"Comparing maternal health indicators between teenagers and older women in sub-Saharan Africa: evidence from DHS"

Monica Magadi[1]
Alfred Agwanda[2],
Francis Obare[3]
and
Negussie Taffa[3]

Abstract

This paper uses DHS data from 21 countries in sub-Saharan Africa, collected in the late 1990s and early 2000s, to examine maternal health indicators among teenagers in the region. A comparison of maternal health indicators between teenagers and older women, based on logistic regression analyses for individual countries as well multilevel logistic analyses applied to merged data, and controlling for the effect of important socio-economic and demographic factors, show that in general, the teenagers are more likely to report unintended fertility (especially mistimed), receive inadequate antenatal care (start late and attend fewer visits), have non-facility delivery, and have a small baby at birth. However, teenagers are less likely to have had Caesarean section deliveries compared to older women. An examination of the country level variations shows significant differences in maternal health indicators between countries. However, there is no evidence that the observed pattern by maternal age varies significantly between countries, suggesting that these patterns are generalizable for the region. For teenagers with characteristics associated with higher Caesarean section or unwanted fertility rates, being in countries with overall higher risks of these outcomes particularly amplifies their chances of experiencing these outcomes.

[1] Division of Social Statistics, School of Social Sciences, University of Southampton, UK.
[2] Population Studies and Research Institute, University of Nairobi, Kenya.
[3] African Population and Health Research Center, Nairobi, Kenya.

Introduction

Most literature supports the notion that teenage childbearing is generally associated with higher risk of adverse maternal and newborn health outcomes. There is however continued debate on whether this association is mainly a factor of unfavorable socio-demographic conditions of adolescent mothers or due primarily to their biological immaturity. Problems related to study designs and analytic methods (i.e. adjusting for all potential confounders), form the crux of this divergence.

Hospital-based studies employing less-rigorous analytic methods mostly reveal that young maternal age is 'causally' associated with increased poor obstetric indicators such as antenatal care attendance, delivery by skilled personnel, and peri-natal death (Anandalakshmy and Buckshee 1993; LeGrand and Mbacke 1993; Ali and Lulseged 1997; Botting et al. 1998; Orvos et al. 1999; Alam 2000; Wasunna and Mohammed 2002). The independent effect of maternal age on the frequency of preterm delivery, low birth weight and neonatal mortality could nevertheless be significant as age at first childbirth falls below 16 years of age (Friede et al. 1987; Lee et al. 1998; Phipps and Sowers 2002).

After controlling for the effect of socio-economic confounders, most studies find no increased adverse obstetric and child health outcome among teenagers compared to older mothers (Pillai et al. 1997; Hoffman 1998; Roth et al. 1998; Jimenez et al. 2000; Tsai et al. 2001; Smith and Pell 2001). Such similarity of obstetric outcomes between teenage and adult mothers for the developed world is partly due to important advances in obstetric care and social contexts of pregnancy (Foix-L'Helias and Blondel 2000). However, there is dearth of systematic documentation of how the obstetric outcomes among teenagers compare with that of older women in the developing countries, especially sub-Saharan Africa. This paper seeks to (i) establish how maternal health indicators of teenagers in sub-Saharan Africa compare with that of older women; (ii) determine the extent to which the observed differences between teenagers and older mothers can be generalised for

countries in sub-Saharan Africa; and (iii) examine the contextual country effect on maternal health indicators among teenagers in sub-Saharan Africa region.

Teenage childbearing in sub-Saharan Africa

Critical issues surrounding teenage childbearing in sub-Saharan Africa include pregnancy wantedness and acceptance by the teenagers themselves as well as the society, especially in cases of premarital childbearing; utilization of maternal health care services; and a conceivably elevated risk of complications during pregnancy or childbirth and poor pregnancy outcomes, especially among the younger teenagers who may not be physically mature for childbearing.

In many countries, sexual activity and childbearing typically begin within marriage but in some cultures, premarital relationships are encouraged as a form of trial marriage and proved fecundity leads to formalizing the union (Bledsoe and Cohen 1993). Previous studies have indicated that in sub-Saharan Africa, the prevalence of unwanted births tend to be lower than in other less developing regions but prevalence of mistimed births is somewhat higher (Bongaarts 1997). Those who are never married are much more likely than married adolescents to report their most recent births as unplanned (Singh 1998). Thus where incidence of marriage among the younger women is high, the reporting of mistimed or unwanted pregnancy is likely to be low. Furthermore, if young girls marry on learning that they are pregnant then they would be less likely to report that their pregnancies were unplanned. The consequences of unintended pregnancies are thought to be substantial. 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 et al. 2002).

The teenagers physiological and social immaturity and lack of prenatal care makes health risks associated with their pregnancies and childbearing more pronounced than those of older women (Zabin and Kiragu, 1998:216). Births to the unmarried teenagers are often unplanned or unwanted and most of the young mothers are often in more precarious

economic position. Such circumstances greatly increase the chance of poor outcomes both in the short and long term (Singh 1998). The situation may be more aggravated for younger women (teenagers) because the facilities are not often oriented to their needs. But more specifically the unmarried ones are less likely to recognize their pregnancy or identify themselves that they are pregnant for fear of reaction from others. They may also not know the importance of prenatal care hence are more likely to attend clinics late. However, an earlier study by Cherlin and Riley (1986) indicated that in Africa, adequate prenatal care is scarce for women of any age. Nevertheless the differences between teenagers and of older women are often differences of degree (Zabin and Kiragu 1998).

The reasons for the relative differences in the uptake of maternity care may be varied. In a study by Gage (1998) using earlier DHS data sets from Kenya and Namibia, mistimed and unwanted births were associated with lower likelihood of institutional delivery and premarital childbearing was an important risk factor for under-utilization of maternity care. The negative effect of premarital births on maternity care was much stronger for the timing of first prenatal visit than the likelihood of institutional delivery. But wantedness *per se* was not a significant determinant of a first visit or institutional delivery except Kenya where women were less likely to have an institutional delivery if they were dissatisfied with the timing of their pregnancy (Gage 1998). Marston and Cleland (2003) also observed that after adjusting for other factors, pregnancy intention status was not consistently related to the probability of supervised delivery, full vaccination or satisfactory child growth. It is only the inadequate antenatal care that was related to intention status.

Although there is evidence that teenage pregnancies are associated with poorer birth outcomes, such as low birth weight, premature births and foetal loss than pregnancies among older women, there is hardly any empirical evidence that teenage mothers are more likely to have pregnancy complications requiring Caesarean section. While Caesarean section deliveries would be expected to be higher among teenage mothers who may not be fully physically developed for childbearing and are at an increased risk of obstructed labour, a number of studies outside Africa have shown that teenage births are

in fact at a lower risk of delivery by Caesarean section (Lubarsky, et al. 1994; Lao and Ho 1998; Jolly et al. 2000; Smith and Pell 2001). It is unclear whether the same pattern would be applicable to Africa, a setting characterised by lack of appropriate maternal and essential obstetric care that would mitigate potential complications, especially among the poorly-nourished very young mothers..

Data and Methods

The Data

The study is based on Demographic and Health Surveys (DHS) conducted in 21 countries of sub-Saharan Africa during the late 1990s or early 2000s. 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 indicators of adolescents aged 15-19 years with that of older women aged 20-34 years and 35 years and above. Indicators of maternal health analyzed include unplanned fertility, maternal health care and birth outcomes relating to births which occurred 3-5 years before the surveys.

The measurement of unplanned or unintended fertility is based on direct questions about desirability status of recent pregnancies reported in the DHS. Unplanned fertility is classified into three categories: mistimed (wanted later), unwanted (wanted no more) and wanted fertility (wanted then). Both mistimed and unwanted fertility constitute overall unplanned or unintended fertility. We acknowledge that the measurement of unplanned childbearing is subject to the well-recognized shortcoming of possible biases in retrospective reporting of pregnancy wantedness (Bongaarts 1991; Gage 1998; Joyce et al. 2002; Magadi 2003; Marston and Cleland 2003). In societies that place high values on children and motherhood, as is the case in much of sub-Saharan Africa, the incidence of unintended pregnancies are likely to be underreported. Such misreporting tendencies would bias downwards the overall levels of unintended childbearing, but our comparison

of teenagers and older women are unlikely to be affected significantly, unless such misreporting tendency is selective by age group.

The indicators of maternal health care analyzed include antenatal care and delivery care. Antenatal care is assessed based on the timing of 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, although the preliminary analysis also includes delivery attendant. We choose to focus on health facility delivery rather than skilled delivery attendant in the multivariate analysis since the definition of the former is less ambiguous and is more consistent across countries. Furthermore, the two indicators often yield fairly similar results since health facility deliveries are often attended to by skilled medical personnel.

Indicators of birth outcomes include size of baby at birth and Caesarean section deliveries. The mother's report on size of baby at birth is used as a proxy for birth weight since the latter is not available for the majority of births taking place outside health facilities. The outcome 'small babysize at birth' includes cases reported to be 'very small' or 'smaller than average'. Previous studies show that reported size of baby at birth is often a reliable proxy for birth weight (Da Vanzo et al. 1984; Boerma et al. 1996; Magadi et al. 2001), especially when the classification for small babysize includes those reported to be very small as well as smaller than average.

The second birth outcome, Caesarean section delivery, should be interpreted with caution. Relatively high levels of Caesarean section deliveries in a population may be indicative of an undesirable outcome or a desirable outcome, especially in the developing world where service accessibility is an issue. Since a small proportion of pregnancies in any population will result in complications requiring Caesarean section deliveries to save the mother and the newborn, very low levels of Caesarean section deliveries may suggest that a significant proportion of deliveries requiring Caesarean section are unable to access such care. On the other hand, very high levels may either suggest elevated pregnancy

complications among a sub-population or unnecessary use of the procedure, both of which are undesirable and indicative of increased risk to maternal health.

Methods of Analysis

All the maternal health indicators are coded as binary outcomes and logistic regression analyses for each country used to compare the outcomes between teenagers and older women after taking into account important demographic and socio-economic determinants of maternal health, namely, parity, education level and urban/rural residence. It is necessary 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. Education is an important socio-economic determinant of maternal health while urban/rural residence takes into account expected urban bias in the allocation of health services. 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 have higher educational attainment, or more likely to have first births, or more likely to reside in urban areas than older women.

The second section of the analysis explores across country variations in the observed differences between teenagers and older women to determine to what extent the observed differences between teenagers and older women are generalized across countries of sub-Saharan Africa, and 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:

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

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 +), to vary randomly at country level to determine if observed differences between teenagers and older women are consistent across countries.

Results

Preliminary Analysis

Table 1 shows the distribution of births by maternal age in the last 3 –5 years prior to survey for 21 countries in sub– Saharan Africa. In all countries, the majority of the births (62-72 percent) occurred to women aged 20-34 years. Another significant proportion of births occurred to teenagers. In nine countries the proportion of births to women aged below 20 is about one fifth of the total number of cases. The lowest proportion is in Togo with about 11 percent while the highest is in Niger with about 23 percent. The proportion of teenage births that are premarital varies considerably between countries from a low of only 1-2 percent in Chad, Niger and Ethiopia, to a high of 22-33 percent in Cote d'Ivoire, Kenya and Zimbabwe.

(TABLE 1 ABOUT HERE)

Table 2a shows the distribution of births by maternal age, according to planning status. Among teenage women (<20 years) the level of mistimed births varies from a low of 7 percent in Tanzania to slightly over 50 percent in Ghana. Mistimed births are highly concentrated among teenage women in specific countries, namely, Ghana, Togo,

Comoros, Kenya and Zimbabwe, where at least 40 percent of births to teenagers are mistimed. The results do not strongly support the premise that in countries where many early births occur to unmarried women, the proportion of births to teenagers that are unplanned (mistimed or unwanted) is expected to be higher (Singh 1998). For instance, Ghana and Comoros have among the highest levels of unplanned fertility among teenagers but at the same time have among the lowest proportion of teenage births that are premarital, as shown in Table 1.

(TABLES 2a, 2b & 2c ABOUT HERE)

Table 2b shows the proportion of births by maternal age and maternal health care (prenatal and delivery care). It is generally recommended that prenatal visits start early in pregnancy and continue at regular intervals throughout the pregnancy. 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. The level is higher in the East and Southern African countries (Kenya, Uganda, Tanzania, Zambia, Malawi, Madagascar, and Zimbabwe) except for Comoros. It is only in Senegal that at least 50 percent 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 is not always the case. For example, Senegal has the highest proportion initiating antenatal care in first trimester, but the vast majority of births in all age groups (in fact the highest compared to all the other countries) received inadequate (less than four) antenatal care visits during pregnancy.

Table 2c shows the distribution of Caesarean section deliveries and reported size of baby at birth by country and maternal age. In four countries (Chad, Madagascar, Niger and Mali) the reported incidence of Caesarean section deliveries is less than one percent. The highest incidence of Caesarean section deliveries is observed in Ethiopia, especially among teenage mothers (about 16 percent). Ethiopia and Niger also record the highest incidence of small babies at birth. In 16 out of the 21 countries, the incidence of small births is highest among the teenagers. In general, the incidence of small babies at birth

declines with age, although the incidence for the 35 years and above age group tends to be elevated in some countries.

Multivariate Analysis

Unplanned fertility

Available evidence suggests that a large proportion of births in the developing countries result from unplanned pregnancies. Such pregnancies have adverse health consequences, including unsafe induced abortions and poor maternal health care (Joyce and Groomsman 1987; Dixon-Mueller 1989; Magadi, Madise and Rodrigues 2000). Teenagers are a particularly vulnerable group in this regard.

Table 3 shows the odds ratios indicating the relative differences in the risk of unplanned pregnancy by age and by country when other factors are controlled for. The results confirm the observations from Table 2a that mistimed births are more likely to be reported by teenage mothers compared to older women in nearly all the countries but the likelihood of unwanted births is considerably higher among the women aged 35 years and above.

(TABLE 3 ABOUT HERE)

Given the high value placed on children and motherhood in African societies and that a high proportion of teenage childbearing occurs within union, most early births would be expected to be wanted at the time it occurred. Young women are much more likely to say that their births were mistimed – not wanted at the time it occurred but some time later in their lives than to say that the births were not wanted at all (Singh 1998; Gage 1998). Not only does unwanted pregnancy vary by stage of the fertility transition but also large differences in unwanted pregnancy levels occur among populations at the same stage of transition. This variation can be attributed to shifts in four proximate determinants:

implementation of fertility preferences, effectiveness of contraceptive use, induced abortion and other proximate determinants (Bongaarts 1997).

Maternal Health Care

Antenatal and delivery care are both critical for maternal and newborn health. 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, and since teenagers are possibly more likely to have unplanned pregnancies, they are a particular group of interest. Table 4 shows odds ratios of antenatal and delivery care for maternal age 20-34 years or 35 or more versus adolescents aged 15-19 years. There is little variation in timing of antenatal care by maternal age, except for a few countries, namely, Cote d'Ivoire, Cameroon, Mali, Nigeria Senegal and Togo, which show some weak association. The association between maternal age and antenatal care is stronger with respect to frequency of visits. In all countries where there is a significant difference between the age groups, the teenagers are more likely to initiate antenatal care late and receive inadequate visits during pregnancy compared to older women, especially those aged 20-34 years.

(TABLE 4 ABOUT HERE)

The pattern for delivery care by maternal age shows an even stronger association, with the teenagers again being the most disadvantaged. In the majority of the countries, there is evidence that the teenagers are less likely to have a health facility delivery compared to older women aged 20-34 or 35 years and above. The effect of maternal age is particularly strong in Nigeria where the odds ratio is 3.4 times higher for women in age 35 or older and 2.1 times higher for those in the age group 20-34 years.

Birth Outcomes

Low birth weight and Caesarean section deliveries are important in both maternal and newborn health. Babies of low birth weight or small size at birth are associated with very high perinatal mortality risks, especially in the developing world where appropriate health care required for such cases needing intensive medical care is either lacking or inaccessible to the majority of the population. The odds ratios for the birth outcomes are presented in Table 5.

(TABLE 5 ABOUT HERE)

In nearly all the countries the risk of Caesarean section deliveries appear elavated for older women. The risk of Caesarean section delivery among women in the oldest age group (35 years and above) relative to teenagers is highest in Chad (odds ratio 12.4), Burkina Faso (odds ratio 5.9) and Zambia (odds ratio 5.7). In many countries the differences are not statistically significant despite the observed relatively high odds ratios. The sparse data is likely to reduce our power to detect significant associations. These results must be interpreted with caution since the relative differences in the Caesarean section deliveries is indecisive given that higher levels may reflect either greater use of essential maternal health care or higher incidence of complications necessitating Caesarean sections. The reported size of baby at birth, however, is similar for women in the different age groups in most countries after controlling for important socio-demographic factors. It is only in Chad, Zimbabwe, Zambia and Malawi where older women are less likely to report small baby size at birth compared to teenagers.

Between Country Variations in Maternal Health Indicators among Teenagers

Unintended Fertility

In this section, we examine between country variations in maternal health indicators among teenagers, using merged data set for 21 countries of sub-Saharan Africa. The variations between countries are examined after taking into account the effect of the main factors known to influence maternal health in the region, such as, urban/rural residence,

mothers' educational attainment, and parity at the time of birth of index child. The main purpose of this analysis is to establish the extent to which the observed patterns in the effect of maternal age are generalizable across countries of sub-Saharan Africa and examine the contextual country effect on maternal health indicators among teenagers in the region. The latter involves an examination of the impact of the contextual country effect on teenagers with least favourable and most favourable socio-demographic characteristics. For the purposes of this analysis, the least favourable and most favourable characteristics refer to characteristics associated with the highest risk and lowest risk of the outcome variables, respectively.

The results in Table 6 confirm that teenagers are, in general, significantly more likely to experience mistimed or overall unintended childbearing compared to older women. Births to women aged 20-34 are on average about 35 percent less likely to be mistimed, about 30 percent less likely to be unwanted, and overall 40 percent less likely to be unintended as births to teenagers. The oldest age group (35+ years) is also associated with lower odds of mistimed or overall unintended childbearing compared to teenagers, but as would be expected, unwanted childbearing is highest in this age group. The results for the other covariates show that urban residence and higher educational attainment are associated with higher likelihood of unintended childbearing, both mistimed and unwanted. As would be expected, higher birth order, especially order 5 and above are significantly more likely to be unintended, compared to first births.

(TABLE 6 ABOUT HERE)

An analysis of the variation in unintended childbearing across countries shows that the levels of mistimed and unwanted fertility vary significantly across countries of sub-Saharan Africa, net of important socio-demographic characteristics including maternal age, parity, residence and educational attainment. However, there is no evidence that the difference between teenagers and older women varies significantly between countries. An examination of unintended childbearing among teenagers with most favourable and least favourable socio-demographic characteristics shows that for those with least favourable

socio-demographic characteristics (i.e high parity, urban residence and secondary+ education), unintended fertility varies from 30 percent in countries with the lowest level of unintended fertility, to a high of about 80 percent in countries with the highest levels of unintended fertility (see Figure 1).

(FIGURE 1 ABOUT HERE)

For those with most favourable characteristics (i.e. first births among rural residents with no formal education), unintended fertility varies from less than 10 percent in countries with the lowest level of unintended fertility to a high of about 45 percent in countries with highest level of unintended fertility. In particular, the country effect is considerable for unwanted childbearing among teenagers with least favourable socio-demographic characteristics, for whom unwanted fertility varies from a low of only 2 percent in countries with lowest unwanted fertility to a high of almost 45 percent in countries with the highest levels of unwanted fertility.

Antenatal and Delivery Care

In general, teenagers are significantly more likely to receive poor antenatal and delivery care (no visit in first trimester, make less that 4 antenatal visits during pregnancy, and deliver at home) compared to older women, net of socio-economic and demographic factors including urban/rural residence, maternal educational attainment and parity (see Table 7). Overall, rural residence, lack of formal education and higher order births are associated with late antenatal care, inadequate visits and home delivery.

(TABLE 7 ABOUT HERE)

The results in Table 7 further reveal that maternal health care in sub-Saharan Africa varies significantly between countries, but there is no evidence that the difference between teenagers and older women differs significantly between countries in the region. An examination of the implications of the country effect on maternal health care among

teenagers with various socio-demographic characteristics in Figure 2 reveals that for antenatal care, the country effect is greatest for those with most favourable characteristics (i.e. first births among urban residents with some formal education). The gap in antenatal care between teenagers with most favourable and those with least favourable characteristics is greatest (about 40 percentage points) in countries with the lowest rates of inadequate or late antenatal care, but narrows considerably (to almost 10 percentage points) in countries with the highest rates of poor antenatal care. For delivery care, the gap between the most favourable and least favourable scenarios is greatest in countries with about average levels of non-facility delivery.

(FIGURE 2 ABOUT HERE)

Birth Outcomes

The analysis of size of baby at birth and Caesarean section deliveries presented in Table 8 shows that in general, adolescents aged 15-19 years have significantly higher odds of having a small baby at birth compared to women aged 20-34 years. However, teenagers are in general less likely to have a Caesarean section delivery than older women aged 20-34 or 35 years and above, net of other important factors such as maternal height, parity and educational attainment. In general, the highest risk of a small baby at birth is associated with nulliparous births to women with no formal education and relatively low body mass index, while the highest risk of Caesarean section deliveries is associated with urban residence, secondary or higher education level, first births and short maternal stature.

(TABLE 8 ABOUT HERE)

The country level variances again show a significant variation in these birth outcomes by country, but there is no evidence that the differences between teenagers and older women vary significantly by country. Figure 3 explores the country effect on birth outcomes

among teenagers with most favourable and least favourable socio-demographic characteristics,

(FIGURE 3 ABOUT HERE)

The country effect on the probability of having a small baby at birth appears to affect more or less equally teenagers with most favourable (i.e. births of order 2-4 among those with at least secondary level education) as those with least favourable characteristics (first births among women with no formal education). For Caesarean section deliveries, there is little variation across countries for teenagers with the most favourable characteristics (i.e. high parity births among rural residents with no formal education), for whom the likelihood of a Caesarean section remains negligible even in countries with the highest rates of Caesarean section deliveries. For those with least favourable characteristics (i.e. first births among urban residents with at least secondary level education), the probability of Caesarean section deliveries varies from a low of 3 percent in countries with the lowest Caesarean section rates to a high of about 25 percent in countries with the highest Caesarean section rates.

Discussions and Conclusions

The results presented in this paper confirm that to a large extent, teenagers in sub-Saharan Africa, as in other developing regions of the world, generally experience poorer maternal health indicators than older women. The incidence of unintended childbearing, especially mistimed births, is significantly higher among teenagers than older women, even though women in the oldest age group (35 years or older) are more likely to have unwanted births. The teenage disadvantage is also evident in the utilization of maternal health care services – they are more likely to initiate antenatal care late, receive inadequate antenatal care visits during pregnancy and deliver outside health facilities. Although there is evidence that teenagers are, in general, more likely to have a small baby at birth compared to women aged 20-34, the Caesarean section deliveries are generally higher among older women than teenagers, especially after controlling for

important factors, namely, maternal height, parity, urban/rural residence and educational attainment. Controlling for these factors is likely to enhance the above association since teenagers are more likely to be shorter (i.e. the younger ones still growing), have a first birth, live in urban areas and have higher educational attainment than the older women – factors all associated with increased incidence of Caesarean section deliveries.

As mentioned earlier, the results of the Caesarean section deliveries should be interpreted with caution since higher rates may reflect either greater use of essential maternal heath care services, or increased incidence of complications necessitating Caesarean deliveries. The results are consistent with previous studies from different parts of the world showing a lower risk of Caesarean section deliveries among teenagers, compared to older women (Lubarsky, et al. 1994; Lao and Ho 1998; Jolly et al. 2000; Smith and Pell 2001). However, given that the Caesarean section rates in most sub-Saharan Africa countries are well below the minimum level necessary in any population to save the life of the mother and newborn, it is possible that lower levels of Caesarean section deliveries to a large extent reflect lack of use of essential maternal health care services. This is consistent with the observation that Caesarean section rates are higher among the more highly educated and urban residents who are more likely to access health services. Hence, it is possible that the low Caesarean section rates among teenagers is a reflection of non-use of essential maternal health services by this sub-group. Generally, a Caesarean section rate below 5 percent is viewed as indicative of limited access to maternal health services (Family Care International 1998). The non-use of services possibly camouflages the expected higher Caesarean sections necessitated by pregnancy complications among very young teenage mothers who may not be fully physically developed for childbearing and at an increased risk of obstructed labour.

An examination of the country level variations in the maternal health indicators analyzed suggest significant variations in the levels of these indicators between countries, after controlling for individual women socio-demographic characteristics. This implies that unobservable country factors have a significant effect on maternal health indicators in

sub-Saharan Africa. These factors 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 indicators between countries, there is no evidence that the differences between teenagers and older women vary across countries. This implies that the observed patterns by maternal age can be generalized for the sub-Saharan Africa region. The analysis by individual countries confirms that whenever there are significant associations, these conform to the general patterns.

A further investigation of the impact of country-level effect on maternal health indicators among teenagers of different socio-economic and demographic characteristics suggests that the country effect has a particularly strong impact on the probability of Caesarean section delivery or unwanted fertility among teenagers with characteristics associated with the highest risk of these outcomes. For these teenagers, being in countries with relatively high overall levels of Caesarean section deliveries or unwanted childbearing greatly amplifies their chances of experiencing these outcomes.

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Table 1: Distribution of births within the last 3-5 years of DHS by country and maternal age

Country/ Year of DHS	Maternal age at birth			Proportion of teenage births pre-marital	Total cases
	<20	20-34	35+		
Benin (2001)	13.7	72.4	13.9	5.3	3302
Burkina Faso (1998/99)	14.9	66.7	18.4	5.2	3711
Cameroon (1998)	22.5	65.5	12.0	18.7	2469
Chad (1996/97)	22.9	66.2	10.9	1.1	4615
Comoros (1996)	12.0	71.7	16.3	2.2	1145
Cote d'Ivoire (1998/99)	20.6	65.2	14.2	32.6	1439
Ethiopia (2000)	14.2	69.2	16.6	2.4	7386
Ghana (1998/99)	12.2	70.1	17.7	7.7	1979
Kenya (1998)	17.3	71.6	11.1	25.4	3464
Madagascar (1997)	21.6	65.0	13.4	18.8	3893
Malawi (2000)	20.2	66.9	12.9	8.2	7956
Mali (1995/96)	17.9	66.2	15.9	11.3	6019
Mozambique (1997)	22.4	64.8	12.8	14.3	4207
Niger (1998)	23.1	62.4	14.5	2.0	5007
Nigeria (1999)	17.4	69.5	13.1	5.8	3551
Senegal (1997)	14.0	67.2	18.8	14.9	4343
Tanzania (1999)	17.3	70.3	12.4	15.4	2080
Togo (1998)	11.5	71.3	17.2	13.8	3978
Uganda (2001)	18.9	68.8	12.3	8.9	4802
Zambia (1996)	20.9	67.5	11.6	17.6	4574
Zimbabwe (1999)	21.5	66.8	11.7	21.5	2257

Table 2a. Distribution of unplanned fertility by country and maternal age

Country/ Year of DHS	Unplanned fertility								
	Mistimed			Unwanted			Total Unplanned		
	<20	20-34	35+	<20	20-34	35+	<20	20-34	35+
Benin (2001)	23.1	21.6	11.7	0.4	3.2	21.5	23.5	24.8	33.3
Burkina Faso (1998/99)	16.4	20.3	21.5	0.5	1.1	12.6	16.9	21.5	23.1
Cameroon (1998)	30.0	18.8	12.6	1.8	3.9	31.8	31.8	22.6	44.4
Chad (1996/97)	8.2	9.0	10.0	0.1	0.6	4.3	8.3	9.6	14.3
Comoros (1996)	46.3	44.7	29.2	5.9	11.0	35.7	52.2	55.7	64.9
Cote d'Ivoire (1998/99)	36.4	24.6	15.6	0.6	3.8	15.7	37.0	28.5	31.3
Ethiopia (2000)	27.0	23.6	10.2	12.3	15.3	37.5	39.3	38.9	47.8
Ghana (1998/99)	51.4	28.6	14.3	0.7	7.0	26.9	52.1	35.6	41.2
Kenya (1998)	45.8	37.3	25.0	3.2	9.0	39.2	48.9	46.4	64.2
Madagascar (1997)	13.9	14.2	8.0	7.8	11.2	25.7	21.7	25.4	33.7
Malawi (2000)	16.6	21.4	15.4	21.1	20.7	44.1	37.7	42.2	59.4
Mali (1995/96)	21.8	18.7	13.4	1.2	3.0	11.4	23.0	21.6	24.8
Mozambique (1997)	23.2	20.1	15.9	0.7	2.1	10.2	23.9	22.2	26.1
Niger (1998)	10.0	11.1	9.1	0.5	0.6	2.8	10.4	11.7	11.9
Nigeria (1999)	20.6	16.8	14.3	0.8	2.0	12.7	21.4	18.8	26.9
Senegal (1997)	30.6	31.6	22.3	1.3	3.1	25.8	31.9	34.7	48.1
Tanzania (1999)	7.3	14.4	5.5	10.1	10.0	22.5	17.4	24.3	28.0
Togo (1998)	49.2	35.2	17.2	4.1	5.1	24.1	53.3	40.2	41.3
Uganda (2001)	26.0	30.5	15.7	10.4	11.6	41.0	36.4	42.1	56.7
Zambia (1996)	34.6	32.1	21.0	3.5	4.6	27.5	38.1	36.7	48.5
Zimbabwe (1999)	40.2	30.3	26.0	2.8	3.9	29.2	43.0	34.2	55.2

Table 2b. Distribution of antenatal and delivery care by country and maternal age

Country/ Year of DHS	Antenatal care						Delivery care					
	Late initiation			Inadequate visits			Delivery at home			Unskilled attendance*		
	<20	20-34	35+	<20	20-34	35+	<20	20-34	35+	<20	20-34	35+
Benin (2001)	59.7	59.4	64.2	31.3	30.4	39.0	21.1	20.7	24.5	38.3	38.1	40.7
Burkina Faso (1998/99)	65.4	64.6	71.8	63.0	62.4	65.6	63.0	65.3	72.0	52.7	51.6	50.6
Cameroon (1998)	57.8	60.8	58.1	32.3	31.2	38.6	46.5	43.3	49.2	49.5	45.1	51.0
Chad (1996/97)	59.4	58.5	58.8	62.3	58.8	59.3	86.0	89.0	91.5	79.6	76.9	75.7
Comoros (1996)	58.8	57.6	67.1	34.7	37.5	40.6	54.4	56.9	60.8	67.2	67.5	68.5
Cote d'Ivoire (1998/99)	68.1	66.3	75.5	62.2	55.9	63.4	51.5	51.4	56.4	90.3	91.8	87.1
Ethiopia (2000)	83.3	78.2	80.4	65.6	61.1	69.5	94.2	94.6	97.3	86.5	85.5	83.3
Ghana (1998/99)	55.7	55.9	66.4	36.0	28.3	35.2	50.1	54.0	58.8	43.4	50.2	55.0
Kenya (1998)	85.7	85.1	88.4	42.8	31.3	38.6	56.3	55.1	68.9	39.9	33.6	36.2
Madagascar (1997)	81.8	78.7	80.4	56.3	50.7	48.2	65.2	65.3	64.7	89.7	86.6	80.6
Malawi (2000)	93.8	93.0	94.0	42.4	40.2	44.6	42.2	45.1	49.1	43.4	44.5	45.0
Mali (1995/96)	60.3	60.2	62.2	42.3	42.3	50.3	62.5	67.2	72.3	60.1	54.5	47.5
Mozambique (1997)	72.7	76.5	77.9	43.2	40.3	45.7	53.8	56.2	54.0	56.9	56.2	51.4
Niger (1998)	70.6	65.0	65.7	77.0	68.8	72.2	82.0	81.6	80.3	68.3	66.6	65.6
Nigeria (1999)	78.2	75.3	77.8	23.5	16.1	24.9	76.1	55.8	60.5	63.9	45.9	47.7
Senegal (1997)	49.7	44.8	49.5	80.4	79.0	83.2	52.6	51.3	51.5	54.0	51.5	46.4
Tanzania (1999)	86.3	89.5	91.1	27.4	27.9	35.1	48.0	57.7	72.0	41.2	43.7	46.1
Togo (1998)	80.6	78.9	85.5	46.3	41.7	45.1	44.9	48.8	57.7	69.5	68.9	69.8
Uganda (2001)	84.5	85.0	88.0	54.9	55.9	60.2	49.7	61.8	71.4	45.6	48.3	42.2
Zambia (1996)	90.4	88.7	88.4	30.7	23.6	26.9	52.8	53.5	67.3	51.9	48.2	44.3
Zimbabwe (1999)	73.5	72.1	76.9	26.3	20.3	23.4	21.1	27.1	34.5	10.8	12.7	17.9

*Unskilled attendance includes TBA, relative, friend and other

Table 2c. Distribution of Caesarean section deliveries and reported size of child at birth by country and maternal age

Country/ Year of DHS	Caesarian section deliveries			Very small/smaller than average		
	<20	20-34	35+	<20	20-34	35+
Benin (2001)	3.0	3.6	3.4	18.5	16.7	16.1
Burkina Faso (1998/99)	1.4	0.9	1.5	20.8	15.8	19.4
Cameroon (1998)	2.3	2.5	3.3	19.1	14.5	20.4
Chad (1996/97)	0.4	0.3	0.8	36.0	32.8	30.7
Comoros (1996)	3.0	5.7	6.0	30.9	24.1	25.8
Cote d'Ivoire (1998/99)	2.9	2.9	0.7	19.8	17.4	15.6
Ethiopia (2000)	15.6	14.4	5.7	39.5	35.6	38.2
Ghana (1998/99)	2.9	4.6	2.7	15.4	12.1	14.6
Kenya (1998)	5.9	7.7	3.0	18.7	14.6	19.7
Madagascar (1997)	0.6	0.6	1.2	30.1	25.8	24.6
Malawi (2000)	2.9	2.6	2.8	21.9	15.7	17.7
Mali (1995/96)	1.1	0.9	0.4	18.6	13.8	14.7
Mozambique (1997)	2.3	2.9	2.5	26.1	19.0	17.8
Niger (1998)	0.5	0.4	1.2	36.1	35.6	37.4
Nigeria (1999)	1.8	4.3	4.9	17.5	14.0	16.8
Senegal (1997)	-	-	-	-	-	-
Tanzania (1999)	3.4	3.2	0.7	16.6	11.2	11.7
Togo (1998)	1.5	2.2	1.7	23.3	17.8	20.7
Uganda (2001)	4.3	2.5	1.3	21.8	18.1	22.1
Zambia (1996)	2.0	1.5	3.5	18.1	12.4	10.6
Zimbabwe (1999)	9.6	6.6	8.1	18.6	16.0	11.7

Table 3: Unplanned Fertility: odds ratios of mistimed and unwanted births for maternal age 20-34 years and 35 years or more versus adolescents aged 15-19 years

Country (Year)	Mistimed (wanted later)		Unwanted (no more)		Total Unplanned (mistimed or unwanted)	
	20-34 Years	35 + years	20-34 Years	35 + years	20-34 Years	35 + years
Benin (2001)	0.873	0.407**	1.185	6.460*	0.876	1.195
Burkina Faso (1998)	0.706*	0.660*	0.703	8.064**	0.691*	1.175
Cameroon (1998)	0.364**	0.211**	0.658	6.592**	0.354**	0.900
Chad (1996/97)	0.671*	0.740	4.152	32.207**	0.708*	1.137
Comoros (1996)	0.702	0.302**	1.018	3.327**	0.707	0.749
Cote d'Ivoire (1998/99)	0.479**	0.362**	0.696	2.595	0.468**	0.634
Ethiopia (2000)	0.761**	0.346**	0.714**	1.911**	0.682**	0.953
Ghana (1998/99)	0.378**	0.163**	2.258	7.164*	0.394**	0.388**
Kenya (1998)	0.657**	0.414**	1.138	4.706**	0.688**	1.222
Madagascar (1997)	0.606**	0.267**	1.041	2.720**	0.710**	0.923
Malawi (2000)	0.770**	0.524**	0.619**	1.491**	0.621**	1.045
Mali (1995/96)	0.548**	0.335**	0.707	2.620*	0.550**	0.594**
Mozambique (1997)	0.503**	0.483**	1.145	5.033**	0.518**	0.840
Niger (1998)	0.614**	0.456**	0.721	3.704	0.612**	0.601**
Nigeria (1999)	0.670**	0.528**	0.763	5.039**	0.640**	0.974
Senegal (1997)	0.627**	0.382**	0.701	5.819**	0.605**	0.903
Tanzania (1999)	0.582*	0.273**	0.937	2.477*	0.657*	0.689
Togo (1998)	0.675**	0.310**	0.386*	1.897	0.615**	0.637**
Uganda (2001)	0.636**	0.268**	0.639**	2.853**	0.566**	0.911
Zambia (1996)	0.508**	0.267**	0.747	6.297**	0.498**	0.763
Zimbabwe (1999)	0.518**	0.318**	0.763	6.957**	0.509**	0.939

*-p<0.05, **-p<0.01

Table 4. Maternal health care: odds ratios of antenatal and delivery care for maternal age 20-34 years or 35 or more versus adolescents aged 15-19 years

Country/ Year of DHS	Antenatal Care				Delivery Care	
	Late initiation (Not 1st trimester)		Inadequate (Less than 4 visits)		Health facility deliveries	
	20-34	35+	20-34	35+	20-34	35+
Benin (2001)	0.799	0.825	0.784	1.041	1.471**	1.422
Burkina Faso (1998/99)	0.868	1.066	0.900	1.036	1.329	1.191
Cameroon (1998)	0.830	0.613*	0.680*	0.809	1.807**	1.781*
Chad (1996/97)	0.958	0.937	0.968	0.928	1.060	1.144
Comoros (1996)	0.926	1.068	1.029	0.903	1.705*	2.570**
Cote d'Ivoire (1998/99)	0.580**	0.667	0.432**	0.464**	1.777**	2.155**
Ethiopia (2000)	0.856	0.747	0.711	0.606*	1.726**	1.996**
Ghana (1998/99)	0.939	1.336	0.620*	0.647	1.311	1.560*
Kenya (1998)	0.858	1.093	0.691**	0.866	1.822**	1.984**
Madagascar (1997)	0.828	0.782	0.864	0.742	1.206	1.740**
Malawi (2000)	0.991	0.967	0.866	0.889	1.115	1.209
Mali (1995/96)	0.759*	0.670*	0.896	1.069	1.278*	1.172
Mozambique (1997)	0.868	0.814	0.623**	0.583**	0.965	1.115
Niger (1998)	0.836	0.846	0.795	0.879	1.139	1.603*
Nigeria (1999)	0.687*	0.657	0.588**	0.745	2.129**	3.436**
Senegal (1997)	0.754*	0.789	0.848	0.944	1.631**	1.948**
Tanzania (1999)	1.198	1.077	0.744	0.876	1.265	1.647
Togo (1998)	0.690*	0.945	0.808	0.863	1.546**	1.604**
Uganda (2001)	0.824	0.994	0.696**	0.700*	0.993	0.933
Zambia (1996)	0.746	0.772	0.806	0.919	1.268*	0.997
Zimbabwe (1999)	0.948	1.085	0.784	0.743	1.188	1.866**

Table 5: Birth Outcomes: odds ratios of Caesarean section deliveries and small baby size for maternal age 20-34 years and 35 years or more versus adolescents aged 15-19 years

Country (Year)	Caesarean section		Small baby at birth	
	20-34 Years	35 + years	20-34 Years	35 + years
Benin (2001)	1.574	2.111	1.095	1.141
Burkina Faso (1998)	1.710	5.929**	0.752	0.909
Cameroon (1998)	1.807	3.656*	0.758	1.032
Chad (1996/97)	1.903	12.429**	0.804*	0.716*
Comoros (1996)	2.198	2.960	0.730	0.757
Cote d'Ivoire (1998/99)	1.430	0.750	0.905	0.863
Ethiopia (2000)	0.649	1.251	0.923	1.019
Ghana (1998/99)	2.862*	3.387	1.080	1.475
Kenya (1998)	1.771*	1.414	0.956	1.113
Madagascar (1997)	0.864	2.803	0.846	0.786
Malawi (2000)	1.083	1.531	0.792*	0.871
Mali (1995/96)	1.162	0.814	0.798	0.876
Mozambique (1997)	1.592	1.738	0.981	1.011
Niger (1998)	1.064	2.558	0.951	1.022
Nigeria (1999)	1.941	2.896	0.974	1.144
Senegal (1997)	-	-	-	-
Tanzania (1999)	2.556*	1.466	0.792	0.782
Togo (1998)	2.612*	2.706	0.870	0.920
Uganda (2001)	1.115	1.199	0.833	1.136
Zambia (1996)	1.350	5.706**	0.717*	0.592*
Zimbabwe (1999)	0.997	2.344*	0.716*	0.486**

*-p<0.05, **-p<0.01

Table 6: Individual and country level parameter estimates (standard errors given in brackets) of mistimed, unwanted and overall unplanned fertility in sub-Saharan Africa

	Mistimed fertility		Unwanted fertility		Unplanned fertility	
Parameters	Estimate(s.e.)	OR	Estimate (s.e)	OR	Estimate (s.e)	OR
Fixed Effects						
Constant	-1.31(0.109)		-3.35(0.201)		-1.03 (0.123)	
Maternal age						
- (15-19) [1]	-	1.00	-	1.00	-	1.00
- 20-34	-0.45(0.028)*	0.64	-0.33(0.055)*	0.72	-0.49(0.027)*	0.61
- 35+	-0.96(0.040)*	0.38	1.11 (0.062)*	3.03	-0.14(0.035)*	0.87
Residence						
- (urban)[1]	-	1.00	-	1.00	-	1.00
- rural	-0.16(0.021)*	0.85	-0.34(0.034)*	0.71	-0.25(0.019)*	0.78
Education level						
- (none) [1]	-	1.00	-	1.00	-	1.00
- primary	0.41 (0.023)*	1.51	0.35(0.034)*	1.42	0.44(0.021)*	1.55
- secondary +	0.50 (0.031)*	1.65	0.41(0.050)*	1.51	0.53(0.029)*	1.70
Birth order						
- (1st birth) [1]	-	1.00	-	1.00	-	1.00
- 2-4	0.36(0.030)*	1.43	-0.17(0.061)*	0.84	0.29(0.028)*	1.34
- 5 +	0.55(0.029)*	1.73	0.91(0.054)*	2.48	0.74(0.027)*	2.10
Country level variance						
Constant	0.23(0.072)*		0.78(0.245)*		0.30(0.095)*	

[1] - reference category , * - significant at 5% level

Table 7: Individual and country level parameter estimates of antenatal and delivery care in sub-Saharan Africa

Parameters	Antenatal care				Delivery care	
	No visit in1st trimester		Less than four visits		Home delivery	
	Estimate (s.e)	OR	Estimate (s.e)	OR	Estimate (s.e)	OR
Fixed Effects						
Constant	1.04 (0.152)		0.89 (0.192)		-0.49(0.182)	
Maternal age						
- (15-19) [1]	-	1.00	-	1.00	-	1.00
- 20-34	-0.27(0.031)*	0.76	-0.42(0.028)*	0.66	-0.29(0.028)*	0.75
- 35+	-0.22(0.043)*	0.80	-0.42(0.039)*	0.66	-0.40(0.038)*	0.67
Residence						
- (urban)[1]	-	1.00	-	1.00	-	1.00
- rural	0.77(0.021)*	2.16	0.86(0.020)*	2.36	1.64(0.021)*	5.16
Education level						
- (none) [1]	-	1.00	-	1.00	-	1.00
- primary / sec+	-0.67(0.028)*	0.51	-0.72(0.021)*	0.49	-1.30 (0.027)*	0.27
Birth order						
- (1st birth) [1]	-	1.00	-	1.00	-	1.00
- 2-4	0.13(0.032)*	1.14	0.18(0.029)*	1.20	0.42(0.029)*	1.52
- 5+	0.37(0.030)*	1.45	0.33(0.027)*	1.39	0.68(0.028)*	1.97
Country level variance						
Constant	0.47(0.145)*		0.75(0.232)*		0.68(0.210)*	

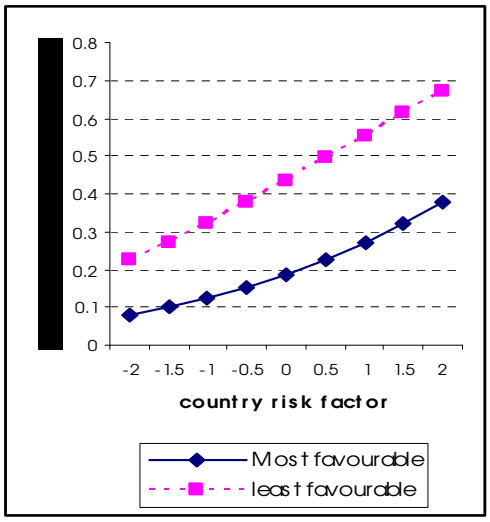
[1] - reference category
* - significant at 5% level

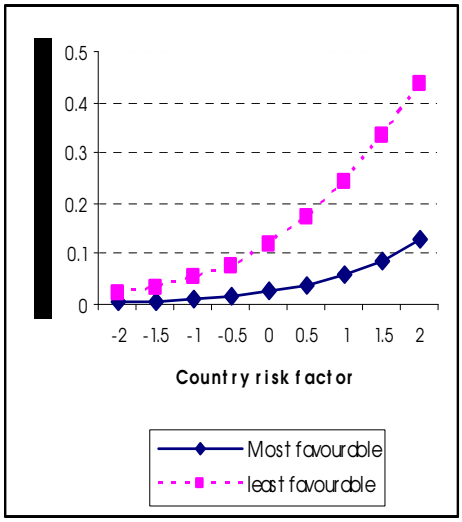
Table 8: Individual and country level parameter estimates of small baby at birth and Caesarean section births in sub-Saharan Africa

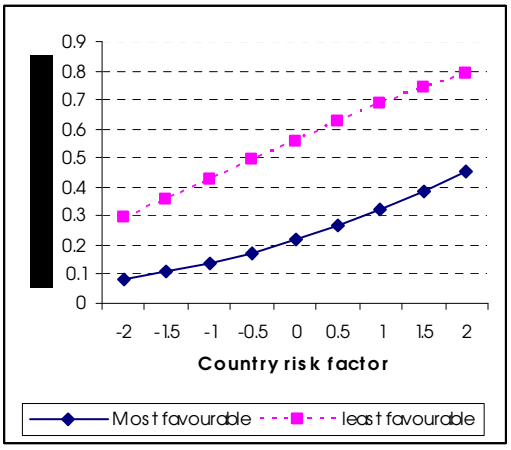
	Small baby		Caesarean section	
Parameters	Estimate (s.e)	OR	Estimate (s.e)	OR
Fixed Effects				
Constant	-0.19 (0.118)		1.40 (0.599)	
Maternal age				
- (15-19) [1]	-	1.00	-	1.00
- 20-34	-0.15(0.030)*	0.86	0.32(0.077)*	1.38
- 35+	-0.08(0.041)	0.92	0.73(0.112)*	2.08
Residence				
- (urban)1	-	1.00	-	1.00
- rural	0.01(0.024)	1.01	-0.82(0.057)*	0.44
Education level				
- (none) [1]	-	1.00	-	1.00
- primary	-0.22(0.025)*	0.80	0.52(0.072)*	1.68
- secondary +	-0.38(0.037)*	0.68	1.04(0.083)*	2.83
-				
Birth order				
- (1st birth) [1]	-	1.00	-	1.00
- 2-4	-0.18(0.032)*	0.84	-0.44 (0.078)*	0.64
- 5 +	-0.13(0.031)*	0.88	-0.75(0.075)*	0.47
Maternal height	-	-	-3.037(0.368)*	0.05
Body mass index	-0.04(0.003)*	0.96	-	-
Country level variances				
Constant	0.15(0.051)*	-	0.39(0.150)*	-

[1] - reference category * - significant at 5% level

Figure 1: Estimated probabilities of mistimed, unwanted and overall unplanned fertility for teenage mothers with most favourable and least favourable socio-demographic characteristics at varying country risk factors.



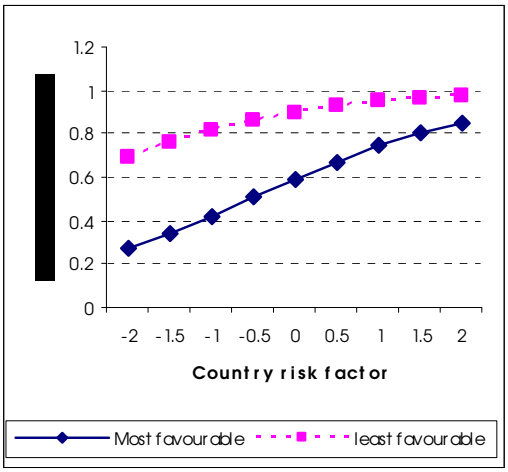


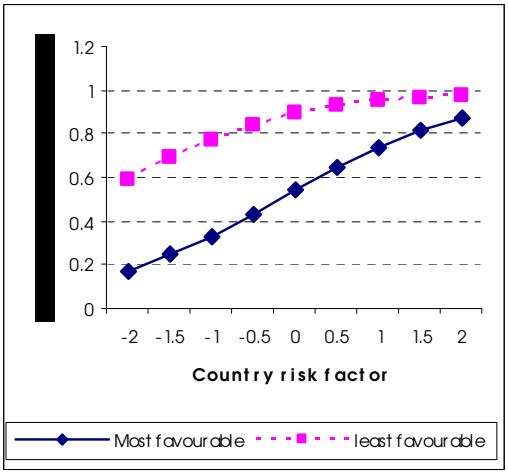


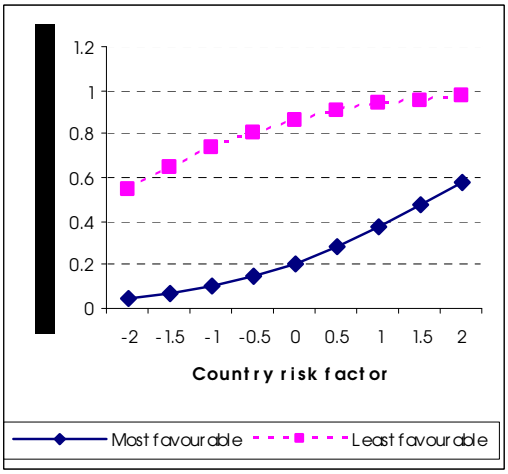
Most Favourable – First births among rural residents with no formal education
Least Favourable – High parity births among urban residents with secondary+ education.

Note:
The most favourable and least favourable refer to characteristics associated with the lowest risk and highest risk, respectively, of the specific outcomes.

Figure 2: Estimated probabilities of late or inadequate antenatal and non-facility delivery for teenage mothers with most favourable and least favourable socio-demographic characteristics at varying country risk factors.

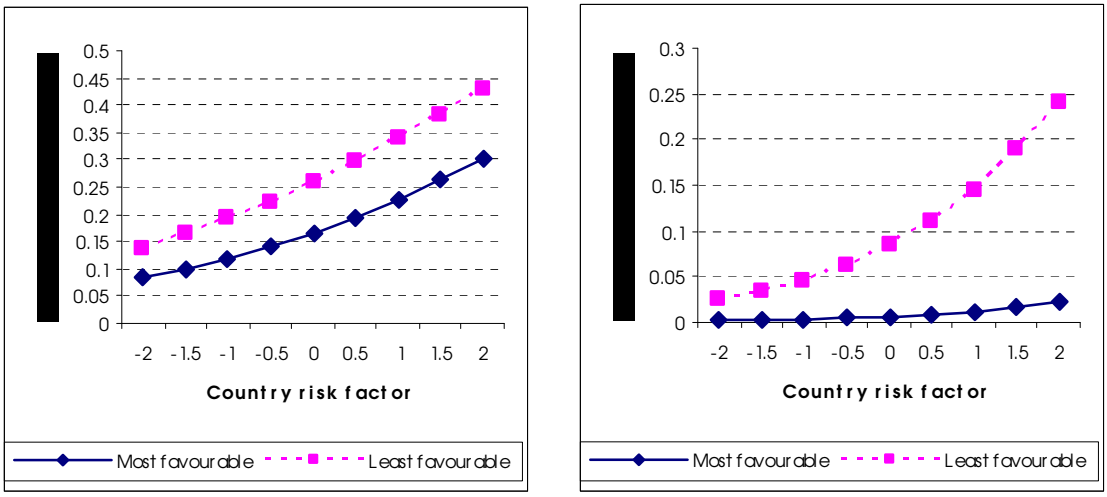






Most Favourable – First births among urban residents with some formal education
Least Favourable – High parity births among rural residents with no formal education.

Figure 3: Estimated probabilities of small baby at birth and Caesarean section births for teenage mothers with most favourable and least favourable socio-demographic characteristics at varying country risk factors.



Small baby size at birth
Most Favourable – Births of order 2-4 among women having at least secondary level education
Least Favourable –First births among women with no formal education

Caesarean section deliveries
Most Favourable – High parity births among rural residents with no formal education.
Least Favourable – Fist births among urban residents with some formal education

Note:

(i) Important anthropometric measurements relating to women's body mass index and height are held at the mean values when obtaining the predicted probabilities for small baby size at birth and Caesarean section deliveries, respectively.

(ii) Urban/rural residence has no effect on size of baby at birth, hence, this variable is not taken into account when computing the predicted probabilities for baby size.