's estimates included in the MBP (WHO 1999). Sources are described where appropriate. Cost data for interventions was estimated using the Mother Baby Package Costing Spreadsheet, except for the cost of providing abortion services, which was taken from the available published cost studies in Africa (King, Benson et al. 1998).

Construction of three model settings

Information from thirty-eight countries in sub-Saharan Africa was gathered to form LOW, MED, and HIGH settings (Annex 1). Countries were ordered according to per capita health expenditures and divided into thirds. Means and ranges for each third were estimated for each indicator included in the analysis (Annex 2).

Methods of Analysis

Cost estimation

All costs used in this analysis are direct costs. We use the Mother-Baby Package Costing Spreadsheet to estimate the costs of implementing the interventions contained in the package. All

cost estimations are based on MBP "standard" treatment. Socio-demographic and health data, as well as coverage rates of interventions, prevalence and incidence of complications and family planning method mix used in cost estimations are based on the profiles we established for the LOW, MED, and HIGH constructed settings (Annex 3).

We grouped under antenatal care all standard interventions proposed by the WHO, as well as the treatment of anemia and of sexually transmitted diseases (STDs). Cost estimates for treatment of neonatal complications and postpartum care are included under "Other" MBP interventions. Family planning and safe abortion are considered one intervention. The cost of providing safe abortion is added to the estimated family planning costs. Two methods are considered: manual vacuum aspiration (MVA) at $8.50 per client and dilation and curettage (D&C) at $78.81. Cost ranges per intervention reflect services provided at lower and higher level facilities, except for abortion services for which cost range is reflective of the type of procedure (MVA or D&C). For the three profile settings, the cost of drugs and other medical materials are presumed to be the same (given by the MBP). Salaries for health professionals are also assumed to be the same, except for LOW settings were we decreased salaries by 25%.

Effectiveness and cost-effectiveness estimation

For each intervention we estimate the cost per death averted and the number of potential deaths averted given a fixed budget available for each setting profile. For this analyses, we run Monte Carlo simulations with 10,000 trials for each intervention, using the established demographic and health profiles and underlying assumptions presented in Annex 3. We use Crystal Ball 2000 (2000), a stochastic modeling supplement for Excel, to run the simulations. Because each intervention (with the exception of family planning and safe abortion) has an estimated potential impact on newborn deaths, the estimates for the cost per death averted also include the newborn deaths averted. The estimates of potential impact of each intervention on newborn deaths are those used by the WHO, embedded in the MBP costing spreadsheet (Annex 4). We use information from AbouZahr (1998) to link causes of newborn deaths and maternal deaths.[3] In

[3] See Table 10, titled "How complications affect mother and baby." AbouZahr, C. (1998). Maternal Mortality Overview. Health Dimensions of Sex and Reproduction. C. J. Murray and A. D. Lopez. Cambridge, MA, Harvard University Press.

this way, newborn deaths averted due to birth injuries are attributed to obstructed labor; sepsis and meningitis to maternal sepsis; neonatal tetanus pneumonia and diarrhea to antenatal care; and birth asphyxia was proportionally distributed to postpartum hemorrhage and eclampsia. The cost of averting a death due to unsafe abortion assumes (for all settings) an abortion rate of 34 per 1,000 women aged 15-44 (AGI 1999). Although imperfect, the antenatal care intervention is linked to other direct and indirect causes of maternal death which represent 21%, and 27% of the total maternal deaths for LOW and MED and HIGH settings respectively. However, the estimates used for potential impact on deaths averted are from studies of specific interventions covered by antenatal care, such as malaria prophylaxis (Salihu, Naik et al. 2002), and iron supplementation (Cuervo and Mahomed 2001).

Optimization

To assess what combination of interventions would avert the greatest number of maternal deaths in low-resources settings, we run an optimization model that maximizes the number of deaths averted within a given budget constraint. The total budget for each setting is estimated based on per capita expenditures on maternal health of $0.50, $1.00, and $1.50 for LOW, MED, and HIGH settings respectively. Crystal Ball's *OptQuest* module was used to run 100 simulations with 10,000 trials per simulation. We perform sensitivity analysis on the results of each setting to test the robustness of the estimates to changes in underlying assumptions.

Results

All results are based on women serviced by the safe motherhood program. Tables 1 through 3 present program costs and effectiveness of six major maternal health interventions for LOW, MED, and HIGH settings respectively. As expected, the total cost of implementing maternal health programs varies according to the country profile setting. The cost of providing services in LOW settings is relatively lower, because of the smaller number of available facilities and the lower salaries of health professionals. MED and HIGH profile settings have the same cost per

client of providing services; differences in program costs reflect higher coverage rates for HIGH settings.

The profile settings have different maternal mortality ratios, so the expected number of annual maternal deaths differs. Each maternal health intervention presented in tables 1 through 3 can avert more newborn deaths than maternal deaths. In absolute numbers, overall implementation of the MBP saves more newborn than maternal lives.

Average cost and number of deaths averted by intervention

Figures 1 through 3 show the average cost and number of deaths averted for LOW, MED and HIGH settings respectively. Results in the figures assume available budget spent on each intervention separately. It is clear from the three figures that averting a maternal death, regardless of the intervention, costs less in low settings, and on average more deaths can be averted in low settings. Within each setting, safe delivery and eclampsia are the least cost-effective interventions. With the exception of antenatal care, safe delivery and eclampsia potentially avert fewer deaths than other interventions. It is interesting to note that when settings are compared, the three most cost effective interventions are the same (family planning and safe abortion, antenatal care, and sepsis). Within given budgets, the highest number of potential deaths can be averted by PPH intervention in all settings.

Results from the sensitivity analysis on the cost per death averted show that for unsafe abortion, the major contributors to the variance are the average cost per safe abortion and the percentage of women using family planning (64% and 35% respectively). For the cost per death averted due to antenatal care intervention, the percent using antenatal care contributes to 55% of the variance and the average cost per antenatal care patient contributes to 45% of the variance. For safe delivery, eclampsia and PPH, the percent of deliveries assisted by skilled personnel is the major contributor to the variance in the cost per death averted (more than 90%). In the cost per death averted due to sepsis, 23% of the variance is attributed to the cost of treating sepsis, while 75% is due to the percentage of assisted deliveries.

Maximizing expected deaths averted

Figure 4 shows the potential maternal deaths averted for each setting when all of the interventions are provided. Combining the interventions can potentially avert more deaths in low settings. Figures 5 through 7 show the contribution to variance in deaths averted for each setting. In all settings, the variance is mostly due to changes in the number of potential deaths averted by postpartum haemorrhage (60%, 68%, and 69% for LOW, MED and HIGH respectively). In other words, the variance depends on the impact (efficacy) of the postpartum haemorrhage intervention on maternal mortality. The difference between the settings is most obvious in the second most important contributor to the variance. Whereas for HIGH and MED settings the second most important contributor to the variance in deaths averted is the antenatal care program (accounting for 12%), for the LOW setting this variable is family planning and safe abortion (29%).

Table 4 presents results from the simulations using the optimization model. Implementing all of the maternal health interventions exceeds the available budget established for all three settings. By constraining the budget for each setting we expect to maximize the number of deaths averted by retaining or excluding some of the six interventions.

As shown in table 4, more than one combination of interventions can result in the same average number of maternal deaths averted. Program planers can thus select from a combination of interventions that best suits the local infrastructure and human resources capacity.

Discussion and Policy Implications

The present study has some limitations that need to be acknowledged. For costing interventions we rely mostly on the MBP costing spreadsheet. The prevalence and incidence of complications are based on reporting of women that survived. We also assume that interventions' efficacy are the same for all settings. As with all modeling exercises, the final results depend on the accuracy of the assumptions used. For this study, some assumptions relate to coverage rates and others to the potential impact of the interventions on maternal mortality. While coverage rates we used are within reach of countries that compose the three settings, it is unclear if every country can achieve the same efficacy of interventions. The efficacy and the costing of interventions used

assumes standards, a certain level of quality of care, and efficiency in service delivery. Moreover, efficacy rates are usually taken from relatively small and well-run studies, and for most of them we have very little evidence of impact on a population level.

Two of the three most cost-effective interventions are preventative, the third being part of obstetric care. One of the preventive cost-effective interventions is the provision of family planning and safe abortions. Maternal deaths due to unsafe abortion and program costs related to treatment of abortion complications could be reduced with the expansion of family planning programs. Increasing access to high quality contraceptive services would decrease unwanted pregnancies and would also prevent a large number of induced abortions (USAID 1996).

Antenatal care, the other preventive intervention contained in the MBP, is also cost-effective but saves fewer maternal lives. However, we recognize its importance in averting most of the newborn deaths, by treating and preventing underlying diseases such as malaria and hookworms, educating women about warning signs, possible complications and where to seek help. In addition, antennal care is associated with a higher probability of seeking trained assistance for delivery (Bloom, Lippeveld et al. 1999), which will impact maternal mortality. It would be imprudent, however, to spend a large portion of resources solely on antenatal care. Most of the complications that happen during delivery and shortly thereafter, cannot be predicted during antenatal care screening (Dayaratna 2000).

Sepsis is not only one of the three most cost-effective interventions; it is also the most cost-effective of the essential obstetric care interventions contained in the package. For LOW and MED settings, sepsis intervention is the second most important in terms of number of deaths averted (the first being PPH). It is highly correlated with trained assistance during delivery and unlike obstructed labor and eclampsia, sepsis intervention can be implemented regardless of the place of delivery and level of trained provider. The seven countries[4] that achieved substantial reductions in maternal mortality in the last decades had one common factor: access to a skilled attendant during delivery (Koblinsky 2003).

[4] countries are: Bolivia, China, Honduras, Malasia, Zimbabwe, Egypt and Jamaica

Postpartum hemorrhage (PPH) causes most deaths, therefore a cost-effective treatment intervention would avert most deaths. The MBP PPH costs are based on treatment with oxytocine that are relatively high . Since the MBP was devised, data has accumulated that misoprostol is an effective uterotonic (Çaliskan et al, 2003; Oboro & Tabowei, 2003; Goldberg et al, 2001; Blanchard, 2002; Mategrano, 2001). It can be easily administered orally, rectally, vaginally or sublingually, and does not require syringes or intravenous (IV) equipment. Misoprostol is also inexpensive, easy to store, and stable in field conditions (El-Refaey, 1997).

The combination of interventions resulting from the optimization model can be used as an indication of the programs that should be prioritized and expanded. We do not suggest stopping service provision of the interventions not retained by the model. On the contrary, current achievements with maternal health indicators should continue to get the same attention. To overcome budget shortfalls in order to fully implement the MBP, strategies to increase resources through savings, cost-recovery, and cost-reduction strategies should be explored.

The implementation of fees is encouraged for all interventions; they should be set according to willingness to pay. For example, some family planning clients in sub-Saharan Africa already contribute (and should continue to do so) with payments for commodities depending on method and mode of delivery. Non clinic-based family planning methods such as pills, condoms (male and female), and injectables should be exclusively distributed through social marketing outlets. However, a special attention should be paid to poor clients unable to pay the cost of commodities (Green 2002). Subsidizing all contraceptive methods to the poor is encouraged because of its high cost-benefit (Dayaratna 2000). Abortion services are known to be profitable, therefore prices should be set accordingly. Drastic changes in the program cost of abortion services can be observed depending on the type of procedure. MVA is shown to be the more cost-effective (Bradley et al 1993; (Johnson, Benson et al. 1993)). Efforts should therefore be made to expand access to this low cost technology, and to make it the preferred procedure for induced abortions or treatment of incomplete abortions.

The MBP has two major costly categories, personnel and facility level (hospitals), which can be revisited. Utilization of higher level facilities such as hospitals should be reserved for referrals.

Higher level facilities should not spend resources on primary health care service provision. The only exception could be delivery, in cases where the hospital is the nearest facility. Some procedures requiring low technology could be directed toward lower level health providers. For example nurse-midwives should be designated to insert IUDs instead of doctors, and also trained to use MVA equipment. At the same time, these procedures could be performed at the lower level facilities instead of hospitals. Antenatal care should be provided by nurse-midwives at health centers, and in general doctors should see only referrals. The WHO review of standard routine antenatal care concluded, moreover, that reducing the number of visits would not decrease the potential impact on mother or newborn health (Carroli, Villar et al. 2001). Combining these changes could result in cost reductions.

Setting priorities based on cost-effectiveness analysis does not take into consideration the influence of political and organizational factors in each setting. These factors can positively or negatively influence priority setting processes even in places where more resources could potentially be allocated to safe motherhood. Various strategies have been used with a noticeable degree of success for increasing attention to maternal mortality. They vary from generation of political will to using human rights principles (Freedman 2001). Shiffman (2003) identified four key factors that program planners need to address in order to help create political will: (i) give evidence of the problem, (ii) identify political figures related to the cause, (iii) organize events that disseminate information about the problem, and (iv) provide politicians with evidence that the problem is surmountable.

Conclusion

Maternal Health program planners need reliable estimates of costs to renew their efforts to address maternal mortality and morbidity. The MBP costing spreadsheet has been designed to assist local program managers in quickly making these cost estimates. This paper contributes to existing evidence on the importance of setting priorities for safe motherhood in resource scarce settings. Our results show that, family planning and safe abortion, antenatal care, postpartum hemorrhage and sepsis, more cost effective that safe delivery and eclampsia interventions. Safe

motherhood interventions save a significant amount of newborn lives. A dollar spent on resource scarce settings saves more lives than in higher resource settings.

To achieve the expected 75% reduction in maternal mortality by 2015 will require program planners to make informed and evidence-based choices when allocating scarce resources. The combinations of interventions that result in largest number of maternal deaths averted should be prioritized and expanded to cover the greatest number of women at risk. Concurrent efforts to generate political will can help draw more attention to safe motherhood problems.

Tables:

Table 1: Country profile LOW

Intervention	Total program Direct cost	Average Cost per client	Cost range	Attributed Causes of maternal deaths	% maternal deaths	Estimated # Maternal deaths	Potential impact in deaths averted	Estimated number of newborn deaths averted
FP AND SAFE ABORTION	**$158,333.55**			**Unsafe abortion**	25.0%	**46**	**75% - 95%**	**--**
Family Planning	$148,907.05	$15.02	**$3.73 - 26.31**					
Safe abortion (MVA $8.50; D&C $78.81)	$9,426.50	$31.90	$8.50 - $78.81					
ANTENATAL CARE	$52,092.70	$4.49	$3.00 - $5.99	**other direct+ indirect**	21.0%	**38**	**12% - 23%**	**185**
ESSENTIAL OBSTETRIC CARE	$54,243.18	$7.28		**Obstructed Labour**	8.0%	**15**	**80% - 90%**	**46**
Normal Delivery Care + assistance	$50,176.63	$13.60	$2.65 - $16.48					
Obstructed Labour	$4,066.55	$58.94						
OTHER OBSTETRIC CARE								
Eclampsia	$203,181.76	$131.20		**Eclampsia**	6.0%	**11**	**48% - 65%**	**45**
Haemorrhage	$104,709.82	$48.60	$22.5 - $54.26	**Haemorrhage**	25.0%	**46**	**55% - 82%**	**45**
Sepsis	$16,751.26	$28.34	$19.37 - $33.18	**Sepsis**	15.0%	**27**	**75% - 86%**	**25**
Other MBP interventions	$116,965.42	$7.95		--	--	--	--	--
Total	**$706,277.71**				100.0%	**182**		**346**

Table 2: Country profile MED

Intervention	Total program Direct cost	Average Cost per client	Cost range	Attributed Causes of maternal deaths	% maternal deaths	Estimated # Maternal deaths	Potential impact in deaths averted	Estimated number of newborn deaths averted
FP AND SAFE ABORTION	**$295,166.61**			**Unsafe abortion**	13.0%	**18**	**75% - 95%**	**--**
Family Planning	$285,842.11	$8.01	$4.8 - $27.22					
Safe abortion (MVA $8.50; D&C $78.81)	$9,324.50	$31.90	$8.5 - $78.81					
ANTENATAL CARE	$188,965.37	$11.23	$10.42 - $12.03	**other direct+ indirect**	27.0%	**37**	**12% - 23%**	**181**
ESSENTIAL OBSTETRIC CARE	$191,518.05			**Obstructed Labour**	8.0%	**11**	**80% - 90%**	**45**
Normal Delivery Care + assistance	$178,143.31	$20.30	$18.8 - $21.8					
Obstructed Labour	$13,374.74	$66.21						
OTHER OBSTETRIC CARE								
Eclampsia	$170,403.37	$161.83		**Eclampsia**	12.0%	**16**	**48% - 65%**	**44**
Haemorrhage	$96,120.28	$44.36	$32.8 - $55.8	**Haemorrhage**	25.0%	**34**	**55% - 82%**	**45**
Sepsis	$25,666.54	$31.37	$26.19 - $36.56	**Sepsis**	15.0%	**21**	**75% - 86%**	**24**
Other MBP interventions	$130,904.24	$7.43		--	--	--	--	--
Total	**$1,098,744.46**				100.0%	**137**		**339**

Table 3: Country profile HIGH

Intervention	Total program Direct cost	Average Cost per client	Cost range	Attributed Causes of maternal deaths	% maternal deaths	Estimated # Maternal deaths	Potential impact in deaths averted	Estimated number of newborn deaths averted
FP AND SAFE ABORTION	**$586,211.66**			**Unsafe abortion**	13.0%	**10**	**75% - 95%**	**--**
Family Planning	$576,785.16	$16.02	$4.80 - $27.23					
Safe abortion (MVA $8.50; D&C $78.81)	$9,426.50	$31.90	$8.50 - $78.81					
ANTENATAL CARE	$197,691.23	$11.20	$10.42 - 12.03	**other direct+ indirect**	27.0%	**21**	**12% - 23%***	**134**
ESSENTIAL OBSTETRIC CARE	$277,660.87	$22.46		**Obstructed Labour**	8.0%	**6**	**80% - 90%**	**33**
Normal Delivery Care + assistance	$236,079.99	$20.12	$19.82 - $20.8					
Obstructed Labour	$41,580.87	$66.21						
OTHER OBSTETRIC CARE								
Eclampsia	$161,341.09	$161.83		**Eclampsia**	12.0%	**9**	**48%** ** - 65%**	**32**
Haemorrhage	$78,500.36	$44.36	$32.84 - $55.88	**Haemorrhage**	25.0%	**19**	**55% - 82%*****	**33**
Sepsis	$30,918.36	$31.00	$26.19 - $36.56	**Sepsis**	15.0%	**12**	**75% - 86%********	**18**
Other MBP interventions	$150,804.46	$8.00		--	--	--	--	--
Total	$1,483,128.02				100.0%	**77**		**250**

Table 4: Results from the optimization model

Profile (available budget)	Average deaths averted	Required budget	Interventions to choose
LOW ($250,000)	117.9	$227,797	ANC + Delivery+ Sepsis+ PPH
	118.0	$210,426	FP& SA + ANC
	118.1	$175,085	FP& SA + Sepsis
MED ($500,000)	80.4	$491,237	FP& SA + Eclampsia + Sepsis
	80.4	$405,703	ANC + Delivery + Sepsis
	80.4	$292,190	Eclampsia+Sepsis+PPH
	80.0	$483,708	Delivery+ Eclampsia+Sepsis+PPH
HIGH ($750,000)	45.1	$746,112	ANC+Delivery+Eclampsia+Sepsis+PPH
	45.1	$517,502	Delivery+ Eclampsia+PPH

Figures:

Figure 1: Average cost and number of deaths averted : LOW setting

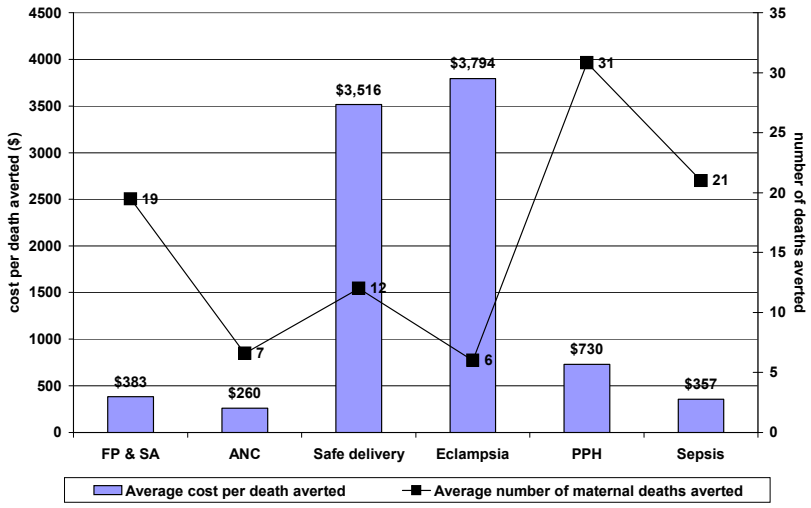


Figure 2: Average cost and number of death averted: MED setting

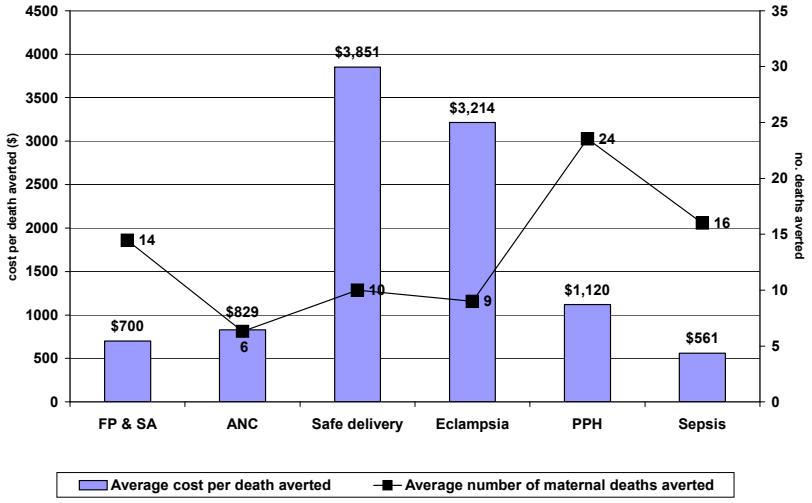


Figure 3: Average number and cost per death averted: HIGH setting

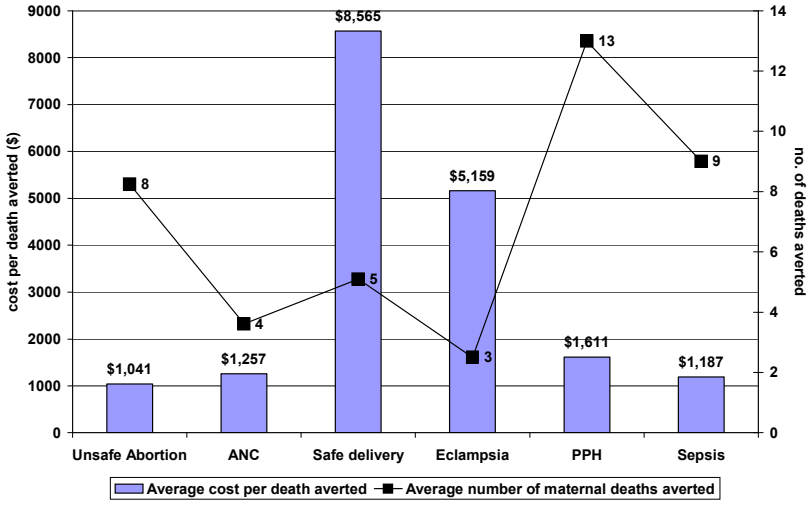


Figure 4:

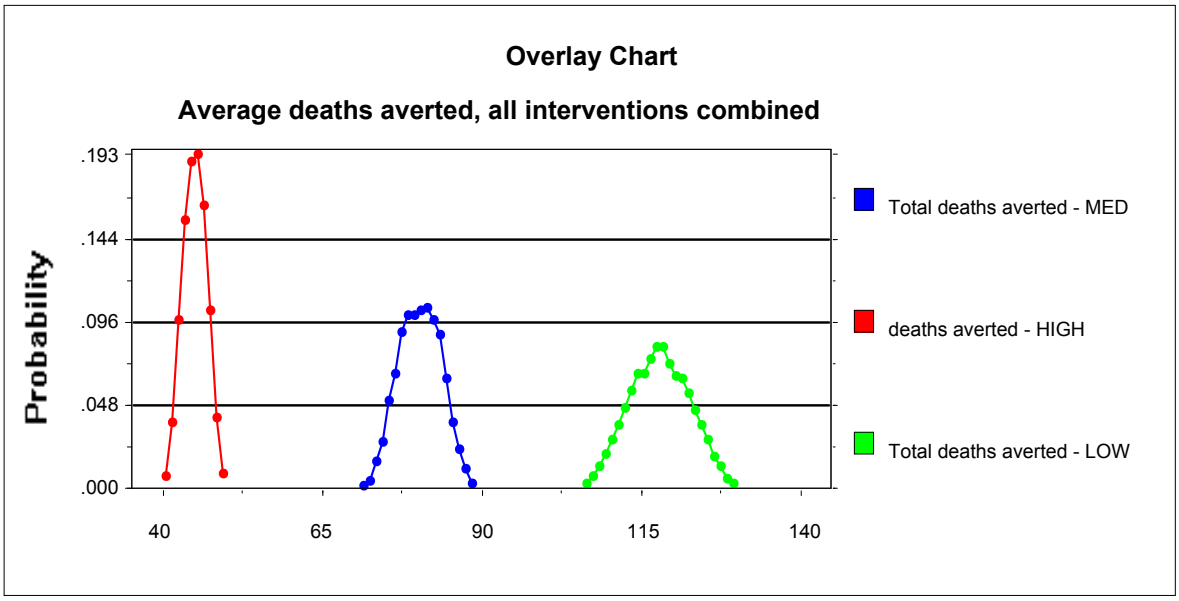


Figure 5

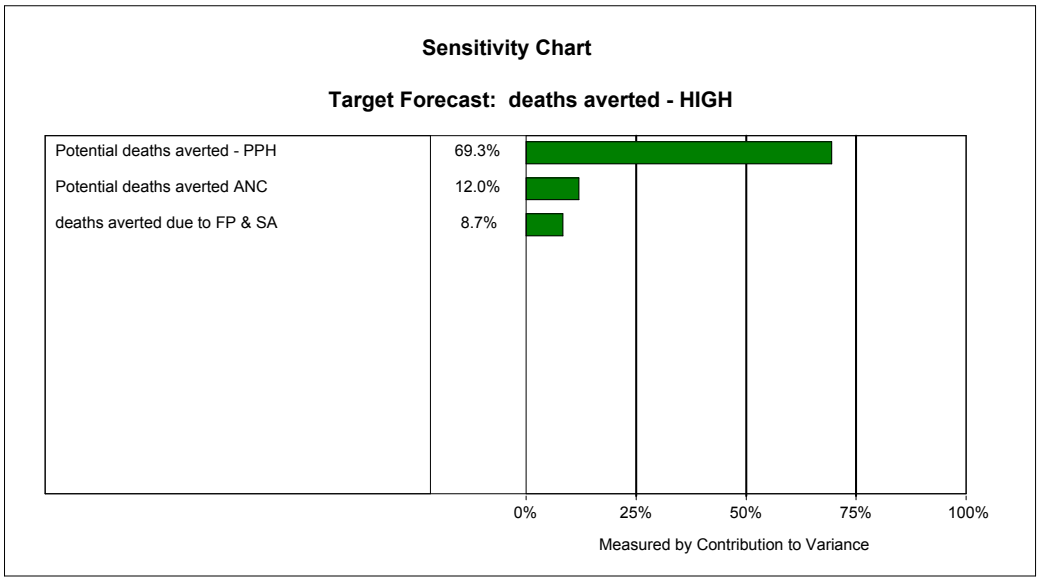


Figure 6

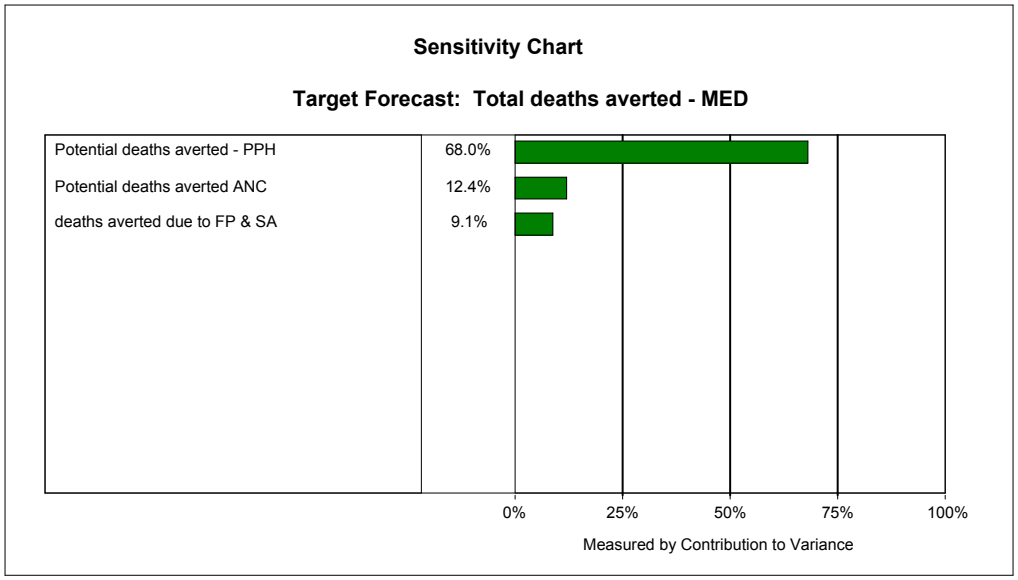
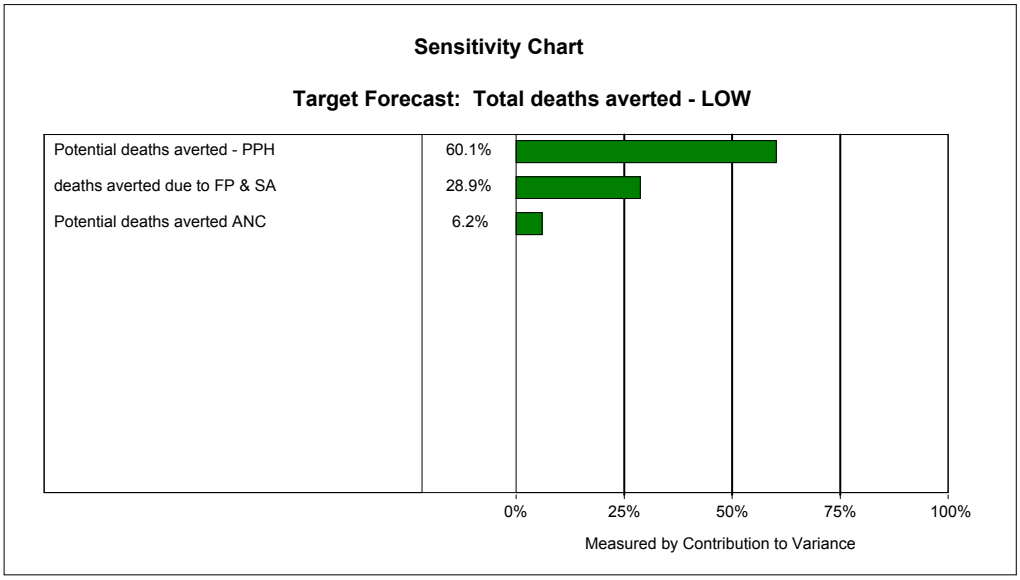


Figure 7



Annexes

Annex 1:

Country	Per Capita GNI (2002) (PPP$2000)	Per capita health expenditures	Infant mortality rate per 100,000 live births	Neonatal mortality	Maternal mortality ratio reported (per 100,000 live births)	Crude birth rate (DHS)	Total Fertility rate per woman	Contraceptive prevalence rate (%)	% receiving ante-natal care	% births attendend by skilled staff
Liberia	150	2	67.9	67.9	..	-	..	..	82.9	..
Burundi	100	3	114	35.2	..		6.8	..	79.0	25
Ethiopia	100	5	116	48.7	870	38.6	6.1	8	26.7	6
Niger	170	5	156	44.2	590	51.2	8	14	41.0	16
Chad	220	6	117	43.9	830	46	6.7	8	41.6	16
Sierra Leone	140	6	182		1800		6.5	4	68.0	42
Burkina Faso	220	8	104	40.8	480	42.5	6.7	12	60.7	31
Central African Republic	260	8	115	42.1	1100	38	4.9	15	66.9	44
Nigeria	290	8	110	36.9	..	34.7	5.4	15	63.6	42
Sao Tome and Principe	290	8	57		..		4	..		86
Togo	270	8	79	41.3	480	34.4	5.3	24	82.0	49
Congo, Dem. Rep.	90	9	129		950		6.7	..		61
Eritrea	160	9	72	24.8	1000	37.5	5.4	5	48.9	21
Guinea-Bissau	150	9	130		910		7.1	8	62.0	35
Madagascar	240	9	84	40.4	490	42.3	5.7	19	73.0	47
Mozambique	210	9	125	53.9	1100	38.7	5.6	6	71.4	44
Gambia	280	10	91		..		4.7	10		51
Mali	240	10	141	57.1	580	44.5	7	8	46.9	24
Uganda	250	10	79	33.1	510	46.8	7.1	23	91.2	39
Benin	380	11	94	38.4	500	40.7	5.7	19	80.3	66
Ghana	270	11	57	29.7	210	32.3	4.1	22	87.5	44
Malawi	160	11	114	41.8	1100	44.9	6.1	31	89.7	56
Rwanda	230	12	96	43.9	1100	38.6	5.7	13	92.4	31
Tanzania	280	12	104	40.4	530	41.4	5.1	25	48.8	36
Comoros	390	13	59	38.2	..	31.2	4.9	21	74.3	62
Guinea	410	13	109	48.4	530	36.9	5.8	6	70.7	35
Sudan	350	13	65	43.8	550	-	4.4	..		86
Cote d'Ivoire	610	16	102	62.2	600	39.3	4.7	15	87.5	47
Zambia	330	18	112	36.7	650	42.9	5.6	25	95.6	47
Senegal	470	22	79	37.4	560	38.7	5	13	77.2	51
Cameroon	560	24	96	37.2	430	35.2	4.6	19	75.3	56
Kenya	360	28	78	28.4	590	34.6	4	39	76.1	44
Lesotho	470	28	91		..		3.8	30	87.6	60
Cape Verde	1290	30	29		35		3.3	53	99.3	53
Swaziland	1180	56	106		230		4.5	..		70
Gabon	3120	120	60	30.1	520	32.9	4	33	94.4	86
Namibia	1780	136	55	31.5	270	38.1	4.6	..	87.2	78
Botswana	2980	191	80	22.5	330	-	3.7	40	96.8	99
South Africa	2600	255	56	19.8	..	21.9	2.6	56	94.2	84
Source: Unless Otherwise noted data are from the the World Developmet Report, 2004;										
DHS data is from the most recent available survey for the country.										

Annex 2:

SELECTED INDICATORS	SETTING PROFILE					
	LOW		MED		HIGH	
	range	mean	range	mean	range	mean
Total Fertility Rate (TFR)	4.0-8.0	6.1	4.1-7.1	5.7	2.6-5.6	4.2
GDI per cap (2002)	$90-$290	$189	$150 - $410	$268.5	$360-$3120	$1,239
Infat Mortality Rate (per 1000 live births)	57-182	109.15	57-141	98.69	20-112	77.60
MMR (per 100,000 live births)	480-1800	900	210-1100	687.30	35-650	433
Neonatal mortality rate (per 1000 live births)	25-68	42.58	30.-57	42.30	20-62	34.96
Crude birth rate (per 1,000)	34-51	40.36	31-47	39.85	22-43	35.45
Per cap health expenditure ($uds)	$3 - $9	$6.50	$9 - $13	$10.77	$16 - $255	$72.10
% Using contraception	4.0-24.0	11.50%	6.0-31.0	16.23%	13-56	32.30%
Receiving antenatal care (%)	27-83	60.12%	47-92	74.02%	75-99	88.29%
% Deliveries attended by skilled personnel	6.0-66.0	36.58%	24-66	43.85%	47-99	66.20%

Annex 3:
Assumptions

		LOW	MED	HIGH
population		500,000	500,000	500,000
% Eclampsia		20.9%	12.0%	8.5%
% Haemorrhage		29.1%	19.6%	12.9%
% c-sections		0.9%	2.3%	5.4%
% Anemia		67.2%	41.5%	25.8%
% Severe anemia (<6g/dL)		8.0%	5.0%	2.0%
Note: maternal health indicators from DHS data available from respective countries				
Family Planning Method Mix				
Condoms		14.9%	14.9%	14.9%
depoprovera		30.0%	25.4%	25.4%
IUDs		9.7%	9.7%	9.7%
Norplant		1.3%	1.3%	1.3%
pill		39.0%	39.0%	39.0%
sterilization		4.0%	9.7%	9.7%
Cause of Maternal Death				
Haemorrhage		15%	25%	25%
Sepsis		6%	15%	15%
Hypertensive disorders/eclampsia		8%	12%	12%
Obstructed labour		25%	8%	8%
Unsafe abortion		1%	13%	13%
Other direct causes		20%	7%	7%
Indirect causes		100%	20%	20%
Total		0%	100%	100%
Prevalence/Incidence of complications				
Percent of pregnancies requiring management of severe anaemia	Anaemia	*8.0%*	*5.0%*	*2.0%*
Percent of pregnant women requiring treatment for syphilis	STD - Syphilis	*3.0%*	*3.0%*	*3.0%*
Percent of pregnant women requiring treatment of STDs other than syphilis (gonorrhoea, chlamydia etc.)	STD - Other	*10.0%*	*10.0%*	*10.0%*
Percent of pregnancies requiring management of incomplete abortion	Abortion complications	*5.0%*	*5.0%*	*5.0%*
Percent of births requiring management of eclampsia	Eclampsia	*20.9%*	*12.0%*	*8.5%*
Percent of births requiring management of postpartum haemorrhage	Haemorrhage	*29.1%*	*19.6%*	*12.9%*
Percent of births complicated by obstructed labor/requiring caesarean	Obstructed	*0.9%*	*2.3%*	*5.4%*
Percent of births requiring management of puerperal sepsis	Sepsis	*8.0%*	*8.0%*	*8.0%*
Percent of babies suffering from complications	Neonatal Complications	*20.0%*	*20.0%*	*20.0%*

Annex 4:

NEWBORN DEATHS AVERTED - LOW

Causes	% of Newborn Deaths	Number of Newborn Deaths	Potential Impact in Deaths Averted	Potential Lives Saved
Birth asphyxia	21.1%	181	50%	91
Birth injuries	10.6%	91	50%	46
Neonatal tetanus	14.1%	121	80%	97
Sepsis and meningitis	7.2%	62	40%	25
Penumonia	19.0%	163	50%	82
Diarrhoea	1.5%	13	50%	6
Prematurity	10.3%	89	–	–
Congenital anomalies	11.1%	95	–	–
Other	5.1%	44	–	–
Total	**100.0%**	859	**–**	**346**

NEWBORN DEATHS AVERTED MED

Causes	% of Newborn Deaths	Number of Newborn Deaths	Potential Impact in Deaths Averted	Potential Lives Saved
Birth asphyxia	21.1%	178	50%	89
Birth injuries	10.6%	89	50%	45
Neonatal tetanus	14.1%	119	80%	95
Sepsis and meningitis	7.2%	61	40%	24
Penumonia	19.0%	160	50%	80
Diarrhoea	1.5%	13	50%	6
Prematurity	10.3%	87	–	–
Congenital anomalies	11.1%	94	–	–
Other	5.1%	43	–	–
Total	**100.0%**	844	**–**	**340**

NEWBORN DEATHS AVERTED - HIGH

Causes	% of Newborn Deaths	Number of Newborn Deaths	Potential Impact in Deaths Averted	Potential Lives Saved
Birth asphyxia	21.1%	131	50%	65
Birth injuries	10.6%	66	50%	33
Neonatal tetanus	14.1%	87	80%	70
Sepsis and meningitis	7.2%	45	40%	18
Penumonia	19.0%	118	50%	59
Diarrhoea	1.5%	9	50%	5
Prematurity	10.3%	64	–	–
Congenital anomalies	11.1%	69	–	–
Other	5.1%	32	–	–
Total	**100.0%**	**620**	**–**	**249**

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