Trends and Differentials in
Age at First Birth in Sub-Saharan Africa

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Abstract
Early childbearing has been linked to higher rates of maternal and child morbidity and mortality, truncated educational opportunities, and lower future family income levels. This paper compares trends and determinants in the timing of first birth during the period of adolescence, with emphasis on differentials in social determinants. The data come from the Demographic and Health Surveys in eight countries that had at least two surveys conducted approximately five years apart. The key hypotheses being tested are whether significant changes occurred in age at first birth between the two surveys and whether within the socio-demographic sub-groups there were differences in the levels of change. The bivariate analysis suggests that in general adolescent births declined, however, these declines varied by education, residence, and mass media exposure. A multivariate analysis provided further evidence for these differentials and indicated that the independent associations still existed, particularly for secondary education. The results suggest that adolescent women's socio-demographic characteristics have more consistent influences on early childbearing than community characteristics. However, further research is needed on community-level variables to find more appropriate measures of adolescents' surroundings.

1. Introduction

Over the past four decades the developed and developing worlds have been witness to important changes in reproductive behavior among their adult and adolescent populations. Accompanied by higher levels of schooling, better health care, increased urbanization, and greater exposure to modern forms of mass communication, fertility has dropped rapidly in many regions. In developing countries in particular, estimates indicate that fertility has dropped by about one-third, from an average of six lifetime children per woman in the 1960's to around four today. However wide variations in reproductive behavior persist at the national and sub-national levels, and across social groups. While much research and analysis has been conducted on the causes and consequences of such differential behavior among adults, until recently adolescents have received relatively little attention. The factors that influence adolescents to behave similarly, or differently, than their older counterparts remain less well understood.

In conjunction with an increasing body of literature on adolescent reproductive behavior produced within the past decade or so, concerns are increasing over the health, social and economic consequences of early childbearing. Early childbearing has been linked to higher rates of maternal and child morbidity and mortality, truncated educational opportunities, and lower future family income. Zabin and Kiragu (1998) review the evidence for the effect that early childbearing has on women (within and outside of union) and state that among the health consequences of early childbearing are, for the woman, higher than average levels of blood pressure, toxaemia, anaemia, bleeding, obstructed and difficult labour, premature delivery, and death. In addition, children born to teenage mothers are susceptible to higher incidence of low birth weight (which itself can lead to neurological problems, retardation, death), prematurity, stillbirth, and perinatal mortality. In addition, long-term demographic effects of adolescent fertility may include larger completed family sizes because the timing of a first birth may be associated with future fertility patterns (see Menken, 1980; Senderowitz and Paxman, 1985; Voydanoff and Donnelly, 1990; Wulf and Singh, 1991).

Modernization has been claimed to be an instigator of fertility decline in many societies (Easterlin 1983, Caldwell 1976, Coale 1973). Innovations in health care, increased education, and improved communication are thought to bring about forces dissolving traditional tendencies toward large families and replacing them with individualism marked by material aspirations. Lower child mortality, and more assurance of surviving offspring resulting from these changes, leads to a reduction in the need to have many pregnancies to achieve the desired number of surviving children. Similarly, lower child mortality might also reduce the pressure for women to start childbearing at a young age in order to meet their family goals.

Sub-Saharan Africa has some of the highest levels of adult and adolescent childbearing in the world. Since the 1980s, several countries in the region have begun a transition toward lower fertility. This has generally been

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accompanied by an upward trend in the age at first birth, although wide variations remain across countries and social groups.

The purpose of this report is to present a comparative perspective of determinants and trends in adolescent childbearing in Sub-Saharan Africa. In addition we investigate which sub-groups of the populations are at the forefront of the trend toward declining adolescent fertility in a context of modernization.

2. Data and Methods

The study examines trends in age at first birth among women in eight countries of Sub-Saharan Africa (Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Mali, Senegal, Tanzania, and Zimbabwe), drawing on information from successive Demographic and Health Surveys (DHS) conducted between 1987 and 1999 (see Table 1). The goal is to evaluate the time-trends and characteristics associated with the risk of a young woman having a first birth before age 18. We have chosen countries that had two surveys at least four years apart so that we can use data from two points in time. This allows us to assume similar recall biases and that the background variables reflect the respondent's characteristics at the time of the birth.

Data
The DHS program has been producing cross-national and comparative quantitative data on fertility throughout the developing world since 1985. The bulk of the information is collected from personal interviews with a representative sample of women of reproductive age (although in certain countries coverage is limited to ever-married women). The standard DHS questionnaire addresses fertility, family planning, and maternal and child health. In some cases additional questionnaires are included for husbands/males and on service availability in the community.

The surveys are carried out in a relatively standardized manner, though questionnaires may be adapted to the needs and conditions of a specific country. Survey samples are designed using scientific sampling probability. Most samples use two-stage stratified designs: selection of area units or clusters in a single stage, normally with probability proportional to size, followed by selection of households. Repeat surveys, usually conducted around five years apart, allow researchers to evaluate national trends. The present study draws on information collected from samples of women regardless of marital status from surveys conducted at least four years apart to allow for time-trend analyses within a given age group.

Data quality
Our analysis focuses on the risk of early initiation of childbearing, using retrospective data compiled from young women on age at first birth. Because the study is heavily dependent on information pertaining to the timing of events, an assessment of the quality of age-related responses is important.

As with all individual-related survey data, responses from the DHS are not immune to various types of error including recall errors due to memory lapses, duration heaping, and event omission (both deliberate and accidental). Previous studies have examined the quality of information on current age reported at the time of interview (Rutstein and Bicego, 1990), age at initiation of reproductive behavior (Blanc and Rutenberg, 1990; Gage, 1995),

Table 1 Summary of Demographic and Health Surveys used in this analysis

Country		Year of Fieldwork	
		Earlier survey	Later survey
Burkina Faso	BF	1992/93	1998/99
Côte d'Ivoire	CI	1994	1998
Ghana	GH	1993	1998
Kenya	KE	1993	1998
Mali	ML	1987	1995/96
Senegal	SN	1992/93	1997
Tanzania	TZ	1991	1996
Zimbabwe	ZW	1994	1999

and other demographic measures (Marckwardt and Rutstein, 1996). In general the quality of age reporting can be considered better among the youngest age groups and improving over time.

In the DHS, the respondent's age in the individual questionnaire is obtained by asking both the birth date and age in completed years. In most of the countries considered here, at least 90 percent of young respondents could provide current age or year of birth information in the latest survey. Changes in questionnaire design, training of interviewers and fieldwork implementation, and data processing across survey phases can affect the quality of the information retrieved.

Information on the timing of first birth is collected from women in the standard DHS individual module. A detailed birth history is collected including all live births in her lifetime, along with the age, birth date, sex, survival status, and living arrangements of each child. Age at first birth is calculated as the difference between the date of birth of the woman and that of her first child. While the accuracy of information on age at first birth is dependent upon that for the date of birth of the first child, the probability of recall errors is less among younger women.

While caution must be exercised when using survey data particularly in certain countries in Sub-Saharan Africa with poor documentation and knowledge of dates, improvements in quality of age reporting can be noted over the course of the DHS program. The impact of such improvements on the direction of timing of first births remains unknown. By limiting our focus on respondents in the youngest age groups, we hope to minimize the damaging bias of recall errors, which tend to be more frequent among older respondents for whom such a first reproductive-related experience generally would have taken place several years earlier. There is a distinct advantage in analyzing trends within a given age group instead of using various cohorts from one cross-sectional database.

Statistical methods
Our analysis examines the probability of a woman having a first birth before age 18. Exposure to the risk is censored for women who are not yet 18, thus we include in our analysis only women ages 18-24 at the time of each survey. Initially we graphically display the trends in the proportion of young women having a first birth by 18 according to socio-economic characteristics. This leads to the multivariate regression models to evaluate trends and determinants of adolescent fertility.

A logistic link is used to model the dichotomous outcomes in the regression models. We use a generalized estimating equation to avoid the inefficient estimation of coefficients, which results from the cluster-based DHS sampling structure. The standard logistic model assumes that the distribution of the error term follows a binomial distribution and the outcomes are random and independent. However, respondents within the same community or cluster are likely to have similar characteristics and behaviors (due to a number of unmeasured and unmeasurable factors), implying that the outcomes are not independent within clusters. General estimating equations allow us to estimate the model parameters while controlling for intra-cluster correlation (Liang and Zeger, 1993).

The key hypotheses being tested are whether changes in socio-demographic and contextual variables are associated with changes in the risk of first birth before age 18. Separate models are run for each country to take account of unobserved characteristics. Trends in the effects of socio-demographic and community variables are analyzed through interaction terms of the characteristic on the survey period. These interaction terms are used to specify how the influences on the outcomes have changed between surveys.

The coefficients in the regression outputs can be described as the log of the odds for a given category of a variable over the odds for the base category of the same variable. To ease interpretation, our results will be expressed in terms of odds ratios, which are calculated by exponentiating the parameters. A ratio greater than unity implies that an individual in the given category would be more likely to have a first birth before age 18 compared to a counterpart in the base category. A ratio lower than unity signals an individual in the given category is less likely to give birth during adolescence compared to a counterpart in the base category.

3. Explanatory Variables

Several individual and contextual indicators of modernization have been linked in the literature to changes in reproductive behavior. The four widely recognized, empirically identifiable aspects of modernization are identified by Easterlin (1983) as follows: innovations in formal schooling; urbanization; the introduction of new goods; and innovations in public health and medical care. We model these basic social influences and examine changes in adolescent fertility within different population sub-groups.

Education
A strong correlation between women's education and reduced childbearing consistently emerges from empirical applications throughout the developing world (see, for example, Ainsworth, 1994; Martin and Juarez, 1995). Mboup and Saha (1998) found that in many countries of Sub-Saharan Africa (including Burkina Faso, Ghana, and Senegal), women with no schooling have about two to three children more than women with secondary or higher education.

Fertility decline is due in part to later ages at first birth. Among adolescents, while we expect more education to be associated with a lower probability of early first birth, the direction of causality is less clear. Young women may decide to delay childbearing in order to complete their formal education. On the other hand, some teenage mothers may be forced to leave school early after having a child. To minimize the chances of reverse causality, we consider 8 years of education as our cut-off point to reduce the number of adolescents who might not have finished their education because of a pregnancy. This also reduces the risk of censoring data for women that have not yet finished their education at the time of the survey. Although the educational systems vary by country, we have chosen to use the categories of no schooling, one to seven years of schooling, and eight or more years of schooling to maintain comparability.

Type of residence
Another variable considered to influence childbearing is place of residence. The rural and urban distinction is important because of differences in access to health facilities, cultural beliefs, living situations, and opportunities. In an urban setting an adolescent has more work or education opportunities that might motivate her to delay childbearing.

Mass media exposure
Access to modern goods and ideas can also affect an individual's reproductive decisions. Cleland and Wilson (1987) suggest that the spread of new knowledge and technology can help explain observed patterns of fertility decline in many low-income countries, independent of economic circumstances. Exposure to modern forms of mass communication in particular has a strong effect on reproductive behavior, especially on contraceptive use and age at marriage (Adamchak and Mbvizo, 1991; Westoff and Bankole, 1997). We consider in this analysis radio listenership as representative of access to the mass media and new ideas. The variable is measured by whether a woman listens to the radio at least once a week. [1] Radio is the communication medium selected here because of the diversity of development levels among the countries studied. This variable needs to be interpreted carefully since television and newspapers may be more popular among young respondents in some countries.

There is increasing evidence that adolescents are strongly influenced by their environment, suggesting that community characteristics might influence reproductive behaviors. Community characteristics are captured through aggregating men and women's individual-level responses within a cluster. Clusters in the DHS are made up of

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[1] In the earlier surveys for Burkina Faso, Côte d'Ivoire, Ghana and Kenya, and in both surveys for Mali, Senegal and Tanzania, respondents were asked whether or not they usually listen to the radio once a week. In the later surveys for Burkina Faso, Côte d'Ivoire, Ghana and Kenya, and for both surveys in Zimbabwe, respondents were asked whether or not they usually listen to the radio every day.

roughly 200 households within a defined geographical area, from which approximately 30 households are randomly selected in each to be interviewed. For the multivariate models that follow, the cluster-level aggregates were transformed into dichotomous variables for high or low community development and strong or weak family planning environment.

Community development
Lloyd, Kaufman, and Hewett (2000) suggest that in areas that have not yet achieved mass schooling, changes in behavior will be slow because of the slower pace of social interaction and diffusion, resulting in a lagging fertility decline. A proxy for community development is measured through the proportion of adult women and men (aged 25 or over) in the cluster who have eight or more years of schooling according to the household schedule.[2] Communities where at least 20 percent of all adults have achieved this level of schooling are considered to have a higher socio-economic development. An exception was made for Mali, where due to small numbers of well-educated adults the cut-off for higher status was set at 10 percent.

Family planning environment
Another influential contextual variable is access (physical, financial, and socio-cultural) to reproductive health care which affects the risk of early childbearing. A strong family planning program in the community could indirectly influence an adolescent's familiarity with contraception and knowledge of the health risks of early sex and childbearing. Ideally health care access would be measured from health facility data on outreach programs and use of services by adolescents. However, the availability of such data is still limited in the DHS. Alternatively, the strength of local health programs can be measured through proxy indicators of whether a large proportion of the adults[3] in the community has practiced family planning. This is measured through cluster-level aggregates of the number of adults (women ages 25 to 49 and men ages 25 to 54) who have reported ever using modern contraceptives. For most countries, communities where at least 50 percent of adults had ever used contraceptives are categorized as having a strong reproductive health care environment. For Mali the cut-off for stronger family planning environment is at least 10 percent of adults ever used contraceptives, while for Zimbabwe it is at least 80 percent.

4. Levels and Trends

This section first looks at trends in the socio-demographic characteristics and reproductive behavior among the adolescent populations in selected countries of Sub-Saharan Africa. We then identify some of the interrelationships between these traits as a prelude to modeling the possible determinants of reproductive behavior in the target groups.

Socio-demographic characteristics
Evidence from the DHS suggests large disparities in the socio-demographic status of the adolescent women across Sub-Saharan Africa (see Table 2). For example, fewer than 10 percent of adolescent women ages 15 to 19 have eight or more years of schooling in Burkina Faso, Mali, and Tanzania. On the other hand, the majority of young women had attained this level of schooling in Zimbabwe (66 percent) and Ghana (51 percent) according to the most

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[2] In the later Côte d'Ivoire, later Senegal, and both Mali surveys, the community development proxy was compiled from women ages 25-49 and men ages 25-54 as reported in the individual questionnaire.

[3] In order to capture the community-level characteristics, each cluster must have a sufficient number of respondents to make a valid assessment of the situation. In cases where we are only interested in a subgroup of the population, it is unlikely that there will be enough individuals per cluster that match the criteria. Moreover attempts to include indicators based on self-reported knowledge and practises among youth may fail to completely overcome the problems of endogeneity of current reproductive health status. Thus cluster-level estimates for the proportion of adolescents who have ever used modern contraception are not deemed reliable. Our indicators rely on information collected from older adults alone: women ages 25-49 and men ages 25-54.

TABLE 2:
Percentage of adolescent women (ages 15-19) by socio-demographic characteristics, according to survey period, select Demographic and Health Surveys, 1987-1999

	Burkina Faso		Côte d'Ivoire		Ghana		Kenya		Mali		Senegal		Tanzania		Zimbabwe	
	1993	1999	1994	1998	1993	1998	1993	1998	1987	1996	1993	1997	1991	1996	1994	1999
Has 8 or more years of schooling	8	6	14	14	56	51	38	42	5	5	8	11	6	6	53	66
Lives in urban area	26	21	48	45	46	37	16	22	30	41	46	46	27	24	30	35
Listens to radio regularly	43	15	44	26	50	56	68	51	52	65	69	68	50	43	41	43

recent survey findings. Rapid improvements in schooling across survey periods can be noted in Kenya, Senegal, and Zimbabwe. Burkina Faso and Ghana experienced decreases in the proportions of better-educated adolescents.

The countries discussed here are predominantly rural. Kenya and Burkina Faso had the lowest proportions of urban adolescent respondents. There was a relatively large increase in the proportion of adolescents living in urban areas in Mali between the surveys.

Exposure to radio varies across the countries in the region. The majority of adolescents listen to the radio regularly in Ghana, Kenya, Mali, and Senegal. In contrast, at most one-quarter of adolescent women reported listening to the radio in the latest survey in Burkina Faso and in Côte d'Ivoire, where listenership has fallen over time. In Kenya and Tanzania there were also relatively large decreases in the proportion of adolescents that listen to the radio regularly.

Reproductive behavior
All but one of the eight Sub-Saharan African countries under observation experienced a decline in adolescent fertility between survey periods. Figure 1 presents the trends in the proportion of young women who had a first birth before age 18 for each survey. The proportion is seen to have declined for all countries in the study except for Burkina Faso. The highest level of adolescent childbearing was observed in Mali (45 percent). In contrast, less than a quarter of young women had an early first birth in Ghana, Kenya, and Zimbabwe. Côte d'Ivoire witnessed the largest inter-survey reduction in the proportion of first births occurring to women under the age of 18 (from 41 to 28 percent). In Mali, the difference was only marginal. This is noteworthy given that Mali also had the largest interval between surveys (in most countries the time between surveys averaged around five years, however in Mali the surveys were eight years apart).

FIGURE 1 Percent of women 18-24 years who reported having had a first birth before age 18, by period of survey

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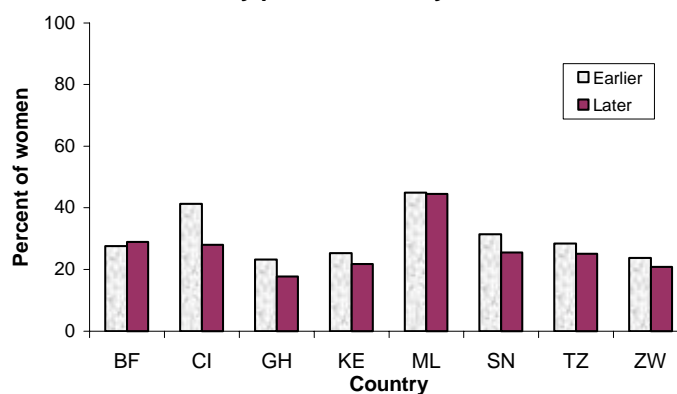
Given the general trends toward lower adolescent fertility, it is important to investigate which subgroups have seen the largest changes. We need to evaluate which background variables are associated with any decline in early childbearing.

Differentials in behavior by socio-demographic characteristics
Trends in early births can be displayed to show which socio-demographic subgroups show the largest differences and changes between the surveys. Figures 2, 3, and 4 display the direction and pace of change for each subgroup. The trend can be seen by the distinct angle of the line between the earlier and later surveys. (Note that this representation is simply for illustrative purposes and does not necessarily imply a linear trend across the inter-survey period.)

Figure 2 shows the trends in the percent of young women with early first birth by educational attainment (no formal schooling, one to seven years, and eight or more years). There is a definite association between education and the proportion of women who have given birth before age 18. Better-educated women are consistently less likely to have had an early first birth than their less educated counterparts. The propensity for early first birth changed for most education categories. Most countries experienced a similar decrease in the percent of women with an early birth, though the pace of change was faster among the most educated women compared to those less educated in Côte d'Ivoire and Mali. Burkina Faso saw slightly increasing proportions of early births between the two surveys for each education level and Zimbabwe saw an increase only among those women with no schooling.

FIGURE 2: Percent of women who had first birth before age 18 by education, selected DHS countries, 1987-1999
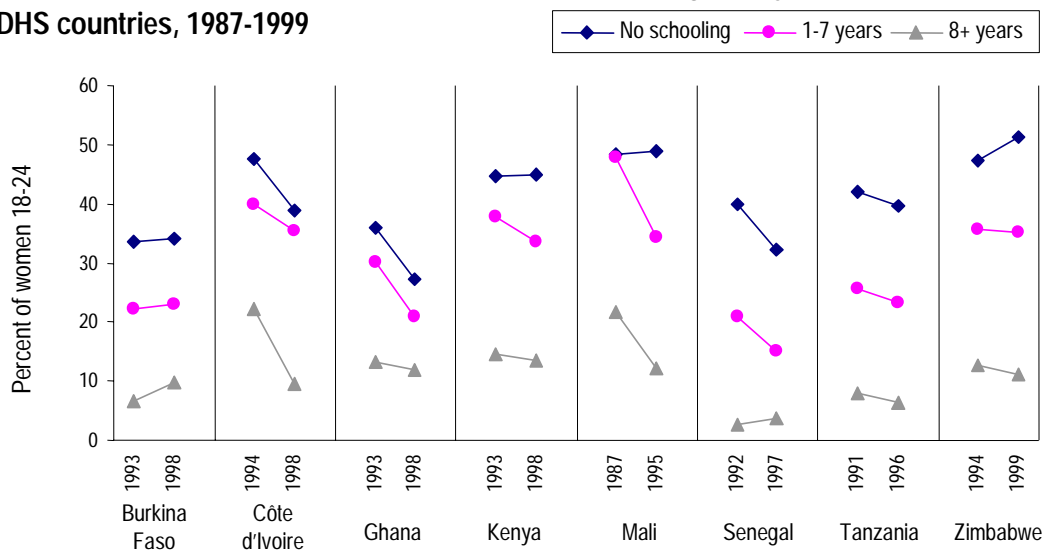

Urban women show lower probabilities of experiencing first birth before age 18 than rural women experience across all countries and survey periods (see Figure 3). In most cases the levels of early first birth are decreasing over time at a fairly uniform pace according to place of residence. Most of the decline between surveys has not been affected by urban-rural differences (i.e. most of the trends lines are relatively parallel indicating steady decline). Only in Burkina Faso do we find discordant trends: The proportion of women having a first birth by age 18 increased in the rural areas but decreased in the urban areas. The increase in early fertility among rural women might be due to lack of alternatives to childbearing, or the desire to secure a union where other methods of gaining social status are limited.

FIGURE 3: Percent of women who had first birth before age 18 by residence, selected DHS countries, 1987-1999
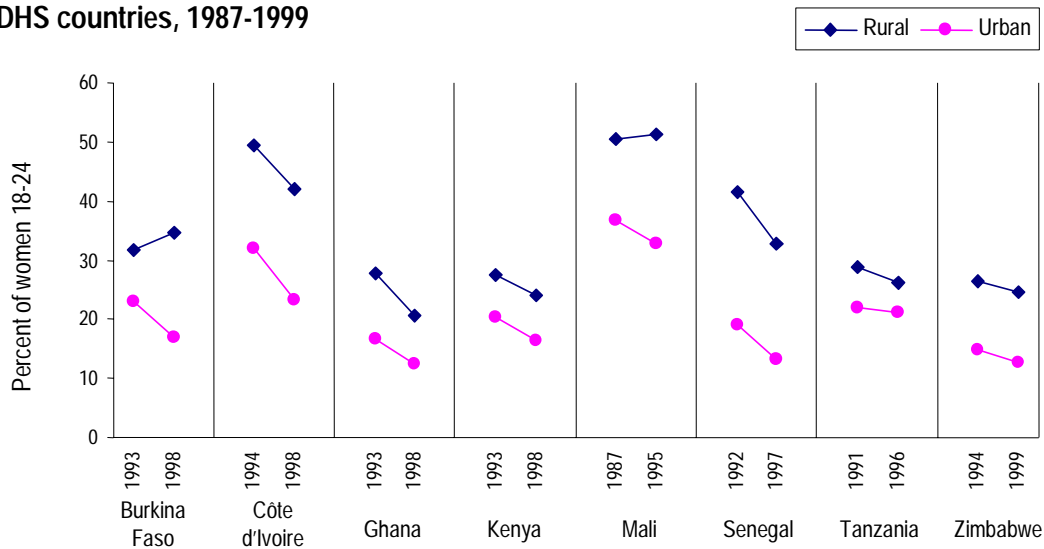
Mass media exposure, as measured though regular radio listening habits, tends to have a negative correlation with likelihood of early child bearing. As seen in Figure 4, in most cases higher proportions of young women who do not listen to the radio regularly reported having a birth before age 18 compared to women who listen regularly. Declines over time in the proportion of women having an early first birth are generally uniform by radio exposure. Only in Mali do discordant differences exist, however they are minor. Côte d'Ivoire had the fastest decline in probability of early first birth among women with little or no radio exposure.

FIGURE 4: Percent of women who had first birth before age 18 by radio exposure, selected DHS countries, 1987-1999
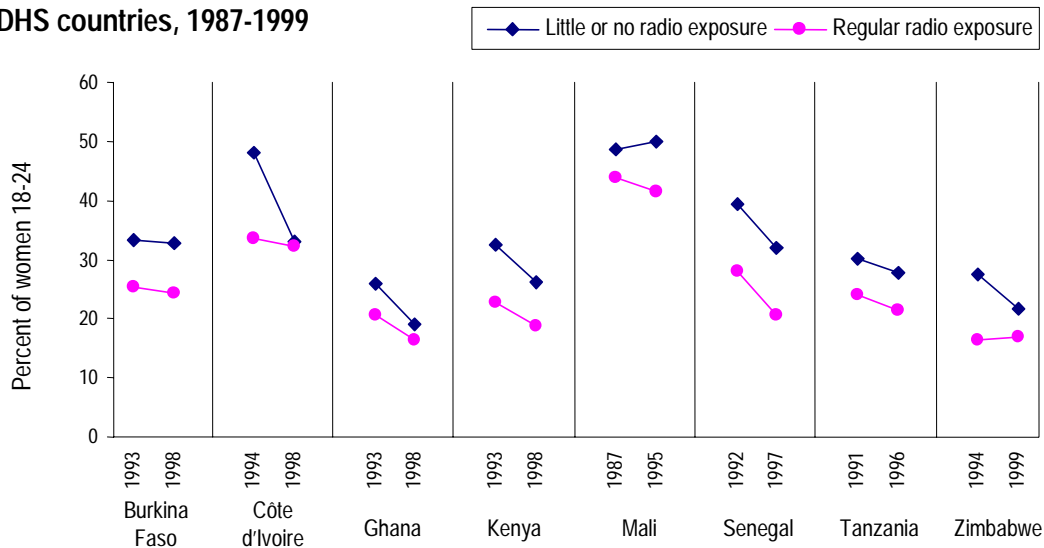
5. Determinants of Changes in Adolescent Reproductive Behavior

The varying trends in early childbearing according to background characteristics suggest that potentially confounding influences are at play. To control for these influences, we have included them in a multivariate model to see if the variables have their own significance. This section describes the results of the multivariate analyses of birth before age 18. Included in the regressions are variables created to describe an individual's socio-demographic characteristics (education, place of residence, and mass media exposure) as well as contextual variables (community development and family planning environment).

Interaction terms are included to specify how the effects of the dependent variables on the outcome variables have changed between surveys. Although stratification of the regressions by survey could help simplify the analyses, in a stratified form we are unable to see if the difference between the coefficients is statistically significant. In some cases we have run the stratified regressions to explain the findings of the interaction term more clearly, however, we do not display those results here.

Table 3 displays the odds ratios for the multivariate analysis. The decline between the earlier and later surveys in the risk of first birth before age 18 was statistically significant in Côte d'Ivoire and Senegal; in the later survey women were 30 and 35 percent less likely to have an early birth, respectively. Overall, young women in the region who were less educated were more likely to have an early birth. Women with secondary schooling were at least 50 percent less likely to have had a first birth before their 18th birthday than those with no education, all else being equal. In Côte d'Ivoire there was a significant interaction effect for education and survey period, with a coefficient less than one. After re-running the analysis separately, we find that the odds ratio for secondary education on delayed childbearing was larger at the time of the earlier survey compared to the later survey, suggesting dissipating influences over time.

In some countries, effects of other socio-demographic and contextual variables were not statistically significant once effects of education were considered. The association between residence and risk of early childbearing was significant in Côte d'Ivoire, Ghana, and Senegal. Women in these countries who lived in urban areas were over 30 percent less likely to have a first birth before age 18 as compared to rural women, a trend expected under the influences of modernization.

Radio exposure was inversely associated with the probability of an adolescent birth in Côte d'Ivoire and Zimbabwe. Both countries also experienced changes in the effects between surveys; stratifying the analysis shows a strong negative association observed in the earlier survey that was no longer significant at the later survey. Again suggesting that radio, despite an association earlier, did not have an independent influence on adolescent childbearing at the later survey.

There was no significant effect of the community development variable for the probability of a first birth before age 18 in any of the countries. The family planning environment proved to be significantly associated with risk of an early birth among young women in Ghana and Senegal, however the direction of the association was not consistent. In Ghana, adolescents in communities with a strong family planning environment were 73 percent more likely to have had an early birth, while in Senegal they were 51 percent less likely to have an early birth. However, the interaction term for Ghana was also significant; it appears that the positive association of a family planning environment at the early survey was no longer significant at the later survey.

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TABLE 3:
Odds ratios of the probability of giving birth before age 18 from the multivariate regressions, select Sub-Saharan African countries, 1990-1999

Country	Burkina Faso	Cote d'Ivoire	Ghana	Kenya	Mali	Senegal	Tanzania	Zimbabwe
MAIN EFFECTS								
Survey (later vs. earlier)	1.08	0.65 *	0.64	1.21	1.11	0.7 *	0.85	0.75
Education (1-7 years vs. none)[1]	0.57 *	0.85	0.75	0.76	1.16	0.6 *	0.49 *	0.64
Education (8+ years vs. none) [1]	0.16 *	0.47 *	0.27 *	0.23 *	0.41 *	0.09 *	0.15 *	0.19 *
Residence (urban vs. rural)	1.37	0.7 *	0.57 *	0.9	0.67	0.59 *	1.02	0.85
Radio exposure (regular vs. little or none)	0.92	0.74 *	0.99	0.86	0.96	0.85	1.01	0.7 *
Community development (higher vs. lower)	0.65	0.77	1.05	0.97	0.9	0.93	0.71	0.94
Family planning environment (strong vs. weak)	0.82	0.87	1.73 *	0.95	1.16	0.49 *	0.72	1.05
INTERACTIONS								
1-7 years of educ. * survey	1.29	1.11	0.91	0.9	0.61	0.87	1.01	0.84
8+ years of educ * survey	2.43	0.47 *	1.38	1.11	0.54	1.8	0.95	0.66
Residence * survey	0.49 *	0.82	1.14	1.1	1.01	0.93	1.19	0.75
Radio exposure * survey	0.98	1.68 *	1.11	1.03	0.96	1.03	1.01	1.71 *
Comm. dev. * survey	0.82	1.25	1.19	0.76	0.85	0.93	0.72	1.45
FP environment * survey	1.54	0.98	0.55 *	0.75	0.94	2.14	1.33	1.16
Sample size	*3,513*	*3,299*	*2,415*	*4,630*	*3,185*	*4,137*	*5,166*	*3,549*

* Significance at .05 level.
1. In Zimbabwe 1-7 years of education was used as the reference group.

6. Discussion and Conclusion

This report investigated trends and differentials in age of childbearing among adolescents in eight countries of Sub-Saharan Africa, drawing on data from successive Demographic and Health Surveys. The key questions we set out to answer were what are the levels and trends of adolescent reproductive behavior, what characteristics are associated with those trends, and in what contexts are those trends occurring.

The data presented in section 4 suggest that, despite the brief time between surveys, there was a decline in the levels of first birth among adolescent women in most countries. An exception was a slight rise in the incidence of early first birth among women in Burkina Faso. Subsequently, multivariate models were used to ascertain the independent impact of a number of socio-demographic and contextual variables on those trends.

As previous research has found, modernization is a key determinant of a reduction in fertility. In our models we proxy modernization through a series of characteristics related to individuals and their environment: education, urbanization, mass media exposure, community development, and family planning environment. Strong disparities

are observed with regard to these characteristics from country to country, suggesting that the pace of modernization varies across the region.

The findings suggest that adolescent women's socio-demographic characteristics (education, residence, and mass media exposure) had more consistent influences on early childbearing compared to the contextual variables. In general, adolescents with education and radio exposure, and residing in urban areas, were less likely to have a birth before age 18. The contextual variables had little association with birth before age 18. None of the eight countries showed an association between risk of early birth and advanced community-level development. Similarly the local family planning environment was associated with early childbirth in only two countries, and these associations were in opposite directions.

In many countries the decline in early childbearing between the earlier and later surveys was no longer statistically significant after controlling for changes in the background variables. Only in Côte d'Ivoire and Senegal was the change significant, with young women about a third less likely to have an early birth in the later survey. In all countries, secondary schooling had among the strongest and most consistent inverse effects, pointing to increased education as the most promising catalyst toward delayed childbearing in the region.

While the ability to conduct quality research in the area of adolescent reproductive health and behavior has been vastly improved in recent years, in particular thanks to the multitude of data collected through the DHS program, in many ways empirical analyses are limited by the surveys' design. The present results are useful for identifying groups for reproductive health services and outreach programs, however the need for more contextual and qualitative information is also evident. For example, while the health consequences of early reproductive behavior have been well documented elsewhere, less is known about the social context under which these events occur. Little information is available about the partner, familial, and community reactions to adolescent childbearing. The variables we have attempted to use here were proxies of what the environment might include, additional research into what factors are important to teenagers is important for defining more precise environmental variables.

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