
What is the cost of maternal health care and how can it be financed ?

Josephine Borghi¹

Summary

This paper reviews the evidence on the cost of providing maternal health services, the use of disability-adjusted life years (DALYs) in the evaluation of the cost-effectiveness of these services, and alternative sources of financing maternal health services. The findings suggest that, for most interventions, care can be provided most cheaply at the primary care level. Personnel and drugs are the main components of cost. Community-based studies indicate that for the provision of emergency obstetric care, the focus should be on improving existing facilities. However, cross-study/country comparisons are difficult due to the inconsistency of costing methods and definitions of maternal health. While the use of DALYs as an outcome measure can help to justify the cost-effectiveness of maternal health interventions, compared to interventions, which target other disease areas, DALYs may underestimate the true burden of maternal mortality and undervalue an intervention's cost-effectiveness due to the infrequency of maternal mortality.

Funding for maternal health services represents approximately 5-11% of total donor contributions to the health sector in developing countries and approximately 4-12% of domestic health expenditure, although it is difficult to determine the trends in these figures over time. The National Health Account framework will facilitate the measurement of expenditure on maternal health and the comparisons across countries. To achieve good maternal outcomes in developing countries, the model of health care financing must facilitate access and guarantee service quality. This can be achieved through a variety of methods: e.g. general taxation and social insurance. The key issue is financial sustainability. At the local level some NGO programmes have been successful in increasing access to essential obstetric care in rural communities and community programmes have been able to generate limited funds to the same end.

¹ MSc in Health Economics. Privada San Miguel n°12, Coyoacan 04030, Distrito Federal, Mexico. Email : jborghi@hotmail.com

Introduction

This review paper is composed of three sections. The first section reviews the evidence on the cost of maternal health services. While the importance of providing maternal health services is universally recognised there is limited information available on the cost of providing these services. Cost information – both measures of unit cost and cost-effectiveness – serves as a critical input into the processes of setting priorities and allocating resources efficiently. Cost studies of maternal health interventions help to assess how well resources are used in different types of health facilities and can provide policymakers with information on how to improve the efficiency and effectiveness of service delivery as well as to assess how adequately funded these services are (Levin, McEuen, Dymatraczenko *et al.* 2000). Hence these studies are useful for the development of health financing schemes in-country. To this end country-specific studies are more useful than global estimates based on hypothetical models.

The second section considers the measurement of the effectiveness of maternal health interventions. We discuss the benefits and disadvantages of using the disability-adjusted life year (DALY) in the evaluation of maternal health programmes and examples of its use in the literature. The third section considers the financing of maternal health services. To understand the viability of specific maternal health interventions in the context of resource constrained economies it is important to consider from where the financing will come. We therefore discuss the trend in government and donor expenditure on maternal and child health care and some examples of alternative ways of financing maternal health care.

Methods

A comprehensive search of Medline and Popline databases was conducted. The results of two reviews were also included: a compilation of studies of reproductive health costs pre-1997 (Mumford, Dayaratna, Winfrey *et al.* 1998) and a review of economic evaluations of antenatal care interventions (Hutton 1996). The web pages of major donors were reviewed along with other unpublished references.

Cost of Maternal Health Services

SCOPE OF ANALYSIS

We begin by presenting the costs of preventative care: antenatal and postnatal visits and, where available, specific components of the visits such as tetanus immunisation. The costs of basic curative care such as normal vaginal delivery are presented as well as those for surgical interventions: caesarean section and abortion. We also discuss the cost data provided in a number of studies relating to the provision of specific essential obstetric services (see Appendix 1) such as setting up blood transfusion facilities, upgrading a health centre for the performance of caesarean sections (c-sections). Although there is an extensive literature relating to other elements of reproductive health, namely family planning services (Janowitz & Bratt 1992), the prevention, detection and treatment of sexually transmitted diseases (STDs) and HIV/AIDS, and breastfeeding promotion, these are not specifically referred to here, but are discussed elsewhere (Mumford, Dayaratna, Winfrey *et al.* 1998, Hutton 1996). This review considers costs to the provider² of providing maternal health services and excludes cost studies from developed countries because of the limited applicability of these studies in developing country settings. Finally, our focus is on the estimated costs of current practice in specific countries or regions, rather than on the cost of 'ideal/standard' practice based on a hypothetical model (Tinker & Koblinsky 1993, Weissman, Sentumbew-Mugisa, Mbonye *et al.* 1999b, Cowley 1995³).

COSTING METHODS USED IN REVIEW STUDIES

Comparisons of costs across studies are difficult because of differences in the methods used to evaluate costs. Cross-country comparisons of cost data are

² Patient costs have been estimated in a number of papers, for example: charges for antenatal care, delivery care (Knowles 1998); charges for antenatal care, delivery care: normal and c-section (Mirembe, Ssengooba & Lubanga 1998); charges and unofficial fees for c-section in Bangladesh (Kawnine, Guinness, Amin *et al.* 1998); direct and indirect costs including charges for antenatal care, vaginal delivery, c-section (Levin, McEuen, Dymatraczenko *et al.* 2000); direct and indirect costs including charges for antenatal care (Borghini, Bastus, Belizan *et al.* 2000).

³ (Tinker & Koblinsky 1993) estimates the public sector costs for possible safe motherhood programmes in three settings: from the weakest health system to the more-developed. (Weissman, Sentumbew-Mugisa, Mbonye *et al.* 1999b) contrasts the costs in Uganda of the 'standard' or 'ideal' practice in order to meet the Safe Motherhood criteria, with the cost of the current practice. (Cowley 1995) develops a hypothetical model to estimate the cost of essential obstetric care.

also problematic as the unit costs of interventions can vary considerably across countries due to differences in resource availability and costs. As indicated in Table 1, the studies included in this review used a variety of different costing methods. Table 1 presents, for each study, the intervention considered, the costing method used, the method of allocating joint⁴ costs, the inclusion or not of indirect⁵ and opportunity⁶ costs, the number of facilities included in the analysis, the type of facility considered and the nature of the service provider. Finally, the table indicates how the costs are presented: total, average and/or marginal⁷ costs, whether costs are disaggregated by input type, whether ranges or confidence intervals are provided for costs, and the year and currency of the costs.

RESULTS

There were 15 studies identified with cost estimates for 16 countries. The majority of estimates refer to countries in Africa (n=7), five in Central and South America and 4 in South and South East Asia. The interventions covered were wide, with 15 country estimates of the average cost of an antenatal care visit, 9 of normal vaginal delivery, 8 of c-section, 4 of abortion, 5 of post-abortion care, 3 of eclampsia and haemorrhage and 2 of sepsis. Estimates are from public, private, mission hospitals and health centres and there is one estimate of home based antenatal and delivery care.

For a number of studies data were not collected or presented in disaggregated form, such as unit costs broken down by resource inputs (prices and quantities). Not all studies clearly report the methods used to calculate costs. Furthermore, methods of costing differed: top-down costing compared to the distribution of a questionnaire to medical staff to identify current practice and then applying costs. Finally the currency and year of cost data are not systematically indicated. The definition of what is being costed is not always clear: a number of studies lump together a range of interventions under the heading maternal and child health or maternal health without specifying the boundaries of the analysis. For all these reasons, caution must be exerted

⁴ Joint costs are the costs of resources which are shared across more than one activity (a typical example are 'overhead' costs).

⁵ These are the costs associated with impaired ability to work or to engage in leisure activities due to morbidity and lost economic productivity due to death (Gold, Siegel, Russell & Weinstein 1996)

⁶ The opportunity cost is the value of time in its next best alternative use death (Gold, Siegel, Russell & Weinstein 1996). A typical example is the valuation of volunteer worker's time.

⁷ Defined here as drugs and medical materials.

when comparing the costs between countries.

COST OF BASIC OBSTETRIC SERVICES

Costs are presented in constant 1998 US Dollars. The methods of conversion were based on (Kumaranayake 2000).

Preventative interventions

Antenatal care (ANC)

Table 2 presents the costs of antenatal care taken from the literature. The range of costs is wide, from US\$2.21 per visit in a public health centre in Uganda to US\$42.41 in a maternity hospital in Argentina⁸. The higher cost in Argentina is reflected by the higher labour costs (>70% of total), with marginal cost (drugs and medical supplies) representing a much smaller proportion of total cost (27%) than most other countries. If we exclude Grenada and Argentina the range of costs narrows to \$2.21-\$15.46. Costs are generally lower in the lower level facilities: at the primary health centre, then at the secondary level hospital and the highest cost is in tertiary facilities, although the differences are not significantly different. Also, there are some exceptions: Argentina, the mission hospitals in Uganda and Ghana, and Bolivia. In Argentina and Ghana this was due to the higher service volume at the hospital level, reducing unit costs. The cost of providing care from a mobile outreach clinic was higher than from a static clinic. There was no difference between the cost of providing care in a private nursing home compared to a public health facility or home-based care. However, the cost of providing care through the private mission facilities was almost consistently higher than in the government facilities. Drugs and medical supplies (indicated by marginal costs) represent a significant proportion of average cost (46.4%). The costs of providing specific components of antenatal care are discussed in Appendix 2.

⁸ The cost estimates for Bangladesh were not comparable due to the chosen outcome measure.

Postnatal care

One study (Anand, Pandav, Kapoor *et al.* 1995) estimated the cost of home-based postnatal care as the same as for antenatal care. Another study (Mitchell, Littlefield & Gutter 1997) estimated the cost at US\$5.43 per visit, similar to that of antenatal care.

Normal Vaginal Delivery

Table 3 illustrates the cost estimates of a normal vaginal delivery. The range of costs is between: US\$2.71 for Uganda and US\$140.41 for Argentina. Costs are significantly lower at the health centre compared to hospital level ($p=0.02$)⁹. The substantially higher cost in Argentina can again be explained by the predominance of labour costs and the fact the deliveries are carried out by obstetricians rather than midwives. The costs are generally higher in the government facilities compared to the private nursing home and the mission hospitals. It is unclear from most of the studies who carries out the delivery (proportion of deliveries carried out by a doctor or a midwife) and so we are not able to establish differences in cost for assistance during delivery by different health staff. The costs of episiotomy figure in Appendix 2.

COST OF COMPREHENSIVE OBSTETRIC SERVICES

Caesarean Section

Table 4 presents the costs of c-section derived from the literature. We were unable to distinguish between emergency and elective c-section. The costs range from US\$46.71 in Uganda to US\$525.57 in Argentina. The cost estimates from the two studies in Bolivia are consistent. The cost of a c-section is on average three times greater than that of a normal vaginal delivery. On average, drugs and medical supplies represent 49.2% of the total cost.

Management of Complications

Post-Operative Infection

A study in Uganda estimated the cost of treatment for postoperative infection with procaine penicillin during an ectopic pregnancy at US\$31.22 and US\$24.50 for ampicillin prophylaxis (including the cost of hospital admission) (Reggiori, Ravera, Coccozza *et al.* 1996). The same study estimated the cost of antibiotic treatment for postoperative infection after c-section, at US\$44.79 for treatment with penicillin and US\$28.06 for ampicillin prophylaxis.

⁹ Independent sample t-test, equal variances not assumed.

laxis. Finally, a study by (Bibi, Megdiche, Ghanem *et al.* 1994) in Tunisia estimated the cost of curative antibiotics for postoperative infection following a c-section, at US\$912.57 compared to US\$91.38 for antibiotic prophylaxis.

Postpartum Haemorrhage

The cost of managing postpartum haemorrhage varied from US\$35.44 in a Ugandan public hospital to US\$114.83 in a mission hospital in Uganda (see Table 5). However, for the lower estimate for Uganda, it was not clear whether the cost corresponded to the management of antepartum or postpartum haemorrhage. Furthermore, this estimate was based on estimated current practice, involving a five-day course of antibiotics and 3-7 days hospital stay, with a small proportion of cases having a blood transfusion (Weissman, Sentumbew-Mugisa, Mbonye *et al.* 1999b). Drugs and medical supplies accounted for 56% of the total cost of patient management.

Pre-eclampsia

The study in Bolivia (Dmytraczenko, Aitken, Carrasco *et al.* 1998) estimates the cost of managing pre-eclampsia at US\$5.59 in a primary health centre, US\$6.74 in a secondary level facility and US\$8.09 at the tertiary level.

Eclampsia

The cost of managing eclampsia ranged from US\$39.88 in Bolivia to US\$159.66 in Uganda (see Table 6). The cost appears to be lower in the secondary compared to the tertiary level hospital in Bolivia. The cost of drugs and medical supplies (22% of the average cost) are secondary to labour costs (up to 68% of the average cost (Weissman, Sentumbew-Mugisa, Mbonye *et al.* 1999b)). A woman with eclampsia will often require attention over several days by well-trained and qualified medical staff, which accounts for the high labour cost.

Sepsis

The cost of managing maternal sepsis ranged from US\$8.76 in Uganda to US\$72.64 in Bolivia (see Table 7). The cost is higher at the tertiary compared to the secondary level in Bolivia.

Abortion Service Delivery

Alternative methods of abortion

Manual Vacuum Aspiration (MVA)

The cost of conducting abortion by MVA varies between US\$2.02 in Tanzania to US\$46.82 in a tertiary level facility in Bolivia (see Table 8). However, the Tanzanian study did not include indirect costs or opportunity costs associated with the intervention, also this study was conducted in a primary level 'medical centre' rather than hospital. The Bolivia study indicates that the cost is lowest in the primary health centre and highest in the tertiary hospital. The cost of drugs and medical supplies, on average, represents 19% of the total cost.

Surgical (dilation and curettage)

The cost of abortion by surgical intervention ranges between US\$2.79 in Kenya to US\$68.96 in Mexico (see Table 9).

Management of post-abortion complications

The cost of managing post abortion complications varies from US\$12.10 in Uganda to US\$304.73 in Nigeria (see Table 10). In the Bolivia study (Rosenthal & Percy 1991) personnel costs are not included, although opportunity costs are measured. However, average costs will vary considerably depending on the extent of complications, as may be expected. Drugs and medical supplies accounted for on average 58% of the total cost.

ESTIMATED COST OF PROVIDING ESSENTIAL OBSTETRIC CARE PACKAGES

Table 1 in Appendix 3 presents the findings of the Prevention of Maternal Mortality Network (PMMN). The alternative models are presented along with the estimated costs and outcomes of the community programmes delivered in hospitals and health centres in West Africa.

Community programmes have a vital place in emergency obstetric care because they can ensure women's access to such care when needed. In general costs are lowest, and sustainability greatest, in programmes that make use of existing capacity. Otherwise stated, the costs of EOC need not be costly when the necessary facilities, equipment and staff are in place. Renovation of facilities, repair of equipment and training of staff, although not without cost, cost substantially less than developing new facilities.

The cost of improving emergency obstetric care by renovating facilities and equipment varied between US\$250 (Leigh, Kandeh, Kanu *et al.* 1997)-US\$1559.3 (Ande, Chiwuzie, Akpala *et al.* 1997) per additional admission with a blood bank, and US\$117 (Oyesola, Shehu, Ikeh *et al.* 1997)-US\$223 (Olukoya, Ogunyemi, Akitoye *et al.* 1997) without. However, the presence of a functioning blood bank enables the safe conduct of obstetric surgery, significantly reducing the risk of maternal death.

One of the barriers to accessing health care for women in rural areas, not well served by health facilities, is transport: the lack of transport or its exorbitant costs. The most cost-effective model was described in Nigeria (Shehu, Ikeh & Kuna 1997), using trained drivers from the local transport union, with the cost per transportation amounting to US\$4.67 per case.

The example of Ghana (Senah, Richardson, Kwofie *et al.* 1997) indicates that the renovation of an abandoned warehouse to serve as a health centre and provide MCH/FP clinics was highly cost-effective. Whereas the maternity waiting home concept, although low in cost was ineffective in mobilising community utilisation (Wilson, Collison, Richardson *et al.* 1997).

The use of DALYs for the evaluation of maternal health interventions

BENEFITS AND DISADVANTAGES OF DALYS¹⁰

Evaluating maternal health conditions/interventions by focusing uniquely on the impact on maternal mortality fails to take into account the losses to health that occur because of morbidity. It is generally accepted that 15% of all live births develop complications which in the absence of treatment, seriously compromise the health of women (AbouZahr 1999). Consequently, narrowing the focus to mortality alone, will underestimate the burden due to pregnancy-related causes. DALYs, avoid this problem, by considering both the morbidity and mortality effects of a disease. DALYs also enable the description of health states in multiple dimensions; they do not rely on self-reported health (which can give counter intuitive results) but on valuations of states provided by experts and the person trade-off (PTO) technique.

However there are a number of problems that have been raised, particularly regarding the evaluation of maternal conditions:

¹⁰ A background to definition and use of DALYs is provided in the Appendix 4.

- The calculation of DALYs is focused on the five main causes of maternal mortality and the associated major morbidity¹¹). No attempt was made to include morbidity arising from other direct causes of maternal death (such as ectopic pregnancy) or indirect causes such as hepatitis or diabetes. Additionally, there is no measure of the burden of the excessive practice of c-section or episiotomy. Furthermore, the calculation of DALYs does not estimate healthy years of life lost for stillbirths because counting can only start at birth, according to the definition. Hence, the burden of disease due to perinatal causes does not include late foetal or intra-partum deaths;
- The DALY methodology does not take into account the everyday burden of certain impeding conditions such as vaginal itching or discharge (AbouZahr 1999);
- The calculations provide general regional estimates of the burden but are not tailored to the conditions in specific countries of the world;
- Disability is based on the ranking of 6 disability states between perfect health '0' and death '1'. They were chosen by a group of predominantly male international clinicians. There was no explicit inclusion of community evaluation or preferences, hence ignoring the impact of social, cultural or economic contexts on the severity of disability;
- A number of conditions arising during pregnancy and the postpartum result in social stigma, such as STDs and abortion. Much psychological distress can result, yet this is not taken into consideration in the calculation of the 'burden' (AbouZahr 1999). An alternative (Hanson 1999) would be to consider the amount of handicap caused by non-fatal outcomes, which would take into account the overall consequences of their impairment as influenced by their social environment (HALY).

BURDEN OF MATERNAL ILL HEALTH USING DALYS

Reproductive ill health accounts for 36% of the total disease burden among women of reproductive age in developing countries (18% for pregnancy-related deaths and disabilities; 10% for sexually transmitted diseases (syphilis, chlamydia, gonorrhoea and pelvic inflammatory disease) and 8% for HIV/AIDS (AbouZahr 1999).

¹¹ Haemorrhage, puerperal infection, eclampsia, obstructed labour and abortion.

THE COST PER DALY FOR MATERNAL HEALTH INTERVENTIONS

The DALY methodology is also used to determine resource allocation and facilitate priority setting. Within the context of economic evaluation, the aim is to minimise DALYs subject to a health budget; hence the outcome of interest is the cost per DALY averted. A comprehensive review of the literature (Mumford, Dayaratna, Winfrey *et al.* 1998) identified 3 studies that estimated the cost per disability-adjusted life year averted: 2 for STDs, 1 for breastfeeding. A more recent review revealed a further 6 related to the vertical HIV-1 transmission. There were no studies identified which present the cost per DALY averted for interventions relating specifically to maternal health, as defined above.

This could be explained by a number of factors. Firstly, there have been very few cost-effectiveness studies of maternal health interventions using any kind of outcome measure (most are cost studies with no outcome data or effectiveness studies with no cost data). This suggests that there has, to date, been little economics research in this area as compared to, for example, HIV/AIDS and malaria. Furthermore, maternal mortality is a relatively infrequent event, and measuring the impact of an intervention in these terms may decrease the apparent cost-effectiveness of maternal health interventions¹².

Trends in domestic and international expenditure on maternal health services

DIFFICULTIES IN OBTAINING DATA

Data on the cost of providing improved maternal health care relative to the available budget are important as these financial figures can assist in closing the gap between what is needed and what is available. An assessment of costs and resource can also help to set priorities.

The analysis of data tracking cash flows and expenditures earmarked for maternal health by governments and donors in the international community will enable the analysis of trends in these expenditures relative to global health spending. This section borrows from a number of studies (Howard 1990, Potts, Walsh, McAninch *et al.* 1999, Zeitlin, Govindaraj & Chen,

¹² There were two interventions in the literature measuring the cost per maternal death averted, the range was between US\$517 and US\$6,677 (27 and 10 respectively)

1994), international donor web sites and National Health Accounts data for Egypt and Sri Lanka (Rannan-Eliya, Berman, Eltigani *et al.* 2000).

First it is necessary to point out the difficulties associated with tracking expenditure flows to a specific component of health care: maternal health. The first issue is definitional, as there are no universally agreed-upon definitions of what activities are included under this heading. Government clinics and health centres are often multipurpose and it is difficult to isolate the costs of one type of service (e.g. maternal health care). Also financial data may be recorded under a variety of categories: e.g. personnel costs, capital etc. without being allocated to specific activities: MCH/FP etc. Figures may be aggregated offering estimates of a package of maternal and child health combined with family planning programmes or just maternal and child health alone and it is not obvious how to disaggregate these figures further¹³. Data on domestic private sector spending are even more difficult to obtain. Furthermore, one study (Howard 1990) found that while data on international funding of population services did exist, information on domestic funding was harder to identify and was not necessarily internationally comparable. Official figures are often not available beyond 1996 and prior to 1993 are incomplete and of dubious quality (Potts, Walsh, McAninch *et al.* 1999).

GENERAL PROJECTIONS

According to ICPD projections, reproductive health costs in developing countries will total US\$17 billion in 2000 and US\$21.7 billion in 2015. Developing countries are expected to meet approximately 2/3rds of the costs and international donors one third (see Table 11).

PAST TRENDS IN EXTERNAL RESOURCES

For multi- and bilateral assistance, data are usually gathered by region or by country, sector specific data are of less operational interest. However, one study (Rannan-Eliya, Berman, Eltigani *et al.* 2000) disaggregated the bilateral and multilateral aid flows by type of activity for 1990. An estimated 44.5% of all external assistance was spent on hospitals and health services, of the rest, 18.8% was allocated to specific health problems, 9.4% to nutrition pro-

¹³ In general, available information of family planning support is the most widespread, followed by STDs and safe motherhood financing data being the most scarce and difficult to interpret.

grammes, 7.6% to maternal and child health programmes and 19.6% to population activities.

It is also interesting to consider the trends over time. A study carried out by the World Bank in 1990 measured the aid flows for the Safe Motherhood Programme before and after the 1987 conference (Howard 1990). For the major bilateral sources, including the European Community, the net trend from 1986 to 1988 showed a gradual increase for total health spending. Projects with direct and indirect effects on maternal health represent about 12% of all bilateral financing, including family planning, primary health care, nutrition, training and disease control. This is illustrated in Table 12. Health sector assistance after stagnating in real terms during the first half of the 1980s has been increasing since 1986 through both bilateral and multilateral channels. During the 1980s multilateral institutions, particularly UNICEF and the World Bank played a larger role in financing health sector assistance than previously.

An updated analysis of financing trends is much needed to illustrate the developments in external assistance during the last decade¹⁴. In the absence of currently available data, the trends for USAID health sector assistance during the 1990s may serve as a rough guide (Table 13). Between 1990-1995, the agency's support for maternal health and nutrition fluctuated between approx. US\$30 million and US\$70 million, but returned to US\$30 million by 1995, demonstrating a lack of serious commitment to increasing resources for basic reproductive health services (Potts, Walsh, McAninch *et al.* 1999).

DOMESTIC RESOURCES

As one author (Howard 1990) points out, there are general difficulties in monitoring health sector expenditures in many countries, with only 20 developing countries reporting to the United Nations system on national accounts in 1990. Furthermore, few governments employ functional accounting enabling the attribution of resource inputs to specific activities.

Table 14 presents the very limited available evidence. It is not possible for any one country to identify the trends in spending over time. For Sri Lanka we have two observations for 1982 and 1997, which apparently suggest that there has been a reduction in spending on maternal health as a proportion

¹⁴ Recognising the need for improved information on international and domestic resources, the UNFPA in collaboration with the Netherlands Interdisciplinary Demographic Institute has started to develop an improved system of annual data collection which should improve the tracking of funding in the future (Potts, Walsh, McAninch *et al.* 1999).

of total health expenditure (from 13% to between 4 and 12%). However, the costing methodologies used and definitions are not consistent between studies. The most recent estimate was derived from the National Health Accounts data¹⁵ (Rannan-Eliya, Berman, Eltigani *et al.* 2000). Depending on the chosen definition of maternal health (a very narrow definition including only antenatal and postnatal care or a wider definition including STD management, family planning services and relevant proportions of hospital care) the figure varies from 1-12%. Unless we can be sure that the definition of maternal health and the method of calculation is consistent over time, across studies, then any comparisons will be potentially misleading. The high estimate of 19% for Bangladesh is based on expenditures for maternal and child health and family planning. The estimate for India includes child health and that of Uganda includes care of the newborn. It seems that overall, the proportion of expenditure on reproductive health is between 12-19%, maternal and child health between 7 and 11% and maternal health about 4%. Studies in Belize, Jamaica, Korea, Malawi and Oman show that the leading use of public hospitals was due to maternal causes, which accounted for between 23 and 43% of all admissions but only 11% of hospital expenditure (Barnum & Kutzin 1993). This suggests that within hospitals maternal health interventions are not receiving an adequate proportion of funds, relative to the number of admissions.

Alternative Financing Methods for Maternal Health Services

Insufficient funding for health services is a nearly universal problem in developing (and developed) countries. In many lower income countries, the percentage of government revenue that has gone into financing health care has declined since the early 1980s (Krasovec & Shaw 2000). In many countries new and increasing demands are being placed on the health system with the increase in population size and rising levels of communication and education levels. There are also competing challenges presented by the rising levels of chronic diseases in urban areas and continually high levels of infectious diseases in rural populations. Funds for health care can be generated by four main sources:

¹⁵ The advantage of using National Health Accounts data is that expenditure is categorised by the type of health facility: hospital /health centre /pharmacy and by the source of finance: government /household /donor. Estimations can be made regarding the proportion of inpatient admissions /outpatient consultations attributed to maternal health, and in this way expenditure can also be allocated.

- Direct government financing;
- Donor financing;
- Private user charges;
- Third party payments (health insurance, community financing or *mutuelle* schemes).

Table 15 indicates three models of health system financing typically encountered.

Here we consider a number of different policies and where possible the impact on maternal health outcomes (either direct morbidity and mortality or utilisation of health services) illustrated in Tables 16, 17 & 18. We consider macro-level financing, the concept of user-fees, at a more micro level, the role that can be played by NGOs in the financing and provision of health services, and a number of community-level financing programmes¹⁶.

MACRO-LEVEL FINANCING

We consider three examples of alternative health system configurations in terms of financing health care at the macro-level as illustrated in Table 16. Sri Lanka provides an example of an largely publicly funded system through general taxation, with an equitable geographic distribution of health care facilities at the primary and secondary levels. The private sector funds 52% of primary care services but only 13% of hospital care. The low level of hospital coverage is due to the failure of the insurance market to provide catastrophic health insurance. Indeed, less than 2% of total health sector financing is from health insurance, and similarly population coverage for health insurance has not increased beyond 2% (Hsiao 2000). For the provision of antenatal care, a group of public health midwives (PHM) associated to a health unit under the supervision of a Medical Officer of Health, provides services at the grass-roots level and is responsible for registering pregnant women and acts as a link between the community and the public health services. This structure may explain the higher proportion of outpatient maternal services provided by the government sector (Rannan-Eliya, Berman, Eltigani *et al.* 2000)

¹⁶ The type of programme considered will affect the type of outcome chosen for evaluation.

The Egyptian case is similar except for the existence of a compulsory social insurance agency operating through the workplace, although this agency is funded almost 50% through the government by general revenues.

Finally, Bolivia a decentralised financing programme, is an example of an insurance programme specifically targeted to Mother and Child health¹⁷. Services are reimbursed on a per service basis by the municipal government. 20% of national revenues are allocated to the municipalities 85% of which are allocated for 'investment purposes'. 3.2% of these investment funds go into a Local Compensatory Health Fund, which reimburse the *Seguro Nacional de Maternidad y Ninez* (SNMN) requests.

In terms of maternal health outcomes and indicators of maternal health, Sri Lanka fares best with 92.2% of pregnant women being attended by a trained birth attendant and 82.2% of live births taking place in government hospitals. However, there are additional non-health system factors which have contributed to this achievement, namely education and the status of women (Samarasinghe 1999). In Egypt, on the other hand, only 28% of mothers receive antenatal care and 30% of women receive trained assistance at delivery. In Bolivia, coverage is also low, but there has been a demonstrated increase in the utilisation of maternal health services (16-39% for antenatal care and 43-50% for delivery care) following the introduction of the SNMN¹⁸.

THE ROLE OF NGOS

There are numerous examples of NGOs working with or in parallel to the government in the provision and/or financing of maternal health services. We consider here examples from Malawi, Bolivia, Brazil and Guatemala, illustrated in Table 17. It is more difficult in these financing programmes, which operate at a more micro-level, to monitor the impact on maternal health outcomes. The study in Guatemala was the only one where an evaluation of impact could be identified. In Malawi and Brazil the government provides subsidies to the NGOs in full or in part for the provision of reproductive health services. In Guatemala the NGOs are contracted by the government to extend basic services to the poor, rural populations. In Bolivia,

¹⁷ Mothers receive treatment free-of-charge for prenatal care, management of pre-eclampsia, eclampsia, delivery (vaginal and c-section), postpartum sepsis and haemorrhage. Neonates are treated for asphyxia, pneumonia and sepsis, and children under five are treated for acute respiratory illnesses and diarrhoea.

¹⁸ Prior to the introduction of SNMN user fees funded maternal and child health services.

PROSALUD is funded by low cost user payments (70%) and international organisations such as USAID.

COMMUNITY-LEVEL FINANCING PROGRAMMES

At the community level projects with varying scope and objectives have been initiated and their success documented. We consider here a number of examples from the African continent: Nigeria, Sierra Leone, The Gambia, Tanzania, Mali and Rwanda (see Table 18). In Nigeria and Sierra Leone the programmes were run by the PMMN and the objective was the provision of funds for emergency care (transport to hospital, drugs and supplies, general treatment) for women during pregnancy, with no pre-payment required, although women were required to repay the loan as soon as possible. Although, the repayment rate was below 100% in each project the impact on utilisation was positive (Chiwuzie, Okojie, Okolocha *et al.* 1997, Fofana, Samai, Kebbie *et al.* 1997) was noted as well as a reduction in the case fatality ratio (Thuray, Samai, Fofana *et al.* 1997). In Mali a similar system was financed partly by the district, partly the community.

In Tanzania, the example is of a health card for reproductive health services funded by households and subsidised by the government. In Rwanda, a similar system targeting farmers, covers preventative and curative care provided by nurses in health centres, providing prepayment is made. However, evidence of the impact was not identified.

Finally, a study in The Gambia (Fox-Rushby & Foord 1996) discusses a system whereby pregnant women have the option of paying a small fee during the antenatal care visit to cover the costs that follow during pregnancy. There was a high uptake, suggesting this was a viable financing option for the women.

USER FEES

Background to user fees

Faced with decreases in both government financing and reduced donor assistance one option for raising funds that has been explored is private user charges for services that were previously provided for free. A 1995 survey of 37 African countries found that 34 governments impose fees of some kind for government provided health services (Samarasinghe 1999). User fees are used in the public sector to generate additional revenue and to improve efficiency by giving consumers appropriate price signals. Experience indicates that they contribute 4-20% to government costs in Sub-Saharan Africa. Some

studies have shown that user fees can increase the use of health services by the poor if they are successfully reinvested at the local facility level and used to improve the quality of services (<http://www.50years.org/update/userfees.html>, Litvack & Bodart 1993). Indeed, the case of Sri Lanka where 60% of patients opt to receive outpatient care in private facilities, indicates that patients are often prepared to pay an affordable fee, with the guarantee of quality care. However, the size of the fee is a determinant factor, depending on whether the charge is purely a nominal amount, or whether the aim is for complete cost recovery through the fee system. The case against user fees is particularly strong for delivery care and life-threatening complications. In these cases the costs can escalate dramatically, placing an unbearable burden on household resources (Hotchkiss 1998). User fees can also be used to support a referral system by charging patients who go directly to tertiary facilities for care that should be provided at lower levels.

Problems with user fees

The user fee structure is inherently regressive and efforts need to be made to ensure that the poor and other vulnerable groups are protected. Cost sharing arrangements are often poorly designed or poorly implemented, thus discouraging the use of reproductive health services, examples include: Kenya, Papua New Guinea, Tanzania, Niger (Grossman, Filippi, De Koninck *et al.* 2000).

Many have argued that user fees should not be used for delivery care as they can serve as a disincentive for hospital deliveries (Stanton & Clemens 1989). The example of South Africa (Schneider & Gilson 1999) indicates the benefits of switching from user fees¹⁹ in 1994, to free provision of maternal and child health care in all government hospitals and health centres. This also led to a reduction in government revenues from fees by 27%, (1.5% of public health budget) and increased drug costs by 1% of recurrent health expenditure. However, utilisation of maternal health services increased: antenatal attendance increased in 8 of the 13 sites by an average of 14.9% and deliveries preceded by an ANC visit increased in 11 of 12 sites by 4.6%. When women are already facing the burden of travel costs, additional fees for the service make the burden of cost insupportable for many women.

¹⁹ With women paying a low, all inclusive, fee (US\$1.50) per outpatient visit and US\$4.40 for inpatient care

Conclusions

There are numerous cost studies of maternal interventions in the literature; however, there is little consistency in the costing methods used making comparisons difficult. Overall, the findings suggest that, for most interventions, care can be provided more cheaply at the health centre rather than the hospital level, so upgrading health centres for the provision of basic EOC is a cost-effective option. However, there were no studies identified which evaluated the costs of home births assisted by skilled personnel. Furthermore, while obstetric surgery often needs a hospital setting, many life-saving procedures can be carried out in health centres and health posts (Maine 1999). However, the more restricted opening hours plus the more limited availability of certain medical staff, might make the health centre less accessible for women to receive emergency treatment. Personnel, drugs and medical supplies are the main contributors to total cost, and for certain interventions (e.g. for postpartum haemorrhage where drugs and medical supplies represent 56% of the total cost) the guaranteed supply of required drugs is essential. As demonstrated by the PMMN studies, in many of the poorest countries, there is an extensive network of health facilities. Therefore, the focus should be on improving the functioning of an emergency obstetric care system, rather than building one up from nothing²⁰.

The cost of a c-section is three times greater than that of a normal vaginal delivery. Hence, the savings from a more rational use of health care can be substantial and support arguments against an over-medicalisation of health care. Similarly, substantial savings can be made by switching from a policy of routine to restrictive episiotomy.

To measure the cost-effectiveness of an intervention, the advantage of the DALY is that it enables comparisons across projects, and can help to justify investments in maternal health projects rather than projects focused on other disease areas. However, maternal mortality is a comparatively rare outcome and the burden of maternal ill-health may be underestimated measured by DALYs. In addition, few economic evaluations have been conducted in this area, which together may explain the lack of evidence in the literature of the use of DALYs for maternal health interventions.

²⁰By improving drug supply, staff training, ensuring the availability of transport to facilities and by promoting educational campaigns to generate community awareness of the availability of service.

There was little evidence in the trends in funding for maternal health although at the donor level the figures were lower than for population programmes. At the domestic level, the adoption of the National Health Accounts framework should facilitate the process of accounting and enable the estimation of comparative expenditure on maternal health care in different settings. A limited review of alternative methods of financing of maternal health care revealed that user fees tend to reduce utilisation (unless there's a parallel improvement in quality). Charges for the treatment of life-threatening complications in particular have been shown to place an enormous financial burden on households. General taxation has worked well if combined with education, although there is the unsolved problem of financing the increasing demand for health services. Large NGOs can play a useful role as can community-based programmes in improving access to health facilities, although the sustainability of funding needs to be considered.

Some recommendations include:

- Ensuring the consistency in the definition of maternal health;
- Developing standard costing methods to facilitate generalisability;
- Encourage consistent national accounting systems, such as the NHA which can be broken down by activity;
- Encourage further cost-effectiveness studies of maternal health interventions, and research into the cost savings associated with increasing the use of evidence based birth practices;
- Ensure the availability of funds to guarantee the availability and efficient use of personnel and drugs / medical supplies within health facilities;
- Further research into alternative methods of financing maternal health services and the impact of each on maternal outcome is essential.

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Table 1. Methodology of relevant cost studies identified

References	Country	Intervention	Costing method	Sample number	Facilities	Cost estimates	Year of costs and currency
Weissman et al. 1999b). Methods in full report (Weissman et al. 1999a)	Uganda	12 interventions contained in the Mother Baby Package ²¹ (MBP)	MBP: interviews with medical personnel on treatment provided, staff time and equipment. Client numbers projected based on DHS and population estimates. Not estimated indirect or opportunity costs.	10 facilities	2 hospitals and 8 health centres. Government facilities in two districts	Total and average costs in hospitals and health centres. Breakdown by input category for hospital costs. No range provided.	1996 US\$
Levin et al. 2000	Ghana, Malawi, Uganda	ANC, vaginal delivery, c-section, postpartum haemorrhage, eclampsia, post-abortion complications	Estimated direct costs: personnel time, drugs, equipment etc. and indirect costs: admin, maintenance, overhead, utilities. Service volume was obtained from facility records.	6 facilities and 20 private midwives.	3 public hospitals and 3 public health centres; 3 mission hospitals and 3 mission health centres, 20 private midwives with 2-3 years training in private nursing homes.	Unit costs of routine services and those relating to obstetric complications. Average for hospital and health centre.	Assumed 1998 US\$
Dmytrachenko 1998	Bolivia	ANC, Delivery, Eclampsia, CS, Sepsis, abortion., episiotomy	Mother-Baby costing package as for Weissman 1999.	31 government facilities in 5 departments in Bolivia	9 facilities are tertiary hospitals: 4 maternity hospitals, 3 paediatrics hospitals, one maternal and child hospital and one general hospital. 8 are secondary level facilities and 14 health posts and health centres in rural and urban areas.	Unit cost of services (average for all facilities, no range provided)	Assumed 1998 in Bolivianos.
Borghi et al. 2000b	Argentina	Episiotomy	Cost of procedure based on questionnaire to 8 obstetricians in Argentina.	2 facilities one in wealthy province of Santa Fe and one in poorer province of Salta.	2 public maternity hospitals.	Unit cost of procedure broken down by resource input. Confidence interval provided.	US\$ 1998
Borghi et al. 2000	Argentina	ANC, vaginal delivery, c-section	Top-down costing and direct allocation of costs. Source: hospital records. Joint costs were allocated based on interviews with personnel. Indirect costs and opportunity costs included.	4 facilities	2 health centres and 2 hospitals	Unit costs are disaggregated by inputs with confidence intervals based on inter-facility variability. Total, average and marginal costs provided.	US\$1998
Galvez et al. 2000	Cuba			13 facilities	12 polyclinics and 1 maternity hospital		
Thinkamr op et al. 2000	Thailand			14 facilities	12 district hospitals and 2 general referral hospitals		
Jinabhai et al. 2000	South Africa			6 facilities	5 health centres and 1 general referral hospital		
Anand et al. 1995	India	Normal vaginal delivery/ANC and postnatal care.	Ingredients approach. Time utilisation study for staff allocation. Other resources allocated based on staff allocation to each activity.	One facility and home.	Primary health centre and home.	Total cost by resource input and unit cost. Marginal cost derived.	Rupees 1991

²¹ Eclampsia, haemorrhage, c-section, neonatal, abortion complications, sepsis, normal delivery, antenatal, family planning, anaemia, syphilis and gonorrhoea.

Family Health International 1996	Ecuador	ANC		10 facilities	Non-governmental clinics			
Suarez & Brambila 1994	Mexico	ANC	Direct and indirect costs. Ingredients approach. Questionnaire to determine time allocation to departments of staff.	6 facilities	Health centres, private not-for profit.	Total and average costs. Total cost broken down by resource input.	US\$ assume 1993-94.	
Mitchell M <i>et al.</i> 1997	Mexico	ANC, postnatal care, ultrasound.	NA	2 facilities	NGOs			
Tinker & Koblinsky 1993	Grenada	ANC	NA	36 facilities	7 health centres and 29 visiting stations	Average cost	US\$ 1991	
Levin <i>et al.</i> 1999	Bangladesh	ANC	Allocation of staff time, equipment, drugs and overheads to each activity.	2 facilities	'rural sites'	Cost per birth averted.	US\$ year not given.	
Rosenthal & Percy 1991	Mexico	Ultrasound	Unable to obtain reference.					
Berman 1989, Berman <i>et al.</i> 1991	Indonesia	Tetanus toxoid immunisation	Costs to the government not including opportunity costs. Expenditures on inputs.	'routine health services' not specified	Government facilities.	Cost per immunised case and per neonatal death averted for routine versus crash programme of tetanus toxoid	US\$ 1985	
		MCH/FP visit incl. drugs and staff and capital.	No definition of MCH/FP or how costs were allocated.	6 facilities	2 health centre 4 subcentres	Cost per capita. Total cost broken down by input.	US\$ 1981	
Fox-Rushby & Foord 1996	The Gambia	ANC	Direct and indirect costs collected from interviews and records.	2 facilities	A mobile maternal outreach service compared to routine ANC a government health centre.	Total cost and average costs of ANC; cost per maternal death averted and per life year gained (LYG).	US\$ 1991.	
Johnson <i>et al.</i> 1993	Mexico and Kenya	Abortion: manual vacuum aspiration and sharp curettage	Rapid assessment methods including qualitative, cross-sectional, limited duration field observations and interviews with small non-representative samples	4 facilities in Kenya and 4 in Mexico	8 government hospitals	Cost per facility per intervention and broken down by input. Hospitalisation costs included.	US\$ 1991	
Magotti <i>et al.</i> 1995	Tanzania	Abortion: manual vacuum aspiration and sharp curettage	Questionnaires with medical staff. Not considered cost of medical instruments, transport, overheads, indirect or social costs.	1 government medical centre		Unit cost, cost of hospitalisation, labour cost, equipment cost and drug cost.	Tshs 1992	

Note to table: NA: Not Available.

Table 2. Costs of antenatal care (ANC)

Country	Public Hospital		Public Health centre		Private maternity home ^a	At home (MC)
	Average cost (AC)	Marginal cost (%AC)	Average cost	Marginal cost (%AC)	Average cost	
Bolivia (secondary) ^b	7.03 (incl. Lab on 1 st visit)	NA	7.13	NA	NA	NA
Bolivia tertiary level	13.87 (incl. lab on 1 st visit)	NA	NA	NA	NA	NA
Mexico	NA	NA	7.47 ^c 4.74 ^d	NA	NA	NA
Ecuador ^e	NA	NA	3.48	NA	NA	NA
Uganda public	4.18 ^a 2.60 ^f	1.48 ^a (35) 1.25 (55) ^f	2.21 ^a	1.03 ^a (47)	1.39/3.42 (0.71/3.01)	NA
Uganda mission ^a	5.20	4.10 (79)	6.43	1.60 (25)	NA	NA
Malawi public ^a	5.48	4.44 (81)	3.23	2.18(67)	NA	NA
Malawi mission ^a	5.77	5.08 (88)	4.18	2.94 (70)	NA	NA
Ghana public ^a	5.45	2.59 (48)	3.17	1.94 (61)	3.02 (1.13)	NA
Ghana mission ^a	2.97	2.09 (70)	4.03	2.37 (9)	NA	NA
Argentina ^g	28.75 (24.40; 42.51)	7.90 (27)	33.46 (26.44; 31.06)	1.65 (5)	NA	NA
Cuba ^h	12.15 (8.85; 15.46)	4.15 (34)	NA	NA	NA	NA
Thailand ⁱ	6.20 (5.33; 7.06)	1.46 (24)	NA	NA	NA	NA
South Africa ^j	9.05 (7.47; 10.62)	0.95 (10)	7.24 (5.78; 8.70)	0.42 (6)	NA	NA
Bangladesh ^k	NA	NA	17.83-92.74 per QALY gained or 30.12-78.29 per QALY gained	NA	NA	NA
Grenada ^l	NA	NA	25.13-29.92	NA	NA	NA
The Gambia ^m	NA	NA	21.32; 9.93	NA	NA	NA
India ⁿ	NA	NA		NA	NA	4.63 (0.14)
Indonesia ^o	NA	NA	0.82-0.91	NA	NA	NA

Notes to table:

For all figures, the inflation adjustment factor based on the consumer price index. Source: Federal Bank of Minneapolis, the annual percentage change in inflation. CPI base year is chained: 1982-84=100

NA: Not Available..

^a Levin *et al.* 2000. Marginal cost considered as 'materials' (drug and supply costs). Private maternity homes: services provided by a private midwife. The range in Uganda is due to the fact that the private midwives may over-report their use of syndromic management of STDs, so the material costs were estimated with and without this component.

^b Dmytraczenko *et al.* 1998. 1US\$=5.19 Bolivian Bolivianos in 01/01/ 1997 (<http://www.oanda.com> FX Converter). Assume average of 2 ante-natal visits per woman: average between first visit: US\$10.02 and second visit: US\$4.24.

^c Mitchell *et al.* 1997

^d Suarez & Brambila 1994

^e Family Health International 1996

^f Weissman *et al.* 1999b, Weissman E *et al.* 1999a

^g Borghi *et al.* 2000

^h Galvez *et al.* 2000

ⁱ Thinkamrop *et al.* 2000

^j Jinabhai *et al.* 2000

^k Levin *et al.* 1999. The range reflects comparison versus intervention groups in two districts each: the first range is for different frequencies of satellite clinics with addition of EPI services. The second intervention is for increased staffing and time open at health and family welfare centres in districts with satellite clinic intervention. The control is home delivery of services.

^l Tinker & Koblinsky 1993. From MotherCare Project, Laukaran, 1990.

^m Fox-Rushby & Foord 1996. Higher figure reflects the cost for the mobile maternal outreach service compared to traditional ANC in government health centre.

ⁿ Anand *et al.* 1995 Exchange rate for 1991/2: 1US\$ = Rs 32.04. By a female multi-purpose worker.

^o Berman 1989. Higher cost reflects MCH/FP outpatient at subcentre, lower cost at health centre.

Table 3. Costs of Normal Vaginal Delivery

Country	Hospital		Health centre		Private maternity home ^e	At home (MC)
	Average cost	Marginal cost	Average cost	Marginal cost	AC (MC)	
Bolivia (secondary) ^b	12.14 (17.53); 28.55 ^c	NA	10.40 (14.07);	NA	NA	NA
Bolivia tertiary level	11.18 (16.76)	NA	NA	NA	NA	NA
Uganda public	33.90 ^a 8.78 ^d	4.31 ^a (13) 1.01 (12 ^b)	2.71 ^a	1.18 ^a (44)	4.27 (3.10)	NA
Uganda mission ^a	32.89	5.28 (16)	15.31	4.48 (29)	NA	NA
Malawi public ^a	24.03	11.34 (47)	10.22	4.63 (45)	NA	NA
Malawi mission ^a	11.76	6.49 (55)	11.14	4.65 (42)	NA	NA
Ghana public ^a	14.60	7.57 (52)	3.17	1.94 (61)	12.75 (3.55)	NA
Ghana mission ^a	11.89	7.26 (61)	4.03	2.37 (59)	NA	NA
Argentina ^e	105.61 (70.81; 140.41)	5.41 (5)	NA	NA	NA	NA
Cuba ^f	21.32 (16.45; 26.20)	5.83 (27)	NA	NA	NA	NA
Thailand ^e	27.25 (22.01; 32.50)	5.54 (20)	NA	NA	NA	NA
South Africa ^h	81.40 (74.49; 88.30)	5.38 (7)	NA	NA	NA	NA
India ⁱ	NA	NA	NA	NA	NA	4.42 (0.14)

Notes to table:

NA: Not Available.

^a Levin *et al.* 2000. Labour costs were not calculated for private midwives in Uganda because the information for calculation of net profit for these solo practitioners was incomplete.

^b Dmytraczenko *et al.* 1998. Delivery without episiotomy (delivery with episiotomy in brackets).

^c Rosenthal & Percy 1991

^d Weissman *et al.* 1999b, Weissman *et al.* 1999a

^e Borghi *et al.* 2000

^f Galvez *et al.* 2000. The confidence limits are based on variability in average costs between the health facilities in the sample.

^g Thinkamrop *et al.* 2000 Based on average of intervention and control hospitals.

^h Jinabhai *et al.* 2000

ⁱ Anand *et al.* 1995 Delivery conducted by a trained birth attendant.

Table 4. Costs of C-section

Country	Year	Average cost (AC)	Marginal cost (%AC)
Bolivia (secondary) ^a	1998	67.63 incl. Lab;	NA
	1991	57.11-106.23 ^b	
Bolivia tertiary level ^a	1998	70.52	NA
Uganda public	1998	46.71 ^c ; 73.10 ^d	38.39 ^e (53) 9.87 (21) ^d
Uganda mission ^c	1998	86.48	53.15 (61)
Malawi public ^c	1998	102.38	54.72 (53)
Malawi mission ^c	1998	61.39	44.12 (72)
Ghana public ^c	1998	88.83	51.20 (58)
Ghana mission ^c	1998	55.60	38.02 (68)
Argentina ^e	1997	525.57 (452.56; 598.58)	80.28 (15)
Cuba ^f	1998	113.98(70.12; 157.83)	43.73 (38)
Thailand ^g	1998	83.00	46.14 (56)
South Africa ^h	1998	140.60 (105.71; 175.48)	24.91 (18)

Notes to table:

NA: Not Available.

^a Dmytraczenko *et al.* 1998

^b Rosenthal & Percy 1991

^c Levin *et al.* 2000

^d Weissman *et al.* 1999b, Weissman *et al.* 1999a

^e Borghi *et al.* 2000. The confidence limits are based on variability in average costs between the health facilities in the sample

^f Galvez *et al.* 2000. The confidence limits are based on variability in average costs between the health facilities in the sample.

^g Thinkamrop *et al.* 2000. Based on average of intervention and control hospitals.

^h Jinabhai *et al.* 2000. The confidence limits are based on variability in average costs between the health facilities in the sample

Table 5. The cost of postpartum haemorrhage

Country	Year	Average cost (AC)	Marginal cost (% AC)
Uganda public	1998	50.63 ^a ; 35.44 ^b	25.76 (51) ^a 3.98 (11) ^b
Uganda mission	1998	114.83 ^a	52.26 (46) ^a
Malawi public ^a	1998	81.51	51.29 (63)
Malawi mission ^a	1998	67.13	46.31 (69)
Ghana public ^a	1998	92.94	36.48 (39)
Ghana mission ^a	1998	37.57	25.78 (69)

Note to table:

^a Levin *et al.* 2000

^b Weissman *et al.* 1999b, Weissman *et al.* 1999a Not specified if this is antepartum or postpartum haemorrhage.

Table 6. The cost of managing eclampsia

Country	Year	Average cost (AC)	Marginal cost (% AC)
Bolivia (secondary) ^a Levin <i>et al.</i> 2000.	1998	39.88 (with lab)	NA
Bolivia tertiary level	1998	45.86 (with lab)	NA
Uganda public	1998	82.37 ^b ; 56.35 ^c	13.33 ^b (16) 8.89 ^c (7)
Uganda mission	1998	159.66	19.50 (12)
Malawi public ^b	1998	106.58	19.50 (18)
Malawi mission ^b	1998	52.66	21.07 (40)

Note to table:

NA: Not Available.

^a Dmytraczenko *et al.* 1998

^b Levin *et al.* 2000

^c Weissman *et al.* 1999b, Weissman *et al.* 1999a

Table 7. The cost of managing maternal sepsis

Country	Year	Average cost (AC)	Marginal cost (% AC)
Bolivia (secondary) ^a	1998	53.56	NA
Bolivia tertiary level ^a	1998	72.64	NA
Uganda ^b	1998	8.76	0.43 (5)

Note to table:

NA: Not Available.

^a Dmytraczenko *et al.* 1998

^b Weissman *et al.* 1999b, Weissman *et al.* 1999a

Table 8. The cost of Manual Vacuum Aspiration, brackets without hospital stay just procedure

Country	Year	Average cost (AC)	Marginal cost (% AC ^a)
Tanzania ^b	1992	4.03 (2.02)	0.31 (8)
Mexico ^c	1991	78.66 (43.12)	12.05 (15)
Kenya ^c	1991	3.52-6.27 (2.37-3.22)	1.20-1.27 (20-34)
Bolivia ^d	1998	16.76; 28.56; 46.82	NA

Note to table:

NA: Not Available.

^a Marginal cost is presented as a proportion of the average cost including hospitalisation.

^b Magotti *et al.* 1995

^c Johnson *et al.* 1993. The range shows variability between hospitals included in the sample.

^d Dmytraczenko *et al.* 1998. The range is primary, secondary and tertiary level facilities respectively for just the procedure (not hospital stay).

Table 9. The cost of surgical (dilation and curettage), brackets without hospital stay just procedure

Country	Year	Average cost	Marginal cost
Tanzania ^a	1992	9.96 (5.03)	4.54 (46)
Mexico ^b	1991	94.82-282.31 68.96	(58.83- 10.78
Kenya ^b	1991	4.77-18.25 (2.70-5.45)	1.03-2.35
Bolivia ^c	1998	51.06-51.83	NA

Note to table:

NA: Not Available.

^a Magotti *et al.* 1995

^b Johnson *et al.* 1993

^c Dmytraczenko *et al.* 1998. Range is for secondary to tertiary level facilities.

Table 10. The cost of managing post-abortion complications

Country	Year	Average cost	Marginal cost
Uganda public	1998	35.43 ^a ; 12.10 ^b	19.43 (55) ^a
Uganda mission	1998	57.60	36.72 (64)
Malawi pu- blic ^a	1998	41.77	12.87 (31)
Malawi mis- sion ^a	1998	29.95	18.49 (64)
Ghana pub- lic ^a	1998	66.46	43.55 (66)
Ghana mis- sion ^a	1998	63.88	41.80 (65)
Bolivia ^c	1998	89.02-104.05	NA
Bolivia ^d	1991	95.26	NA
Nigeria ^e	1987	304.73	NA

Note to table:

NA: Not Available.

^a Levin *et al.* 2000

^b Weissman *et al.* 1999b, Weissman *et al.* 1999a

^c Dmytraczenko *et al.* 1998. Range is for secondary to tertiary level facilities.

^d Rosenthal & Percy 1991

^e Konje *et al.* 1992

Table 11. Annual projections of reproductive health costs (in \$US billions) for developing countries, by funding source and type of cost, according to year

Source and cost	2000	2005	2010	2015
Total	17.00	18.50	20.50	21.70
Source				
International donors	5.70	6.17	6.38	7.23
Developing country govts.	11.30	12.33	13.67	14.47
Type of cost				
Family Planning	10.20	11.50	12.60	13.80
STD Prevention	1.30	1.40	1.50	1.50
Basic RH ²²	5.00	5.40	5.70	6.10
Research, data, policy analysis	0.50	0.20	0.70	0.30

Table 12. Trends in Bilateral and Multilateral Maternal health expenditure (constant 1990 US\$ (%))

	1986 ^a	1987 ^a	1988 ^a	1990 ^b
Family Planning	470.1	442.9	519.2	936
Other maternal	169.8	156.6	187.8	360
TOTAL direct and indirect	1296.3	1218.2	1432.1	1929

Notes to table:

^a Howard 1990. Figures for 1988, indicated that maternal health was 12% of total direct and indirect health expenditure for bilateral donors and 15% for multilateral aid. For family planning the figures were: 37 and 36%. These proportions were used here in the calculations for 1986 and 1987. FP and maternal health limited to family planning, community-based maternal care, referral facilities for the complications of pregnancy, and communication and transport systems to support referral cases. Direct and indirect includes all programmes that influence maternal mortality and morbidity.

^b Rannan-Eliya *et al.* 2000. Figure for family planning classified as 'Population' in original text which includes the collection and analysis of demographic survey data. Total direct and indirect includes: reproductive health (excluding communicable disease, chronic disease and health services).

²² The authors confess that there is no agreed upon definition of this area of activities, but that Safe Motherhood constitutes the largest part.

Table 13. Trends in USAID assistance to the health sector in developing countries (constant 1995 US\$)

	1986	1987	1988	1990	1992	1995
Safe Motherhood activities	321.8	304.3	297.6	NA	NA	NA
Non-family planning component	43.1	22.8	38.6	30	70	30

Note to table:

1986-1988 (Howard 1990).

1990-1995 (Potts *et al.* 1999).

Table 14. Trends in domestic expenditure on maternal health as a percentage of total health expenditure

Countries	% to maternal health							
	1983	1982	1988	1990	1992	1994/5	1997	1998
Sri Lanka		13					4-12 ^a	
Malawi ^b	4							
Egypt ^c							8	
Bangladesh ^d						19		
India ^e					11			
Uganda ^f								7
Papua new Guinea ^g			8-9(1987)					
Total developing countries ^b				4-17				
Latin American & the caribbean ^b				13				

Notes to table:

^a Rannan-Eliya *et al.* 2000. Estimates that maternal health alone represents 1% of national health expenditure, but if we include other components of reproductive health: infant and child care, family planning services, STDs is 4%, if we consider 15% of hospital inpatient care, 6% of hospital outpatient care, 6% outpatient curative care, 6% other registered medical care professionals, 2% traditional medical advisors, 6% medical goods supplied to outpatients, then the percentage increases to 12.4%

^b Howard 1990. For Malawi this is based on a non-references 'report' and expenditure is attributed to 'maternities and 'dispensary maternities'

^c Rannan-Eliya *et al.* 2000, Rannan-Eliya *et al.* 1997.

^d Merrick 1999. Health Economics Unit estimates suggest that total funding for the health sector was \$855 million in 1994/95, equivalent to \$7.1 per capita or 3.1% of GNP. Expenditures on MCH/FP were estimated at \$1.41 per capita.

^e Anand *et al.* 1995. Cost of MCH as % of total cost of primary health care.

^f Weissman *et al.* 1999b, Weissman *et al.* 1999a. It was found that the Ugandan government

currently spends about US\$ 0.50 per capita on maternal and newborn health care, and we assumed a \$7 per capita total health expenditure (Sentumbwe, [http://www.insp.com/The Structural Adjustment programme and the health Sector in Uganda](http://www.insp.com/TheStructuralAdjustmentprogrammeandthehealthSectorinUganda)).

^g Mitchell *et al.* 1991. Based on government and church facilities: health centres and subcentres.

Table 15. 3 stereotype health systems

	Public sector plays the predominant role in financing and provision	Mixed public-private roles in financing and provision	Strong private sector presence and reliance on market mechanisms
Finance:	General tax revenues, donor funds, user fees	General tax revenues, earmarked social insurance funds	Out-of-pocket payments, social health insurance funds

SOURCE: Krasovec & Shaw 2000.

Table 16. Macro-level Models of Health care Financing

Country/ study	Financing of MCH	Macro implications	•	Maternal outcome
Sri Lanka	<ul style="list-style-type: none"> • Government funds 48% of primary care services and 87% of hospital services. • The private sector funds 52% of primary care services. Only 13% of hospital services are financed by the private sector due to the failure of the insurance market to provide catastrophic health insurance. Less than 2% of total health sector financing is from health insurance, and similarly population coverage for health insurance has not increased beyond 2% (Hsiao 2000). • A recent study reports that public financing accounts for more than 90% of all funding for MCH services, which are mostly prenatal and postnatal care, despite household's willingness to pay for out-patient services (Rannan-Eliya <i>et al.</i> 2000). 	<ul style="list-style-type: none"> • Expansion of service provision during the 1930-40s was financed by increasing taxation of the plantation sector. • 1950-70s public services deliver an increasing volume of services by halving unit costs, hence, using personnel and infrastructure even more intensively (Hsiao 2000) 	•	<ul style="list-style-type: none"> • 96% of women given birth in a hospital • 99.6% antenatal coverage • 90% maternal tetanus immunisation • 0.8/1000 maternal mortality 1999

Egypt (Rannan-Eliya et al. 2000)	<ul style="list-style-type: none"> • Government services are subsidised and provided largely free to all citizens. • Health Insurance Organisation (HIO), established 1964, a compulsory social insurance agency levying payroll contributions on formal sector workers and their employers. Coverage does not extend to dependents. Premiums range from 2.5% of assessed salaries. It also receives ad hoc subsidies from the Egyptian government: so funded part social insurance, part general revenues (50-50%). • A separate HIO program was introduced in 1993, the Student Medical Insurance Programme (SMIP), financed by a mix of individual premiums by enrolled students, earmarked cigarette tax and general revenue (76% in 1994/95 and 14% by premiums). • HIP runs its own service delivery system: 31 hospitals in 1995 and a large number of outpatient clinics. 	<ul style="list-style-type: none"> • Restricted coverage of HIO 9.7% of the population 	<ul style="list-style-type: none"> • 28% of mothers receive regular antenatal care • 43% of mothers received two doses of tetanus toxoid immunisation before giving birth • 1/3rd deliveries took place in a health facility with trained medical personnel
Bolivia (http://www.phpr.com/publicat/hrps/finan.html)	<ul style="list-style-type: none"> • Local governments are required to use 6% of the federal tax dollars they receive to support a maternal and child health insurance fund that provides basic entitlements to primary and curative care (Krasovec & Shaw 2000). • Bolivia's National Mother and Child Health Insurance Program: introduced in 1996; provide free essential medical care for women of child-bearing age, newborns and children up to five years old. • Covers selected priority health needs such as birth and antenatal care. Program financing comes from the municipalities and is earmarked for reimbursing providers for medicines, supplies and hospitalisation. 	<ul style="list-style-type: none"> • Reimbursement rates do not cover the actual cost of drugs, supplies and hospitalisation. Facilities are left short of operating cash for drugs and other supplies. • Facilities are not reimbursed by SNMN for personnel and other indirect costs which are a large proportion of total cost especially in the tertiary facilities 	<ul style="list-style-type: none"> • Use of all covered services increased, at a much faster rate than those services which were not covered (18 months prior and after introduction): <ul style="list-style-type: none"> • Increase 16% to 39% for prenatal visits • Births increased from 43% to 50% • According to patient exit interviews, new users had previously only received health-care at home.

Table 17. The role of NGOs in the financing of Maternal Health Care Services

Country /study	Financing of MCH	Scope of services provided	Maternal outcome
Malawi (Krasovec & Shaw 2000)	<ul style="list-style-type: none"> The government works closely with the Christian Health Medical Association (CHAM) subsidising approx. 15% of the recurrent cost of the mission facilities in return for provision of a range of FP services and IEC 	NA	NA
Bolivia (Mintz & Savedoff 2000)	<ul style="list-style-type: none"> PROSALUD began in 1985 as a non-profit organisation operating in facilities provided by the municipal government but managing its own and operations. Financed from a system of cross-subsidies, where the middle class population of certain clinics would subsidise the lower prices charged in clinics in areas with a lower standard of living. The majority of resources came from users' low cost payments and the rest from outside funding such as USAID. Financed 70% by revenues in 1994²³. 	<ul style="list-style-type: none"> 34 health centres 1 referral hospital 1 child development centre Services cover a population of 400,000 in 6 regions of the country. 	NA
Brazil (Krasovec & Shaw 2000)	<ul style="list-style-type: none"> Governments subsidises non-governmental organisations or traditional medical practitioners to deliver reproductive health services to poor families. About 30% of the municipal governments in Brazil provide funding to the Sociedade Civil Bem Ester Familiar No Brasil (BEMFEM) and NGO that provides services in public-sector health posts and training to public sector health personnel, as well as operating its own clinics providing a broad array of reproductive health services. 	<ul style="list-style-type: none"> Concentrated in poorest regions of the country 	NA
Guatemala (Nieves & La Forgia 2000)	<ul style="list-style-type: none"> Large-scale government contracting of NGOs to extend basic health services to poor populations in Guatemala The programme to extend coverage of basic services (PECSB) aims to extend coverage and reach poor, rural, indigenous populations, who had no regular access to modern health services. The government funds NGOs to provide and administer these services. The payment covers the direct cost of the basic package plus administrative expenses and expenses related to institutional strengthening. In 1999, the average per capita payment was approx. \$6.25. 	<ul style="list-style-type: none"> The programme started at the end of 1997 and by the end of 1999 The total number of contracted NGOS were 89. The level of public spending in coverage by NGOs in-creased from US\$ 1.7 million in 1997 to US\$ 12.4 million in early 2000. The population that NGOS were contracted to serve reached a total of 3.5 million in 1999. 	<ul style="list-style-type: none"> Substantial increase in coverage and quality of Essential Obstetric care (EOC) Increased hospital based delivery rates Increase in met need (greater % of women with complications seek care)

²³ Sample fees for delivery: between 21.78-27.22 US\$. Prenatal care free of charge.

Table 18. Community-level financing programmes

	Aim	Financing method	Issues	Outcomes
Nigeria (Chiwuzie <i>et al.</i> 1997)	Cost recovery system for emergency transport to health facilities for pregnant women or other funds they might need	<ul style="list-style-type: none"> • A loan fund: donations were made from the heads of 13 clans (65%) and the PMM team (35%). • Women in need of financial assistance for problems relating to pregnancy or delivery can apply • Payback loan with interest of 2%. 	<ul style="list-style-type: none"> • There was a 93% repayment rate. • Need higher interest rate in future. 	<ul style="list-style-type: none"> • 30 pregnancy-related loans administered per month.
Sierra Leone (Thuray <i>et al.</i> 1997)	Cost recovery system for drugs	<ul style="list-style-type: none"> • Drug provision on monthly basis obtained directly from commercial supplier in Amsterdam rather than going through the government • Charges to patients on basis of full cost of obtained drugs, including handling and transportation and a mark-up of 85% to allow for inflation and less than full cost recovery • The patients could receive treatment without advance payment although the family was encouraged to pay all fees before the family was discharged. 	<ul style="list-style-type: none"> • Prices were lower than private pharmacy and hospital pharmacy. 57% cost recovery rate during the study period. 	<ul style="list-style-type: none"> • The case fatality ratio for women in project area fell from 12% in 1992 to 4% in 1993 compared to 13-11% in the non-project area.
Sierra Leone (Fofana <i>et al.</i> 1997)	Community loan fund	<ul style="list-style-type: none"> • 2 chiefdoms were mobilised to establish funds. • The local leadership imposed levies on the adults of the community: 20 cents (1992) for each male and 10 cents for each female. • The loan fund was managed by the village development committee • In an emergency women could receive treatment immediately and at discharge a bill provided. If she was unable to pay she could take it to the loan fund committee. Payment was later enforced. 	NA	<ul style="list-style-type: none"> • Increase in utilisation compared to non-intervention area.
The Gambia (Fox-Rushby & Foord 1996)	Form of insurance paid during ANC visit and ensuring free access to health services that followed	<ul style="list-style-type: none"> • Each pregnant woman was paid US\$3.16 (1992) to the midwife at, or soon after the first consultation. If the woman did not pay she was responsible for her own expenses 	<ul style="list-style-type: none"> • 82% of hospital and health centre drug costs for maternity care were recovered in theory 	<ul style="list-style-type: none"> • Very high insurance uptake (90%)

Tanzania (Krasovec & Shaw 2000)	Community health fund in Igunga District	<ul style="list-style-type: none"> • Cost sharing by house-holds along with government subsidies for a health card entitling households to basic reproductive health and other health services at rural health centres. 	<ul style="list-style-type: none"> • Is now expanding to 6 other districts 	NA
Mali (63)	An emergency referral and evacuation system for obstetric care	<ul style="list-style-type: none"> • 30% financing from district level, 30% from the community and 30% from evacuees who pay user fees 	NA	NA
Rwanda (Krasovec & Shaw 2000)	A prepayment scheme covering preventative and curative care provided by nurses in health centres, essential drugs and hospital cover and ambulance transfer to hospital in case of obstetric emergencies	<ul style="list-style-type: none"> • Enables farmers to access care, when they would typically forgo care in times of need due to the lack of resources to pay (except at specific times: 2 post-harvest periods) 	NA	NA

Appendix 1

DEFINITIONS

We were interested in the evaluation of costs of providing basic and comprehensive essential obstetric care. The definitions considered for this study are provided below:

Basic essential obstetric care: (Post 1997): Includes antibiotics, sedatives for hypertensive convulsions, oxytocics, manual removal of placenta for retained placenta with postpartum haemorrhage, assisted delivery such as vacuum extraction, forceps for prolonged labour and manual vacuum aspiration for management of incomplete abortion. Basic EOC can also be as simple as an obstetric first aid kit to stabilise the patient before referral (just oxytocics, antibiotics, sedatives), necessary for the management of eclampsia, haemorrhage, sepsis and abortion complications (Weissman et al. 1999). Basic essential obstetric care is usually provided by an upgraded health post or a health centre.

Comprehensive essential obstetric care: (Post 1997): Includes basic EOC services plus surgical (caesarean-section) and blood transfusion capabilities: usually in the form of a rural or district hospital with 24-hour care.

Appendix 2. Cost of Specific Components of Maternal Health Care

COMPONENTS OF ANTENATAL CARE

Ultrasound

One study (Rosenthal & Percy 1991) estimated the cost of the ultra-sound procedure in Mexico at US\$41.51 per visit.

Maternal tetanus immunisation

One study (Berman, Quinley, Yusuf *et al.* 1991) estimates the cost per person successfully covered of a mass campaign delivered through the routine health service system compared to the routine programme of tetanus toxoid immunisation. The cost of the routine programme is estimated to range from US\$0.86 - US\$3.63 (average: US\$2.37). The cost of the crash programme was estimated at: US\$2.41. The cost per neonatal death averted through the routine programme was estimated at between: US\$40.87-US\$174.08 (average: US\$113.37) compared to US\$189.22, for the crash programme.

Iron and folic supplementation

One study (Mitchell, Littlefield & Gutter 1997) estimated the cost of iron and folic supplementation in both Mexico and Zimbabwe at US\$1.30.

Management of maternal anaemia:

One study (Weissman, Sentumbew-Mugisa, Mbonye *et al.* 1999b) of Uganda estimated the cost of managing maternal anaemia at US\$3.60.

Comments

Ultrasound is a high cost intervention which is beyond the capacity of many constrained developing country economies at a cost of US\$41.51. One study (Berman 1989) demonstrates the cost-effectiveness of a mass campaign is similar to the routine programme.

COMPONENTS OF NORMAL VAGINAL DELIVERY

Episiotomy

One study (Dmytraczenko, Aitken, Carrasco *et al.* 1998) enabled the estimation of the cost of an episiotomy in Bolivia. The cost of episiotomy was estimated to range from: \$3.66 for delivery in a health post/health centre, \$5.39 in a secondary hospital and \$5.58 in a tertiary hospital. Similarly another study (Borghini, Fox-Rushby, Bergel *et al.* 2000b) estimated the cost of episiotomy in Argentina (including the cost of suturing and anaesthetic): US\$6.01. There has been much debate surrounding the indications for episiotomy and what should be the 'ideal' rate (Carroli *et al.* 1999). In Argentina a randomised controlled trial suggested that a reduction in the episiotomy rate from 80% to 30% would significantly improve maternal health outcome (Argentine Episiotomy Trial Collaborative Group 1993). Hence, there is substantial scope for cost saving by reducing this practice in countries where the rate is higher than optimal. However, in some regions in sub-saharan Africa the concern should be with increasing this practice to a higher level.

Appendix 3

Table 1. Cost of different approaches to improving EOC and outcomes

Study	Country/ time period	Interven- tion	Approach	Health facility type	Total Costs	Outcome	Cost per outcome
(Ande <i>et al.</i> 1997)	Nigeria 1992-95	Improve EOC and blood bank	<ul style="list-style-type: none"> ✧ Restore surgical theatre (repair/ purchase equipment) ✧ Renovate maternity ward ✧ Training physicians/midwives in obstetrics and installed emergen- cy drug pack system and set up revolving drug fund²⁴. Introduce system of blood dona- tion for families of women atten- ding antenatal care. ✧ Additional staff ✧ Repair blood bank and standby generator. 	District hospital	\$12,779 plus \$938 per year recurrent salary. Total \$15,593.	10 more admissions and 7 deli- veries	\$1559.3 per admis- sion and \$2227.6/d elivery
(Djan <i>et al.</i> 1997)	Ghana 1993-95		Also establish running water supply.	Health centre	\$30,316	100 more obstetric admission; 43 delive- ries; 67 cases of ob-stetric sur-gery (OS)	\$301 per admission, \$705 per delivery, \$452.5 per case of OS
(Leigh <i>et al.</i> 1997)	Sierra Leone 1990-95		Posted a physician with obstetric skills and 2 nd physician was trained and nurses and midwives..	District hospital	\$38,957 (incl new generator: \$16,000)	156 more admissions, 464 obste- tric proce- dures ²⁵	\$250 per admission and \$84 per obstetric procedure.
(Oyesola <i>et al.</i> 1997)	Nigeria 1991-95	Improve EOC no blood bank	✧ Set up electric supply.	State referral hospital	\$12,289	105 more admissions and 21 de- liveries.	\$117 per admission and \$585 per delivery.
(Olukoya <i>et al.</i> 1997)	Nigeria 1994-95			Secondary referral hospital	\$45,505	204 more obstetric admissions	\$223 per admission.
(Sabitu <i>et al.</i> 1997)			✧ Restored ambulance	Secondary facility	\$31,827 (incl new staff costs: \$7,270)	1241 more deliveries and 2329 additional atten- dances for ANC ²⁶	\$25.65 per delivery; \$13.67 per ANC visit.

²⁴ Designed for patients with obstetric complications for surgical intervention, containing surgical consumables.

²⁵ Including c-section and abortion.

²⁶ Based on the difference between the average utilisation between 1991-93 and 94-95.

(Gold <i>et al.</i> 1996)	Nigeria 1994	Establishing a bloodbank	<ul style="list-style-type: none"> ✧ Establish blood bank, backup generator, reagents and supplies. ✧ Refresher training to on e laboratory technician. 	Small hospital	\$8,800	14 blood transfusions per	\$628.57 per transfusion
(Sengeh <i>et al.</i> 1997)	Sierra Leone 1992-93		<ul style="list-style-type: none"> ✧ Education campaign to encourage blood donation. 	District hospital	\$9,869	197 additional blood units drawn, case fatality rate reduced by 8	\$50.01/cas e of blood; \$1233 per death averted.
(Ottong <i>et al.</i> 1997)	Nigeria 1991-94		<ul style="list-style-type: none"> ✧ Upgrade blood facilities in teaching hospital and secondary facility. ✧ 15 community mobilisation sessions. 	Teaching hospital & secondary referral hospital	\$17,531	increase 41 pints of blood and 21 additional blood transfusions	\$282.76 per pint referred.
(Senah <i>et al.</i> 1997)	Ghana 1992-95	Establish MCH/FP clinic	<ul style="list-style-type: none"> ✧ Renovate an abandoned warehouse ✧ Equip with beds, refrigerator, safe water supply, drugs and supplies. ✧ Posted community health nurse and senior nurse-midwife. ✧ Training of 10 TBAs. 	Health centre	\$12,550 assume \$3000 per year recurrent staff salaries. Total: \$24,550	702 antenatal registrants; 86 deliveries.	\$34.97 per antenatal registrant; \$285.47 per delivery.
(Samai & Sengeh 1997)	Sierra Leone 1992-93	Improve transport and communication to EOC	<ul style="list-style-type: none"> ✧ 4-wheel drive posted to hospital and radio (x10) linking system to primary health units. ✧ Community education activities. ✧ Bicycles (x2) ✧ Trained drivers from the local transport union ✧ Set up a revolving emergency fuel fund. 	PHU to hospital	\$46,836	21 cases referred with vehicle	\$2230 per referred case;
(Shehu <i>et al.</i> 1997)	Nigeria 1993-95		<ul style="list-style-type: none"> ✧ Trained drivers from the local transport union ✧ Set up a revolving emergency fuel fund. 	Home to hospital	\$268	56 transportations	\$4.79 per case
(Wilson <i>et al.</i> 1997)	Ghana 1992-94	Maternity waiting home	<ul style="list-style-type: none"> ✧ Ward of abandoned hospital renovated and furnished: 8 old beds repaired. 	maternity waiting home	\$10,505	Lack of staff: 25 women referred only 1 stayed.	NA

Note to table: *Assumed material costs are one time investment.

Appendix 4. Background and Approach to Calculation of DALYs

The disability-adjusted life year (DALY) was originally developed in order to calculate the global burden of disease (GBD) initiated by the World Bank and WHO in an attempt to provide information on (a) levels of ill-health from premature mortality and (b) from non-fatal health outcomes, and the contribution of different diseases, injuries and risk factors (Murray & Lopez 1998, Murray & Lopez 2000). This term has been increasingly appearing in health policy discussions since the publication of the 1993 World Development Report (World Bank 1993).

Methods of measuring the total disease burden at the global level and for setting priorities among health interventions using the principles of cost-effectiveness require a 'generic' measure of health status which can be used to aggregate across different disease conditions with differing health outcomes.

The DALY is one such measure. The DALY is a composite measure of health status combining the time lost due to premature mortality (Years of life lost: YLL) and the time lived with a disability (years lived with disability: YLD). The process of calculation is complex, however, broadly defined, there are four main steps:

1. Calculation of the number of years of life lost due to maternal causes;
2. Calculate of the loss in quality of life for those living with the conditions;
3. Application of age weighting: reflecting the social value of people at different ages;
4. Application of a discount rate to reflect the rate of time preference (benefits sooner rather than later).