Health care financing and utilization of maternal health services in developing countries

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Background	The Millennium Development Goals call for a 75% reduction in maternal mortality between 1990 and 2015. Skilled birth attendance and emergency obstetric care, including Caesarean section, are two of the most important interventions to reduce maternal mortality. Although international pressure is rising to increase donor assistance for essential health services in developing countries, we know less about whether government or the private sector is more effective at financing these essential services in developing countries.
Methods	We conducted a cross-national analysis to determine the association between government versus private financing of health services and utilization of antenatal care, skilled birth attendants and Caesarean section in 42 low-income and lower-middle-income countries. We controlled for possible confounding effects of total per capita health spending and female literacy.
Findings	In multivariable analysis, adjusting for confounders, government health expenditure as a percentage of total health expenditure is significantly associated with utilization of skilled birth attendants ($P = 0.05$) and Caesarean section ($P = 0.01$) but not antenatal care. Total health expenditure is also significantly associated with utilization of skilled birth attendants ($P < 0.01$) and Caesarean section ($P < 0.01$).
Discussion	Greater government participation in health financing and higher levels of health spending are associated with increased utilization of two maternal health services: skilled birth attendants and Caesarean section. While government financing is associated with better access to some essential maternal health services, greater absolute levels of health spending will be required if developing countries are to achieve the Millennium Development Goal on maternal mortality.
Keywords	Antenatal care, skilled birth attendants, Caesarean section, health systems, health economics, health care financing, Millennium Development Goals

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KEY MESSAGES

- In developing countries, total health care expenditures and the extent of government's participation in health care financing are associated with higher levels of utilization of more intensive maternal health services such as skilled birth attendants and Caesarean section.

- Female literacy does not predict use of Caesarean section, possibly because of severe constraints on access to this procedure.

- Improving utilization of essential maternal health services, including Caesarean section, will benefit from higher overall health budgets and greater government participation in health care financing.

Introduction

Maternal mortality is one of the greatest development and health challenges facing the world. In the developing world, maternal mortality ratios have barely fallen in the last 50 years, even as other health indicators have improved. The average woman in sub-Saharan Africa faces a 1 in 16 lifetime risk of dying in pregnancy and childbirth, compared with a 1 in 2800 chance for a woman in a developed country. The maternal mortality ratio (chance of dying in pregnancy or within 42 days of delivery) stands at 830 per 100 000 live births in Africa, compared with 20 in the developed world. Of the 529 000 estimated maternal deaths each year, nearly half occur in Africa (World Health Organization 2003a). Another 300 million women in developing countries suffer short or long-term illness as a result of pregnancy and childbirth (Safe Motherhood 2006).

The inclusion of maternal mortality reduction as one of the eight Millennium Development Goals has lent new urgency to efforts to tackle this persistent public health and development problem. The Millennium Development Goals call for a 75% reduction in the maternal mortality ratio between 1990 and 2015. An effective strategy for meeting this ambitious goal requires both the right technical interventions and an appropriate plan for financing universal access to those interventions.

Maternal death and illness are both linked to the conditions at and soon after delivery. Up to 80% of maternal deaths are due to direct obstetric causes (e.g. haemorrhage, eclampsia, infection, obstructed labour, complications of unsafe abortion), with the remainder due to underlying illness (World Health Organization 2003a; Khan *et al.* 2006). While genetic, behavioural and socio-economic factors all influence a pregnant woman's likelihood of dying during pregnancy, delivery or the postpartum period, timely access to health care is one of the most important and remediable factors. Historic experience in Europe and the United States confirms that access to skilled professionals, midwives and later to emergency obstetric care services, including Caesarean section, dramatically reduced maternal mortality (Loudon 1992; Hogberg 2004; Bullough *et al.* 2005). More recent empiric research shows that skilled birth attendants and emergency obstetric care (i.e. a set of interventions to treat direct obstetric complications, from oxytocin for post-partum haemorrhage to vacuum extraction and Caesarean section) are two of the most potent weapons in the battle against maternal mortality (Graham *et al.* 2001; Paxton *et al.* 2005; World Health Organization 2006a). The World Health Organization (WHO) recommends that Caesarean section rates should be in the range of 5 to 15% of all deliveries to minimize maternal and

neonatal mortality and morbidity (AMDD Working Group on Indicators 2004). While some developing countries in Latin America have overly high Caesarean section rates, which are associated with increased maternal morbidity, the predominant problem in low-income countries is inadequate access to Caesarean section (Ronsmans *et al.* 2006).

On the other hand, antenatal care, which was thought to predict impending obstetric complications, has not been effective in reducing maternal mortality ratios (Bullough *et al.* 2005; Safe Motherhood 2006). This is likely because most complications arise without warning, often in women categorized as low risk. Antenatal care, however, is widely offered even in the poorest countries and additional research is under way to understand how to optimize this health service to benefit mothers (Villar *et al.* 1998).

While skilled birth attendants and emergency obstetric care are widely acknowledged to be essential to combating high maternal mortality, their provision requires functioning health systems that include trained and motivated workers, equipped facilities and rapid referral systems for complications. These are largely absent in the under-funded health systems of developing countries. The WHO Commission on Macroeconomics and Health estimated that an essential basket of health services, including emergency obstetric care, costs approximately US$35 per capita in low-income countries (World Health Organization 2001). Yet in 2003, 34 of the 46 countries in the WHO African region spent less than US$35 per capita, with 29 of the countries spending US$20 or less (World Health Organization 2006b). It is no surprise, therefore, that women in the poorest countries have very limited access to skilled birth attendants and even less access to emergency obstetric care (World Health Organization 2005b).

New international initiatives like the Millennium Development Goals have raised attention to the severe underfunding of health systems and other areas of social development in low-income countries. As a result, donor countries are beginning to spend more on development assistance. As of June 2005, 16 out of 22 high-income donor countries have met or agreed to meet the target of spending 0.7% of their GDP on development assistance by 2015 (UN Millennium Project 2005a,b). Low-income countries have also acknowledged the need to spend a higher proportion of their own resources on health. At the Abuja Summit on HIV/AIDS, Tuberculosis and Other Related Infectious Diseases in April 2001, African heads of state set a target of increasing health sector funding to 15% of government budgets (Organisation of African Unity 2001). These commitments promise to substantially accelerate progress in achieving universal access to health care

as well as achieving other development priorities in the next decade.

Given the potential for additional resources, both governments and donors need evidence on whether higher levels of government spending on health care will result in improved access to the specific health services that are most needed to meet the Millennium Development Goals. This is particularly urgent as increasingly donors are moving away from direct funding for health projects to pooled funding for health (i.e. sector-wide approaches or SWAps) controlled by the recipient country's government. This approach is still relatively new but generally seen as a positive move in building health systems (Goodburn and Campbell 2001; UN Millennium Project 2005b). Evidence of the effectiveness of government spending on increasing access to essential health services would add further weight to the push for pooled funding approaches.

Health care can be financed by governments (e.g. taxation, social insurance), private citizens directly (e.g. private insurance, out-of-pocket payments) or external funders (e.g. donor funding). While there is substantial work demonstrating that increased *levels* of health system funding are linked to better access to maternal and child health services (Wagstaff 2002; Wang 2003; Palmer *et al*. 2004; Prata *et al*. 2004), there are fewer studies that examine the role of government financing in access to services generally, and even fewer on access to the particular services needed for maternal mortality reduction. Evidence on the relative effectiveness of government financing compared with private financing is also important in light of the trend towards privatization of health services, in line with the market-based health sector reform policies promoted by international financial institutions and bilateral donors in the 1980s and 1990s.

A recent review of country-level financing mechanisms for maternal health found that direct out-of-pocket payments at the point of care reduced utilization of maternal health services in a number of countries and that pooled payments schemes (e.g. insurance) can help increase access (Ensor and Ronoh 2005). A number of sub-national studies indicate that private financing approaches reduce access to maternal, child and other essential health services (Wang 2003; Falkingham 2004; Jacobs and Price 2004; Palmer *et al*. 2004; Prata *et al*. 2004; Xu *et al*. 2006). Out-of-pocket payments for health services have also been found to be an important cause of impoverishment in several countries (Wagstaff 2002; Liu *et al*. 2003; Jacobs and Price 2004). However, these within-country studies are highly specific to local context and use different research methodologies, making them difficult to generalize. Furthermore, they do not directly tackle the effectiveness of governments as primary payers of health services. Such information is essential to guide national policy as well as donor actions. This paper uses a cross-national analysis to examine whether greater government participation in health care financing is associated with utilization of essential maternal health services.

Methods

Data

The primary dependent variables of interest in this analysis were rates of utilization of three maternal health services: antenatal care, skilled birth attendants and Caesarean section. Utilization of antenatal care was defined as the proportion of live births in the 3 years before the survey period before which the mother visited a trained health professional (doctor, nurse or midwife) at least once. Utilization of a skilled birth attendant is defined as having a doctor, nurse or midwife present at the delivery. This variable excludes births delivered by a traditional birth attendant, who is defined by the WHO as a community-based provider with no formal training in obstetric delivery care and independent of the health system (World Health Organization 2004). This is an important distinction as traditional birth attendants have not been shown to be effective in averting maternal deaths (Rosenfield and Maine 1985; Greenwood *et al*. 1990; Smith *et al*. 2000; Goodburn and Campbell 2001). The third dependent variable was Caesarean section, a key obstetric intervention for many life-threatening delivery complications.

The data for the dependent variables were taken from the Demographic and Health Surveys (DHS) (MEASURE DHS 2006a). MEASURE DHS is a project, funded by USAID with contributions from other donors, to perform surveys in developing countries that can inform policy. Since 1984, DHS surveys have been done in 75 countries and based on a common format to allow comparability across countries. These surveys are administered to a nationally representative sample of 5000 to 30 000 households. The data are analysed and verified before being released in the country and to researchers through an online database (MEASURE DHS 2006b). We analysed those DHS surveys that reported information on the maternal health services of interest. The survey questions for these indicators were comparable across countries and years. The surveys chosen spanned 14 years, 1990–2004.

The key independent variable in our analysis was government health expenditure as a percentage of total health expenditure. Government health expenditure is the expenditure on health by all government entities, and includes social insurance schemes and extra-budgetary spending on autonomous health institutions such as university hospitals etc. This includes donor funding that is channelled through the government (e.g. through sector-wide approaches), but excludes off-budget donor funding for discrete projects (World Health Organization 2003b).

Other independent variables included per capita health expenditure and female literacy rate. As discussed earlier, higher absolute levels of spending buy more health services, increasing utilization (Wagstaff 2002; Wang 2003; Palmer *et al*. 2004; Prata *et al*. 2004). Thus we included total health expenditure in international dollars at purchasing power parity (PPP) rates as an independent variable in our model. The WHO defines total health expenditure by financing agent as general government expenditure plus private expenditure. Private health expenditure comprises out-of-pocket expenditures or those made by private social insurance, other private insurance, not-for-profit institutions including non-governmental organizations, and private firms and corporations (World Health Organization 2003b). Along with Evans *et al*. (2001), we did not include GDP per capita in our final models as this measure of wealth is highly correlated with absolute amount of health spending, and we found that including it did not change the fundamental associations between independent and dependent variables (Evans *et al*. 2001).

Lastly, we included female adult literacy, which is an important independent predictor of women's behaviour, income and health outcomes (Caldwell 1993; Subbarao and Raney 1995; Anand and Barnighausen 2004).

The data for per capita health expenditures and government share of health expenditure for the years 1998–2004 were taken from WHO's national health accounts database (World Health Organization 2006b). Because health expenditure data was not routinely tracked by WHO before 1998, we accessed the World Bank's *World Development Report 1993*, which focused on health care financing, for 1990 health expenditure data (World Bank 1993). While the data from both sources was collected directly from governments, there may be some differences in how the final numbers were calculated. Health expenditures were converted to constant 2000 international dollars (PPPs) using the respective countries' 2000 official exchange rate and country-specific purchasing power parity rates (World Bank 2006b). Female literacy rates were taken from the United Nations (UN) Human Development Indicator Database (UN Statistics Division and UNESCO 2006). Literacy data in the database come from national censuses, the Multiple Indicator Cluster Survey (MICS) or the UN Education, Science and Cultural Organization (UNESCO).

Statistical analysis

We used DHS data to obtain values on each of the dependent variables of interest for the 1990–2004 period. For the countries with multiple DHS surveys, we selected the most recent survey containing the three dependent variables. We regressed three health access indicators—antenatal care, utilization of skilled birth attendants and Caesarean section—individually against government expenditure as a proportion of total health expenditure while controlling for per capita health expenditure and female literacy.

Data for several of the independent variables of interest were not available for all the years of the DHS surveys used in the analysis. National health account (NHA) data were only available for 1990 (World Bank data) and then from 1998 onward (WHO data). Therefore, for countries where we were using DHS values from 1990 or from 1998 onward, we also used national health account data (government health expenditure as a percentage of total health expenditure and per capita total health expenditure) from the matching year. For six countries (surveys 1991–1997) for which exact year NHA data were not available, we used an average of 1990 and 1998 values for the NHA variables. This method is similar to that used by Wang (2002). Survey-derived empiric values for female literacy were available for a single year between 2000 and 2004 for each country. We also performed sensitivity analysis using several different year-matching methods to test the effect of such approaches on our results. First we assessed all models using only the most recent data for all independent variable indicators. We then used a combination of matching the year of the survey where possible and using the temporally closest available data where same year data was not available. Neither of these approaches appreciably changed the results.

We examined each variable's distribution and descriptive statistics including means, medians and ranges. To improve the linear relationship between per capita total health expenditures and our outcomes of interest, we transformed this indicator using a natural log function. We determined bivariate associations between each of the independent variables and the dependent variables of interest. We used separate multivariable models to assess the relation between the independent variables (government expenditure as a proportion of total health expenditure while controlling for per capita health expenditure and female literacy) and the dependent variables of interest (antenatal care, utilization of skilled birth attendants and Caesarean section). Model fit was assessed using a combination of Root Mean Squared Error and R-squared. To further explore the relationships of interest, we calculated predicted value of each of the dependent variables at rising levels of government share of health spending within the range of possible values of government share of health spending in the dataset, holding all other independent variables constant at their median.

Results

Of the 75 countries for which DHS surveys are available, we restricted our analysis to 54 countries that had complete survey modules on antenatal care, skilled birth attendants and Caesarean section. We eliminated three countries with gross national incomes per capita over US$2355 (South Africa, Gabon and Turkey) to focus on low-income and lower-middle-income countries (World Bank 2006a). These countries are generally considered to be developing countries and are the focus of the UN Millennium Development Goals initiative. We eliminated a further nine countries with missing values for one or more independent variables.

Table 1 lists the countries used in the analysis. Twenty-two of the 42 sample countries were in Africa, the continent with the lowest incomes per capita and highest maternal mortality ratios. Table 2 shows some basic descriptive statistics for the 42-country sample. The average share of government health expenditure in the sample was 44.4%. To put this in perspective, in 2004 the industrialized nations of the Organisation for Economic Co-operation and Development (OECD) averaged 73% government financing, and even in the United States, with its market-based health system, 45% of all health spending was by government (Organisation for Economic Co-operation and Development 2006). The median values for the dependent variables—antenatal care, use of skilled birth attendants and Caesarean section—were 83.80, 49.80 and 3.15%, respectively (World Health Organization 2001). Utilization of skilled birth attendants and Caesarean section were far below international target levels, defined by WHO as 100% (World Health Organization 2006a) and 5–15% (AMDD Working Group on Indicators 2004) of pregnant women, respectively. Only six countries in the sample had Caesarean section rates over 15% and only three of these had rates over 20%. The median of per capita health expenditures in our country sample was just over 68 PPPs. According to WHO, the median health spending in our 42 countries in 2000 was US$18 (World Health Organization 2006b), which is below the US$35 per capita minimum for essential health services suggested by the Commission on Macroeconomics and Health (World Health Organization 2001).

Table 1 Countries and year of the surveys used in the analysis

Country	Year
Armenia	2000
Bangladesh	2004
Benin	2001
Bolivia	2003
Brazil	1996
Burkina Faso	2003
Cambodia	2000
Chad	1997
Colombia	2000
Comoros	1996
Côte d'Ivoire	1998
Dominican Republic	2002
Egypt	2000
Ethiopia	2000
Guatemala	1999
Haiti	2000
Indonesia	2003
Jordan	2002
Kazakhstan	1999
Kenya	2003
Madagascar	2004
Malawi	2000
Mali	2001
Mauritania	2001
Morocco	2004
Mozambique	2003
Nepal	2001
Nicaragua	2001
Niger	1998
Nigeria	2003
Pakistan	1991
Paraguay	1990
Peru	2000
Philippines	2003
Rwanda	2000
Senegal	1997
Togo	1998
Tanzania	1999
Uganda	2001
Uzbekistan	1996
Yemen	1997
Zimbabwe	1999

Table 3 shows the results of the regression modelling. In multivariable modelling, government share of health care spending is not significantly associated with antenatal care ($\beta = 0.167$, $P = 0.368$), but is associated with presence of a skilled birth attendant ($\beta = 0.370$, $P = 0.048$) and with proportion of Caesarean section ($\beta = 0.148$, $P = 0.010$) in separate models adjusted for absolute amount of health spending and female literacy rate.

Figure 1 shows that for higher percentiles of government's share of health spending, utilization of both skilled birth attendants and Caesarean section increase. As the government share of health spending increases, utilization of skilled birth attendants increases more than utilization of Caesarean section.

Discussion

Government participation in health care financing is associated with utilization of skilled birth attendants and Caesarean section, two key interventions for reducing maternal mortality. There are several potential reasons for this. Government financing may increase access to maternal health services to a greater extent than the private sector (including households paying out-of-pocket) as these services represent a substantial investment in the supply of hospitals, nurses and doctors—an investment that cannot be tackled by households or the nascent private health care sector. Also, higher levels of government spending imply lower levels of out-of pocket financing, which has been shown to reduce access to basic health services (Wang 2003; Falkingham 2004; Jacobs and Price 2004; Palmer *et al*. 2004; Prata *et al*. 2004; Xu *et al*. 2006). Thus, in countries where governments participate heavily in health care financing, essential services such as skilled birth attendants may be exempt from user fees, encouraging more people to use them. Government financing for health is all the more important in some of the poorest countries in sub-Saharan Africa where several decades of market-based reforms left health systems with minimal infrastructure and inadequate numbers of health workers (Logie and Woodroffe 1993).

We found that government financing does not influence women's access to antenatal care. This latter observation may be a result of the fact that some antenatal care (at least one visit, the measure used here) is provided near universally, even in the lowest income countries. Antenatal care can thus be seen as a 'sub threshold service'; one that nearly all governments provide irrespective of their level of participation in health financing, having historically viewed it as a core part of an essential health basket. For example, a median of 85% of women in WHO's Africa region reported at least one visit to a trained provider (World Health Organization 2006b), similar to the 82.8% of women in our sample. The relatively high utilization rate of antenatal care is likely also due to its low cost and low infrastructure requirements, which means that even rural women can find a provider for at least one antenatal visit.

The size of the effect of government financing is different for skilled birth attendants and Caesarean section. Multivariable modelling suggests a higher elasticity of government spending on skilled birth attendants than Caesarean section: keeping total health expenditure constant, a 10% increase in government's share of health expenditure is associated with an increase in use of skilled birth attendants by 3.70% compared with 1.48% for Caesarean section. However, these cannot be compared directly because their rates of optimal utilization are very different—5–15% for Caesarean section and 100% for utilization of a skilled birth attendant. Thus a small increase in

Table 2 Descriptive statistics for key variables

	Mean	Standard deviation	Median	Minimum	Maximum
Independent variables					
Government health expenditure as percentage of total health expenditure	44.41	14.81	43.67	14.20	80.90
Total health expenditure per capita	126.03	115.22	68.18	19.00	485.00
Female literacy rate	69.39	26.54	72.25	14.00	99.90
Dependent variables					
Antenatal care	74.30	21.30	83.80	26.20	98.70
Use of skilled birth attendant	53.00	26.54	49.80	5.60	99.30
Caesarean section	7.03	8.46	3.15	0.40	36.70

$n = 42$

Table 3 Multivariable regression models

	Antenatal care	Use of skilled birth attendant	Caesarean section
Government health expenditure as percentage of total health expenditure	0.167 $P = 0.368$	0.370 $P = 0.048$	0.148 $P = 0.010$
Total health expenditure per capita	−0.719 $P = 0.859$	15.504 $P < 0.001$	6.803 $P < 0.001$
Female literacy	0.510 $P < 0.001$	0.320 $P = 0.021$	0.032 $P = 0.428$
n	42	42	42
Adjusted R^2	0.3392	0.5820	0.6303
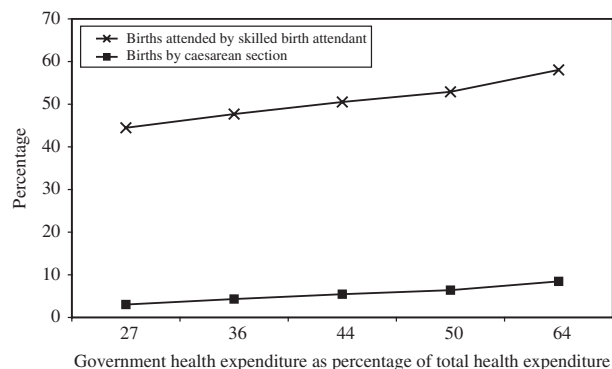
Figure 1 Proportion of births with a skilled birth attendant and Caesarean section by government's share of health expenditure

Caesarean sections will bring a country closer to the international target than the same increase in use of birth attendants. The reason for the lower responsiveness of Caesarean section to increases in government share of health expenditures may be that at a given level of health spending many cash-strapped ministries of health choose to allocate more of their limited budgets to less resource-intensive, lower-tech health services, including skilled birth attendants. Thus unless health budgets increase dramatically, in many countries we are unlikely to see rates of Caesarean section rise to the levels needed to reduce maternal deaths due to labour complications.

Total health expenditure per capita is significantly associated with higher utilization rates of skilled birth attendants and Caesarean section. This is probably because both services require trained personnel, medical supplies and infrastructure that will be more available in countries that spend more on health. Total health expenditure is not significantly associated with antenatal care access in a multivariable model that includes female literacy rate. Female literacy rate is a strong and significant predictor of utilization of antenatal care and of skilled birth attendants but not of Caesarean section. The former findings are consistent with current understanding. Female literacy increases the 'demand' side factors for utilization of health care but presumably cannot offset shortages in supply of services. For example, literate women use basic services like antenatal care and skilled birth attendants, which are generally more available in poor countries, at a greater rate (Raghupathy 1996; Addai 2000; Paredes *et al.* 2005). However, we found that the same association may not hold for a more specialized, higher intensity health service, such as Caesarean section. The reason for this may be that providing appropriate levels of Caesarean section requires higher health budgets than those of most of the countries in the sample and therefore access to this service is highly restricted, especially outside urban areas. Thus lack of supply rather than inadequate demand would seem to be the binding limit on utilization. In addition, given the low observed rates of Caesarean section in this sample, most of the Caesarean sections are likely to be emergency rather than elective procedures, thus making literacy and voiced demand less important determinants than the medical condition and supply of surgical services. This hypothesis is consistent

with our finding that total health spending is more important than female literacy in determining utilization of Caesarean section.

There are important limitations to the data we used in this study. The sample size is small. It would be important to repeat this analysis as more country surveys on maternal health service utilization become available. Data for some independent variables were not available for the specific years of some DHS surveys in the sample. We tested for different methods to match available data, finding little variation in the results documented here. However, it is necessary to replicate these results using more complete datasets including all the covariates of interest when available. The data available only permit cross-sectional analyses; longitudinal work is needed to allow inference about *changes* in government share of health spending and improvements in maternal health service utilization.

Caveats considered, our work suggests that higher levels of government participation in health financing are associated with higher utilization rates of skilled birth attendants and Caesarean sections—two services essential to meeting the maternal health Millennium Development Goal. However, highly constrained health budgets are limiting developing countries' ability to provide universal access to essential maternal services, particularly Caesarean section. Donor assistance is urgently required to boost government health budgets. WHO estimates that to provide 95% coverage of essential maternal and newborn health services in the 75 worst-off countries an additional US$39 billion will be required between 2006 and 2015. This translates to US$0.22 per developing country inhabitant per year initially, expanding to US$1.18 by 2015 (World Health Organization 2005a). This is an eminently affordable price tag for the international community that pledged to jointly reduce maternal deaths by three-quarters by the year 2015.

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