DHS Analytical Studies 7

Trends in Delivery Care in Six Countries

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Trends in Delivery Care in Six Countries

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Preface

One of the most significant contributions of the MEASURE *DHS+* program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Analytical Studies* series and the *DHS Comparative Reports* series examine these data, focusing on specific topics. The principal objectives of both series are: to provide information for policy formulation at the international level, and to examine individual country results in an international context. Whereas *Comparative Reports* are primarily descriptive, *Analytical Studies* take a more analytical approach.

The *Analytical Studies* series comprises in-depth, focused studies on a variety of substantive topics. The studies are based on a variable number of data sets, depending on the topic under study. A range of methodologies is used, including multivariate statistical techniques. The topics covered are selected by MEASURE *DHS+* staff in conjunction with the MEASURE *DHS+* Scientific Advisory Committee and USAID.

It is anticipated that the *Analytical Studies* will enhance the understanding of significant issues in the fields of international population and health for analysts and policymakers.

Martin Vaessen
Project Director

Acknowledgments

This study is a collaborative venture between the MEASURE *DHS+* project at ORC Macro, USA and the SAFE (Skilled Attendance For Everyone) International Research Partnership coordinated by the Dugald Baird Centre for research on Women's Health in Aberdeen, Scotland. Funding was provided by the U.S. Agency for International Development and the European Union. We wish to thank Julia Hussein, Cynthia Stanton, Wendy Graham, Nancy Fronczak, and Anja Giphardt, who read and commented on drafts of the report, and Christine Smith, who was involved in the early work on the report.

Executive Summary

Increasing the proportion of deliveries with skilled attendants present is being advocated as the most important step in preventing maternal deaths worldwide. The indicator most commonly used as a proxy for skilled attendance at delivery is the percentage of deliveries attended by a health professional, which has been selected as one of the Millennium Development Indicators for measuring reductions in maternal mortality.

The objective of this study is to provide an in-depth understanding of trends in delivery with a health professional over the last decade, across a range of developing countries: Bangladesh, Bolivia, Ghana, Indonesia, Malawi, and the Philippines. In particular, the study analyzes trends in the types of professionals providing services, the place of delivery, and some composite indicators of skilled attendance. Throughout the report, emphasis has been placed on identifying subnational variation in trends by socioeconomic and obstetric characteristics of the women.

The proportion of deliveries with a health professional has increased over the last decade in all six countries. The national trends were statistically significant in three countries—Bangladesh, Bolivia, and Indonesia—with the largest absolute increases in Bolivia and Indonesia. National trends, however, mask variations between different groups of women. Urban-rural residence, economic status (wealth index), parity, maternal education, and age were all associated with delivery with a health professional. The results suggest that inequities among women of different backgrounds may be increasing, emphasizing the importance of subnational analyses to ensure that the women least likely to seek care are not marginalized.

1 Introduction

The purpose of this study is to provide a better understanding of trends in and the determinants of delivery care for women across a selected range of developing countries. It involves a detailed secondary analysis of data from Demographic Health Surveys (DHS).

This is a collaborative venture between the MEASURE *DHS+* project at ORC Macro, USA (ORC Macro, 2003) and the Skilled Attendance For Everyone (SAFE) International Research Partnership (SAFE, 2003), which is being coordinated by the Dugald Baird Centre for Women's Health, Aberdeen, Scotland (University of Aberdeen). SAFE is a multicenter operations research study that aims to provide new knowledge to identify, implement and improve strategies designed to increase skilled attendance at delivery in developing countries. ORC Macro has been collecting survey data in developing countries since 1986 through the Demographic and Health Surveys (DHS) program. One of its most significant contributions is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. Among the maternal health indicators collected is information about individual deliveries—who attended them and where they took place—and it is this information that is the focus of this collaborative study.

The study examines data from consecutive surveys in six countries to establish trends in delivery care and explore the use of process indicators. Established indicators "delivery with a health professional" (DHP) and "place of delivery" are examined; and alternative indicators—the partnership ratio between doctors and midwives, and composites of DHP and place of delivery—are introduced. The characteristics of women who use maternal health services are assessed as predictors of skilled attendance, with particular emphasis on the relationship between use of antenatal care and use of delivery care and on the consistency of use of delivery care across pregnancies. Finally, there is an examination of trends in early neonatal death and the relationship of early neonatal death to delivery care. We do not have data linking delivery care with individual maternal deaths.

This analysis aims to provide new knowledge about ways of investigating levels of skilled attendance at delivery that can be used by health service providers to target those women who do not receive professional delivery care. Policymakers may also find the results helpful in developing policies targeting underserved women.

In an overview of maternal health issues, Section 2 discusses the measurement of maternal health outcomes, the problems encountered, and the resulting use and limitations of process indicators. It explains the focus on skilled attendance and introduces some issues of equity in delivery care. Section 3 describes the DHS surveys and discusses their strengths and limitations. Section 4 introduces the methods used in the study and the indicators used in the report. It also discusses some key methodological issues such as the decision to use birth-based analysis in preference to woman-based analysis. Section 5 presents the main results of the analyses, and Section 6 is a discussion of the findings and their implications.

2 Maternal Health Issues

2.1 Measuring Maternal Health Outcomes

In the context of safe motherhood programs the outcome indicators refer to the health outcomes of maternal mortality and morbidity; they are the target of efforts at the program level (Campbell, 1999). Maternal health outcomes are measured in order to direct resources and monitor trends, to evaluate the effectiveness of interventions designed to improve outcomes, and to learn more about the causes of morbidity and mortality (Fortney and Smith, 1999). The most commonly quoted maternal health outcome indicator is the maternal mortality ratio (MMR).[1] There are three main sources of information on maternal deaths in developing countries: vital registration, health service statistics, and community-based surveys (AbouZahr, 1998). Countries with high levels of maternal mortality also tend to have poor statistical infrastructure. In 1989, the UN estimated that more than two-thirds of the world's population live in areas that lack complete death registration (United Nations, 1991). Studies have shown that even countries with comprehensive vital registration regularly misclassify maternal deaths, and that in developing countries as many as 60 percent can be missed (Campbell and Graham, 1991). Health service figures may record maternal death with varying degrees of completeness and accuracy, but their main flaw is that they are usually not representative of the general population of pregnant women. They will tend to over-represent both complicated emergency cases and low-risk women from affluent backgrounds. To obtain accurate information on maternal deaths it is therefore important to use sources of data from reliable population-based surveys.

One method of obtaining information on maternal death uses household survey techniques and the sisterhood method (Graham, Brass, and Snow, 1989). DHS surveys use a modification of the sisterhood method by calculating the MMR from reports on the survival status and pregnancy status at death of respondents' sisters (Stanton et al., 2001). In order to obtain precise current estimates this approach requires large sample sizes because maternal death is relatively rare even where the MMR is high. The size of the DHS surveys (typically including 4,000-8,000 women) is insufficient for this purpose and estimates obtained in this way tend to be imprecise. Also, the sisterhood method creates a retrospective estimate for the previous 10-12 years and not a current one. These limitations mean that most estimates of MMR cannot be used to monitor short-term trends and therefore are not helpful in assessing the impact of programs aimed at improving maternal health care.

Problems of measurement and the current lack of a reliable, precise, and practical way of estimating maternal health outcomes have meant that safe motherhood program managers have found it difficult to demonstrate progress. This in turn has made funding difficult to obtain. The deadlock situation of limited information on maternal health indicators and low priority given to maternal health has been called the "measurement trap" (Graham and Campbell, 1992).

The measurement of maternal morbidity was seen as a useful alternative to mortality because of its higher incidence, but studies have shown that the reliability and validity of women's self-reports are often poor (Fortney and Smith, 1999; Filippi, Graham, and Campbell, 1990). It is also difficult to compare different morbidities and to standardize outcomes.

2.2 The Evolution of Process Indicators

The problems associated with measuring maternal health outcomes have led to an increasing reliance on process indicators; these measure the levels and changes in processes that are believed to influence the outcome of interest (Wardlaw and Maine, 1999). Process indicators are being recommended for

[1] Maternal deaths per 100,000 live births

the measurement of levels and changes in the activities of a program to monitor progress toward the reduction of maternal mortality. Ideally, they should be closely correlated with mortality but have the advantage of being easier and cheaper to collect. They can often be derived from routinely-collected data or as part of program implementation and are more sensitive to change, permitting frequent measurement and short-term feedback on interventions (Wardlaw and Maine, 1999). Another benefit is that process indicators provide information on the deficits in a service, allowing policymakers to target interventions to reduce maternal mortality more effectively. These indicators can measure the provision of services—e.g., the number of essential obstetric care facilities per 500,000 population or the percentage of hospitals with caesarean section facilities (Maine et al., 1997)—or service utilization such as the proportion of births attended by a health professional (Ronsmans, 2001). Such coverage statistics require population-based data sources, but even with these it is difficult to establish a correlation between the indicator and maternal health outcomes.

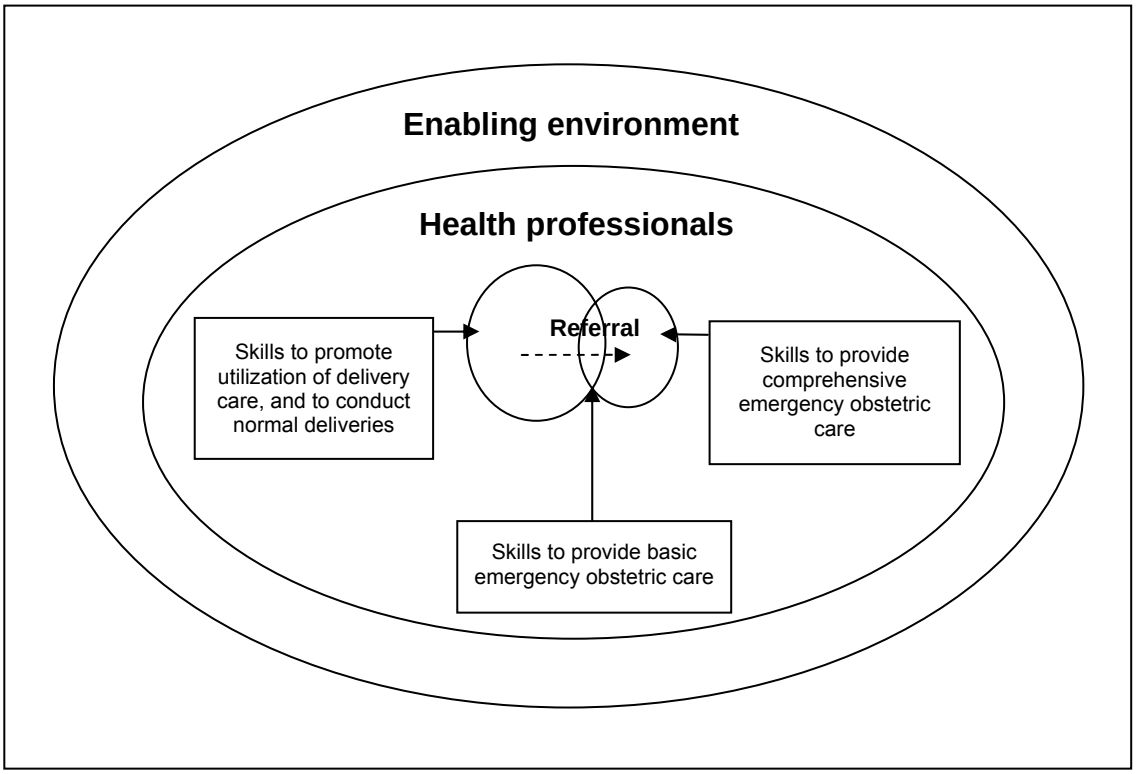
2.3 Delivery with a Health Professional, Skilled Attendants, and Skilled Attendance

Providing skilled attendants for delivery care, along with the equipment, drugs and supplies necessary for effective management of obstetric complications, is now being advocated as the single most important factor in preventing maternal deaths (WHO, 1999). For this reason, the benchmark indicator ”percentage of births attended by a skilled attendant” is currently used to monitor progress toward international goals for maternal mortality reduction (United Nations, 2002). At the General Assembly of the World Health Organization in 2001, it was stated that where maternal mortality rates are high, countries should strive to ensure that 60 percent of deliveries are assisted by a skilled attendant by the year 2015 (WHO, 2001).

The importance placed on this benchmark indicator has been debated by many international groups (Graham, Bell, and Bullough, 2001; Safe Motherhood Inter-Agency Group, 2000). The advantage of this indicator is that it is widely available for many developing countries from community health surveys such as the DHS. However, several aspects of its measurement have been challenged. The definition of a “skilled attendant” is not always clear. Until recently the term “trained attendant” was used and grouped both professional and nonprofessional health workers together. In 1999, the WHO/UNFPA/UNICEF/World Bank statement recognized the skilled attendant as a “health professional” with midwifery or obstetric skills who can manage complications of delivery as well as normal deliveries. Health professionals include nurses, midwives, physicians, and other medical personnel (WHO, 1999). This can lead to differences in interpretation in many countries, particularly where intensive but shortened training has been provided to relieve the shortages of more traditionally trained doctors and nurse-midwives. Furthermore, the presence of a health professional does not necessarily imply competence or skills in conducting deliveries (Graham, Bell, and Bullough, 2001).

It is generally agreed that to provide skilled attendance the attendant alone is not enough and that an enabling environment is also necessary. The Safe Motherhood Inter-Agency Group has defined skilled attendance as a process through which a woman is provided with adequate care during labor, delivery, and the postpartum period (Safe Motherhood Inter-Agency Group, 2000). The clarification of this concept is represented in Figure 2.1, which demonstrates that skilled attendance can only be provided when health professionals operate within a functioning health system or enabling environment, where drugs, equipment, supplies, and transport are all available. Skilled attendance therefore requires (i) a health professional with midwifery or obstetric skills; (ii) the availability of referral systems to facilities that provide basic obstetric care and comprehensive obstetric care; and (iii) the provision of the necessary supplies of drugs, equipment, and transport to deal with obstetric emergencies (Graham, Bell, and Bullough, 2001).

Figure 2.1 The concept of skilled attendance requires an enabling environment as well as health professionals who provide adequate care during labor, delivery, and the postpartum period



Research being conducted by the SAFE International Research Partnership is addressing some of the complexities of measuring skilled attendance described above. Nevertheless, data currently available on skilled attendance is limited to the proportion of deliveries with different types of delivery attendants, whether health professionals, other health workers, traditional birth attendants (TBAs), or relatives. Whenever possible, differentiation will be made in appropriate sections on whether analysis refers to delivery with a health professional or otherwise.

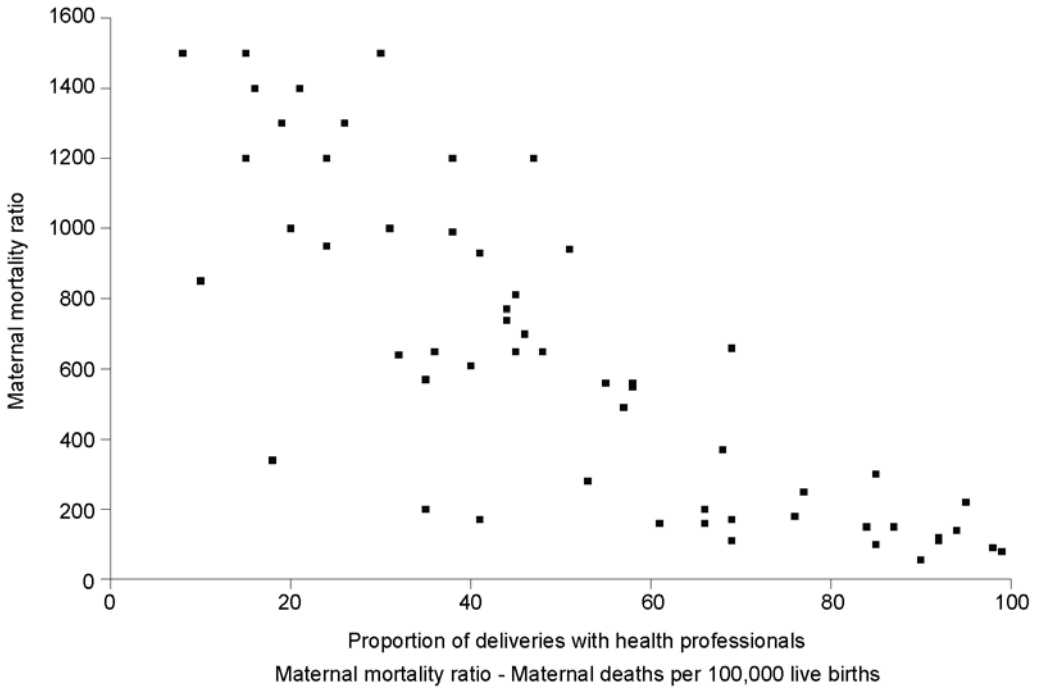
2.4 The Focus on Skilled Attendance

One of the reasons for this focus on skilled attendance at delivery is that epidemiological data relating to maternal deaths in developing countries shows that about two-thirds of deaths occur at around the time of delivery (AbouZahr, 1998). During pregnancy, any woman can develop serious life threatening complications that require medical care. Because there is no reliable way to predict which women will develop these complications, it is essential that all women be treated with watchful expectancy during delivery, and that emergency obstetric care remains within reach of all pregnant women (Maine and Rosenfield, 1999). These situations require access to skilled care during delivery, with the implication that there will be benefits for care throughout the pregnancy for the mother as well as the neonate. Delivery with a health professional is at the center of this focus because there is no robust evidence to show that the training programs directed at TBAs have had any effect in lowering levels of maternal mortality (Ronsmans et al., 1997).

An argument used for advocating skilled attendance is the existence of correlational evidence linking the proportion of deliveries with health professionals with maternal mortality (Figure 2.2). Historical data also points to the essential role played by the improvement of delivery care in reducing the incidence of maternal deaths (De Brouwere, Tonglet, and Van Lerberghe, 1998; Koblinsky, Campbell,

and Heichelheim, 1999; Loudon, 1992). It is important to point out that no sound epidemiological evidence exists for a causal connection between the two (Graham, Bell, and Bullough, 2001).

Figure 2.2 Proportion of deliveries with health professionals and the maternal mortality ratio for 50 developing countries, ~1990



There is currently no evidence to indicate that improvement of skilled attendance at delivery, nor of any other safe motherhood intervention strategy, will necessarily lead to a reduction in maternal mortality (Graham, 2002). However, if it is taken that improvement in the quality of care is in itself a step forward, then the emphasis being placed on ensuring skilled attendance is worthwhile. If the potential of increasing skilled attendance to reduce maternal and perinatal mortality is realized, its effects will reach far beyond those related only to maternal health—6.9 million perinatal deaths every year are related to maternal complications (Koblinsky et al., 2000)—and have far-reaching consequences for family life, stability of the family unit, and economic status.

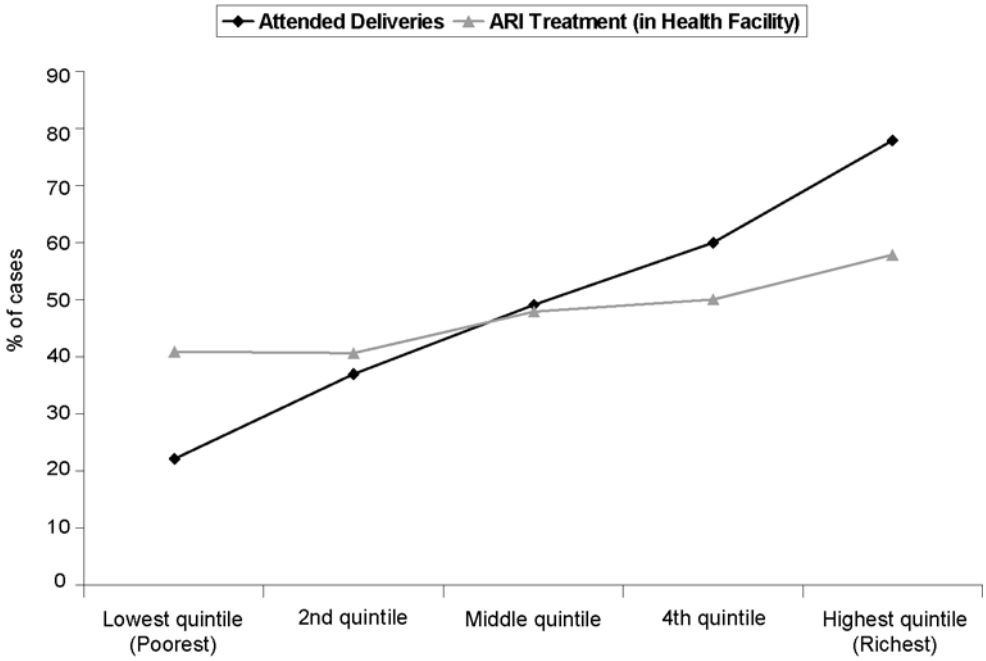
2.5 Issues of Equity in Delivery Care

In the richest and most developed countries, almost all women deliver with a health professional, while in the sub-Saharan countries the proportion ranges from 15 to 70 percent (Stewart, Stanton, and Ahmed, 1997) and can fall as low as 12 percent (NIPORT, Mitra and Associates, and ORC Macro, 2001). Apart from the inequities between richer and poorer countries, the national figures quoted can disguise internal inequities in the provision and use of maternal health services between different groups of women.

Access to skilled attendance at delivery is still limited for many women especially in rural areas (Le Bacq and Rietsema, 1997). In many African countries where there may be difficulties with transportation, women from rural areas may have to walk long distances to reach the nearest health services (Gwatkin et al., 2000; Rose et al., 2001; Starrs, 1997; UNICEF, 1999). Women who live in urban areas are often three times as likely to have delivery care as their rural counterparts (Stewart, Stanton, and Ahmed, 1997).

As well as urban-rural differences, economic differentials in access to delivery care have also been demonstrated (Gwatkin et al., 2000). Figure 2.3 shows that differences in the percentage of attended deliveries vary by as much as 50 percentage points between women in the richest and poorest households. The inequity is far more pronounced for delivery care than for other services such as care for acute respiratory infection (ARI) in children.

Figure 2.3 Economic differentials in access to types of health care



Source: World Bank, 1999

Women's use of antenatal care (ANC) may give some indication of service coverage (Bulatao and Ross, 2000). However the generally higher uptake of ANC seen in most countries (compared with delivery care) could be due to the greater availability of antenatal services through lower level health facilities and mobile services, which may be due to the lower cost of providing ANC compared with delivery care. In addition, unlike ANC, the precise timing of a delivery is unpredictable, making it more difficult for women without access to transportation to reach delivery care. It is also the case that user charges are levied less frequently for ANC than for delivery care. It is clear that socioeconomic disadvantage can have a detrimental effect on maternal health and that indicators such as level of household wealth and level of education are associated with women's utilization of all maternal health care services (Kunst and Houweling, 2001). For many women the cost of using formal health services is prohibitive (Graham and Murray, 1997). Other factors influencing women's use of skilled attendance are cultural beliefs about where a woman should deliver. There may be restrictions on women's movement outside the home and lack of decision-making rights regarding health care.

The causal pathways between maternal mortality and process indicators remain uncertain. Until the validity of this association can be determined, the use of process indicators to improve the understanding of trends and determinants is justified, theoretically at least. This report uses existing DHS data related to maternal health care to highlight the issues of who attends deliveries and where they take place.

3 Sources of Data

Demographic and Health Survey (DHS) data have been collected from over 70 countries since 1986. Surveys are typically repeated every three to five years, allowing analysis of trends in key indicators for many countries. Data from these surveys are now available on the web.

3.1 Surveys Included in This Study

In this study data were obtained from six countries where at least two DHS surveys have been conducted. The number of countries was limited to six because two recent DHS reports (Rose et al., 2001; Stewart, Stanton, and Ahmed, 1997) already provide comparisons of a wide range of countries, and this study aims to look at the same subject matter in greater depth. The original intention was to study countries that were participating in the SAFE study (Bangladesh, Ghana, Jamaica, Malawi, and Mexico). These countries represent a broad spectrum from very low to relatively high proportions of delivery with a health professional (DHP) and a good geographical spread. However, no DHS surveys have been conducted in Jamaica, and there is only one survey available for Mexico. Alternatives were chosen on the basis of levels of DHP and global representation. The countries finally selected were Bangladesh, Bolivia, Ghana, Indonesia, Malawi, and the Philippines. There have been three surveys in Bangladesh (1994, 1997, 2000), three in Bolivia (1989, 1994, 1997), three in Ghana (1988, 1993, 1998), four in Indonesia (1987, 1991, 1994, 1997), two in Malawi (1992, 2000), and two in the Philippines (1993, 1998).

3.2 Questions of Relevance to Delivery Care

DHS surveys typically interview all women age 15-49 in selected households.[2] Women are asked a series of questions on pregnancy and delivery care for each live birth they report occurred in the past five (or three) years. The specific questions on delivery care (ORC Macro, 2001a; ORC Macro, 2001b) are:[3]

- Who assisted with the delivery of (NAME OF CHILD)? Anyone else?
- Where did you give birth to (NAME OF CHILD)?
- Was (NAME OF CHILD) delivered by caesarean section?

In addition, respondents were asked the following questions on antenatal care:

- When you were pregnant with (NAME OF CHILD), did you see anyone for antenatal care for this pregnancy? IF YES: Whom did you see? Anyone else?
- How many months pregnant were you when you first received antenatal care?
- How many times did you receive antenatal care during this pregnancy?

The DHS questions allow for multiple responses to be recorded for the person assisting with delivery and the person providing antenatal care.

The questionnaire includes a complete live birth history from which neonatal deaths can be identified. Information is also collected on background characteristics of the woman such as socioeconomic characteristics, level of education, and place of residence.

[2] In Indonesia and Bangladesh only ever-married women were interviewed.
[3] Exact question wording can vary slightly by survey. See individual survey reports for the exact wording used in a particular survey.

3.3 Additional Information

Economic status levels have recently been described by using DHS data to classify women into quintile groups according to household wealth. Wealth is measured by means of an asset score that is based on principal component analysis on more than 40 asset variables—these include durable consumer goods, housing facilities, and housing materials (Gwatkin et al., 2000). These asset scores were added to several of the recent surveys, thus enabling exploration of the relationship between poverty and women's use of delivery care.

3.4 Strengths and Limitations of the Data

DHS data have a number of strengths and limitations that it is important to be aware of when interpreting the results of this analysis.

Strengths:

1. The data are population-based and so are representative of the experience of women in the general population.

2. DHS surveys employ standardized, well-tested procedures to maximize data quality, including rigorous interviewer training, field supervision, and data processing procedures.

3. DHS survey questions have been used in over 100 surveys and so are well tested in the field.

4. The data have been collected in a consistent manner allowing comparisons across countries and across time.

5. DHS surveys contain substantial background information on the women interviewed.

6. The questions are simple, making them relatively easy to collect, and the indicators based on these questions are widely used internationally.

Limitations:

1. Information about attendant at delivery and place of delivery is only recorded for live births. This means that it is not possible to calculate perinatal mortality rates by type of attendant because information on attendants involved in stillbirth deliveries is not available.

2. It is not known how accurately women are able to identify their attendants. Different categories of attendants may appear similar, and it is not known to what extent women can distinguish, for example, between trained TBAs and midwives and between midwives and doctors. Also, there is no way of knowing the level of skill of individual practitioners. We have only the professional labels reported by the women.

3. The level of involvement of attendants reported by the women is not clear. It is assumed that the attendants recorded have had significant involvement in the delivery, but this is not certain.

4. The health facility indicator includes a wide range of care, and there is insufficient information about the health facilities recorded to enable stratification by level of obstetric care available (basic or comprehensive).

5. It is not possible to control effectively for complications of pregnancy or delivery. Some DHS surveys do collect information on women's self-reported complications, but such data in household surveys has been shown to be unreliable.

Most of these limitations are unavoidable in surveys of this type and they do not detract from the utility of either the surveys or this report. DHS surveys give us the best estimates of many reproductive indicators and remain the main source of international information in the area of safe motherhood. Although a wide range of data can be collected, the scope of the surveys necessitates a sacrifice in terms of the depth of information available.

4 Methods

4.1 Delivery Care Indicators

It is not possible to determine from the available data whether a delivery had skilled attendance according to the definition in Figure 2.1 because there is neither information about the environment nor the actual skills of the health professionals. For this reason, the following indicators were chosen for analysis.

Delivery with a Health Professional (DHP)

The percentage of (live) deliveries that are attended by a health professional

This is a standard international indicator of delivery care. The term "health professional" rather than "skilled attendant" is used here because the surveys record the professional label used by the women to identify their attendants and provide no indication of the individual's level of practical skill. As noted above, DHS surveys record all the attendants named by the woman, but for the purposes of this analysis the indicator is defined by the most qualified attendant mentioned. For example if a woman reported a midwife and a doctor in attendance, the delivery will be classified as attended by a doctor for the analysis. Not all health professionals are qualified to attend deliveries, as defined by the World Health Organization (WHO, 1999). For the purposes of this analysis we define health professionals as midwives, doctors, and nurses. The complete listing of categories that we have chosen to define as health professionals are shown in Table 4.1 for the selected countries.

Table 4.1 Categorization of health professionals by country

Country	Health professional	Non-health professional
Bangladesh	Doctor, nurse or midwife	Family welfare visitor, TBA (trained and untrained), relative, other, none
Bolivia	Doctor, nurse or midwife	Auxiliary midwife, TBA, relative, other, none
Ghana	Doctor, nurse or midwife	TBA (trained and untrained), relative, other, none
Indonesia	Doctor, nurse or midwife	Auxiliary midwife, relative, other, none
Malawi	Doctor, nurse or midwife, clinical officer/medical assistant[1]	TBA (trained and untrained), relative, other, none
Philippines	Doctor, nurse or midwife	TBA (trained and untrained), relative, other, none

TBA = Traditional birth attendant
[1] In the 2000 survey clinical officers were coded in the same category as doctors. In the 1992 survey they were coded with medical assistants in a separate category (for most qualified attendant at delivery n=7). For comparability between surveys, the 1992 clinical officer/medical assistant category was coded as health professional.

Delivery in a Health Facility[4]

The percentage of (live) deliveries that occur in a health facility

All health facilities were included in this indicator—hospitals, clinics, health centers, and maternity homes. However, the data do not indicate anything about the enabling environment (described in Section 2.4) available in these facilities.

[4] Information on place of delivery was not collected for Bolivia 1989, Ghana 1988, and Indonesia 1987, so only Bangladesh and Indonesia will have three points in any trend analysis of a composite indicator.

Composite Indicators

We also examine three composite indicators. These represent an attempt to get closer to the concept of skilled attendance described in Section 2.4 by combining attendant and place of delivery, or combining types of attendants.

(i) **The percentage of (live) deliveries attended by a health professional in a health facility.** This may give a better approximation of the real level of skilled attendance, although it still contains no information about the environment of care and the availability of referral systems, which are an integral part of the concept.

(ii) **The percentage of (live) deliveries attended by a health professional outside of a health facility.**

(iii) **The partnership ratio (PR).** This has been used as an indicator to emphasize the importance of different health professionals with complementary skills working together (Graham, Bell, and Bullough, 2001). It is expressed as two mutually exclusive figures: the proportion of deliveries where a doctor is the most qualified attendant and the proportion of deliveries where the most qualified attendant is a midwife—for example *PR (10,55)*—with the sum indicating the total proportion of deliveries with a health professional. If the goal of 100 percent of deliveries with professional attendants is accepted, along with the need for doctors to attend at least 15 percent of these (this being the usual estimate of the percentage of births with life-threatening complications) then an optimum point can be plotted at *PR (15,85).*

4.2 Background Characteristics Associated with Delivery Care

Table 4.2 summarizes the independent variables used in the bivariate and multivariate analyses of the determinants of delivery care. This is not an exhaustive list of factors that are expected to be associated with delivery care. For example, biomedical risk factors such as history of complications during index and previous pregnancies are expected to influence use of delivery care but are not available in the DHS surveys. Similarly, direct measures of access to delivery services are not available in these surveys. However, this list covers basic characteristics that are theoretically expected to be associated with delivery care. The variables are grouped into three categories: utilization of other maternal health services, obstetric characteristics, and socioeconomic factors.

Table 4.2 Summary of independent variables

Variable	Definition
Utilization of other maternal health services	
Number of ANC visits	Number of ANC visits for index pregnancy: none, 1-3 or 4 plus
Timing of first ANC visit	Timing of the first ANC visit for index pregnancy: early (before 5 months), late (after 5 months) or no visits
Obstetric characteristics	
Parity during index pregnancy	0, 1-2, 3-5 and 6+ (based on live births only)
Age at time of index birth	<19, 19-34, 35+
Multiple birth	Single or multiple
Socioeconomic factors	
Maternal education level	None, primary or secondary plus (categorized by DHS)
Area of residence	Urban or rural (based on DHS definition)
Poverty quintile	Quintiles based on asset factor scores (Gwatkin et al., 2000)

Utilization of other maternal health services. We include two variables to measure use of ANC services by the mother during the index pregnancy: the number of visits made and the timing of the first visit. Utilization of ANC during the pregnancy is expected to reflect several things including the mother's access to, knowledge of, and attitude toward antenatal services, and her awareness of the potential problems of pregnancy. In addition, women who receive ANC may be encouraged to use professional delivery services during their antenatal visits. We therefore expect women who seek ANC more frequently and at an earlier point in their pregnancy to be the most likely to use delivery care, and those who do not receive ANC at all to be the least likely to use delivery care.

Obstetric characteristics. DHS collects data on certain obstetric characteristics such as parity (the number of viable births a woman has experienced), maternal age, and past obstetric history. While individual obstetric characteristics have been associated with various types of unfavorable obstetric and infant outcomes, they are poor predictors of obstetric risk because they are not direct causes of poor outcome (Rooney, 1992). Nevertheless, characteristics such as youngest and oldest women and women experiencing first births and high order births continue to be used as clinical markers for identifying individual women who need referral or extra care in pregnancy. The validity and usefulness of risk assessment for reducing maternal mortality is not fully understood.

Socioeconomic characteristics. Use of delivery care is expected to be strongly associated with socioeconomics status. Maternal education is consistently and strongly associated with all types of health behavior and we expect use of delivery care to be higher among more educated mothers. The service and social environments are typically very different in urban and rural areas, so strong urban-rural differentials in use of delivery care are expected. Several analyses are presented separately for urban and rural areas because of the large differences in access to delivery care. Finally, economic status is an indicator of access to delivery care, and use of delivery care is expected to be substantially higher among mothers in the upper quintiles of the wealth index.

4.3 Sample Issues

Before proceeding with the analysis, there are two related issues to be resolved concerning which deliveries to include in the analysis sample. The first issue concerns the choice between birth-based or woman-based analysis. The second issue concerns the choice between a three-year or five-year reference period.

4.3.1 Birth-based Analysis

Birth-based analysis uses all the deliveries recorded for a representative sample of women over a set period. DHS reports present birth-based estimates, using all births that occurred in either the preceding five years or the preceding three years, depending on the period used for the delivery questions in that particular survey.

Advantages and disadvantages of the birth-based approach

The advantages of birth-based analysis are:

- Statistically representative of all births in a given period (John, Menken, and Trussell, 1988);
- Simple to calculate because it does not involve random selection of a birth for women with multiple births;
- Provides a larger sample size and thus smaller sampling errors than a woman-based analysis.

The disadvantage of a birth-based analysis is that individual women may contribute more than one birth to the sample. Thus, while the sample is representative of all births in a given period, it over-represents women who deliver more than once in the period. These women are not representative of the total population of women. They tend for example to be less educated and more rural. They also tend to be less likely to have a professional attendant or facility delivery. Thus, estimates of the percentage of deliveries occurring with a health professional or in a health facility will typically be lower than for a corresponding woman-based analysis. The size of this difference will depend on the proportion of women contributing multiple births to the sample and how different the delivery care behavior of those women is compared with women who contribute only one birth to the sample.

4.3.2 Woman-based Analysis

Woman-based analysis addresses these issues by using only one delivery per woman. One approach is to select only the woman's most recent birth in the last five (or three) years. However, Grummer-Strawn (Grummer-Strawn and Stupp, 1996) shows that this can lead to biased results, although the bias was less for pregnancy and delivery-related indicators than for other child health indicators examined. An alternative is to randomly select one birth per woman if the woman has multiple deliveries during the analysis period.

4.3.3 Time-period for Analysis

As mentioned in Section 3, DHS collects information on delivery care for all live births that occurred in either the five years preceding the survey or the three years preceding the survey. This leads to the second, related sample issue—the choice of a five-year or a three-year reference period. Most of the surveys included in this analysis collected data for births in the five years preceding the survey. The exceptions are Bangladesh 1994 and Ghana 1993, which used a three-year reference period. The three-year reference period provides a more current estimate than the five-year period and should therefore be less prone to recall error by women. It will also provide greater consistency between the birth-based and woman-based samples because fewer women will contribute multiple births to the sample than with a five-year reference period. However, it will yield a smaller sample size and thus greater standard errors for the indicators.

4.3.4 Comparison of Approaches

Table 4.3 illustrates these issues for our data by presenting the indicator "percentage of deliveries attended by a health professional" based on different sample options. Standard errors are presented in parentheses.[5]

Woman versus birth-based estimates

As expected, levels of professional attendance obtained from birth-based estimates tend to be lower than those obtained from woman-based estimates over the same reference period. For the three-year reference period the differences are small, with most less than one percentage point (range: 0-2.0 percentage points). The differences between birth-based and woman-based estimates are substantially larger for the five-year reference period, with most differences greater than one percentage point (range: 0-6.3 percentage points). The larger difference for the five-year period reflects the fact that more women contribute

[5] The sample errors are calculated taking into account the complex sample designs in the DHS surveys and, when applicable, the correlation between births to the same woman. Because of data limitations, the standard errors presented for Bolivia 1989, Ghana 1988, and Indonesia 1987 have not been adjusted for the survey design. However, the estimates for these are weighted to be representative at the national level.

Table 4.3 Percentage of births attended by a health professional (and standard errors) based on different sample options, Demographic and Health Surveys, 1987-2000

	Sampling option and reference period					
			Woman-based sample			
	Birth-based sample		Random birth		Last birth	
Survey	3 years	5 years	3 years	5 years	3 years	5 years
Bangladesh						
1994	9.1 (0.5)	u	9.3 (0.5)	u	9.1 (0.6)	u
1997	8.1 (0.6)	7.6 (0.5)	8.7 (0.6)	9.1 (0.6)	8.6 (0.6)	9.0 (0.5)
2000	12.1 (0.7)	11.5 (0.6)	12.5 (0.8)	12.6 (0.7)	12.3 (0.8)	12.4 (0.7)
Bolivia						
1989	43.1 (1.0)	42.0 (0.8)	44.1 (1.1)	45.8 (1.0)	44.2 (1.1)	46.2 (1.0)
1994	45.7 (1.5)	u	46.6 (1.5)	u	46.8 (1.5)	u
1998	58.2 (1.2)	55.3 (1.1)	59.9 (1.1)	60.3 (1.0)	60.2 (1.1)	61.6 (1.0)
Ghana						
1988	40.6 (1.0)	39.8 (0.8)	41.0 (1.0)	41.3 (0.9)	40.6 (1.0)	41.2 (0.9)
1993	43.4 (1.6)	u	43.8 (1.5)	u	43.8 (1.5)	u
1998	44.7 (1.5)	44.1 (1.4)	45.1 (1.5)	46.5 (1.3)	45.2 (1.5)	46.1 (1.4)
Indonesia						
1987	37.6 (0.8)	36.2 (0.6)	37.3 (0.9)	36.2 (0.7)	37.2 (0.9)	36.2 (0.7)
1991	35.7 (1.0)	35.1 (0.9)	35.9 (1.0)	35.9 (1.0)	36.0 (1.0)	35.9 (1.0)
1994	41.5 (1.1)	39.7 (1.1)	41.7 (1.2)	40.6 (1.1)	41.7 (1.2)	40.6 (1.1)
1997	50.9 (1.2)	49.0 (1.1)	51.1 (1.2)	50.1 (1.1)	51.1 (1.2)	50.1 (1.1)
Malawi						
1992	52.5 (1.9)	54.5 (1.8)	53.2 (1.9)	55.2 (1.9)	52.7 (2.0)	53.6 (1.8)
2000	52.9 (1.2)	54.1 (1.1)	53.7 (1.2)	56.1 (1.2)	53.4 (1.2)	54.7 (1.2)
Philippines						
1993	53.9 (1.1)	52.8 (1.1)	54.4 (1.1)	55.4 (1.0)	54.6 (1.1)	55.5 (1.0)
1998	57.5 (1.1)	56.4 (1.0)	59.0 (1.1)	59.7 (1.0)	58.9 (1.1)	59.3 (1.0)

Note: Standard errors presented here are adjusted for the sample design. Due to data limitations, the standard errors presented for the following surveys were not adjusted for the complex survey design: Bolivia 1989, Ghana 1988, Indonesia 1987. However, the estimates for these are weighted to be representative at the national level.
u = Unknown (not available)

multiple births to the five-year birth-based sample and therefore there is a greater difference between the woman-based and birth-based samples.

Five-year versus three-year reference period

For birth-based samples, estimates of professional attendance for five-year periods tend to be lower than those for three-year periods (range: 0.5-2.9 percentage points) except in Malawi. The differences probably reflect a trend toward increasing use of professional delivery care because, on average, the five-year estimate refers to a point in time approximately a year earlier than the three-year estimate. However, the differences are small.

In contrast, in the woman-based samples estimates of professional attendance tend to be slightly higher for the five-year reference period than for the three-year period (range: 0.1-2.4 percentage points). This probably reflects that women of higher socioeconomic status tend to have lower fertility and are therefore less likely to have had a birth in the last three years than women of lower socioeconomic status.

Random versus last birth

Using different methods to obtain woman-based estimates of professional attendance, i.e., random birth and last birth, appears to have little effect on the estimates. Differences are small for the three-year period because most women contribute only one birth, so the random birth is often the last birth. For the five-year period, differences are also small—0.5 percentage points or less in all countries except Malawi, where the differences are larger at around 1.5 percentage points.

Sample sizes and sampling errors

Considerable gains in sample size can be made when considering a birth-based rather than a woman-based sample: 7 to 24 percent for a three-year reference period and 26 to 58 percent for a five-year reference period. Comparing reference periods reveals larger differences; woman-based samples from a five-year period are 19 to 46 percent larger than those from a three-year period, and birth-based samples show a 57 to 77 percent gain. However, the gains in sample size had relatively little effect on the estimated sampling errors.

4.3.5 Choice of Approach: Birth-based Analysis Using a Three-year Reference Period

The selection of the unit of analysis should be influenced by the question under study (Filippi, Graham, and Campbell, 1990). Delivery care programs typically target women, so it could be argued that woman-based estimates are the more relevant. However, because the objective of safe motherhood programs is that every woman should have a skilled attendant for every delivery, there is also a strong case for using a birth-based indicator as an approximation to a delivery-based indicator, given that we don't have information for non-live deliveries. In addition, if we want to consider delivery care in the context of neonatal outcomes, the analysis should be birth-based.

Taking into consideration these factors, we chose to use a birth-based sample with a three-year reference period for most of the analyses in this report.[6] The main reasons for this decision are:

- It allows a consistent reference period to be used across all surveys.
- It provides a more recent estimate.
- There is little difference between the woman-based and birth-based samples, so results are relevant to either situation.

The one exception is the analysis of consistency in use of delivery care, which is woman-based and uses as much information as is available to maximize the sample size.

[6] Multiple births are only included once in the sample because they represent only one delivery.

5 Analysis and Results

5.1 General Patterns of Delivery Care

The first analysis examines trends in selected indicators of delivery care in six countries to obtain a picture of the changes that have occurred in delivery care between the late 1980s and the late 1990s. National trends are presented first. We then look at urban and rural trends to determine what changes have occurred in these two very different environments.

5.1.1 Delivery with a Health Professional

Table 5.1.1 shows the percentage of deliveries that were attended by a health professional, by type of attendant.[7] Figure 5.1 summarizes these results by showing trends in delivery with a health professional. According to the most recent surveys, the percentage of deliveries attended by a health professional ranges between 44 and 58 percent in five of the six countries. The exception is Bangladesh where only 12.1 percent of deliveries were attended by a health professional. The percentage of deliveries attended by a qualified health professional has increased in all six countries. The largest absolute increases are observed in Bolivia and Indonesia (16.4 and 13.3 percentage points, respectively) and the lowest increase is observed in Malawi (0.2 percentage points). The increases are statistically significant at the 5 percent level in three of the six countries (Bangladesh, Bolivia, and Indonesia).

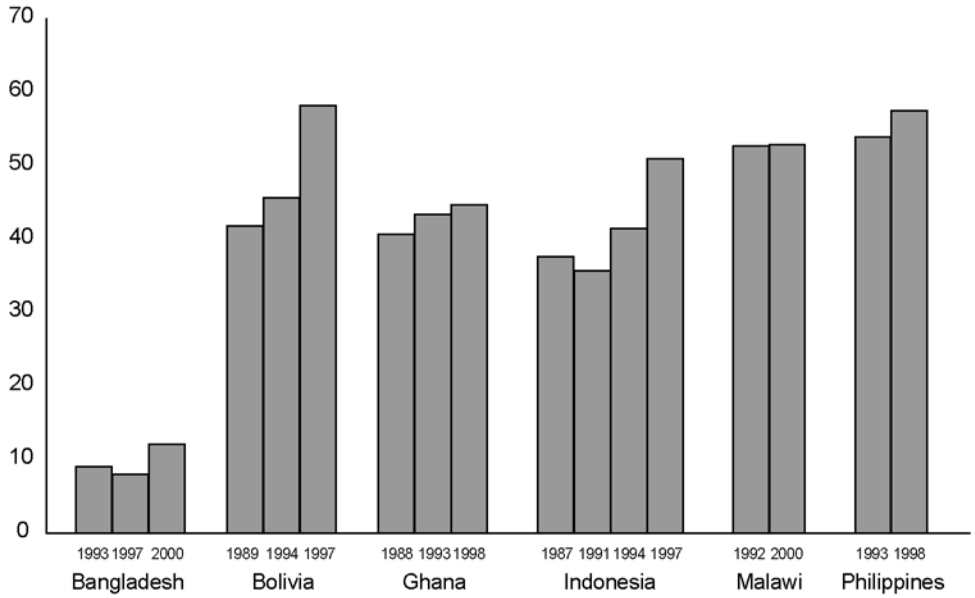
Table 5.1.1 Trends in percentage of deliveries attended by a health professional: National level

	Health professional			Non-health professional					
Survey	Doctor	Nurse or midwife	Total HP	Trained TBA	TBA[1]	Other HW	Total Non-HP	No attendant	Number of deliveries (weighted)
Bangladesh									
1993	4.2	4.9	9.1	4.1	60.5	0.3	89.3	1.4	3,898
1997	5.6	2.4	8.1	7.7	64.7	0.5	90.6	1.3	3,637
2000	7.6*	4.5	12.1*	10.4*	63.4	0.7	86.3*	1.5	4,180
Bolivia									
1989	38.8	3.0	41.8	u	12.7	1.4	53.2	4.8	3,531
1994	42.5	3.2	45.7	u	10.3	1.3	52.1	2.1	3,588
1997	55.4*	2.8	58.2*	u	7.1*	1.0	40.3*	1.3*	4,080
Ghana									
1988	6.3	34.2	40.6	u	27.7	u	53.1	5.9	2,507
1993	6.4	37.0	43.4	15.7	30.8	u	51.7	4.7	2,152
1998	7.4	37.4	44.7	24.2*	41.6*	u	50.2	4.7	1,888
Indonesia									
1987	3.8	33.8	37.6	u	59.9	u	61.8	0.2	4,617
1991	4.8	30.9	35.7	u	59.6	u	64.0	0.3	8,613
1994	6.7	34.8	41.5	u	54.5	u	58.1	0.4	10,052
1997	7.4*	43.6*	50.9*	u	46.1*	u	48.8	0.3	9,685
Malawi									
1992	4.6	48.2	52.7	11.1	18.9	u	41.9	5.1	2,789
2000	5.2	47.8	52.9	u	23.9*	1.4	44.6	2.4*	7,590
Philippines									
1993	26.9	27.0	53.9	39.9	43.3	u	45.9	0.2	5,356
1998	32.7*	24.8	57.5	u	40.4	u	42.3	0.2	4,530

Note: If respondent mentioned more than one person attending the delivery, only the most qualified person is considered.
*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
[1] Includes trained and untrained TBAs as well as those whose training status was unknown.
HP = Health professional
HW = Health worker
TBA = Traditional birth attendant
u = Unknown (not available)

[7] If the respondent mentioned more than one person attending the delivery, only the most qualified person is considered.

Figure 5.1 Trends in the percentage of deliveries with a health professional



While all of the countries show an increase in attendance at delivery by a health professional, the dynamics of the changes vary across countries. In Bangladesh, the small upward trend has occurred primarily because of a small increase in deliveries by doctors, but overall, professional attendance at delivery remains extremely low. Bolivia exhibits a medical model of delivery care with the large recent increase in professional attendance driven entirely by greater use of doctors, while use of nurses or midwives appears to have declined slightly and is very low. Ghana and Indonesia show very different rates of change but in both cases trends are related to a greater use of nurses and midwives, accompanied by much smaller increases in the use of doctors. Malawi has experienced little change in professional attendance at delivery while the Philippines has experienced a slight shift from nurses/midwives and nonprofessional attendants to doctors.

In all countries, delivery with a nonprofessional attendant or no attendant has correspondingly decreased as professional attendance has increased. However, there are a couple of interesting patterns regarding the use of TBAs. In Bangladesh, there has been a large relative increase in the use of trained TBAs alongside the smaller increase in professional attendance. Ghana has also experienced a large increase in the percentage of deliveries attended by TBAs, particularly trained TBAs, alongside the more modest increases in the percentage of deliveries attended by doctors, nurses, and midwives. In contrast, Indonesia has seen a marked shift away from TBAs; the percentage of deliveries attended by TBAs there has declined from 60 percent in 1987 to 46 percent in 1997.

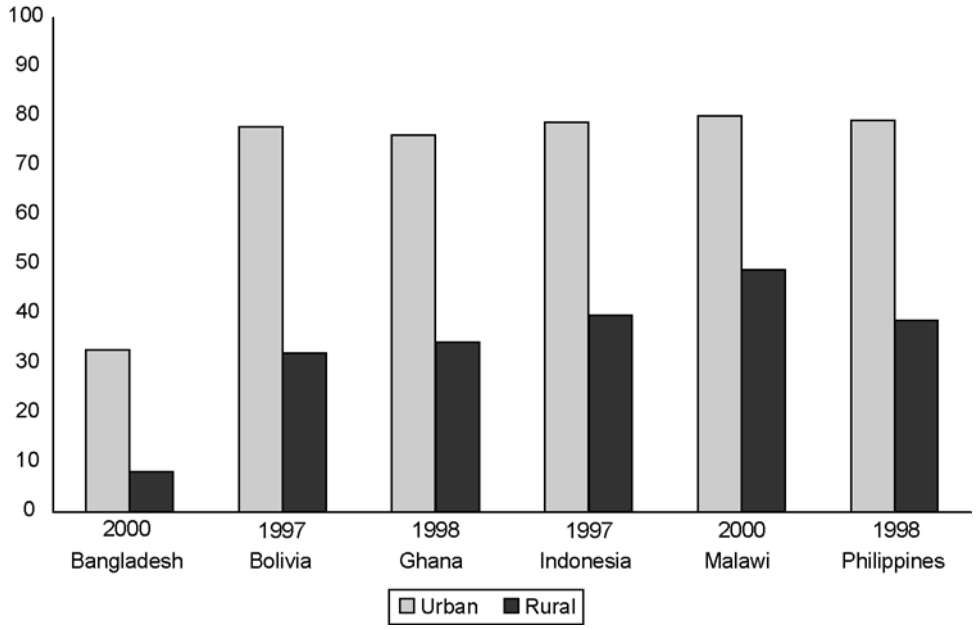
Women are about twice as likely to deliver with a health professional if they live in an urban area compared with a rural area in all countries except Bangladesh, where they are four times more likely to do so (see Table 5.1.2, Figure 5.2). According to the most recent surveys, over 75 percent of urban deliveries were attended by a health professional in every country except Bangladesh, where the figure was only 33 percent. In all countries, deliveries in urban areas were two to five times more likely to be attended by a doctor than deliveries in rural areas. The differences between the likelihood of delivery by a nurse or midwife in urban and rural areas were less marked with ratios in the range of 1.4 to 3.

Table 5.1.2 Trends in percentage of deliveries attended by a health professional by urban-rural residence

Survey	Health professional			Non-health professional				No attendant	Number of deliveries (weighted)
	Doctor	Nurse or midwife	Total HP	Trained TBA	TBA[1]	Other HW	Total Non-HP		
URBAN									
Bangladesh									
1993	17.9	16.1	34.0	4.7	49.2	0.4	65.4	0.5	392
1997	25.6	10.3	35.9	10.6	50.0	0.0	63.8	0.4	328
2000	22.3	10.5	32.8	9.5*	49.9	1.2	66.1	1.0	687
Bolivia									
1989	58.8	3.0	61.8	u	11.9	1.0	35.2	2.9	1,712
1994	61.4	3.8	65.2	u	8.2	0.6	33.1	1.4	1,882
1997	75.7*	2.1	77.9*	u	5.4*	0.2*	21.2*	0.5*	2,327
Ghana									
1988	10.8	58.0	68.9	u	14.2	u	26.2	4.4	684
1993	15.7	64.7	80.4	4.9	10.2	u	16.7	2.5	598
1998	17.0*	59.3	76.3	10.3	17.7	u	20.9	2.3	471
Indonesia									
1987	10.4	60.9	71.3	u	27.9	u	28.3	0.1	1,239
1991	12.8	55.4	68.2	u	30.4	u	31.8	0.0	2,495
1994	16.0	62.3	78.2	u	20.5	u	21.7	0.1	2,798
1997	16.0*	63.8	78.8	u	19.6	u	20.0	0.1	2,693
Malawi									
1992	15.5	70.4	85.9	3.0	5.8	u	11.9	2.0	315
2000	8.6*	71.5	80.1	u	11.0	0.9	18.5	1.3	951
Philippines									
1993	41.3	30.5	71.8	25.2	27.3	u	28.1	0.1	2,618
1998	50.2*	29.1	79.2*	u	20.1*	u	20.6*	0	2,089
RURAL									
Bangladesh									
1993	2.6	3.7	6.3	4.0	61.8	0.3	92.0	1.5	3,507
1997	3.7	1.7	5.3	7.4	66.2	0.5	93.2	1.4	3,309
2000	4.7*	3.4	8.1	10.6*	66.0	0.6	90.2	1.6	3,493
Bolivia									
1989	19.9	3.0	22.9	u	13.5	1.7	70.2	6.6	1,819
1994	21.6	2.5	24.1	u	12.6	2.0	73.0	2.8	1,706
1997	28.4*	3.7	32.1*	u	9.4*	2.1	65.6	2.2*	1,753
Ghana									
1988	4.7	25.3	30.0	u	32.8	u	63.2	6.5	1,823
1993	2.8	26.3	29.1	19.8	38.7	u	65.2	5.5	1,554
1998	4.2	30.1	34.3	28.8*	49.5*	u	59.9	5.5	1,418
Indonesia									
1987	1.4	23.8	25.3	u	71.7	u	74.1	0.2	3,378
1991	1.5	20.9	22.4	u	71.5	u	77.1	0.4	6,118
1994	3.1	24.2	27.3	u	67.5	u	72.2	0.5	7,254
1997	4.0*	35.8*	39.8*	u	56.4*	u	59.9*	0.3	6,992
Malawi									
1992	3.2	45.3	48.5	12.2	20.5	u	45.7	5.5	2,484
2000	4.7	44.4	49.0	u	25.8	1.4	48.4	2.6*	6,639
Philippines									
1993	13.2	23.6	36.8	53.9	60.6	u	62.9	0.2	2,738
1998	17.7*	21.1	38.8	u	57.8	u	60.8	0.3	2,441

Note: If respondent mentioned more than one person attending the delivery, only the most qualified person is considered.
*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
[1] Includes trained and untrained TBAs as well as those whose training status was unknown.
HP = Health professional
HW = Health worker
TBA = Traditional birth attendant
u = Unknown (not available)

Figure 5.2 Percentage of deliveries with a health professional by urban-rural residence (most recent survey)



Trends in delivery with a health professional in rural areas largely mirror those observed at the national level. The percentage of rural deliveries attended by a health professional increased in every country, with Indonesia demonstrating the most substantial increase (14.5 percentage points). The increase was statistically significant only in Bolivia and Indonesia. The trends in the type of professional attending deliveries in rural areas also mirror the trends seen at the national level. For example, the increase in professional attendance in rural Bolivia is due to increased use of doctors, accompanied by a slight increase in the use of midwives; while in rural Indonesia, the increase in professional attendance is mainly due to increased use of midwives and nurses.

In Bolivia, Ghana, and the Philippines, the absolute increase in the percentage of deliveries attended by a health professional was higher in urban areas than in rural areas. In contrast, the increase was higher in rural areas than in urban areas in Indonesia, while delivery with a health professional decreased slightly in urban Bangladesh and Malawi. In urban areas, increases in professional attendance are driven mainly by increased use of doctors. The urban use of midwives and nurses has generally changed very little except for a slight decline in Bangladesh and a slight increase in Indonesia.

5.1.2 Partnership Ratio

Figures 5.3 and 5.4 show the information from Tables 5.1.1 and 5.1.2 for the most recent surveys in the form of partnership ratio graphs. In these graphs, the percentage of deliveries with nurses or midwives is plotted against the percentage of deliveries with doctors, and the optimal point *(15,85)* is indicated (Graham, Bell, and Bullough, 2001). The vertical dotted line represents 15 percent of deliveries attended by doctors whereas the horizontal line marks 80 percent of deliveries with nurses/midwives. The intersection of the two dotted lines represents universal delivery care where 15 percent of deliveries are attended by doctors and 85 percent by nurses/midwives. The partnership ratio graphs enable us to see where countries fall with respect to this optimal point.

Figure 5.3 Partnership ratio at the national level: Percentage of deliveries with nurses or midwives by percentage of deliveries with doctors

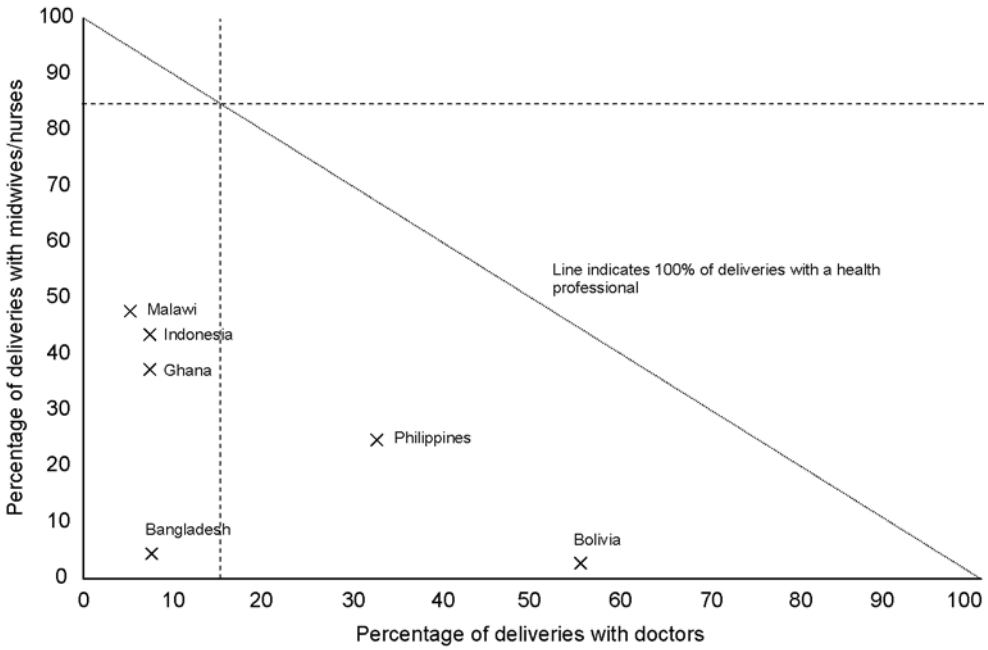
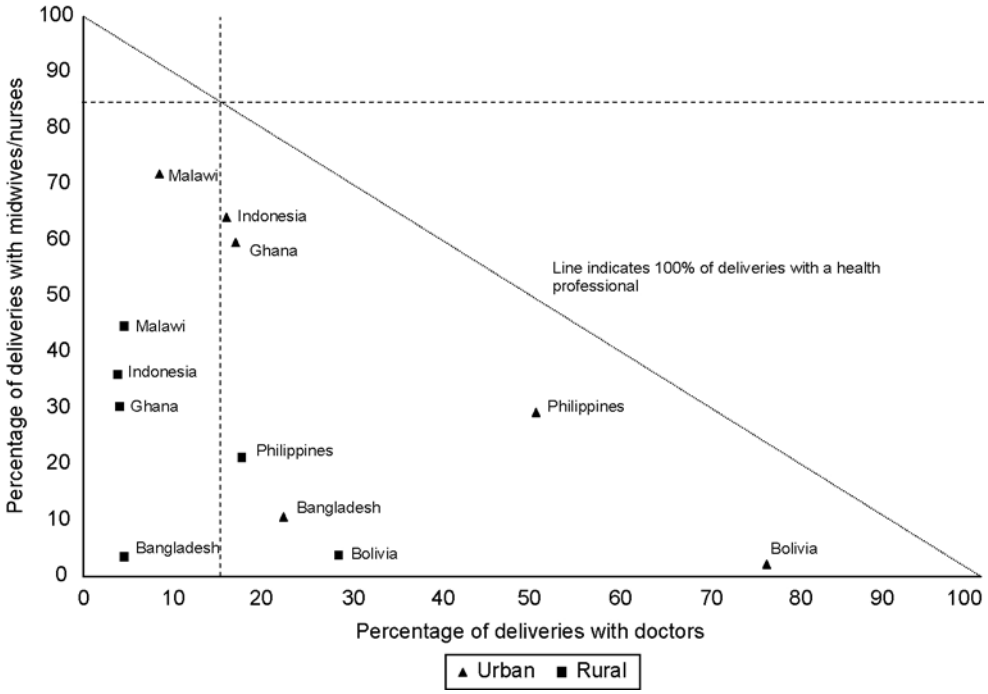


Figure 5.4 Partnership ratio in urban and rural areas: Percentage of deliveries with nurses or midwives by percentage of deliveries with doctors



The plotted national figures for the partnership ratio fall far short of the optimal value of *(15,85)*. Ghana, Indonesia, and Malawi lie about halfway to the optimum values on both components, while Bangladesh stands out as very low on both. In contrast, the percentage of deliveries with doctors exceeds the optimal point in Bolivia and the Philippines, while deliveries with midwives are well below the optimum.

Bolivia in particular stands out as having almost exclusive reliance on doctors for professional delivery care. When stratified by urban-rural residence however, the urban partnership ratios in Ghana, Indonesia, and Malawi all approach the ideal. In Bolivia and the Philippines the urban figures approach the diagonal indicating close to 100 percent attendance, but with a heavy reliance on doctors, particularly in Bolivia.

5.1.3 Place of Delivery

Table 5.2.1 and Figure 5.5 show trends in the distribution of deliveries by place of delivery. According to the most recent surveys, the percentage of deliveries in health facilities is highest in Bolivia and Malawi (55.9 percent and 54.0 percent, respectively) and lowest in Bangladesh (8.6 percent). The majority of deliveries in health facilities take place in government hospitals or health centers in all countries except Indonesia, where the private sector dominates.

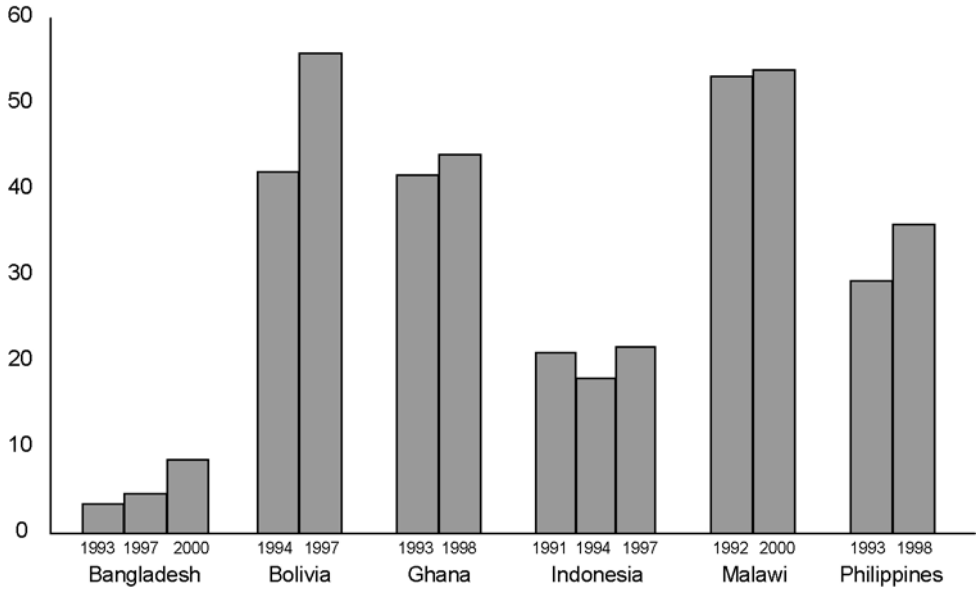
Table 5.2.1 Trends in place of delivery over time: National level

Survey	Government hospital	Government health center	Private hospital/health center	Other health facility	All health facilities	Domiciliary	Number of deliveries (weighted)
Bangladesh							
1993	1.7	0.3	1.4	u	3.4	96.2	3,898
1997	2.2	0.5	1.9	u	4.6	94.4	3,637
2000	4.0*	0.7	3.0*	0.9	8.6*	91.1*	4,180
Bolivia							
1989	u	u	u	u	u	u	u
1994	20.1	4.6	10.9	6.5	42.1	57.4	3,588
1997	28.4*	7.6*	12.7	7.2	55.9*	43.5*	4,080
Ghana							
1988	u	u	u	u	u	u	u
1993	24.4	4.7	5.1	7.6	41.7	57.4	2,152
1998	26.6	5.6	5.4	6.6	44.1	54.8	1,888
Indonesia							
1987	u	u	u	u	u	u	u
1991	5.2	1.6	12.1	2.2	21.0	78.5	8,613
1994	6.1	2.0	9.7	0.3	18.1	81.7	10,052
1997	6.5	2.5	12.1	0.6*	21.7	78.3	9,685
Malawi							
1992	19.3	11.7	10.5	11.7	53.2	44.9	2,798
2000	18.8	20.6*	10.5	4.1*	54.0	45.2	7,590
Philippines							
1993	16.4	1.8	10.9	0.3	29.4	70.5	5,356
1998	18.5	1.4	16.0*	0.1	36.0*	63.8*	4,530

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

The percentage of deliveries occurring in health facilities increased in each country over time, with the largest absolute increase observed in Bolivia (13.8 percentage points). However, the increases were less than three percentage points in Ghana, Indonesia, and Malawi, and were statistically significant only in Bangladesh, Bolivia, and the Philippines. Although the absolute rise in institutional deliveries in Bangladesh was small (5 percentage points) this represented a relative increase of over 150 percent between 1993 and 2000. The largest increase was generally observed in use of government hospitals except in Malawi where the main increase was seen in government health centers, and in the Philippines where use of private hospitals and health centers increased more than use of government hospitals. In most cases, the increased use of government hospitals for delivery is associated with decreased home births. However, in Malawi the increased use of government health centers is associated with a shift away from deliveries in other types of facilities (government health posts, maternity facilities, private health centers) rather than deliveries at home.

Figure 5.5 Trends in the percentage of deliveries in a health facility



As expected, a much higher percentage of deliveries occur in health facilities in urban areas than in rural areas (Table 5.2.2 and Figure 5.6). Urban-rural differences are most striking in Bangladesh where a delivery in an urban area is more than five times as likely to occur in a health facility as a delivery in a rural area. In Indonesia, the urban-rural ratio in the percentage of deliveries occurring in a health facility is about 3 and in the other countries it is approximately 2.

In Ghana, Indonesia, and Malawi the percentage of deliveries that took place in a health facility declined by between 2 and 6 percentage points in urban areas (all non-significant). In Malawi, the decline was related to a decrease in deliveries in government hospitals and other health facilities that was only partly compensated for by an increase in deliveries in government health centers; in Indonesia, the decline was mainly because of a decrease in deliveries in other health facilities; and in Ghana it occurred because of a combination of declines in deliveries in government health centers and in other health facilities. Urban areas in Bangladesh, Bolivia, and the Philippines showed increases of between 7 and 14 percentage points in the percentage of deliveries occurring in health facilities (this trend was not significant in Bangladesh).

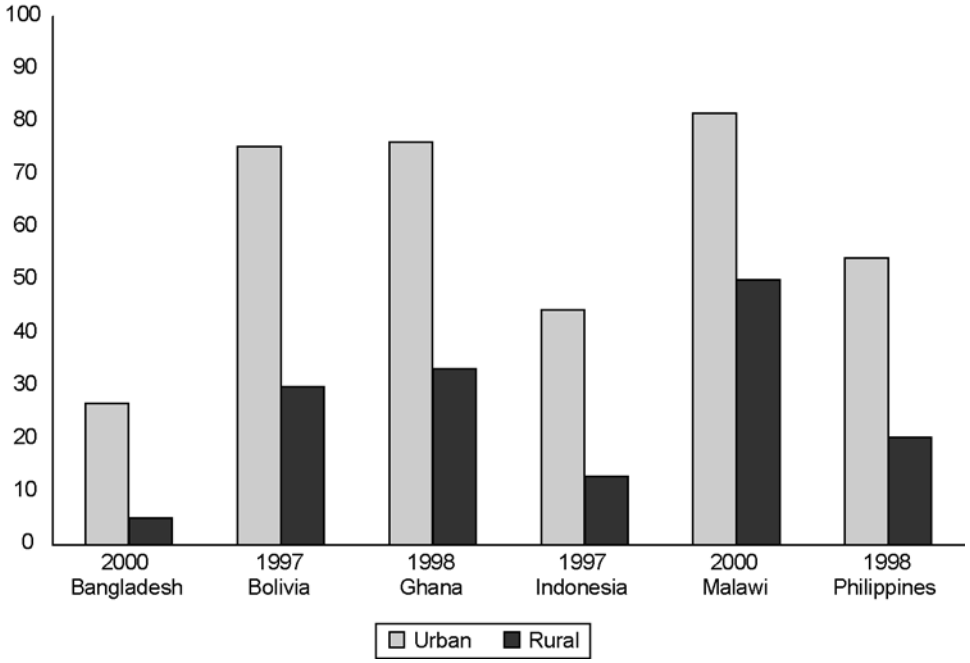
All countries demonstrated an increase in institutional deliveries in rural areas, which was significant in Bangladesh, Bolivia, Indonesia, and the Philippines. In rural Bangladesh the percentage of deliveries occurring in health facilities tripled between 1993 and 2000, although this represents an absolute rise of only 3.4 percentage points. Most of the increases are attributable to increased use of government sector delivery care; the only notable private sector increase in rural areas was in the Philippines where the share of rural deliveries in private health facilities doubled from 3 percent to nearly 7 percent. In Indonesia a national increase in deliveries in health facilities of 0.6 percentage points masks an increase of nearly 4 percentage points in rural areas and a decline of nearly 6 percentage points in urban areas.

Table 5.2.2 Trends in place of delivery over time by urban-rural residence

Survey	Government hospital	Government health center	Private hospital/health center	Other health facility	All health facilities	Domiciliary	Number of deliveries (weighted)
			URBAN				
Bangladesh							
1993	9.5	1.3	8.9	u	19.7	79.2	392
1997	11.0	0.9	12.8	u	25.7	72.2	328
2000	12.6	0.4	10.3	3.6	26.8	72.7	687
Bolivia							
1989	u	u	u	u	u	u	u
1994	27.5	7.0	16.8	10.0	61.3	38.3	1,882
1997	35.2*	10.1	18.9	11.2	75.4*	24.0*	2,327
Ghana							
1988	u	u	u	u	u	u	u
1993	53.0	4.7	10.2	10.9	78.8	20.9	598
1998	53.9	2.7	10.5	9.1	76.2	21.9	470
Indonesia							
1987	u	u	u	u	u	u	u
1991	11.8	3.2	29.0	6.3	50.3	49.1	2,495
1994	13.6	3.7	26.2	0.5	44.1	55.8	2,798
1997	11.6	3.8	28.4	0.8*	44.5	55.5	2,693
Malawi							
1992	56.4	6.4	13.8	9.2	85.8	13.5	315
2000	49.5	16.7*	14.8	0.8*	81.7	18.1	951
Philippines							
1993	22.8	3.3	18.8	0.5	45.4	54.4	2,618
1998	25.4	2.3	26.6*	0.1	54.3*	45.5*	2,089
			RURAL				
Bangladesh							
1993	0.8	0.2	0.6	0	1.6	98.1	3,507
1997	1.3	0.5	0.8	0	2.5	96.6	3,309
2000	2.3*	0.7*	1.6*	0.4	5.0*	94.7*	3,493
Bolivia							
1989	u	u	u	u	u	u	u
1994	12.0	1.9	4.4	2.6	20.9	78.5	1,706
1997	19.4*	4.3	4.5	1.8	29.9*	69.4*	1,753
Ghana							
1988	u	u	u	u	u	u	u
1993	13.4	4.6	3.1	6.3	27.4	71.4	1,554
1998	17.5	6.5	3.7	5.8	33.4	65.7	1,418
Indonesia							
1987	u	u	u	u	u	u	u
1991	2.4	1.0	5.1	0.5	9.1	90.5	6,118
1994	3.2	1.4	3.3	0.2	8.1	91.7	7,254
1997	4.5*	2.0*	5.8	0.5	12.9*	87.2*	6,992
Malawi							
1992	14.6	12.3	10.1	12.0	49.1	48.8	2,484
2000	14.4	21.2*	9.9	4.6*	50.1	49.1	6,639
Philippines							
1993	10.3	0.4	3.2	<0.1	14.0	85.8	2,738
1998	12.6	0.7	6.9*	0.2	20.3*	79.4*	2,441

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

Figure 5.6 Percentage of deliveries in a health facility by urban-rural residence (most recent survey)



5.1.4 Deliveries by Health Professionals in Health Facilities and Homes

The indicators for attendant at delivery and place of delivery were combined to give two composite indicators; the percentage of deliveries attended by health professionals in health facilities, and the percentage of deliveries attended by health professionals in homes. These indicators are shown in Table 5.3.1 and Figure 5.7.

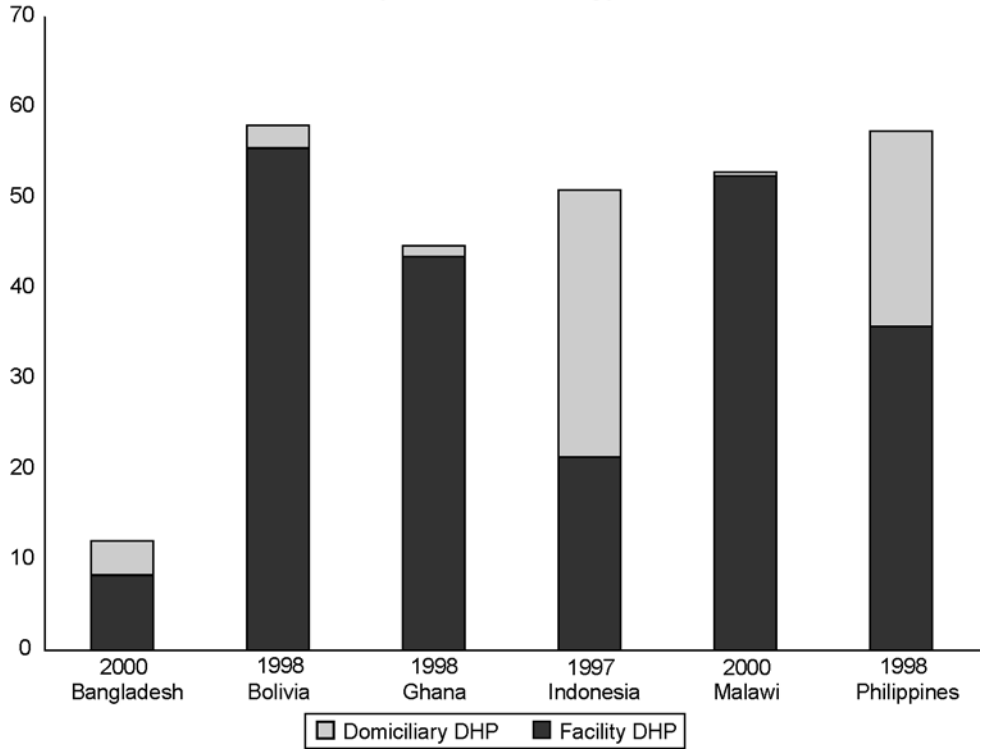
The trends in these two composite indicators vary across countries, reflecting different models of delivery care. In Bolivia and Ghana, the recent increases in the percentage of deliveries attended by health professionals documented earlier are associated with an increase in institutional professional deliveries. This trend reflects a delivery care model in which virtually all births attended by health professionals occur in health facilities. In Malawi, virtually all professionally attended deliveries also occur in health facilities but there was essentially no change in use of delivery care between 1992 and 2000. In Bangladesh the recent increase in professionally attended deliveries reflects a move toward professional delivery in a health facility, while professional delivery at home actually declined slightly between 1993 and 1997 (both these changes are significant). The Philippines has also experienced a shift away from professional delivery at home toward professional delivery in a health facility, but professional home delivery remains a common form of delivery care there (about one in five deliveries). Indonesia is the only country that has seen an increase in professional attendance at delivery driven by an increase in professionally attended home births. The percentage of deliveries attended by a health professional in a health facility remained fairly constant during the 1990s at around 20 percent, while the percentage of deliveries attended by a health professional at home doubled from 15 to 30 percent.

Table 5.3.1 Delivery care indicators: partnership ratio, health professional in health facility, health professional at home: National level

Survey	Partnership ratio		Health professional in health facility	Health professional at home	Number of deliveries (weighted)
	Doctor	Nurse or midwife			
Bangladesh					
1993	4.2	4.9	3.4	5.5	3,898
1997	5.6	2.4	4.4	3.2	3,637
2000	7.6*	4.5	8.3*	3.8*	4,180
Bolivia					
1989	38.8	3.0	u	u	3,531
1994	42.5	3.2	42.0	3.7	3,588
1998	55.4*	2.8	55.5*	2.5	4,080
Ghana					
1988	6.3	34.2	u	u	2,507
1993	6.4	37.0	41.1	2.1	2,152
1998	7.4	37.4	43.5	1.2	1,888
Indonesia					
1987	33.8	37.6	u	u	4,617
1991	30.9	35.7	20.9	14.7	8,613
1994	34.8	41.5	17.9	23.5	10,052
1997	43.6*	50.9*	21.4	29.5*	9,685
Malawi					
1992	4.6	48.2	52.4	0.4	2,789
2000	5.2	47.8	52.4	0.5	7,590
Philippines					
1993	26.9	27.0	29.3	24.6	5,356
1998	32.7*	24.8	35.8*	21.6	4,530

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

Figure 5.7 Deliveries with a health professional by place of delivery (most recent survey)



Births are much more likely to be attended by health professionals in health facilities in urban areas than in rural areas (Table 5.3.2). In the three countries in which professionally attended home deliveries make up a significant proportion of all deliveries (Bangladesh, Indonesia, and the Philippines), urban births are also more likely than rural births to be attended by a health professional at home, although the differential is less pronounced than for institutional births. Trends are generally similar in urban and rural

Table 5.3.2 Delivery care indicators: partnership ratio, health professional in health facility, health professional at home, by urban-rural residence

Survey	Partnership ratio: Doctor	Partnership ratio: Nurse or midwife	Health professional in health facility	Health professional at home	Number of deliveries (weighted)
			URBAN		
Bangladesh					
1993	17.9	16.1	19.5	13.4	392
1997	25.6	10.3	25.2	9.0	328
2000	22.3	10.5	25.8	6.9*	687
Bolivia					
1989	58.8	3.0	u	u	1,712
1994	61.4	3.8	61.2	3.9	1,882
1998	75.7*	2.1	75.2*	2.6	2,327
Ghana					
1988	10.8	58.0	u	u	684
1993	15.7	64.7	78.4	2.0	598
1998	17.0*	59.3	75.6	0.5	471
Indonesia					
1987	10.4	60.9	u	u	1,239
1991	12.8	55.4	50.0	18.0	2,495
1994	16.0	62.3	44.0	34.2	2,798
1997	16.0*	63.8	44.3	35.5*	2,693
Malawi					
1992	15.5	70.4	85.4	0.4	315
2000	8.6*	71.5	80.1	0.1	951
Philippines					
1993	41.3	30.5	45.3	26.4	2,618
1998	50.2*	29.1	54.0*	25.2	2,089
			RURAL		
Bangladesh					
1993	2.6	3.7	1.6	4.7	3,507
1997	3.7	1.7	2.4	2.7	3,309
2000	4.7*	3.4	4.8*	3.1	3,493
Bolivia					
1989	19.9	3.0	u	u	1,819
1994	21.6	2.5	20.7	3.3	1,706
1998	28.4*	3.7	29.4*	2.5	1,753
Ghana					
1988	4.7	25.3	u	u	1,823
1993	2.8	26.3	26.8	2.2	1,554
1998	4.2	30.1	32.8	1.5	1,418
Indonesia					
1987	1.4	23.8	u	u	3,378
1991	1.5	20.9	9.0	13.4	6,118
1994	3.1	24.2	7.9	19.4	7,254
1997	4.0*	35.8*	12.6*	27.2*	6,992
Malawi					
1992	3.2	45.3	48.2	0.4	2,484
2000	4.7	44.4	48.4	0.5	6,639
Philippines					
1993	13.2	23.6	13.9	22.8	2,738
1998	17.7*	21.1	20.2*	18.5	2,441

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

areas and reflect the national trends described above. Indonesia is again an interesting case. In urban areas there has been a decline in the percentage of deliveries attended by a health professional in a health facility, accompanied by an large increase in the percentage attended by a health professional at home. In rural areas, however, there has been an increase in both institutional and domiciliary professionally attended deliveries, although the increase has been much larger for professionally attended home births.

5.2 Differentials in Delivery with a Health Professional

The analysis in Section 5.1 used several different indicators of delivery care to obtain a comprehensive picture of delivery care patterns and trends in the six selected countries. With that context established, we focus on one indicator of delivery care, the percentage of deliveries attended by a health professional, for the remainder of the report. This indicator is selected for more in-depth analysis because it is the most commonly used indicator of delivery care, is featured among the United Nations' Millennium Development Goals (United Nations, 2002), and is used internationally as a proxy for monitoring skilled attendance at delivery. In this section we examine demographic and socioeconomic differentials in delivery with a health professional and examine the extent to which trends in delivery with a health professional vary among demographic and socioeconomic groups. Figures showing selected results are presented below; the actual percentages and confidence intervals are presented in Table 5.4.

5.2.1 Parity

Figure 5.8 shows the percentage of deliveries that were attended by a health professional by the number of live births the mother had experienced at the time of the most recent survey. Primiparous women are consistently more likely to deliver with a health professional than any other parity group; the percentage of first births attended by a health professional ranges from 18 percent in Bangladesh to 76 percent in Bolivia, in the most recent surveys, and exceeded 58 percent in the other four countries. High-parity women (6+ births) are the least likely to deliver with a health professional; Malawi has the highest

Figure 5.8 Percentage of deliveries with a health professional by the number of previous live births (most recent survey)

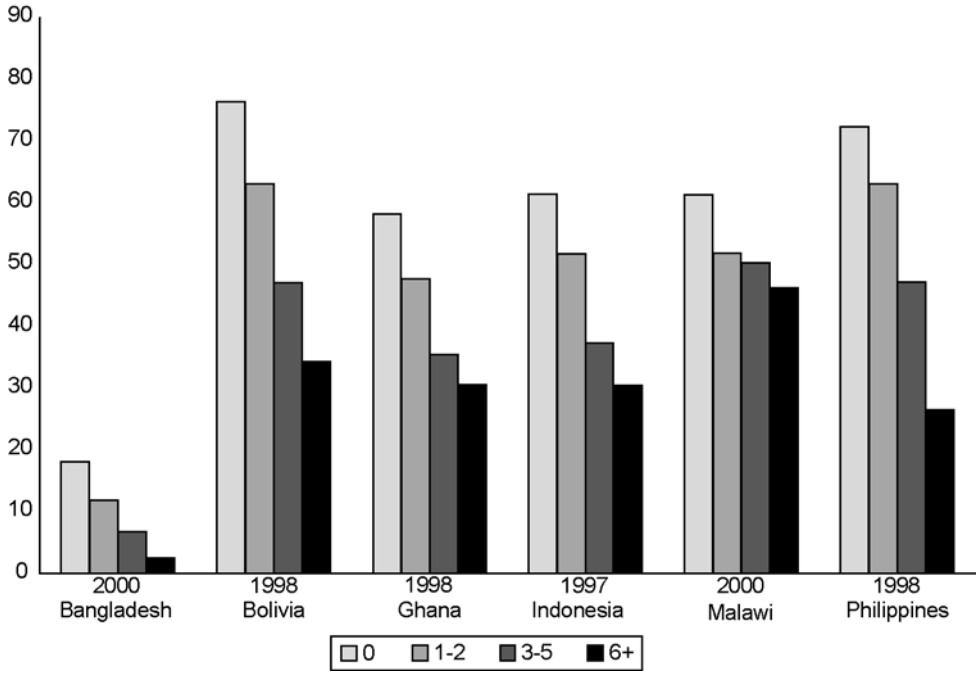


Table 5.4 Trends in the percentage of deliveries with a health professional (DHP), by background characteristics

	Parity								Age					
	0		1-2		3-5		6+		Less than 20		20-34		35 and over	
Survey	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n
Bangladesh														
1993	13.7	1,007	9.1	1,515	5.9	1,020	5.4	357	8.8	792	9.4	2,866	6.6	240
1997	15.1	1,023	6.9	1,451	3.4	868	3.0	295	6.6	924	8.6	2,538	8.1	176
2000	18.1*	1,263	11.9	1,786	6.8	875	2.5	256	9.7	1,061	13.4*	2,897	7.2	222
Bolivia														
1989	55.4	722	48.3	1,212	34.3	1,048	23.9	549	44.3	315	43.7	2,633	32.0	583
1994	62.8	820	53.0	1,216	33.8	951	26.2	601	49.6	326	47.7	2,682	34.1	580
1998	76.4*	1,001	63.1*	1,450	47.1*	1,062	34.3*	567	66.7*	394	59.1*	2,993	49.5*	693
Ghana														
1988	52.5	488	40.1	843	36.5	797	34.8	379	46.9	162	41.6	1,784	35.5	561
1993	56.2	447	44.2	792	38.7	653	30.4	260	48.3	149	44.4	1,555	38.2	448
1998	58.2	459	47.7	670	35.4	536	30.6	223	50.7	106	46.2	1,334	39.1	448
Indonesia														
1987	45.8	1,200	36.7	1,791	32.1	1,154	33.7	472	25.1	379	39.3	3,776	34.0	463
1991	42.7	2,415	35.7	3,382	31.2	2,146	24.8	670	24.9	778	37.3	6,901	32.8	934
1994	50.7	3,032	42.8	3,995	33.6	2,176	22.6	849	26.1	831	44.3	7,974	33.7	1,248
1997	61.4*	3,237	51.8*	3,982	37.3	1,936	30.5	529	40.1*	858	53.4*	7,579	43.7*	1,248
Malawi														
1992	57.4	524	53.6	808	53.2	889	46.5	577	52.8	355	54.2	1,947	46.8	496
2000	61.3	1,810	51.9	2,712	50.3	2,072	46.2	996	56.7	1,005	53.2	5,618	47.5	967
Philippines														
1993	67.0	1,212	57.9	1,964	45.6	1,478	37.4	702	44.9	234	54.9	4,253	51.5	868
1998	72.3	1,161	63.1	1,720	47.2	1,166	26.5	483	49.7	219	59.7*	3,587	48.8	724

	Education						Wealth index (quintile)									
	No education		Primary		Secondary+		Poorest		Second		Third		Fourth		Richest	
	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n
Bangladesh																
1993	4.5	2,241	6.5	1,059	31.2	598	u	u	u	u	u	u	u	u	u	u
1997	2.6	2,051	7.3	972	27.6	614	1.6	803	2.2	848	3.8	735	9.2	675	29.7	576
2000	5.4	1,919	8.0	1,199	28.8	1,062	3.8*	1,093	5.4*	921	6.8	842	13.2	681	41.8*	643
Bolivia																
1989	11.5	709	32.4	1,817	80.1	1,006	u	u	u	u	u	u	u	u	u	u
1994	11.5	511	33.1	1,751	75.4	1,326	9.8	850	28.7	791	48.5	769	74.2	673	90.2	504
1998	21.8*	454	42.1*	1,951	86.8*	1,676	19.7*	1,074	48.1*	868	67.1*	879	88.1*	770	97.7*	489
Ghana																
1988	24.8	1,076	49.9	1,306	79.2	125	u	u	u	u	u	u	u	u	u	u
1993	23.4	862	53.9	1,171	84.0	119	24.5	428	24.2	484	31.0	451	62.0	431	84.9	358
1998	26.7	694	51.8	1,079	87.3	116	17.5	510	30.2	394	48.7*	377	64.9	350	87.7	258
Indonesia																
1987	12.0	779	32.3	2,957	78.2	881	u	u	u	u	u	u	u	u	u	u
1991	14.9	1,167	26.7	5,417	71.7	2,030	9.6	2,075	17.0	1,858	32.7	1,626	51.2	1,658	84.3	1,396
1994	11.7	1,077	30.2	5,978	74.7	2,997	14.9	2,425	21.8	2,140	41.4	1,896	56.6	1,626	88.1	1,666
1997	20.3*	817	38.4*	5,521	79.2	3,346	21.8*	2,177	36.7*	1,999	50.5*	1,933	66.6*	1,933	89.3	1,625
Malawi																
1992	42.7	1,409	60.9	1,303	93.9	86	u	u	u	u	u	u	u	u	u	u
2000	42.9	2,323	54.3	4,741	85.1	525	44.6	1,620	45.3	1,497	48.0	1,763	49.6	1,352	81.1	1,357
Philippines																
1993	10.7	140	35.4	2,154	68.9	3,061	u	u	u	u	u	u	u	u	u	u
1998	12.4	95	30.6	1,479	72.4	2,956	22.3	1,267	47.0	1,037	73.1	862	84.7	758	92.6	606

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

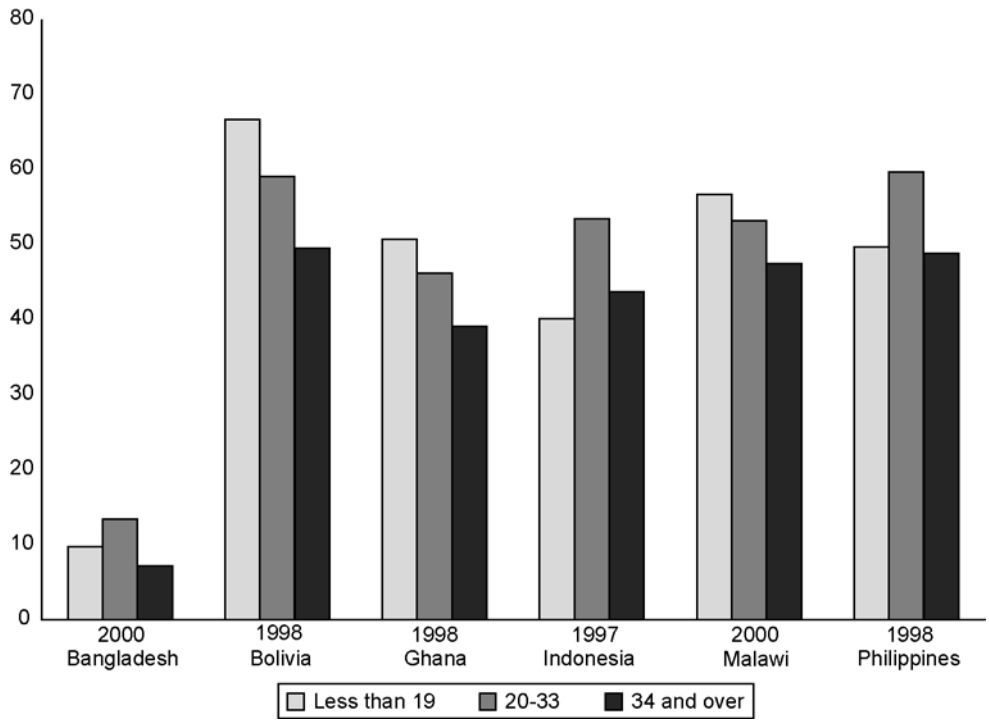
percentage of births of order six or higher attended by a health professional (46 percent) and Bangladesh has the lowest (2.5 percent). Bangladesh also shows the largest relative difference between the highest and lowest parity groups (a ratio of 7.2) while Malawi has the smallest difference, with primiparous women only 1.3 times more likely to have DHP than the high-parity group.

In all six countries the percentage of deliveries attended by a health professional has increased for most parity categories (Table 5.4). The largest increases have occurred among women in the low-parity groups. Among high-parity women the percentage of deliveries attended by a health professional has increased only in Bolivia (a significant increase of 10 percentage points). In Indonesia, the percentage of deliveries to high-parity women that were attended by a health professional declined between 1987 and 1994 but has increased again more recently. In the other four countries delivery with a health professional among high-parity women has declined, most notably in the Philippines, where an 11 percentage point decline has occurred. These patterns have resulted in widening parity differentials over time.

5.2.2 Age

Figure 5.9 and Table 5.4 show the percentage of births attended by a health professional by mother's age at the time of the birth. The differentials in DHP by age are not consistent across countries. The most common pattern observed is for lower use of DHP among mothers over the age of 35 (Bolivia, Ghana, Malawi, Bangladesh except in 1997, and the Philippines in 1998). In these countries there is generally little difference in DHP between mothers under 19 and mothers age 19-34. In Indonesia and the Philippines in 1993, DHP was lowest among mothers under 19 and highest among mothers age 19-34.

Figure 5.9 Percentage of deliveries with a health professional by mother's age (most recent survey)

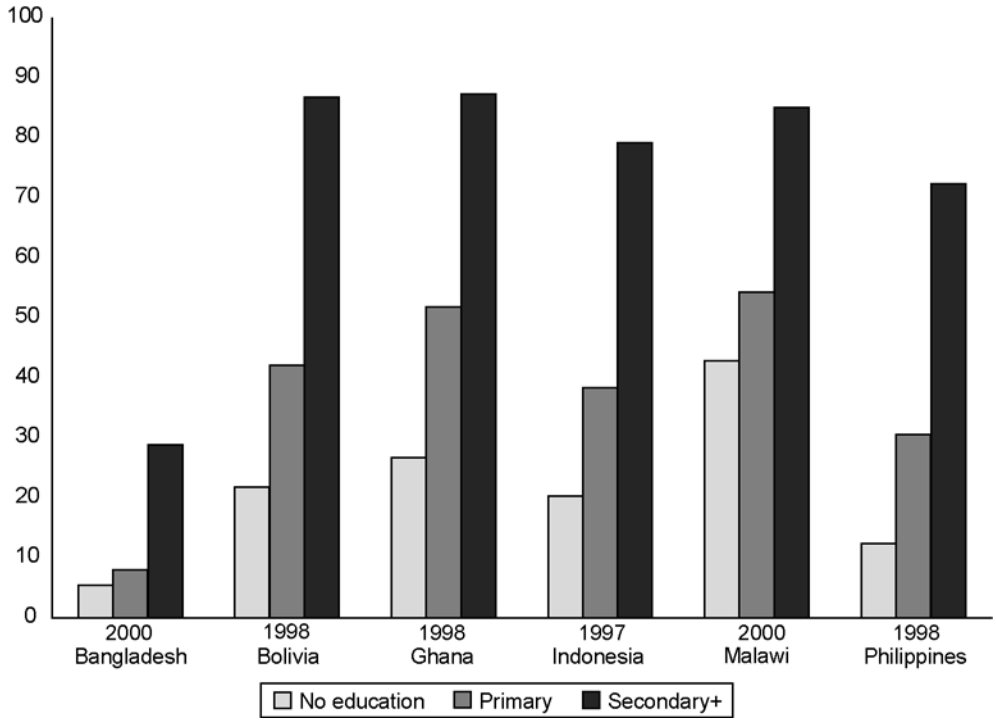


National trends in the use of DHP are fairly similar across age groups. In Bolivia and Indonesia there is evidence that DHP has increased most rapidly among mothers under 19 in the most recent period, so that by the most recent survey there is relatively little difference between the youngest and oldest age groups. In Malawi there is also some suggestion of a more rapid increase in DHP among mothers under 19 and in Bangladesh trends in DHP use among women age 35 and older are the opposite of those observed among younger women.

5.2.3 Maternal Education

Maternal education is strongly associated with delivery by a health professional (Figure 5.10 and Table 5.4). At the time of the most recent survey, over 70 percent of deliveries to mothers with at least a secondary education were attended by a health professional in every country except Bangladesh. In contrast, the highest percentage of deliveries with a health professional among women with no education was 43 percent in Malawi. Women with secondary education were two to six times more likely to deliver with a health professional than those with no education. Countries with the most difference between education groups were Bangladesh and the Philippines (which had ratios of over 5). Malawi showed the least difference in this respect: women with secondary education were just two times more likely than women with no education to have professional assistance at delivery.

Figure 5.10 Percentage of deliveries with a health professional by mother's education (most recent survey)



In general, trends in delivery with a health professional are similar among women at each level of education, so differentials between levels have remained fairly constant over time. Education differentials appear to have narrowed in Indonesia and Malawi. In Indonesia this is because there has been a significant increase in the use of health professionals at delivery among women who have not gone beyond primary education; in Malawi it is because of declining use of professional attendants among mothers with primary and secondary education. By contrast, in the Philippines differentials may have widened because of a larger increase in the use of professional attendants among women with secondary education than among women with no education, and a slight decline in the use of professional attendants among mothers with primary education (these differences are not statistically significant).

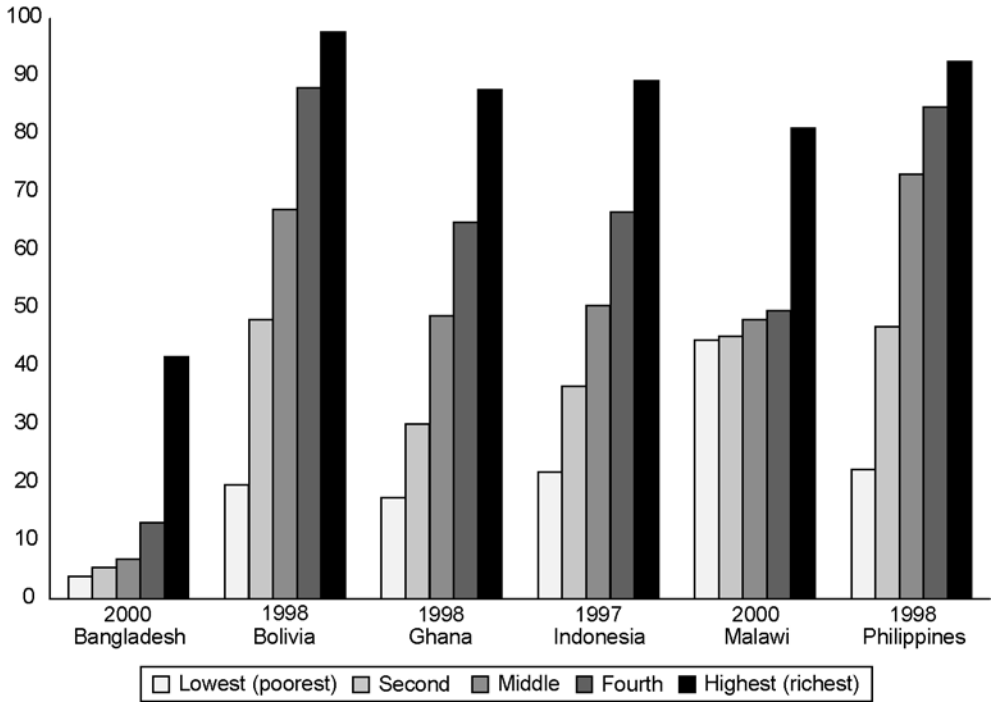
5.2.4 Wealth Index

Lastly, Table 5.4 shows the percentage of deliveries that were attended by a health professional by wealth quintile and year for Bangladesh, Bolivia, Ghana, and Indonesia. The wealth index cannot be calculated in a comparable way for many of the earlier DHS surveys because the list of assets collected in

the earlier surveys was less detailed than in later surveys. Therefore, trends in the use of professional delivery care by wealth quintile are not available for Malawi and the Philippines, and are available only for a small number of data points in the other four countries. Trends in delivery care by wealth quintile have to be interpreted carefully because the quintiles measure relative wealth, not absolute wealth. This means that the poorest quintile represents the poorest 20 percent of households in each survey. However, the poorest 20 percent in one survey could be richer (or poorer) in absolute terms than the poorest 20 percent in the previous survey.

There are marked differentials in use of health professionals at delivery by wealth quintile. Figure 5.11 shows that in the most recent surveys, the percentage of births in the highest (richest) quintile that were attended by a health professional ranged from 42 percent in Bangladesh to 98 percent in Bolivia, and exceeded 80 percent in all countries except Bangladesh. In the lowest (poorest) quintile, the percentage of deliveries attended by a health professional was highest in Malawi (45 percent) and lowest in Bangladesh (4 percent). Malawi was the only country in which more than 22 percent of deliveries in the lowest quintile were attended by a health professional. Bangladesh again fared the worst in terms of relative inequity with a ratio of 11 between the use of professional delivery care in the highest and the lowest quintiles, while Bolivia had the largest absolute difference (78 percentage points). Malawi had the lowest relative difference (ratio of 1.8) and absolute difference (36.5 percentage points). Malawi is also unusual in that it shows very little difference in professional attendance at delivery between the first four quintiles.

Figure 5.11 Percentage of deliveries with a health professional by economic status (wealth quintile) of the mother (most recent survey)



The trends in use of professional delivery care by wealth quintile vary across countries. In Bangladesh, the percentage of deliveries attended by a health professional has increased most in the highest quintile and has changed little in the others, resulting in widening economic differentials over time. In Bolivia, the smallest increases were seen in the highest quintile—where there is little room for improvement—and in the lowest quintile. The middle three quintiles show fairly similar rates of increase. Thus, there is a narrowing of the differentials between the four highest quintiles while the lowest quintile, which includes the poorest sections of society, is falling further behind. Ghana has seen very little increase in the

use of professional attendants in the top two quintiles, larger increases in the second and middle quintiles, particularly the middle quintile, and a decline in use in the lowest quintile (although none of these trends are significant). This again results in an overall widening of economic differentials. Finally, in Indonesia, increases in professional attendance at delivery have been smallest in the highest quintile, where delivery care was already close to universal in 1991, compared with the four lower quintiles. However, the lowest quintile has seen smaller increases than the next three quintiles.

5.2.5 Multivariate Analysis

The last part of this section uses logistic regression models to examine these basic determinants of delivery care as a group. The analysis has two objectives. The first objective is to examine the extent to which the national trends in DHP in these six countries are associated with changes in basic socioeconomic and obstetric characteristics. To do this we first fitted a simple logistic regression model containing only the survey year dummy variable to estimate the crude trend in DHP. This is presented in Model 1 of Table 5.5 for each country and is equivalent to the initial trend analysis in Table 5.1.1. We then added the other variables to the model to estimate the trend after controlling for age, parity, education, and urban-rural residence (Model 2, Table 5.5). The change in the parameter estimate for the survey year variable indicates the extent to which the observed change in DHP is explained by changes in the basic socioeconomic and obstetric characteristics of the population.[8] The second objective is to estimate the association between each socioeconomic and obstetric determinant and DHP after controlling for the other variables. This will enable us to gauge the relative importance of each determinant as well as the consistency in the relationships across the six countries.[9] Wealth index is not included in any of the multivariate analyses. Although the bivariate analysis found wealth quintile to be strongly associated with use of professional delivery care, the wealth index variable is not available in the earliest surveys. Therefore, including it in the multivariate analysis would mean that we would have to drop a number of surveys from the analysis.

The results of the logistic analysis are presented in Table 5.5. As expected, given the earlier bivariate analysis, the crude increase in DHP is only significant in Bangladesh, Bolivia, and Indonesia. Even in these countries, the odds ratio is only significant for the most recent survey. In Bangladesh, the significant increase in DHP becomes an insignificant decrease when the other factors in the model are controlled. Additional exploratory analysis (not shown) suggests that it is socioeconomic factors rather than obstetric factors that drive this change. Therefore, it appears that the recent increase in DHP in Bangladesh is primarily associated with favorable changes in maternal education and the urban-rural distribution of births. In Bolivia and Indonesia the increase in DHP is reduced by controlling for the other variables in the model but remains significant. Again, the decline in the odds ratio for the trend is primarily associated with controlling for education and urban-rural residence, particularly in Indonesia (data not shown), rather than with controlling for obstetric characteristics. In the remaining three countries the crude trend in DHP is not significant and is not affected much by controlling for other variables.

The odds ratios in the second model largely confirm the patterns observed in the bivariate analyses. The largest effects are consistently observed for education; the odds of DHP are between 5 (Malawi) and 14 (Bolivia) times higher among births to women with secondary or higher education than among births to women with no education. The odds ratios for births to women with primary education are more

[8] The logistic regression models are weighted to control for the different sample designs used in each year. This is particularly important in the crude model to ensure that it is consistent with the bivariate analysis and because we are not able to control for sample stratification effects in such a simple model. We ran the full main effects model both weighted and unweighted and the parameter estimates were very similar in both models with the exception of the trend parameter. The trend parameter will pick up any uncontrolled sample design effects in the unweighted model (e.g., due to changing regional stratification over time) so is expected to differ slightly.

[9] Note that this model includes only a limited set of the variables that are likely to be associated with use of professional delivery care. Therefore, the parameter estimates should not be interpreted causally.

Table 5.5 Odds ratios for delivery with a health professional (DHP) by trends over time and background characteristics, simple logistic regression model (Model 1) and regression model plus other variables (Model 2)

Background characteristic	Bangladesh (n=11553)		Bolivia (n=11423)		Ghana (n=6565)		Indonesia (n=35047)		Malawi (n=10170)		Philippines (n=10354)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Survey												
First survey	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Second survey	0.87	0.83	1.17	0.94	1.12	1.10	0.92	0.75*	1.02	0.87	1.16	1.09
Third survey	1.38**	0.95	1.94***	1.62***	1.19	1.17	1.17	0.93	na	na	na	na
Fourth survey	na	na	na	na	na	na	1.71***	1.39*	na	na	na	na
Residence												
Urban	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00
Rural	na	0.19***	na	0.29***	na	0.18***	na	0.18***	na	0.28***	na	0.26***
Education												
No education	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00
Primary	na	1.65***	na	2.77***	na	2.72***	na	2.36***	na	1.59***	na	3.79***
Secondary	na	6.13***	na	13.50***	na	8.10***	na	10.77***	na	5.36***	na	11.91***
Mother's age												
Less than 20	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00
20-34	na	2.20***	na	1.26	na	1.34*	na	1.97***	na	1.09	na	2.00***
35+	na	3.50***	na	2.13***	na	1.56**	na	2.56***	na	1.15	na	3.38***
Parity												
0	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00	na	1.00
1-2	na	0.49***	na	0.65***	na	0.61***	na	0.68***	na	0.79***	na	0.63***
3-4	na	0.34***	na	0.52***	na	0.53***	na	0.59***	na	0.85	na	0.42***
5+	na	0.26***	na	0.40***	na	0.53***	na	0.48***	na	0.74**	na	0.27***

Note: Model 1 presents the crude trend in DHP. Model 2 presents the trend in DHP adjusted for background characteristics of the mother.
*p<0.05; **p<0.01; ***p<0.001
na = Not applicable

modest in size (1.6 to 3.8) but are still highly significant. Rural residence is also strongly and consistently associated with lower use of DHP; odds ratios range from 0.18 in Ghana and Indonesia to 0.29 in Bolivia.[10]

The multivariate analysis shows consistently lower odds for use of DHP with increasing parity in all six countries. The association is particularly strong in Bangladesh and the Philippines and is somewhat weaker in Malawi. Interestingly, the multivariate analysis also shows consistently higher odds of use of DHP with increasing age. This relationship is significant in every country except Malawi. The odds of DHP are between 1.2 (Malawi) and 3.5 (Bangladesh) times higher for births to women age 35 and older than for births to women under 19, after controlling for other variables in the model. This contrasts with the bivariate results discussed above, which found much less consistency. Age is highly correlated with both parity and education. The results suggest that the lower levels of DHP often observed among births to mothers over age 35 in the bivariate analysis are likely to be associated with the higher parity and lower maternal education of older mothers rather than to age per se.

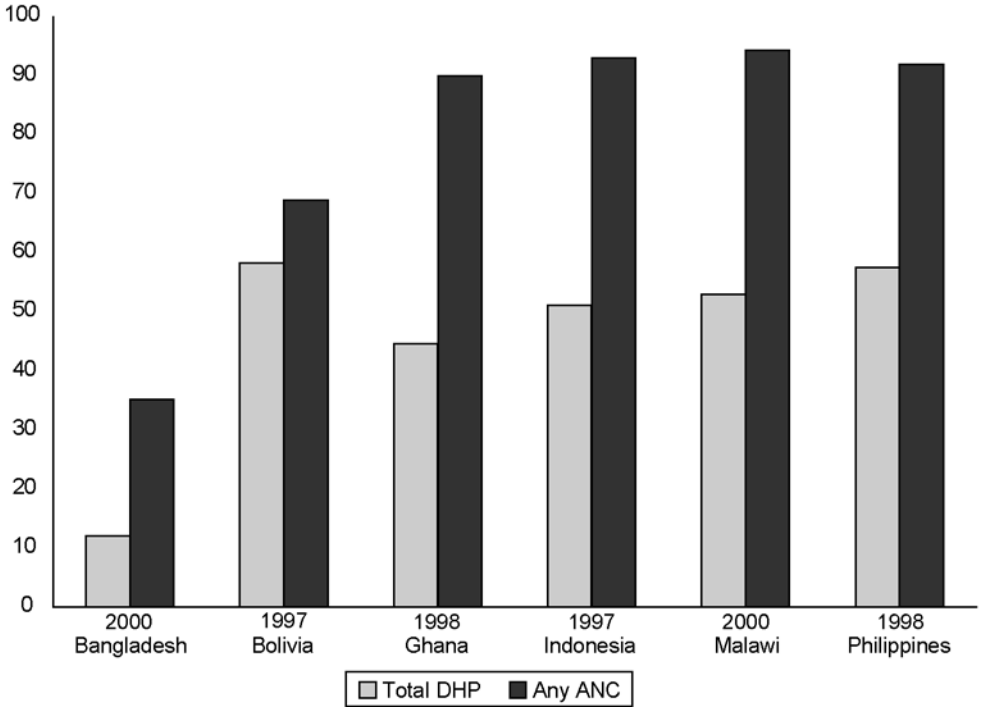
5.3 Use of Delivery Care and Antenatal Care

Delivery care and antenatal care (ANC) are two key components of maternity care, so the relationship between them is of particular interest. One might expect that women who are motivated to attend antenatal services during pregnancy would also be motivated to use delivery services. However, use of

[10] We also ran models including an interaction between the survey variable and urban-rural residence to test for significant differences in the trends in urban and rural areas after controlling for other factors in the model. The interaction was only significant in Ghana and had little effect on the other parameter estimates in any of the countries. Therefore, we decided not to include it in the final model.

antenatal care is consistently higher than use of delivery care in the six countries reviewed here (Figure 5.12). In this section we examine the association between use of ANC and use of delivery care.

Figure 5.12 Percentage of deliveries attended by a health professional and percentage of pregnancies for which mothers had at least one ANC visit (most recent survey)



5.3.1 Patterns of Use of Delivery Care and Antenatal Care

Figure 5.13 shows the patterns of use of delivery care and antenatal care observed in the most recent surveys. Women received DHP and ANC for about half of births in Bolivia, Indonesia, Malawi, and the Philippines, making that service combination the most common in these countries. In Ghana, the percentage of women that received both services was only slightly less than the percentage that received ANC only (44 percent versus 46 percent). In Bangladesh the situation is completely different; women received neither DHP nor ANC for 62 percent of births, and only 10 percent received both. The percentage of women without DHP or ANC is also substantial in Bolivia (25 percent), but for the remaining countries this category accounts for less than 9 percent of women with births. Women receiving only ANC make up a notable proportion in every country (ranging from 16 percent in Bolivia to 46 percent in Ghana). The DHP only category is the smallest in every country, ranging from 5 percent in Bolivia down to 0.7 percent in Indonesia.

Table 5.6.1 shows that the percentage of births for which women receive both DHP and ANC has increased in every country, most notably in Bolivia and Indonesia (13 percentage points). The increase was minimal in Ghana and Malawi, and although the absolute change was small in Bangladesh (3 percentage points) this represents a relative increase of over 50 percent. The percentage of births for which women received neither DHP nor ANC fell in all countries except the Philippines; again the greatest improvement was seen in Bolivia and Indonesia (14 and 12 percentage points, respectively). There has been little change in the proportion of women receiving only DHP. The percentage of births for which women received only ANC has risen in some countries and fallen in others, but the changes were small (not more than 4 percentage points in either direction).

Figure 5.13 Patterns in the use of antenatal care and delivery with a health professional (most recent survey)

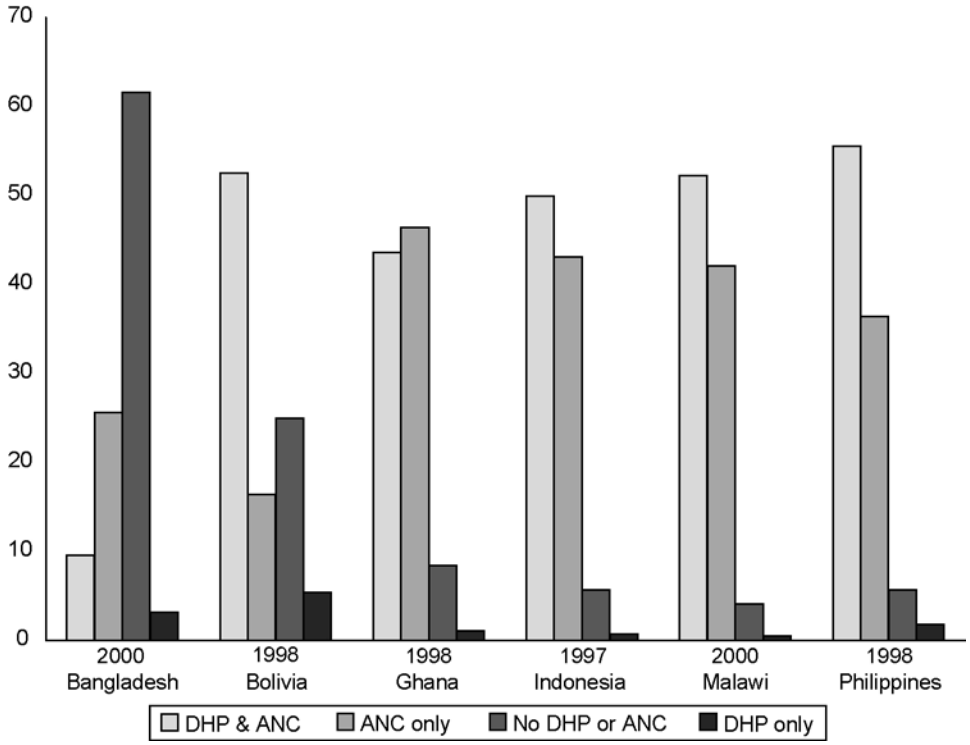


Table 5.6.1 Women's use of health professionals for delivery care and antenatal care: National level

Survey	DHP and ANC	DHP only	ANC only	No DHP or ANC	Number of deliveries
Bangladesh					
1993	5.8	3.3	21.5	69.1	3,898
1997	6.3	1.8	24.5	67.3	3,637
2000	9.6*	3.2	25.6*	61.6*	4,180
Bolivia					
1989	u	u	u	u	u
1994	37.8	7.6	15.1	39.0	3,588
1998	52.5*	5.4*	16.4	25.0*	4,080
Ghana					
1988	u	u	u	u	u
1993	41.9	1.3	44.5	11.5	2,152
1998	43.6	1.1	46.4	8.4	1,888
Indonesia					
1987	u	u	u	u	u
1991	34.3	1.3	46.1	17.9	8,613
1994	40.4	0.9	47.7	10.5	10,052
1997	49.9*	0.7*	43.1	5.7*	9,685
Malawi					
1992	51.3	0.4	40.1	6.4	2,798
2000	52.2	0.5	42.1	4.1	6,604
Philippines					
1993	51.4	2.2	40.4	5.1	5,356
1998	55.5	1.8	36.4	5.7	4,530

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

In urban areas more than 70 percent of women received both DHP and ANC in all countries except Bangladesh (29 percent) (Table 5.6.2). In contrast, in rural areas the percentage of women that received both services was much lower, ranging from 6 percent in Bangladesh to 48 percent in Malawi. Correspondingly, the percentage of women that received neither DHP nor ANC was higher in rural than in urban areas for all the countries, and was the most common service combination in rural Bangladesh and rural Bolivia. The percentage of women that received DHP only was larger in urban areas than in ru-

Table 5.6.2 Women's use of health professionals for delivery care and antenatal care, by urban-rural residence

Survey	DC & ANC	DC only	ANC only	No DC or ANC	Number of women (weighted)
			URBAN		
Bangladesh					
1993	28.9	5.1	27.1	38.6	392
1997	33.5	2.4	31.8	32.3	328
2000	29.1	4.8	30.0	36.0	687
Bolivia					
1989	u	u	u	u	u
1994	55.6	9.4	12.4	22.1	1,882
1998	71.3*	6.3*	9.8	11.9*	2,327
Ghana					
1988	u	u	u	u	u
1993	79.4	0.8	16.6	2.5	598
1998	75.0	1.3	19.4	3.8	471
Indonesia					
1987	u	u	u	u	u
1991	66.7	1.4	27.3	4.4	2,495
1994	77.3	0.7	19.5	2.1	2,798
1997	79.1*	0.3*	18.9	1.2*	2,696
Malawi					
1992	81.0	0.5	12.4	1.6	315
2000	79.7	0.3	18.3	1.0	854
Philippines					
1993	68.2	2.8	25.1	2.9	2,618
1998	76.7*	2.4	18.5*	2.0	2,089
			RURAL		
Bangladesh					
1993	3.2	3.1	20.9	72.5	3,507
1997	3.6	1.7	23.7	70.8	3,309
2000	5.7*	2.9	24.7	66.7*	3,493
Bolivia					
1989	u	u	u	u	u
1994	18.1	5.7	18.1	57.5	1,706
1998	27.5*	4.3	25.2*	42.4*	1,753
Ghana					
1988	u	u	u	u	u
1993	27.5	1.4	55.2	15.0	1,554
1998	33.2	1.1	55.3	10.0*	1,418
Indonesia					
1987	u	u	u	u	u
1991	21.0	1.3	53.8	23.5	6,118
1994	26.2	1.0	58.5	13.8	7,254
1997	38.7*	0.9	52.3	7.5*	6,992
Malawi					
1992	47.6	0.4	43.6	7.0	2,484
2000	48.1	0.6	45.7	4.6	5,750
Philippines					
1993	35.2	1.5	55.1	7.2	2,738
1998	37.3	1.3	51.7	8.9	2,441

*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

ral areas for all countries except Indonesia and Malawi, where ANC is virtually universal. The higher percentage of women receiving DHP only in urban areas than in rural areas may reflect better access to emergency services in urban areas.

Bangladesh was the only country where women in urban areas were more likely to receive ANC only than women in rural areas (where the majority of women reported no DHP or ANC). In all other countries the ANC only group was at least twice as large in rural areas as in urban areas (where the majority of women received both DHP and ANC). The largest urban-rural differences were in Bangladesh, where women in urban areas were five times as likely to receive both DHP and ANC as women in rural areas, and in Indonesia, Malawi, and the Philippines, where women in rural areas were four to six times as likely to receive no DHP or ANC compared with their urban counterparts.

The percentage of women receiving DHP and ANC has generally increased over time in both urban and rural areas. The main exceptions to this pattern are Ghana and Malawi, where the percentage of women receiving both services in urban areas fell slightly. The percentage of women that received ANC only declined in urban areas of Bolivia, Indonesia, and the Philippines, but it generally increased or was fairly stable in rural areas. This pattern reflects the different points that urban and rural areas are at in terms of use of maternity services. In urban areas ANC is close to universal in most of the countries, so improvements come from a shift from ANC only to use of both services. In rural areas, there are still many women that do not receive either service, so there are shifts from use of no services to use of ANC only. With a couple of exceptions (urban Ghana, rural Philippines) the percentage of women that received neither service has declined in both urban and rural areas. The differences between urban and rural areas in women's use of maternity services has been decreasing over time except in Malawi where the disparity has remained constant between surveys.

5.3.2 Relationship Between ANC Use and Delivery with a Health Professional

Table 5.7.1 examines the percentage of deliveries that were attended by a health professional by the level of ANC care they received. Two aspects of ANC use are examined; the timing of the first visit and the total number of visits. As expected, the percentage of deliveries that were attended by a health professional was consistently lower for births to mothers who had not received ANC than for births to mothers who had received ANC. In each of the countries, births to mothers who received ANC before they were five months pregnant were more likely to delivery with a health professional than those who were not seen until later in their pregnancy. At the time of the most recent survey the *early* ANC attendees had rates of DHP ranging from 35 percent in Bangladesh to 81 percent in Bolivia, while the *late* ANC attendees had rates from 19 to 64 percent (also Bangladesh and Bolivia). Similarly, there is a clear positive association between the number of antenatal visits and DHP (see Figure 5.14). Women who made 4 or more ANC visits were generally about five times as likely to have DHP as those who had no ANC visits at all. The exceptions were Bangladesh (11 times as likely) and the Philippines (three times as likely).

At the national level, DHP generally increased over time in all categories of antenatal care. The main exceptions were among women with no ANC in the Philippines and women who attended 1-3 times in Ghana. The magnitude of increase varied across countries and level of ANC use. For example, in Malawi there was virtually no change in the use of health professionals for delivery among users of ANC services, but there was a small nonsignificant increase among those who did not receive ANC. In Indonesia, there were relatively large increases in use of health professionals for delivery in all categories of ANC use; these increases were significant among women who received antenatal care.

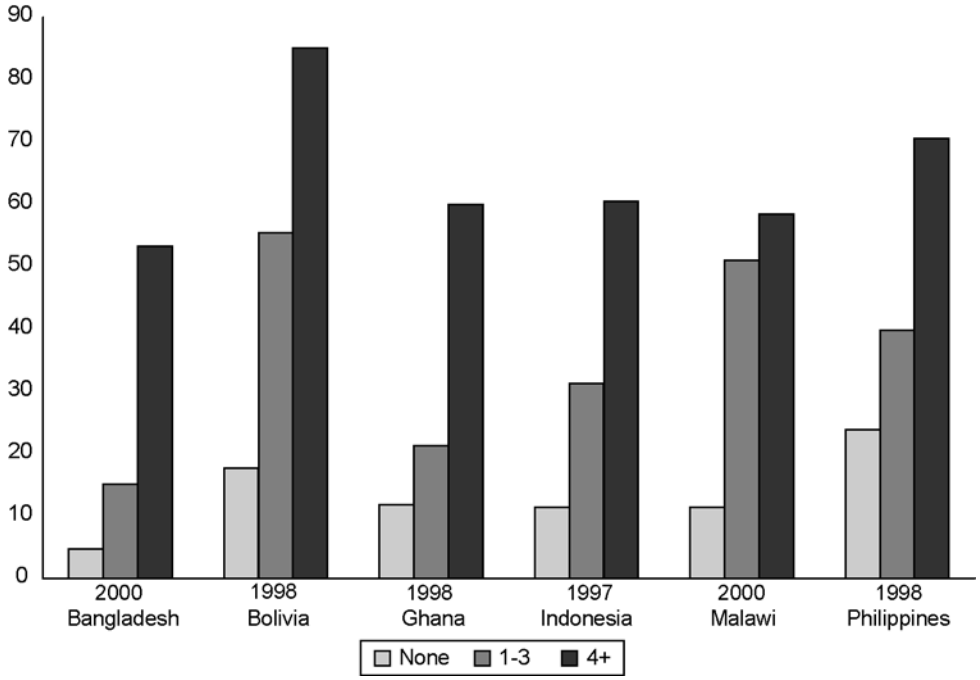
The relationships between ANC and DHP observed at the national level are also observed in urban and rural areas; i.e., use of DHP is highest among women who received ANC early and often, and

Table 5.7.1 Percentage of deliveries with a health professional (DHP), by use of antenatal care services: National level

	Timing of first antenatal visit				Number of antenatal visits					
	Early		Late		None		1-3		4+	
Survey	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n
Bangladesh										
1993	27.3	536	15.1	532	4.6	2,823	13.8	850	50.1	217
1997	26.4	548	14.6	570	2.6	2,512	12.9	884	48.9	233
2000	35.4	608	19.1	858	4.7	2,711	15.1	1,055	53.3	414
Bolivia										
1989	u	u	u	u	u	u	u	u	u	u
1994	78.1	1,320	56.0	579	16.3	1,678	50.6	762	85.4	1,136
1997	80.5	2,100	63.8	712	17.7	1,251	55.5	849	85.1	1,962
Ghana										
1988	u	u	u	u	u	u	u	u	u	u
1993	54.8	1,130	38.8	711	9.8	275	26.3	574	58.4	1,286
1998	54.1	1,114	37.2	576	11.8	182	21.3	509	60.0	1,192
Indonesia										
1987	u	u	u	u	u	u	u	u	u	u
1991	47.8	5,223	26.7	1,679	6.9	1,660	20.0	2,127	52.6	4,797
1994	50.8	6,776	30.3	2,090	7.9	1,145	23.2	2,413	54.4	6,441
1997	57.9*	7,298	35.8*	1,726	11.4	625	31.3*	2,093	60.5*	6,911
Malawi										
1992	59.1	666	55.4	1,927	6.3	192	50.9	823	58.5	1,739
2000	58.7	1,446	54.3	4,835	11.4	308	51.0	2,564	58.4	3,664
Philippines										
1993	62.9	2,966	45.7	1,964	29.8	389	38.2	2,087	69.1	2,829
1998	67.2	2,705	47.5	1,462	23.9	341	39.8	1,385	70.6	2,776

Note: During the Malawi 2000 and Bangladesh 2002 surveys, information about the timing and number of ANC visits was only asked relative to the most recent live birth in the 3-year reference period, whereas in all the other surveys, the data represent all live births in the 3-year reference period.
*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
u = Unknown (not available)

Figure 5.14 Percentage of deliveries attended by a health professional by the number of ANC visits for that pregnancy (most recent survey)



lowest among those who received no ANC (Table 5.7.2). For every category of ANC use, women in urban areas have higher levels of DHP than women in rural areas. The difference in DHP levels between women with four or more ANC visits and those with no visits is always higher in rural areas than urban

Table 5.7.2 Percentage of deliveries with a health professional by use of antenatal care services and urban-rural residence

	Timing of first antenatal visit				Number of antenatal visits					
	Early		Late		None		1-3		4+	
Survey	% DHP	n	% DHP	n	% DHP	n	% DHP	n	% DHP	n
URBAN										
Bangladesh										
1993	60.6	137	36.3	84	11.6	171	34.8	113	69.2	107
1997	63.1	140	28.9	74	6.9	114	30.3	108	72.7	106
2000	60.3	214	33.2	191	11.4	281	26.8	211	70.1	195
Bolivia										
1989	u	u	u	u	u	u	u	u	u	u
1994	86.5	936	68.9	348	29.7	598	63.2	371	89.4	908
1997	90.2	1,493	79.5*	400	34.0	431	74.4*	419	91.7	1,469
Ghana										
1988	u	u	u	u	u	u	u	u	u	u
1993	85.7	384	76.6	188	a	20	63.4	82	86.0	492
1998	79.9	328	77.3	116	a	24	47.8	65	84.6	380
Indonesia										
1987	u	u	u	u	u	u	u	u	u	u
1991	73.9	1,974	54.8	367	23.8	145	39.4	369	76.9	1,976
1994	82.2	2,340	65.4	373	24.6	76	57.9	300	82.6	2,409
1997	82.1	2,351	69.8	294	18.3	39	57.3	277	83.4	2,361
Malawi										
1992	91.8	75	86.0	230	a	7	81.7	72	88.4	222
2000	82.4	250	80.6	592	a	11	80.6	251	81.7	586
Philippines										
1993	77.0	1,611	66.0	846	49.9	149	55.0	803	82.0	1,640
1998	84.7*	1,429	69.9	558	54.9	92	63.6	437	85.3	1,551
RURAL										
Bangladesh										
1993	15.9	339	11.1	448	4.1	2,652	10.6	737	31.7	111
1997	13.8	408	12.5	496	2.4	2,399	10.4	775	29.1	127
2000	21.9	394	15.0	667	3.9	2,430	12.1	844	38.4	219
Bolivia										
1989	u	u	u	u	u	u	u	u	u	u
1994	57.6	384	36.6	231	8.9	1,080	38.6	391	69.5	228
1997	56.5	607	43.8	313	9.1	820	37.0	431	65.5	493
Ghana										
1988	u	u	u	u	u	u	u	u	u	u
1993	38.9	746	25.2	523	8.6	255	20.1	492	41.3	794
1998	43.3	786	27.1	459	9.8	158	17.4	444	48.4*	812
Indonesia										
1987	u	u	u	u	u	u	u	u	u	u
1991	32.0	3,249	18.9	1,312	5.3	1,515	16.0	1,758	35.7	2,821
1994	34.2	4,436	22.7	1,718	6.7	1,069	18.3	2,114	37.5	4,032
1997	46.5*	4,947	28.9*	1,432	10.9*	585	27.3*	1,816	48.6*	4,549
Malawi										
1992	55.0	591	51.2	1,697	5.6	185	48.0	752	54.2	1,517
2000	53.8	1,195	50.7	4,244	10.7	297	47.8	2,313	53.9	3,078
Philippines										
1993	46.2	1,355	30.3	1,119	17.4	240	27.7	1,284	51.2	1,189
1998	47.7	1,277	33.7	905	12.6	249	28.8	948	52.0	1,225

Note: During the Malawi 2000 and Bangladesh 2002 surveys, information about the timing and number of ANC visits was only asked relative to the most recent live birth in the 3-year reference period, whereas in all the other surveys, the data represent all live births in the 3-year reference period.
*Indicates a significant difference (at the .05 level) between the first and last survey in the country.
a = Figure is based on fewer than 25 unweighted cases and has been suppressed
u = Unknown (not available)

areas. Trends in DHP by ANC-utilization group are less consistent in urban and rural areas than at the national level—in part because of the small sample size for some subgroups—and no general conclusions can be drawn.

5.4 Consistency of Delivery Care Use Between Pregnancies

Another aspect of delivery care that is of particular interest is the extent to which women repeat the same delivery care across different pregnancies. For example, do women who choose to have a health professional deliver their first child continue to use delivery care for subsequent births, or do they stop using delivery care for later births as their familiarity and confidence in the birthing process increases. Literature from other areas of health behavior research suggests that past behavior is a very strong predictor of subsequent behavior (Nuwaha et al., 2001; Sutton, 1994) so we would expect a strong correlation in the use of health professionals at delivery for births to the same woman.

To examine this issue for the six countries in this study, we begin by summarizing the delivery care behavior of women who had more than one birth in the five years preceding each survey. Note that this analysis is based on women, not births. In order to maximize the number of women with more than one birth in the reference period, we use only those surveys that collected information on delivery care for the five calendar years before the survey. However, even with the longer reference period there are relatively few women with multiple live births in the reference period and it is important to remember that this group of women is a relatively select group because it represents women who tend to have higher fertility and shorter birth intervals. These women are typically of lower socioeconomic status and, as noted earlier, are less likely to use delivery care. In addition, given the short reference period, most women with multiple deliveries have only two deliveries in the period. This feature of the sample means we will underestimate the percentage of women who change their delivery care behavior over their lifetime because we are only observing a limited part of their reproductive experience.

In Tables 5.8.1 and 5.8.2 women with multiple deliveries are classified according to whether they reported DHP for all, some, or none of their deliveries. In all surveys except the most recent surveys in Malawi and the Philippines, women who did not receive professional delivery care for any of their deliveries were the largest proportion, ranging from 36 percent in Malawi to 89 percent in Bangladesh. The percentage of women who reported having DHP for all their deliveries ranged from 5 percent in Bangladesh to 44 percent in the Philippines. Although most women were consistent in their use or nonuse of DHP, a significant minority of women did change their delivery care behavior between pregnancies in the last five years; the percentage of women with multiple deliveries who reported delivery with a health professional for some, but not all, of their births ranged from 7 percent in Bangladesh to 27 percent in Malawi.

The percentage of women who had DHP for all of their deliveries increased in each of the countries except Malawi where it fell by 2 percentage points. The largest increases were seen in Bolivia and Indonesia (9 percentage points). These increases were largely achieved through declines in the percentage of women who reported delivery care for none of their deliveries; the percentage of women reporting inconsistent delivery care behavior remained fairly constant over time in all countries except Bangladesh and Bolivia, where it increased by about 3 percentage points.

As with other indicators, the national-level data on consistency of delivery care mask differences by urban-rural residence. The shift toward more consistent use of delivery care was more marked in urban areas than in rural areas in Bangladesh, Bolivia, Ghana, and Indonesia. In each of these countries the percentage of women who used delivery care for successive births increased sharply in urban areas. The gains were statistically significant in Bolivia, Ghana, and Indonesia, but not Bangladesh, where the urban sample was smaller. In rural areas, the increases were significant only in Bangladesh and Indonesia. These gains were accompanied by declines in the percentage of women who did not receive delivery care

Table 5.8.1 Consistency of use of health professionals for delivery services among women with more than one delivery over a five-year period: National level

Survey	Use of health professionals by women with more than one delivery			Number of women (weighted)
	All deliveries	Some deliveries	No deliveries	
Bangladesh				
1993	u	u	u	u
1997	1.8	3.7	94.5	2,979
2000	4.8*	6.7*	88.5*	3,164
Bolivia				
1989	28.9	10.9	60.2	3,750
1994	u	u	u	u
1997	38.1*	13.9*	48.1*	4,109
Ghana				
1988	27.6	17.7	54.7	2,573
1993	u	u	u	u
1998	29.6	16.5	54.0	1,594
Indonesia				
1987	31.5	9.6	58.9	4,184
1991	28.1	9.2	62.7	6,327
1994	31.9	10.0	58.2	6,692
1997	40.1*	9.2	50.7*	5,644
Malawi				
1992	40.0	28.1	31.9	3,072
2000	37.7	26.8	35.6*	7,539
Philippines				
1993	41.8	13.5	44.6	5,747
1998	43.9	14.1	41.7*	4,657

*Indicates a significant difference (at the 0.05 level) between the first and last survey in the country.
u = Unknown (not available)

for any of their births. These declines were also larger in urban areas than rural areas, and were significant in Bolivia and rural Bangladesh and Indonesia.

Differences by urban-rural residence for women who received delivery care for some, but not all their births, varied by country, and the Philippines and Malawi showed distinct patterns. In the Philippines, the national shift toward more consistent delivery care was driven almost entirely by changes in behavior among urban women. In urban areas in the Philippines, the percentage of women receiving delivery care for all births increased significantly while the percentage of women receiving no delivery care for any births declined significantly. At the same time, there were no significant changes in behavior among rural women. Malawi was the only country that experienced a shift away from consistent delivery care—a shift that was most evident in urban areas. While the decline in the percentage of women in Malawi receiving delivery care for all their births was not significant in either urban or rural areas, the percentage of women in that country who reported no delivery care for any of their births increased significantly in urban areas and showed a smaller, nonsignificant increase in rural areas.

Another way of looking at this issue is to estimate the effect of whether or not the previous child received DHP on the probability of the index child receiving DHP. This is best done in a multivariate framework. The sample for this analysis consists of all children born in the past five years who had an older sibling born in the same five-year period. Again, a five-year reference period is used for this analysis to maximize the sample of births for the model. As with the previous woman-based analysis, it is important to remember that this subsample of births is selective because it will tend to include higher order births with shorter preceding birth intervals. However, for this analysis our interest is in the odds ratio for the effect of the delivery care received for the preceding birth and not on the overall level of use of DHP.

Table 5.8.2 Consistency of use of health professionals for delivery services among women with more than one delivery over a five-year period, by urban-rural residence

Survey	Health professional in attendance			Number of women (weighted)
	All deliveries	Some deliveries	No deliveries	
URBAN				
Bangladesh				
1993	u	u	u	u
1997	13.4	10.5	76.2	203
2000	17.3	15.8	66.9	435
Bolivia				
1989	46.4	13.2	40.4	1,636
1994	u	u	u	u
1997	60.5*	14.1	25.4*	1,967
Ghana				
1988	54.0	21.2	24.8	633
1993	u	u	u	u
1998	65.2*	14.2	20.7	308
Indonesia				
1987	63.3	10.6	26.2	1,147
1991	58.5	11.6	29.9	1,822
1994	69.7	12.8	17.5	1,647
1997	72.6*	6.6*	20.8	1,434
Malawi				
1992	76.9	15.7	7.4	320
2000	69.3	18.3	12.5*	786
Philippines				
1993	60.0	14.4	25.4	2,661
1998	68.4*	12.9	18.5*	1,960
RURAL				
Bangladesh				
1993	u	u	u	u
1997	1.0	3.2	95.8	2,776
2000	2.8*	5.3*	91.9*	2,729
Bolivia				
1989	15.3	9.1	75.6	2,115
1994	u	u	u	u
1997	17.5	13.6*	68.9*	2,142
Ghana				
1988	19.0	16.6	64.4	1,940
1993	u	u	u	u
1998	21.0	17.0	62.0	1,285
Indonesia				
1987	19.5	9.3	71.2	3,037
1991	15.8	8.2	76.0	4,505
1994	19.5	9.1	71.5	5,046
1997	29.1*	10.1	60.8*	4,211
Malawi				
1992	35.7	29.5	34.8	2,753
2000	34.0	27.8	38.3	6,753
Philippines				
1993	26.1	12.7	61.1	3,086
1998	26.1	15.0	58.6	2,696

*Indicates a significant difference (at the 0.05 level) between the first and last survey in the country.
u = Unknown (not available)

Table 5.9 shows the odds ratios from a logistic regression model that includes DHP for a previous child as a predictor of the index child being delivered by a health professional. We also include interactions between parity and the delivery care of the previous child to investigate whether women become less inclined to repeat use of professional delivery care for higher order births. The results demonstrate that a preceding delivery with a health professional was by far the strongest predictor of DHP in the index pregnancy. The association between DHP and education level or urban-rural residence is small in com-

Table 5.9 Odds ratios for delivery with a health professional for previous child as a predictor of delivery with a health professional for subsequent child, by background characteristics, simple logistic regression model (Model 1) and regression model plus other variables (Model 2)

Background characteristics	Bangladesh (n=3098)		Bolivia (n=2312)		Ghana (n=2078)		Indonesia (n=6631)		Malawi (n=2343)		Philippines (n=3208)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Delivery care for previous child												
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	25.59***	18.33***	38.99***	39.99***	18.79***	16.22***	50.64***	42.82***	7.29***	7.63***	33.85***	24.40***
Survey												
First survey	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Second survey	0.92	0.93	0.89	0.89	1.18	1.17	1.03	1.03	0.85	0.84	0.94	0.94
Third survey	0.97	0.97	1.82***	1.81***	1.04	1.04	1.14	1.13	u	u	u	u
Fourth survey	u	u	u	u	u	u	1.16	1.15	u	u	u	u
Residence												
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.27***	0.26***	0.50***	0.50***	0.40***	0.40***	0.27***	0.27***	0.31***	0.31***	0.51***	0.51***
Education												
No education	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary	1.36	1.38	1.78**	1.79**	1.60**	1.60**	1.81***	1.80***	1.30*	1.30*	1.40	1.32
Secondary	4.12***	4.25***	4.03***	4.03***	3.89***	3.87***	3.23***	3.24***	4.77***	4.71***	2.57**	2.47**
Parity												
1-2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3-4	1.32	0.88	1.21	1.23	1.07	0.94	1.16	0.99	1.21	1.32	1.00	0.75
5+	1.14	0.85	0.88	0.90	0.95	0.77	1.05	0.86	1.22	1.22	0.89	0.59*
Interactions												
Parity 3-4 *delivery care for previous child	u	4.05*	u	0.96	u	1.25	u	1.43	u	0.87	u	1.77*
Parity 5 +*delivery care for previous child	u	2.48	u	0.95	u	1.48	u	1.66	u	1.00	u	2.57*
P-value for likelihood ration test	u	0.01	u	0.99	u	0.49	u	0.07	u	0.79	u	0.01

*p<0.05; **p<0.01; ***p<0.001
u = Unknown (not available)

parison. The interaction between delivery care for the preceding child and parity is significant in Bangladesh and the Philippines, and suggests that the effect of use of professional delivery care for the preceding child is even stronger for births of parity 3-4 than for births of parity 2.

5.5 Professional Attendance at Delivery and Pregnancy Outcomes

In this final section we briefly explore the relationship between use of professional attendants for delivery and selected outcomes of pregnancy. However, the types of outcomes that we are able to look at with DHS data and the way we can look at the association between delivery care and outcomes are very limited. As discussed in the introduction, it is extremely difficult to measure maternal mortality and, even when maternal mortality data are available, they are not sufficiently precise to allow us to look at trends over the same periods that we are looking at for use of professional attendants. Therefore, we do not include any analysis of maternal mortality here. There are also no data on maternal morbidity in the DHS that can be used here. Therefore, we focus only on caesarean section rates and early neonatal mortality rates (ENMR).

Table 5.10 presents trends in the percentage of births that were attended by a doctor and by a health professional alongside trends in the percentage of births that were delivered by caesarean section and the early neonatal mortality rate. This analysis provides a simple comparison of trends in different maternal health outcomes and enables us to see whether the patterns fit with our expectations. We cannot infer causality from this type of comparison.

Table 5.10 Trends in percentage of deliveries attended by a doctor, percentage of deliveries attended by a health professional, percentage of deliveries by caesarean section, and percentage of early neonatal deaths

Survey	Delivery attended by: Doctor	Delivery attended by: Health professional	Caesarean section	Number of deliveries	Early neonatal deaths (0-6 days)	Number of births (weighted)[1]
Bangladesh						
1993	4.2	9.1	u	3,898	3.3	3,926
1997	5.6	8.1	u	3,637	2.4	3,665
2000	7.6*	12.1*	2.8	4,180	2.9	4,212
Bolivia						
1989	38.8	41.8	u	3,531	2.3	3,548
1994	42.5	45.7	10.3	3,588	2.0	3,615
1997	55.4*	58.2*	14.6*	4,080	2.1	4,106
Ghana						
1988	6.3	40.6	u	2,507	3.4	2,565
1993	6.7	43.4	4.5	2,152	2.9	2,204
1998	7.4	44.7	4.0	1,888	2.4	1,927
Indonesia						
1987	3.8	37.6	u	4,617	1.3	4,652
1991	4.8	35.7	1.2	8,613	2.0	8,697
1994	6.7	41.5	2.8	10,052	2.2	10,131
1997	7.4*	50.9*	4.2*	9,685	1.6	9,768
Malawi						
1992	4.6	52.7	3.4	2,798	3.5	2,854
2000	5.2	52.9	2.6	7,590	3.0	7,758
Philippines						
1993	26.9	53.9	6.4	5,356	1.3	5,393
1998	32.7*	57.5	6.1	4,530	1.5	4,566

*Indicates a significant difference (at the 0.05 level) between the first and last survey in the country.
u = Unknown (not available)
[1] Includes multiple births

As discussed throughout this report, the percentage of births attended by a health professional has increased in all six countries as has the percentage of births attended by a doctor. However, the percentage of births delivered by caesarean section has only increased in Bolivia and Indonesia, the countries that saw the largest increases in professional attendance. It appears that the increases observed in the percentage of deliveries attended by a health professional is not large enough in the other countries to have a significant impact on use of C-sections. The World Health Organization recommends that national caesarean section rates should not be lower than 5 percent or higher than 15 percent (Maine et al., 1997), and a recent study estimated that a caesarean section rate of 3.6 to 6.5 percent is needed to address obstetric complications in West Africa (Dumont et al., 2001). C-section rates are below 5 percent in four of the six countries, and of these only Indonesia has seen significant improvement. This raises concerns about the adequacy of access to C-sections in these countries. In Bolivia and Indonesia the increase in the use of C-sections has been associated with a significant increase in the use of doctors for delivery care. These data do not allow an assessment of the proportion of these C-sections that were necessary nor the proportion of women for whom a C-section was indicated, but not performed.

Early neonatal mortality rates have declined slightly in four of the six countries but the declines are small and not statistically significant. The changes do not seem to be associated with increases in professional attendance at delivery. For example, Indonesia has seen large increases in professional attendance at delivery but early neonatal mortality rates have fluctuated between 1.3 percent of live births in 1987 and 2.2 percent of live births in 1994. One problem with this type of analysis is that the sample sizes are small for detecting change in early neonatal mortality rates so the rates tend to fluctuate due to sampling noise. In addition, the quality of reporting of early neonatal deaths can be poor (Curtis, 1995) so variations in the quality of data between surveys could also contribute to fluctuations in the early neonatal mortality rate.

Table 5.11 presents the early neonatal mortality rates for births that were attended by a health professional and those that were not. According to the most recent surveys in Bangladesh, the ENMR is slightly higher among births attended by a health professional than those not attended by a health professional. Given the very low level of delivery with a health professional in Bangladesh, this finding probably represents selection effects whereby the deliveries that occur with a health professional are more likely to be those with complications and therefore at higher risk of early neonatal death. Another possible type of selection is that delivery with a health professional is more common among more educated and economically advantaged mothers, who also report early neonatal deaths more completely. In the remaining countries, the ENMR is either similar among births attended and not attended by a health professional (Ghana, Indonesia, the Philippines) or it is slightly higher among births not attended by a health professional (Bolivia, Malawi). Differences are small though and should be interpreted with caution given the potential for selection effects to operate as described for Bangladesh.

Trends in the ENMR for the two groups of births vary across countries and there are no consistent patterns. The ENMR for deliveries by nonprofessionals decreased in Bangladesh but increased for deliveries by a health professional. The reverse was true in Bolivia. In Ghana, there was a decline in both groups, and in Indonesia both groups increased in surveys 2 and 3 and then declined in survey 4. Changes in the ENMR were very small in Malawi and the Philippines.

Table 5.11 Trends in early neonatal death (0-6 days) by attendance of a health professional at delivery

	Early neonatal deaths (0-6 days)			
Survey	Health professional in attendance	Number of births (weighted)	No health professional In attendance	Number of births (weighted)[1]
Bangladesh				
1993	1.6	362	3.4	3,557
1997	4.0	296	2.2	3,365
2000	4.5	516	2.6	3,692
Bolivia				
1989	2.0	1,486	2.6	2,055
1994	1.5	1,656	2.3	1,952
1998	1.4	2,395	3.0	1,701
Ghana				
1988	3.9	1,049	2.8	1,506
1993	2.8	964	2.9	1,235
1998	2.1	864	2.2	1,056
Indonesia				
1987	0.7	1,757	1.6	2,875
1991	1.6	3,101	2.2	5,575
1994	2.1	4,206	2.2	5,924
1997	1.6	4,982	1.5	4,786
Malawi				
1992	3.0	1,501	4.0	1,346
2000	2.3	4,113	3.7	3,642
Philippines				
1993	1.3	2,911	1.1	2,479
1998	1.5	2,627	1.5	1,933

[1] Includes multiple births

6 Discussion

6.1 Methodological Issues

One of the key methodological issues highlighted in this comparative study is related to sampling. Our choice to use a birth-based analysis of deliveries in the past three years is explained in Section 4. The results identified the merits and weaknesses of different approaches, and made clear the pitfalls of comparing surveys that have different data collection periods or different approaches (woman-based analysis versus birth-based analysis). Researchers examining the data should be aware that comparison of heterogeneous data sets can lead to biases in results and the identification of trends where there are none, or no trends where they do in fact exist.

Another important methodological consideration is related to the statistical significance of differences observed in levels of DHP over time and between subgroups of women. Sometimes these differences may appear large but are based on small numbers of women and, therefore, can easily be due to random fluctuation and not to any real difference in use of delivery care.

In addition, a variety of methods for investigating the levels and characteristics of delivery care are presented in this study, using both new and established indicators. Various processes of analyses are used including bivariate analysis, multivariate analysis, and stratification of indicators by women's use of ANC and demographic and obstetric characteristics. We used this wide range of methods in pursuit of our aim to increase the depth of understanding of delivery care indicators and to identify the degree of information that can be extracted from existing data.

The value of stratification is demonstrated by the differences observed in use of delivery care by urban-rural residence. These were substantial throughout the analysis, in both levels and rates of change. For example, in Indonesia a national increase in deliveries in health facilities of 0.5 percent masks an increase of nearly 4 percent in rural areas and a decline of nearly 6 percent in urban areas. In each of the countries DHP levels were at least twice as high in urban areas as in rural areas. This stratification demonstrates how national figures can mask differences at the subnational level and the importance of separate analysis.

This comparative study has provided the opportunity to use DHS data to create composites of more than one variable. It was noted earlier that the proportion of deliveries with a health professional is only a crude indicator of skilled attendance, and measures only one of its components. The composite indicators used in this study combine attendant and place of delivery, or types of attendants, in an attempt to capture the complexity of skilled attendance.

6.2 Substantive Findings

National trends in delivery with a health professional over the past decade show an increased use of delivery care in the countries analyzed here, although the increase was negligible in Malawi. In three of the countries this trend was statistically significant at the 5 percent level but the magnitude of the trends was reduced after controlling for socioeconomic factors, and became nonsignificant in Bangladesh. The change in the estimated trend when controlling for other factors indicates the extent to which the observed change in DHP is explained by changes in the basic socioeconomic and obstetric characteristics of the population. In each of the countries the prevalence of factors associated with favorable levels of DHP are increasing; there is a shift toward urban residence, lower parity, and improved levels of maternal education. In Bangladesh, these changes have been relatively large—between 1993 and 2000, for example, the proportion of women with at least a secondary education rose from 15 percent to 25 percent and urban residence increased from 10 percent to 16 percent. These shifts in the characteristics of the population

completely explained the observed trend in DHP, which is an important factor to consider in any assessment of the effectiveness of national safe motherhood programs.

The increase in DHP was lowest in Malawi, where there was essentially no change. There may be several reasons for this lack of progress. Despite reasonably good access to health facilities where health professionals are based, Malawi has had to face the challenge of one of the most severe HIV/AIDS epidemics in sub-Saharan Africa, with a national prevalence of 15 percent documented at sentinel surveillance sites (MOHP, 1999). In addition to the stigma associated with positive HIV status among seekers of delivery care, the HIV/AIDS epidemic has also affected the human resource pool of professionals. Malawi is also the seventh poorest country in the world according to recent World Bank estimates (World Bank, 2002).

As noted earlier, the proportion of deliveries with a health professional measures only one component of skilled attendance. Considering attendant and place of delivery together is an attempt to capture a little more of the complexity of skilled attendance, and it reveals an additional dimension hidden by considering the two components separately. The investigation of national trends using these composite indicators illustrates the existence of two main models of care used by the six countries. One approach—the medical model where women travel to health facilities to be attended by a professional during delivery—has resulted in the establishment of provision of care by health professionals in health facilities (Bolivia, Ghana, and Malawi), with the vast majority of deliveries with a health professional occurring in facilities. The other approach—the community or domiciliary model where professionals in the community are available to attend home-based deliveries—adopted in Indonesia, brings the services of health professionals into the community and has strengthened the domiciliary model (Ronsmans et al., 2001). In Bangladesh and the Philippines, a transition between the two models is taking place, with a move toward institutional care.

It is generally agreed that skilled attendance can only be provided when health professionals operate within a functioning health system (or enabling environment) where drugs, equipment, supplies, and transport are all available. The definition of skilled attendance does not preclude domiciliary deliveries, but if these deliveries are to be included in the total of those receiving skilled care, consideration must be given to the enabling environment. If this is judged to be inadequate (for all or a substantial part of a country) then DHP would provide a poor approximation of skilled attendance in places where professional domiciliary deliveries account for a non-negligible proportion of total deliveries. For example, in Indonesia the exclusion of professionally attended home births would reduce the level of skilled attendance by more than half, and translate an apparent substantial improvement in delivery care into a trivial one. A related question is whether institutional deliveries are necessary for skilled attendance. It is crucial to clarify this issue, as advocating the institutionalization of all deliveries would have profound resource and logistical implications as well as raising concerns over the risks of over-intervention and iatrogenicity. Even deliveries with a health professional in a health facility cannot be assumed to meet the criteria for skilled attendance, and some of them certainly will not. The adequacy of an enabling environment in either facility or domiciliary settings cannot be captured by the simple indicator used in this analysis and is best assessed at the local level.

The partnership ratio, another composite indicator used in this analysis, provides another approach to examining delivery care data. It is a good visual aid and is easier to interpret than tables of figures, while providing a perspective on skilled attendance related to the type of delivery attendant. Furthermore, it is a good advocacy tool for reinforcing the sense of partnership between doctors and nurses or midwives. It does not generate new information, but presents what we already have in a different way. The partnership ratio also incorporates a widely used statistic that 15 percent of deliveries can be expected to require medical attention (Maine et al., 1997), although the evidence for this appears to be based on a limited number of sources.

Plotting the partnership ratio by urban-rural residence produces the interesting finding that in urban areas the ratio nearly attains the optimum level of *(15,85)*. It would be interesting to be able to look at MMR by urban-rural residence to see how the two correlate, but such a breakdown of the mortality data is not available at present.

Not surprisingly, the increased use of DHP seen in all countries corresponds to a decline in the use of nonprofessional delivery attendants. However, analysis of deliveries with no professional present reveals differences between countries and emphasizes the importance of considering trends among nonprofessionals. Bangladesh and Ghana both show significant increases in the use of trained TBAs, while delivery care in Indonesia has shifted away from TBAs. As noted earlier, strategic approaches being advocated in these countries differ, and this could explain the differential use of nonprofessionals. Indonesia has been pursuing a policy of posting a trained midwife in every village (Ronsmans et al., 2001), making health professionals more geographically accessible to women. Ghana, on the other hand, has pursued a strategy of training TBAs (MOHG, 1997), while nurse midwives continue to practice almost exclusively in health facilities. In addition, user fees in Ghana for health facility care were only removed in 1998, a policy that had previously made the services of a health professional less accessible to women because of the cost (Asenso-Okyere, 1998). The findings suggest that a demand for better trained delivery attendants is likely to exist no matter what the programmatic strategy, and approaches that improve access to delivery care will be taken up.

A significant finding of this study is that even in countries where national trends in DHP show improvement, large differentials remain. The associations observed between delivery care and maternal education, urban-rural residence, economic level, and parity were consistent with previous work (Stewart, Stanton, and Ahmed, 1997). An interesting new finding is that parity differentials are increasing in most of the countries. Urban-rural differentials also increased in three of the countries, educational differentials increased in Ghana and the Philippines, and wealth differentials increased to some extent in Bangladesh and Ghana. It is important to remember that these countries are currently experiencing changes in the characteristics of their populations that may explain all or part of this effect. For example, the proportion of births to high-parity women is declining in these countries as a result of a general decline in fertility. As this fertility decline becomes established, the women who progress to very high parities will increasingly be women with the least physical, social, or economic access to health services. These selection effects may in part explain the decline in the use of health professionals for delivery care among high-parity women. Similar patterns are observed for maternal education—with the proportion of women receiving no education declining—and for residence, as people continue to move to urban areas. These changes may mean that women in rural areas, those with no education, and high-parity women become an increasingly poorly-served but also a declining proportion of the population, in which overall levels of DHP may continue to rise due to these same changes in the characteristics associated with delivery care.

Multivariate analysis also shows that education and urban-rural residence are the strongest predictors of DHP, controlling for year, parity, and maternal age. These findings are consistent with other studies that focus on predictors of professional delivery care (Thaddeus and Maine, 1994).

Despite the clear association between DHP and use of ANC, sizeable percentages of women receive ANC only (e.g., in rural Bangladesh three times the number of those that receive DHP). This means that there are a substantial number of women able to access services who could be encouraged to use DHP at the time of their antenatal visits. The substantially higher levels of ANC compared with DHP suggests a disparity in the access to these two related services. For example, in some countries ANC is more likely to be free of charge than DHP, or it may be provided in a way that makes it more likely to be locally available to women than DHP (e.g., mobile clinics). The inability to predict the precise timing of a delivery may also make DHP less accessible to women compared with ANC.

We have also shown that women tend to be consistent in their use or nonuse of professional delivery care for successive births. This could be interpreted as showing that it is important to recruit women for professional delivery care early in their reproductive lives, because they tend to continue with the type of care with which they are familiar.

It is difficult to assess the relationship between perinatal outcomes and professional attendance at delivery because of the bias that inevitably comes from our ability to consider only live births. Until more information is available, it is only possible to anticipate that the presence of a skilled health professional will increase the likelihood of improved perinatal outcomes.

It is important to recognize that the indicator of DHP used in this analysis is very simple. While in many ways its simplicity is one of its strengths, it also gives rise to a number of limitations. The definition of a skilled attendant has not always been clear. Until recently, the term trained attendant was used and grouped both professional and nonprofessional health workers together. Only in 1999, were skilled attendants recognized as "health professionals with midwifery skills who have been trained to proficiency in the skills necessary to manage normal deliveries and diagnose or refer obstetric complications" (WHO, 1999). These changes can cause confusion and may lead to differences in interpretation in many countries, particularly where intensive but shortened training has been provided to relieve the shortages of more traditionally trained doctors and nurse-midwives. Furthermore, the presence of a health professional does not necessarily imply competence or skills in conducting deliveries as there is no way of knowing the level of midwifery or obstetric skill of individual practitioners.

Another limitation of DHP as used here is the reliance on women's self-reports of the type of attendant present at delivery. It is not known how accurately women are able to identify the category of their attendant, nor do we know the extent of involvement of the health care provider in the delivery. In addition, the DHS information about deliveries is only recorded for live births, which misses a not-insignificant number of deliveries involving stillbirth. The biases resulting from these limitations are impossible to identify without further work.

While it is important to recognize these inherent limitations when interpreting findings, it is also important to recognize the strengths of these data. The data are population-based so are representative of the experience of women in the general population; they contain large amounts of background information on the women; the surveys employ standardized, well-tested procedures to maximize data quality, and data have been collected in a consistent manner allowing comparisons across time. DHS surveys provide the best estimates currently available of many reproductive indicators including DHP in many countries, and remain the main source of international information in the area of safe motherhood.

Future research in this area might include the development of population-based surveys that include: (i) validation work on the accuracy of women's reports when asked about delivery attendants, e.g., their ability to identify the type of attendants present at delivery, and the level/timing of involvement of the attendants reported; (ii) the collection of data for all deliveries rather than only live births; and (iii) improved links with health facility information so that these can be classified into facilities providing basic and comprehensive emergency obstetric care. Other suggestions include improving countries abilities to perform data analysis similar to that described in this report for themselves; and increasing the availability of indicators for skilled attendance at delivery. These latter suggestions are partially addressed in the SAFE Strategy Development Tool (SAFE, 2003b), which provides guidelines on the secondary analysis of DHS data and a module on creating a skilled attendance index based on data collected from delivery records.

Although national levels of professional attendance are increasing by varying degrees in the six countries included in the study, national trends mask substantial subnational variation in levels and trends in delivery care, and inequity in service use is increasing in some cases. Changes in the socioeconomic

profile of populations bode well for the uptake of delivery care at the national level. However, even when progress is being made at the national level, it is important to look deeper into the distribution of service utilization. Care must be taken not to neglect the disadvantaged women in society whose needs may be masked by the aggregated figures, and to be aware that although their numbers may be falling, they still make up a substantial proportion of the population.

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