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A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: Evidence from Demographic and Health Surveys (DHS)

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Abstract

This paper uses Demographic and Health Surveys data from 21 countries in sub-Saharan Africa to examine the use of maternal health services by teenagers. A comparison of maternal health care between teenagers and older women, based on bivariate analysis shows little variation in maternal health care by age. However, after controlling for the effect of background factors such as parity, premarital births, educational attainment and urban/rural residence in a multivariate analysis, there is evidence that teenagers have poorer maternal health care than older women with similar background characteristics. The results from multilevel logistic models applied to pooled data across countries show that teenagers are generally more likely to receive inadequate antenatal care and have non-professional deliveries. An examination of country-level variations shows significant differences in the levels of maternal health care across countries. However, there is no evidence of significant variations across countries in the observed patterns of maternal health care by maternal age. This suggests that the observed patterns by maternal age are generalizable across the sub-Saharan Africa region.

Keywords: Maternal health care; Sub-Saharan Africa; Teenagers; Multilevel models; Antenatal care; Delivery care

Introduction

The maternal mortality ratio in Africa remains the highest in the world and despite on-going efforts, the average ratio actually increased from 870 per 100,000 live births in 1990 to 1000 per 100,000 live births in 2001. Pregnancy among adolescents, in particular, has been noted to present a unique and frightening picture (WHO, 2004). Experts on reproductive health have painted a grim picture of maternal and child health in the region and warned that the situation could worsen in the next decade if immediate remedial actions are not taken by Africa's governments and development partners (SAHIMS, 2004). One area of concern relates to poor maternal health care in the region. The low number of births attended to by skilled health personnel has been observed to be strongly

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correlated with high maternal mortality rates (Buor & Bream, 2004). The United Nations (2005) recognizes professional care at birth as one of the key factors that can lower maternal mortality.

Antenatal and delivery care are both critical for maternal and newborn health. Although the effectiveness of antenatal care in preventing serious maternal morbidity and mortality has recently been questioned, there is no doubt that appropriate maternal heath care can avert adverse pregnancy outcomes for the mother and newborn mainly through preventive measures or effective management of obstetric complications. Previous studies suggest that unplanned pregnancies are less likely to receive appropriate maternal health care (Joyce, Kaestner, & Korenman, 2002; Magadi, Madise, & Rodrigues, 2000) and since teenagers are more likely to have unplanned pregnancies (see, for example, Magadi, 2003), they are a particular group of interest. It is generally recommended that prenatal visits start early in pregnancy and continue at regular intervals throughout the pregnancy to mitigate potential pregnancy complications. With respect to delivery care, it is important that mothers deliver their babies in hygienic settings with suitable equipment and supplies, and in the presence of a qualified attendant to reduce the risk of infections and ensure that any complications can be effectively managed.

In this paper, we use data from the Demographic and Health Surveys (DHS) from 21 countries in sub-Saharan Africa to examine the association between maternal age and two indicators of maternal health care: antenatal and delivery care. The specific objectives are to: (i) explore how the use of maternal health services by teenagers in sub-Saharan Africa compares with that of older women; (ii) determine the extent to which observed differences in the use of maternal health services between teenagers and older mothers vary across countries of sub-Saharan Africa; and (iii) examine the contextual country effect on the use of maternal health services among teenagers in the region.

Our interest in antenatal and delivery care among teenagers in sub-Saharan Africa is driven by a number of factors. In an analysis of levels, trends and differentials in antenatal care in developing countries, Abou-Zahr and Wardlaw (2003) found that while women were, in general, more likely to present themselves for antenatal care during the first trimester, sub-Saharan Africa was an exception. In this region, most women were more likely to wait until the second trimester and a substantial proportion presented themselves in the third trimester. Even though some studies have found no evidence of an effect of prenatal care on pregnancy outcomes (e.g., Hellerstedt, Pirie, & Alexander, 1995; Thomas, Golding, & Peters, 1991), others have established a significant association (e.g., Balcazar, Hartner, & Cole, 1993; Blankson et al., 1993; Goldani, Barbieri, Silva, & Bettiol, 2004; Magadi, Madise, & Diamond, 2001). Moreover, high levels of antenatal care use are also likely to be associated with the use of safe delivery care, hence, reduced adverse pregnancy outcomes (Abou-Zahr & Wardlaw, 2003; Bloom, Lippeveld, & Wypij, 1999). The importance of antenatal care is more apparent for sub-Saharan Africa given that the region is characterized by high maternal mortality and morbidity and any opportunities for contact with health services are likely to make an impact (Abou-Zahr & Wardlaw, 2003; Carroli, Rooney, & Villar, 2001). For teenagers, the fact that antenatal care services in the region are not often oriented to their needs makes the health risks associated with their pregnancies and childbearing more pronounced than those of older women (Zabin & Kiragu, 1998).

There is on-going debate on the relative importance of parity as opposed to maternal age in determining poor pregnancy outcomes among teenagers. Second teenage pregnancies have been found to be strongly associated with adverse outcomes than first pregnancies (see for example Akinbami, Schoendorf, & Kiely, 2000; Blankson et al., 1993; Hellerstedt et al., 1995; Smith & Pell, 2001). Blankson et al. (1993) found that adolescents were more likely to present themselves late for prenatal care by about two and half weeks and make fewer total clinic visits in their second pregnancies. This could partly account for the adverse outcomes associated with the second pregnancy among teenagers. Another critical issue surrounding maternal health care among teenagers in sub-Saharan Africa is pregnancy *wantedness* and acceptance by the teenagers themselves as well as the society, especially in cases of premarital childbearing. Unintended pregnancies have been shown to be associated with use of fewer health inputs such as prenatal care because of delay in recognizing or acknowledgement of pregnancy (Joyce & Grossman, 1990; Joyce et al., 2002; Kathryn, Landry, & Darroch, 1998; Magadi et al., 2000). Births to unmarried teenagers are often unintended and most of the young mothers are in more precarious

economic position. Such circumstances greatly increase the chance of poor outcomes both in the short and long-term (Singh, 1998). Furthermore, the socio-cultural contexts in most of sub-Saharan Africa accord teenagers little power over decision-making in terms of seeking multiple health care paths for maternal health care.

Besides demographic factors such as parity and marital status, individual socio-economic characteristics such as mothers' education, social status, place of residence and, religion have also been observed to influence use of maternal health care services in the developing countries (Abou-Zahr & Wardlaw, 2003; Jejeebhoy, 1995; Mekonnen & Mekonnen, 2003; Ojanuga & Gilbert, 1992). In particular, the impact of education on reproductive behaviour has been observed to be greatest beyond specific threshold levels of education, and when education offers women an expanded role in family decisions and control over resources (Jejeebhoy, 1995). It is also important to recognize the potential effect of contextual country factors, including socio-economic context, national policies relating to provision and cost of health care as well as socio-cultural norms and practices. The fact that gross national product (GNP) per capita and health expenditure are strongly associated with maternal mortality (see, for example, Buor & Bream, 2004) suggest that these factors are potentially significant in maternal health care. Furthermore, higher health expenditure per capita has been observed to be associated with improved performance of national health systems (Evans, Tandon, Murray, & Lauer, 2001).

A recent study on maternal health care in sub-Saharan Africa based on descriptive statistics, confirmed the importance of individual socio-economic and demographic factors such as mother's education, urban/rural residence, parity and wealth distribution in antenatal care (Abou-Zahr & Wardlaw, 2003). However, age was not significant, although older women had slightly lower levels of antenatal care use. In this article, we expand on the analysis of the association between maternal age and maternal health care by comparing teenagers and older women using multivariate and multilevel modelling to simultaneously take into account other important factors, including contextual country-level effects. This study places particular emphasis on country-level variations to shed some light on the nature and extent of observed and unobserved contextual country level effects on maternal health care among teenagers in sub-Saharan Africa. We recognize that use of maternal health care services can also be influenced by service availability and accessibility as well as provider attitudes (Kyomuhendo, 2003; Magadi et al., 2000; Stekelenburg, Kyanamina, Mukelabai, Wolffers, & Roosmalen, 2004), but data limitations do not allow us to explicitly examine these factors.

Data and methods

The data

The study is based on DHS conducted in 21 countries of sub-Saharan Africa during the late 1990s or early 2000s. Selection of countries was based on availability of comparative data at the time of the analysis. The DHS apply probability-based sampling to provide nationally representative samples of women of reproductive age (i.e., aged 15–49 years). This study compares the maternal health care indicators of teenagers aged 15–19 years with those of older women aged 20–34 and 35–49 years. These age categories were used for comparison since mothers aged 20–34 are usually considered to have the most favourable maternal outcomes, while those aged 35 years or older are considered to have a higher risk of various unfavourable maternal health outcomes. Indicators of maternal health care analysed include antenatal care and delivery care relating to births which occurred during the last three years before the surveys. Although some of the surveys collected information relating to births which occurred within five years before the survey, we have limited our analysis to births within the three years to minimize recall errors and enhance data comparability. For multiple births, only the first is included in the analysis to avoid replicating information, since they would have experienced similar maternal health care.

Antenatal care is assessed based on timing of the first visit and the frequency of visits during pregnancy. We recognize that the content of antenatal care is an important aspect of quality of care, but this is not included in the analysis due to lack of data. Delivery care focuses on place of delivery and delivery attendant. Although the two indicators of delivery care may be expected to yield fairly similar results since health facility deliveries are often attended to by skilled medical personnel, preliminary analysis revealed notable differences,

hence, we have included the analysis of both indicators.

Methods of analysis

The analysis starts with bivariate analysis before employing multivariate models to allow comparison of teenagers with older women of similar background characteristics. All the maternal health care indicators are coded as binary outcomes and logistic regression analyses used to compare the indicators between teenagers and older women for each country after taking into account important demographic and socio-economic characteristics associated with maternal health care, namely, parity, premarital births, education level and urban/rural residence. We consider education to be an important proxy for socio-economic status while urban/rural residence takes into account the expected urban bias in the accessibility of health services. We recognize that births among teenagers are more likely to be premarital and unintended, which may influence their maternal health care behaviour. Hence, we have controlled for the effect of premarital births and included in the preliminary analysis the distribution of premarital teenage births to give an indication of the variation in premarital teenage childbearing across countries. Finally, it was particularly important to control for parity given the expected positive association between parity and age that would result in estimates for the different age categories being confounded with the parity effect. Given the expected correlation between maternal age and parity, we paid special attention to any evidence of multicollinearity in the multivariate analyses.

Although it would have been desirable to include other factors shown in previous studies to be associated with maternal health care such as socio-economic status and religion, this has been hindered by lack of comparative data across countries that could be reliably incorporated in the multivariate analyses. For instance, some types of religious affiliations are predominant in specific countries but almost non-existent in others. Furthermore, it was not possible to derive a meaningful comparable measure of socio-economic status based on available information on household possessions and amenities since these indicators have different meanings in different country or urban/rural contexts and some were almost non-existent in specific settings. It was also difficult to determine the extent to which individual women could leverage those assets. Thus, it is important to keep in mind the possible effects of variables not controlled for in our interpretation of the effect of maternal age on maternal health care.

The second section of the analysis explores country-level variations in the observed differences between teenagers and older women. This is to determine the extent to which the observed differences between teenagers and older women can be generalized across countries of sub-Saharan Africa and also assess the contextual country effect on maternal health indicators among teenagers in sub-Saharan Africa region. This analysis uses pooled data for the 21 countries and employs two-level logistic regression models, with country at the second level. The general form of the multilevel logistic regression model used in the analysis may be expressed as

$$\text{Logit}\,\pi_{ij} = X'_{ij}\beta + Y'_{ij}u_j,$$

where π_{ij} is the probability of a given outcome for a particular birth, i, in country, j; X'_{ij} is the vector of covariates which may be defined at birth, or country level; β is the associated vector of fixed parameters; Y'_{ij} is a vector of covariates (usually a subset of X'_{ij}) the effects of which vary randomly at country level; and u_j is the vector of country level random effects.

The multilevel regression analyses are carried out using the *MLwiN* statistical package (Institute of Education, 2000). The modelling allows for the effect of the main study variable, maternal age (categorized as 15–19 [teenagers], 20–34 and 35–49), to vary randomly at country level to determine if observed differences between teenagers and older women are consistent across countries. A significant age effect at country level would imply that the age differences in maternal health care vary significantly across countries. On the other hand, a non-significant age effect at country level would imply that the age effect is relatively consistent across countries, hence, generalizable age patterns in maternal health care across countries in the region.

The estimates of country level variances are used to calculate intra-country correlation coefficients to examine the extent to which antenatal and delivery care are consistent within countries in sub-Saharan Africa, after taking into account the effect of significant covariates. The intra-country correlation coefficient is given by

$$\rho_u = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2},$$

where σ_u^2 is the total variance at country level; and σ_e^2 is the total variance at individual pregnancy/child level.

For the multilevel logistic regression model, the level-1 residuals, e_{ij}, are assumed to have a standard logistic distribution with mean zero and variance $\pi^2/3$ (π is the constant 3.1416).

In addition to the individual woman-level characteristics mentioned earlier, the multilevel logistic regression models included contextual country-level factors, which are likely to influence provision and use of maternal health care services. These included World Bank development indicators, namely, Gross National Income (GNI) per capita, health expenditure per capita, health expenditure percent of GNI, and female literacy levels. Whilst the first three indicators were used as proxies for resource availability and priority given to the health sector which would influence provision of health care services in specific countries, female literacy rate was used as an indicator for women's status, which has significant bearing on power over decision making to seek health care services. The country-level development indicators were lagged by one year before the survey to ensure that the measurements fall within the reference period (i.e., three years before the survey).

We further explored the effect of unobserved country characteristics (i.e., the country random effect) on the use of maternal health services by teenagers of different individual characteristics. The country random effect was varied between -2 and $+2$, representing countries with the lowest and the highest risk of poor maternal health outcomes, respectively. Since the random effects have a standard normal distribution (see for example Goldstein (1995)), 95 percent of the random country effects will lie in the interval $[-1.96, +1.96]$, hence our choice of $[-2, +2]$. We considered countries with the best maternal health care (i.e., with lowest proportions initiating antenatal care late in pregnancy, having inadequate visits, non-facility deliveries, and unskilled birth attendant) as having the lowest risk, while those with poorest maternal health care were considered as having the highest risk.

It is important to note two key study assumptions that should be borne in mind when interpreting the findings. First, given the cross-sectional nature of DHS data, some of the information used in the analysis related to the time of the survey rather than the time of birth or pregnancy. We have derived information for the time of birth for the key variables (e.g., age, parity and premarital births), but this was not possible for educational attainment and urban/rural residence. Hence, we have assumed that residence and educational attainment had not changed between the time of birth of child and the survey. Limiting the analysis to births within three years prior to the survey minimized the chances that residency status or education level would have changed for a significant proportion of women in the analysis. Second, it is important to recognize that the observed differences between teenagers and older women based on multilevel models are averaged across countries and may not be applicable to specific countries.

Results

Bivariate analysis

Table 1 shows the distribution of births by maternal age in the last three years prior to the survey for 21 countries in sub– Saharan Africa. In all countries, the majority of the births (63–72 percent) occurred to women aged 20–34 years. Another significant proportion of births (12–24 percent) occurred to teenagers, while births to women aged 35–49 years made up less than 20 percent of births in all countries. On average, the proportion of births to teenagers was about one fifth of the total number of cases. The lowest proportion was in Togo with about 12 percent while the highest was in Chad with about 24 percent. The proportion of teenage births that were premarital varied considerably between countries from a low of only two–three percent in Chad, Comoros, Niger and Ethiopia, to a high of 27–38 percent in Cote d'Ivoire, Kenya and Zimbabwe. Premarital births were defined as cases where date of birth of index child preceded mother's date of first marriage, or births to never married women. This is a fairly conservative definition of premarital births since it excludes premarital pregnancies where marriage took place before the birth of index child.

Tables 2(a) and 2(b) show the distribution of births by maternal age, according to antenatal and delivery care. In nearly all the countries, a very high proportion of women initiated prenatal care late (in the second or third trimester) with little or no variation by age. Even where there was some evidence of significant variations, the patterns were inconsistent, with the older women, and sometimes

Table 1
Percent distribution of births by maternal age and proportion of teenage births that are premarital during the last 3 years preceding DHS by country

Country/year of DHS	Maternal age at birth (%)			Proportion of teenage births premarital ψ (%)	Total cases
	<20	20–34	35–49		
Benin (2001)	13.7	72.3	14.0	9.0	3238
Burkina Faso (1998/1999)	15.3	66.8	17.9	7.9	3504
Cameroon (1998)	22.1	65.9	12.0	24.6	2265
Chad (1996/1997)	23.5	66.0	10.4	1.9	4489
Comoros (1996)	12.1	71.6	16.3	2.2	1116
Cote d'Ivoire (1998/1999)	20.1	66.6	13.2	38.1	1277
Ethiopia (2000)	14.3	69.9	15.8	2.9	6450
Ghana (1998/1999)	11.7	69.8	18.5	10.3	1979
Kenya (1998)	17.2	71.2	11.6	35.7	3481
Madagascar (1997)	22.5	64.5	12.9	23.5	3641
Malawi (2000)	21.2	66.5	12.3	12.1	7618
Mali (1995/1996)	18.3	66.3	15.4	13.2	5941
Mozambique (1997)	22.0	64.4	13.7	21.2	4062
Niger (1998)	22.6	62.8	14.5	2.9	4714
Nigeria (1999)	17.8	69.4	12.8	8.4	3486
Senegal (1997)	14.5	67.3	18.3	17.2	4466
Tanzania (1999)	16.5	70.2	13.3	20.8	1981
Togo (1998)	11.5	71.2	17.3	18.2	4067
Uganda (2001)	20.0	69.0	11.1	13.8	4418
Zambia (1996)	21.2	66.9	12.0	23.0	4557
Zimbabwe (1999)	21.9	65.8	12.3	27.3	2275

ψ—premarital births refer to cases where date of birth preceded date of first marriage, or births to never married women.

teenagers, being most likely to start antenatal care late in pregnancy. Late initiation of antenatal care was most common in the East African region with a number of countries (Malawi, Tanzania, Zambia, Uganda and Kenya) having more than 80 percent of births receiving late antenatal care. It was only in Senegal where about 50 percent or more births in all the three age groups initiated antenatal care in first trimester. Even though the same pattern would be expected in the proportion with inadequate visits since late initiation and having insufficient visits may be partly related, this was not always the case. For example, Senegal had the highest proportion initiating antenatal care in first trimester, but the vast majority of births in all age groups (in fact among the highest top three countries) received inadequate (less than four) antenatal care visits during pregnancy. The frequency of antenatal care showed more significant differences by maternal age, with older women, and sometimes teenagers, being the most likely to have inadequate visits.

Table 2(b) shows no clear sub-regional patterns in delivery care. The lowest proportions of non-facility deliveries and unskilled attendance were observed in Benin and Zimbabwe, while relatively high proportions of the two indicators were observed in Chad and Ethiopia, for both teenagers and older women. Relatively high levels of unskilled attendance were also observed in Cote d'Ivoire and Madagascar, although these were not matched with similarly high levels of non-facility delivery. For place of delivery, it was Niger, and to some extent Nigeria (for teenagers) that tended to show relatively high levels of non-facility deliveries, with more than three quarters of births being delivered outside health facility. With the exception of Nigeria, and to some extent Madagascar, the observed patterns of delivery care by maternal age suggest that women aged 35–49 years were more likely to have non-facility deliveries or receive unskilled attendance compared to younger women.

Multivariate analysis

To determine more precise differences in maternal health care between teenagers and older women in individual countries, we use results from logistic regression models including late start of antenatal care (after first trimester), inadequate antenatal care visits (fewer than four visits during pregnancy),

Table 2(a)
Percent distribution of births according to timing and frequency of antenatal care by country and maternal age

Country/year of DHS	Percent with late start (after first trimester)				Percent with inadequate visits (less than 4 visits)			
	Maternal age			Significance	Maternal age			Significance
	<20	20–34	35–49		<20	20–34	35–49	
Benin (2001)	60.1	59.4	65.7	ns	40.1	37.6	48.5	[a]
Burkina Faso (1998/1999)	63.9	62.6	70.2	[a]	76.3	74.9	80.5	[a]
Cameroon (1998)	56.8	57.6	55.2	ns	45.4	41.4	50.0	[a]
Chad (1996/1997)	55.5	54.4	54.9	ns	79.4	79.7	82.3	ns
Comoros (1996)	58.5	57.5	67.8	ns	39.7	45.5	53.1	ns
Cote d'Ivoire (1998/1999)	67.1	62.2	70.9	ns	63.0	54.6	67.7	[a]
Ethiopia (2000)	73.9	73.6	76.7	ns	87.8	87.1	91.9	[a]
Ghana (1998/1999)	54.5	55.9	66.9	[a]	38.3	36.4	44.1	[a]
Kenya (1998)	86.6	85.8	89.2	ns	46.3	35.7	45.4	[a]
Madagascar (1997)	79.9	75.2	77.9	[a]	63.5	56.4	56.5	[a]
Malawi (2000)	93.3	93.1	93.4	ns	43.0	43.4	48.1	[a]
Mali (1995/1996)	58.9	59.0	60.8	ns	71.4	72.2	77.6	[a]
Mozambique (1997)	75.4	76.2	77.8	ns	51.8	49.7	56.0	[a]
Niger (1998)	68.2	61.7	64.0	[a]	90.1	84.5	86.9	[a]
Nigeria (1999)	77.4	75.2	77.2	ns	62.9	41.2	49.9	[a]
Senegal (1997)	50.7	45.9	50.2	[a]	83.7	82.9	86.8	[a]
Tanzania (1999)	85.8	90.0	90.3	ns	30.9	27.3	36.8	[a]
Togo (1998)	82.4	80.3	87.4	[a]	52.7	51.2	60.2	[a]
Uganda (2001)	83.8	83.7	87.4	ns	53.7	55.0	63.6	[a]
Zambia (1996)	89.9	88.2	88.7	ns	34.1	27.3	31.5	[a]
Zimbabwe (1999)	73.7	72.5	78.4	ns	30.4	24.4	26.8	ns

ns—not significant at 5 % level.
[a]Age differences in percentages significant at 5 % level.

non-facility delivery, and unskilled birth attendant, taking into account important factors such as parity, premarital births, educational attainment and rural/urban residence. It is necessary to control for the effects of these factors to avoid attributing observed differences between teenagers and older women to the fact that on average, teenagers are more likely to have higher educational attainment, more likely to have first births or premarital births, or more likely to reside in urban areas than older women. Preliminary analysis (not shown) suggests that overall: 26 percent of teenagers, compared to 20 percent of older women aged 35–49 years lived in urban areas; 47 percent of teenagers, compared to 68 percent of women aged 35–49 had no education; and teenagers had substantially higher proportions of premarital and first order births, compared to the older age groups. Table 3 shows odds ratios of antenatal and delivery care, estimated by the logistic regression models, for mothers aged 20–34 years and 35–49 years, compared to teenagers aged 15–19 years, for which the odds ratio (not shown) would be 1.0.

There was evidence of significant variations in the timing of antenatal care by maternal age in some countries, namely, Cote d'Ivoire, Cameroon, Mali, Nigeria, Senegal and Togo. The association between maternal age and antenatal care was stronger with respect to frequency of visits, being significant for more than half of the countries included in the analysis. The significant odds ratios in Table 3 are less than 1.00 showing that teenagers were more likely to initiate antenatal care late and receive inadequate visits during pregnancy compared to older women, especially those aged 20–34 years.

The patterns of delivery care by maternal age were similar to antenatal care, with the teenagers again being the most disadvantaged. In most countries, there was evidence that the teenagers were less likely to receive professional delivery care compared to older women aged 20–34 or 35–49 years. The effect of maternal age was particularly strong in Nigeria where the odds of a non-professional delivery care (i.e., non-facility delivery or unskilled birth attendant) for teenagers was

Table 2(b)
Percent distribution of births according to delivery care by country and maternal age

Country/year of DHS	Percent with non-facility delivery				Percent with unskilled attendance[b]			
	Maternal age			Significance	Maternal age			Significance
	<20	20–34	35–49		<20	20–34	35–49	
Benin (2001)	22.0	22.4	26.9	ns	46.1	47.3	50.9	ns
Burkina Faso (1998/1999)	59.3	61.1	70.5	[a]	54.1	55.1	58.0	ns
Cameroon (1998)	43.8	39.1	46.3	[a]	46.5	43.1	51.1	[a]
Chad (1996/1997)	80.4	84.8	86.4	[a]	76.4	79.5	82.3	[a]
Comoros (1996)	54.8	57.3	61.5	ns	67.4	68.5	70.3	ns
Cote d'Ivoire (1998/1999)	42.8	39.0	45.6	ns	96.1	96.6	95.3	ns
Ethiopia (2000)	89.4	89.3	95.3	[a]	83.0	84.2	90.9	[a]
Ghana (1998/1999)	54.3	59.3	66.1	[a]	46.8	57.3	64.1	[a]
Kenya (1998)	59.8	59.1	72.5	[a]	46.9	45.6	62.9	[a]
Madagascar (1997)	66.6	66.5	65.8	ns	90.1	88.4	84.8	[a]
Malawi (2000)	42.0	44.4	49.8	[a]	42.8	45.0	50.1	[a]
Mali (1995/1996)	66.6	69.9	74.7	[a]	63.9	66.5	69.3	[a]
Mozambique (1997)	44.7	50.0	56.2	[a]	49.5	53.8	61.4	[a]
Niger (1998)	77.8	76.0	76.1	ns	76.1	76.3	75.1	ns
Nigeria (1999)	78.1	59.6	63.2	[a]	77.2	57.7	61.2	[a]
Senegal (1997)	55.1	54.8	56.9	ns	60.3	59.5	60.7	ns
Tanzania (1999)	47.1	57.3	66.2	[a]	39.4	45.9	49.8	[a]
Togo (1998)	48.2	52.4	62.7	[a]	77.3	78.0	82.5	[a]
Uganda (2001)	46.6	58.5	70.3	[a]	45.8	56.8	68.6	[a]
Zambia (1996)	55.3	57.4	69.9	[a]	55.8	57.7	69.7	[a]
Zimbabwe (1999)	32.9	38.1	50.5	[a]	11.3	16.0	24.4	[a]

ns—not significant at 5 % level.
[a]Age differences in percentages significant at 5% level.
[b]Unskilled attendance includes TBA, relative, friend, none and other.

about triple the odds for women aged 35–49 years and about double the odds for those in the 20–34 years age group.

The results for the covariates included in the logistic models as controls (not shown) conformed to the expected patterns. In general, non-premarital births, urban residence, higher educational attainment, and first order births were associated with greater utilization of maternal health care services.

Between country variations in maternal health indicators among teenagers

In this section, we examine between country variations in maternal health care among teenagers, using pooled data for 21 countries of sub-Saharan Africa. The variations between countries were examined after taking into account the effect of individual and contextual country-level factors that are likely to be associated with maternal health care in the region. Individual-level factors controlled for included: premarital births, urban/rural residence, mothers' educational attainment, and birth order of index child; while the contextual country level factors included health expenditure per capita, gross national income (GNI) per capita; health expenditure percent of GNI; and women literacy levels. The main purpose of this component of the analysis was to establish the extent to which the observed patterns in the effect of maternal age were generalizable across countries of sub-Saharan Africa and examine the country effects on maternal health care among teenagers in the region. The latter involved an examination of the impact of the random country effect on teenagers with the least favourable and the most favourable socio-demographic characteristics. For the purposes of this analysis, the least favourable and most favourable characteristics referred to characteristics associated with the highest risk and lowest risk of the outcome variables, respectively. Thus, non-premarital first births among urban residents with some secondary education were considered the most favourable, while premarital high parity births among rural residents

Table 3
Maternal health care: odds ratios of antenatal and delivery care for maternal age 20–34 years or 35–49 years versus adolescents aged 15–19 years

Country/year of DHS	Antenatal care				Delivery care			
	Late start (not 1st trimester)		Inadequate visits (less than 4 visits)		Non-facility deliveries		Unskilled attendant[b]	
	20–34	35–49	20–34	35–49	20–34	35–49	20–34	35–49
Benin (2001)	0.83	0.88	0.71[a]	0.94	0.67[a]	0.68[a]	0.93	0.98
Burkina Faso (1998/1999)	0.89	1.07	0.85	1.02	0.75[a]	0.86	0.93	0.86
Cameroon (1998)	0.85	0.62[a]	0.67[a]	0.74	0.56[a]	0.56[a]	0.74	0.73
Chad (1996/1997)	0.95	0.91	0.93	0.94	0.95	0.83	0.97	1.00
Comoros (1996)	0.98	1.16	1.09	1.07	0.58[a]	0.40[a]	0.76	0.58
Cote d'Ivoire (1998/1999)	0.58[a]	0.69	0.43[a]	0.50[a]	0.55[a]	0.46[a]	0.74	0.54
Ethiopia (2000)	0.87	0.73	0.75[a]	0.60[a]	0.59[a]	0.53[a]	0.82	0.76
Ghana (1998/1999)	0.95	1.38	0.75	0.79	0.79	0.63[a]	1.25	1.37
Kenya (1998)	0.87	1.12	0.70[a]	0.95	0.56[a]	0.51[a]	0.62[a]	0.72
Madagascar (1997)	0.85	0.81	0.86	0.69[a]	0.83	0.58[a]	0.77	0.45[a]
Malawi (2000)	1.04	1.02	0.89	0.95	0.90	0.83	0.86	0.79[a]
Mali (1995/1996)	0.78	0.70[a]	0.76[a]	0.85	0.80	0.87	0.89	0.87
Mozambique (1997)	0.86	0.80	0.65[a]	0.58[a]	0.99	0.86	0.98	0.93
Niger (1998)	0.83	0.83	0.70[a]	0.75	0.87	0.62[a]	1.10	1.11
Nigeria (1999)	0.70[a]	0.66	0.50[a]	0.47[a]	0.48[a]	0.30[a]	0.50[a]	0.33[a]
Senegal (1997)	0.75[a]	0.79	0.79	0.89	0.63[a]	0.53[a]	0.58[a]	0.46[a]
Tanzania (1999)	1.21	1.12	0.74	0.92	0.80	0.60[a]	0.96	0.73
Togo (1998)	0.69[a]	0.93	0.85	1.00	0.67[a]	0.64[a]	0.76	0.66[a]
Uganda (2001)	0.81	0.96	0.69[a]	0.73	1.01	1.08	0.98	1.05
Zambia (1996)	0.78	0.80	0.79[a]	0.92	0.81	1.04	0.79[a]	0.98
Zimbabwe (1999)	0.97	1.10	0.71[a]	0.65	0.96	0.74	0.91	0.73

Note: Variables controlled for in the logistic regression models are: parity, premarital birth, educational attainment, and urban/rural residence.

[a]Significantly different from an odds ratio of 1.0 at 5% level.

[b]Unskilled attendance includes TBA, relative, friend, none and other.

with no formal education were considered the least favourable.

The results in Tables 4(a) and 4(b) confirm that teenagers were, in general, significantly more likely to receive poor antenatal and delivery care (no visit in first trimester, make less that 4 antenatal visits during pregnancy, have non-facility delivery, and have unskilled delivery attendant) compared to older women of similar socio-economic and demographic characteristics, with respect to whether or not a birth was premarital, urban/rural residence, maternal educational attainment and parity. Overall, premarital births, rural residence, lack of formal education and higher order births were associated with late antenatal care, inadequate visits, non-facility delivery and unskilled delivery attendant. Higher GNI per capita was associated with reduced late antenatal care and non-facility delivery. However, for unskilled attendance, health expenditure per capita seemed to be the significant factor. It was interesting to note that women in countries with higher women literacy levels were more likely to start antenatal care late in pregnancy, but less likely to make inadequate visits.

The results in Tables 4(a) and 4(b) further revealed that maternal health care in sub-Saharan Africa varies significantly between countries. However, as suggested by the non-significant age effect at country level, there was no evidence that the difference between teenagers and older women varies significantly between countries in the region. The intra-country correlation coefficients, derived from the country-level variances, suggest some degree of consistency in maternal health care within countries, with almost 10 percent of the total unexplained variation in antenatal care, and up to 15 percent of the total unexplained variation in delivery care being attributable to unobserved country level factors.

Table 4(a)
Individual and country level parameter estimates of antenatal care in sub-Saharan Africa

Parameters	No visit in1st trimester		Less than four visits	
	Estimate (s.e)	Odds ratio	Estimate (s.e)	Odds ratio
Individual level factors				
Constant	0.89(0.115)	—	0.02(0.132)	—
Maternal age (15–19)[a]				
20–34	−0.21(0.034)[b]	0.81	−0.30(0.028)[b]	0.74
35–49	−0.18(0.046)[b]	0.84	−0.26(0.038)[b]	0.77
Residence (urban)[a]				
Rural	0.38(0.023)[b]	1.46	0.87(0.021)[b]	2.39
Education level (none)[a]				
Primary	−0.20(0.027)	0.82	−0.63(0.021)[b]	0.53
Sec+	−0.63(0.034)[b]	0.53	−1.33(0.031)[b]	0.26
Birth order(1st birth)[a]				
2–4	0.16(0.034)[b]	1.17	0.16(0.030)[b]	1.17
5+	0.34(0.033)[b]	1.40	0.30(0.029)[b]	1.34
Premarital birth (no)[a]				
Yes	0.31(0.048)[b]	1.36	0.31(0.041)[b]	1.35
Contextual country factors				
Health expenditure per capita	ns	—	ns	—
GNI per capita	−0.27(0.075)[b]	0.76	ns	—
Health expenditure % of GNI	ns	—	ns	—
Women literacy level (%)	0.03(0.006)[b]	1.03	−0.03(0.006)[b]	0.97
Country level variance				
Constant	0.25(0.145)[b]	—	0.34(0.106)[b]	—
Maternal age 20–34	ns	—	ns	—
Maternal age 35–49	ns	—	ns	—
Intra-country correlation coefficient	0.07	—	0.09	—

ns–not significant.
[a]Reference category.
[b]Significant at 5% level.

The implications of the country effect on maternal health care among teenagers of different sociodemographic characteristics are illustrated in Figs. 1 and 2. The figures show the risk of late antenatal care and inadequate visits for teenage mothers in two groups: those with most favourable and least favourable individual risk factors. The graphs plot variation in relation to country conditions. For timing of antenatal care, the widest gap between teenagers with most favourable characteristics and those with least favourable characteristics was in countries with low risk factors. For frequency of antenatal care visits, the difference between teenagers of different characteristics was as considerable in high risk as in low risk countries.

For delivery care (Fig. 2), the gap in place of delivery between the most favourable and least favourable individual scenarios was considerable for all countries, and seemingly greatest in countries with about average levels of non-facility delivery. For unskilled delivery attendance, the difference between teenagers of different characteristics was considerably greater in low risk than in high risk countries, such that in countries with high risk factors, teenagers with most favourable characteristics were almost as likely as those with least favourable characteristics to have unskilled delivery attendant. The gap in unskilled delivery attendance between teenagers with most favourable and those with least favourable characteristics was about 60 percentage points in countries with the lowest rates of unskilled attendance, but narrowed considerably to about 15 percentage points in countries with the highest rates of unskilled attendance. This suggests that teenagers with least favourable characteristics (i.e., premarital birth, high parity, rural residence and no formal education) are particularly disadvantaged in countries where a relatively high

Table 4(b)
Individual and country level parameter estimates of delivery care in sub-Saharan Africa

	Non-facility delivery		Unskilled attendant	
	Estimate (s.e)	Odds ratio	Estimate (s.e)	Odds ratio
Individual level factors				
Constant	−0.51(0.158)	—	1.28(0.178)	—
Maternal age (15–19)[a]				
20–34	−0.30(0.028)[b]	0.74	−0.17(0.027)[b]	0.84
35–49	−0.41(0.038)[b]	0.66	−0.23(0.037)[b]	0.79
Residence (urban)[a]				
Rural	1.65(0.022)[b]	5.21	1.11(0.021)[b]	3.03
Education level (none)[a]				
Primary	−0.86(0.022)[b]	0.42	−0.63(0.022)[b]	0.53
Sec+	−1.74(0.032)[b]	0.18	−1.36(0.033)[b]	0.26
Birth order (1st birth)[a]				
2–4	0.43(0.030)[b]	1.54	0.27(0.029)[b]	1.31
5+	0.69(0.029)[b]	1.99	0.42(0.028)[b]	1.52
Premarital birth (no)[a]				
Yes	−0.03(0.042)	0.97	−0.07(0.041)	0.93
Contextual country factors				
Health expenditure per capita	ns	—	−0.07(0.027)[b]	0.93
GNI per capita	−0.21(0.097)[b]	0.81	ns	—
Health expenditure % of GNI	ns	—	ns	—
Women literacy level (%)	ns	—	ns	—
Country level variance				
Constant	0.51(0.155)[b]	—	0.59(0.182)[b]	—
Maternal age 20–34	ns	—	ns	—
Maternal age 35–49	ns	—	ns	—
Intra-country correlation coefficient	0.13	—	0.15	—

ns–not significant.
[a]Reference category.
[b]Significant at 5% level.

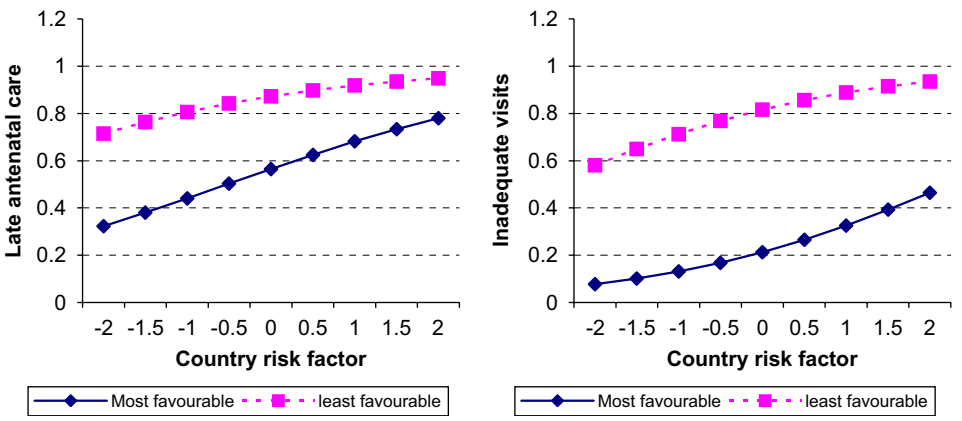

Fig. 1. Estimated probabilities of late and inadequate antenatal care for teenage mothers with most favourable and least favourable socio-demographic characteristics in relation to varying country risk factors. *Country risk factor*—effect of unobserved country characteristics. *Most favourable individual conditions*—non-premarital first births among urban residents with at least some secondary education *Least favourable individual conditions*—premarital high parity births among rural residents with no formal education.

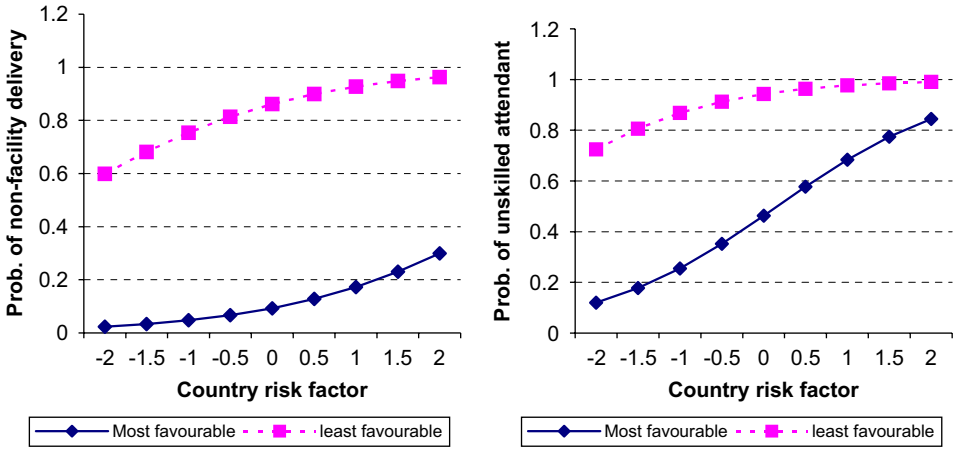

Fig. 2. Estimated probabilities of non-facility delivery for teenage mothers with most favourable and least favourable socio-demographic characteristics in relation to varying country risk factors. *Country risk factor*—effect of unobserved country characteristics. *Most favourable individual conditions*—Non-premarital first births among urban residents with at least secondary education. *Least favourable* individual conditions—Premarital high parity births among rural residents with no formal education.

proportion of pregnant women have skilled delivery attendance.

Discussions and conclusions

The main objectives of this paper were threefold: to examine how maternal health care indicators (antenatal and delivery care) of teenagers compare with those of older women in sub-Saharan Africa; to determine the extent to which differences in maternal health care between teenagers and older mothers vary across countries in the region; and to examine the country-effect on maternal health care among teenagers in the region. Preliminary bivariate analysis showed that a very high proportion of women in sub-Saharan Africa initiate prenatal care late in the second or third trimester, with little variation by age, which tends to corroborate an earlier finding by Abou-Zahr and Wardlaw (2003). A regional pattern was observed whereby countries in Eastern Africa region (Malawi, Tanzania, Zambia, Uganda and Kenya) had particularly high proportions of women initiating antenatal care late in pregnancy. We also observed that initiating antenatal care early may not necessarily translate into making adequate number of visits, as in the case of Senegal. Abou-Zahr and Wardlaw (2003) found a similar trend for sub-Saharan Africa and Asia, where the latter region was characterized by earlier initiation of antenatal care but fewer visits compared to the former.

When we controlled for background factors in the multivariate analysis, the results showed that to a large extent, teenagers in sub-Saharan Africa experience poorer maternal health care than older women with similar characteristics. The teenage disadvantage was evident in the utilization of both antenatal and delivery care services. They were more likely to initiate antenatal care late, make inadequate antenatal care visits during pregnancy, deliver outside health facilities, and have an unskilled birth attendant, compared to older women. The teenage disadvantage only becomes apparent when other factors associated with maternal heath care, especially parity, were included in the model. Since teenagers are more likely to have first-order births which are in turn associated with better maternal health care, they may appear to have better care if parity is not controlled for. This possibly explains the lack of association between maternal age and maternal health care, or the apparent poorer care among older women observed in our preliminary analysis and in an earlier study by Abou-Zahr and Wardlaw (2003), based on bivariate analysis. We recognized the potential risk of multicollinearity in the multivariate analysis, given the expected correlation between maternal age and parity. However, our preliminary investigation showed no evidence of milticollinearity (see Neter,

Kutner, Nachtsheim, & Wasserman, 1996), with fairly stable estimates and modest standard errors when parity was introduced in the models.

It is important to note that the observed patterns of maternal health care by maternal age controlled for the effect of premarital births, which reduced the observed teenage disadvantage, even though the effect remained significant. Separate analyses (not presented) show that teenagers are more likely to experience premarital and unintended births than older women, and that premarital or unintended births are more likely to receive poorer maternal health care as also noted in earlier studies (Gage, 1998; Magadi et al., 2000; Marston & Cleland, 2003). The observed general underutilization of maternal health services by teenagers, coupled with their relatively higher experience of premarital unintended childbearing, particularly in countries with relatively high levels of premarital teenage births (such as Cote d'Ivoire and Kenya where more than one third of all teenage births are premarital), make them a particular sub-group of concern. In such settings, improving access to family planning services for teenagers is likely to make a significant impact on overall teenage maternal health through prevention of premarital unintended pregnancies.

An examination of the country-level variations in maternal health care indicators suggest significant differences in the levels of these indicators between countries, after controlling for individual women's socio-demographic characteristics and observable country factors. This implies that unobservable country factors have a significant effect on maternal health care in sub-Saharan Africa. The intra-country correlation coefficients suggest that 7–15 percent of the total unexplained variations in antenatal and delivery care are attributable to unobserved country-level factors. These could range from national policies influencing utilization of services such as cost-sharing policies, to availability and accessibility of maternal health services within countries.

Despite the significant variations in levels of maternal health care between countries, there was no evidence that the differences between teenagers and older women vary across countries. This implies that the observed patterns by maternal age are fairly consistent across sub-Saharan Africa, hence, can be generalized for the region. The multivariate analysis for individual countries confirmed that whenever there were significant associations, these conformed to the general patterns.

Further investigation of the impact of country-level effect on maternal health care among teenagers with different socio-economic and demographic characteristics suggested that for unskilled delivery attendance (and to some extent timing of antenatal care), the gap between teenagers of different socio-demographic characteristics was widest in generally low risk countries. Consequently, teenagers with least favourable characteristics (premarital births, high parity, rural residence and no formal education) who were in countries where a relatively high proportion of pregnant women had skilled delivery attendant (or start antenatal care early in pregnancy) appeared to be particularly disadvantaged. National policies that ensure provision of affordable maternal health care services and youth-friendly services are likely to be an important first step to improving maternal health care among teenagers in the region.

The issues addressed in this paper have important implications for national and international maternal health policy. The need for improved maternal health has long been on international agenda, since the launch of the global conference on safe motherhood in 1987 in Nairobi, Kenya. The World Summit for Children in 1990 adopted as a specific goal: "Access by all pregnant women to prenatal care, trained attendants during childbirth and referral facilities for high-risk pregnancies and obstetric emergencies". Similar aims have been voiced in other major international meetings, including the 1994 International Conference on Population and Development (ICPD), the Fourth World Conference on Women in 1995, their five-year follow-up evaluations of progress, and the United Nations General Assembly Special Session on Children in 2002 (WHO & UNICEF, 2004). The core policy framework supporting maternal health is the ICPD (chapter 8) now supplemented by ICPD +5 and the Millennium Development Goals (MDGs). Actions suggested included 'Expanding the provision of maternal and child health services in the context of primary health care'. Implementation of the Programme of Action will significantly contribute to attainment of the MDG Goal 5 (target 6) of improving maternal health and reducing maternal deaths (WHO, 2004). However, a shortcoming of the international treaty process is the glaring gap between countries' adoptions of these global contracts in the international arena, and implementation at the domestic level. In addition, most countries in sub-Saharan Africa have not

addressed policy issues even where policies have significant effects on maternal health (Rogo, 2006). It is important that individual countries in sub-Saharan Africa pay particular attention to the implementation of relevant programmes of action aimed at addressing the international maternal health goals to improve maternal health in the region.

Whilst laudable, the international maternal health initiatives have been perceived to be too vast and daunting in low resource settings. Since the 1980s, many developing country governments launched health sector reforms as long-term efforts to strengthen and improve their health systems (Dmytraczenko, Rao, & Ashford, 2003). However, issues of cost and cost recovery remained central to policy makers and user fees, for instance, were introduced to improve drug supplies and help cope with insufficient funding for the health sector. Despite carefully defined exemptions for children and preventive services, including antenatal care, anecdotal evidence suggests that exemptions for maternity services were rarely implemented (Jowett & Ensor, 1999). Published literature shows that the introduction of user fees had a negative impact on utilization levels, including an increase in the number of babies 'born before arrival at facility'. In addition there is evidence that even when preventive services are exempt from user fees, utilization still falls since preventive care, including antenatal services, is sometimes delivered to patients who come to health facilities for curative care. As demand for curative care falls following the introduction of user fees, there has been a knock-on effect on the amount of preventive care supplied (Jowett & Ensor, 1999). Although resource availability may be a major constraint to improving maternal health in sub-Saharan Africa, the evidence from this paper suggests that the amount of available resources, as measured by health expenditure per capita or GNI per capita, are only marginally important. Hence, with appropriately targeted and concerted efforts, it is possible to realize significant improvements in maternal health care, even where resources are limited.

Finally, it is important to note that despite the ICPD consensus, reproductive health issues, especially those relating to adolescent needs and services have been fraught with controversy (Bernstein, 2005). It is, therefore, not surprising that this paper identifies a relative disadvantage of teenagers compared to older women with respect to the utilization of maternal health care services in sub-Saharan Africa. International maternal health initiatives need to recognize the special position of teenagers while setting specific international goals and targets. Furthermore, there is need for national policies to pay particular attention to the disadvantaged and vulnerable sub-groups of the population for whom issues of reproductive health are surrounded with controversy in many settings. This study reveals that the gap in maternal health care between teenagers with different characteristics is more pronounced in countries with relatively better maternal health care, suggesting that the socio-economically disadvantaged sub-groups may have benefited least from improvements in maternal health care in such settings.

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