

Modeling Adolescent Reproductive Health in Ghana
An Application of the ARH Model

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I. Introduction

“Adolescence” or “young adulthood” is a relatively recent concept in relation to the focus of development programs, especially in developing countries where the transition from childhood to adulthood is rapid, marked by reproductive maturity and accompanying socioeconomic privileges and responsibilities. The social construction of adolescence occurs in response to expanded formal and nonformal educational opportunities for young men and women.

Reproductive health (RH) is a major concern of the adolescent period, in part because earlier sexual maturation and later marriage have increased the period of risk for early or nonmarital pregnancy and exposure to sexually transmitted infections (STIs). Changes in familial and societal patterns and values have also resulted in a relaxation of social constraints associated with nonmarital sexual activity. HIV infection is the most recent, and most serious, addition to the array of STIs common in this age group.

Adolescence is also a period during which RH behavior is formed and thus can influence fertility regulation during the entire reproductive life cycle. Programs aimed, therefore, at behavioral changes in youth are likely to effect changes beyond the time in which the programs are implemented, as today’s youth become tomorrow’s adults.

Adolescent fertility has consequences well beyond the repercussions for the young women and their families. Adolescent childbearing, illness, and disability sometimes impose a heavy cost on society. The social and economic consequences of adolescent fertility can be related to factors of early marriage and early pregnancies that occur frequently in Ghana. Health consequences include complications of abortions and the RH risks of contracting STIs and HIV/AIDS. Teenage pregnancies may also contribute to young women dropping out of school. Adolescent females who give birth early in life not only face many possible health hazards but are also less likely to enjoy the benefits of education.

II. Overview of Adolescent RH in Ghana

Ghana has been called a pronatalist society, where a woman’s fertility has great influence on her status (Awusabo-Asare and Anarfi, 1997). However, fertility has begun to decline in Ghana. Surveys from the 1970s through 1988 indicated a total fertility rate (TFR) of more than 6 children per woman, with a TFR of 6.4 in 1988. By 1993, the TFR had declined to 5.5 (Nabila et al., 1997); and according to the 1998 Ghana Demographic and Health Survey (GDHS), the TFR was estimated to be 4.5. At the same time, marriage age was slowly rising in Ghana. In 1998, the median age at first marriage for women 20–24 was 19.3 years compared with 18.7 years for those 40–49. Thus, by age

25, 83 percent of women in Ghana were married, with approximately 23 percent living in polygynous unions (1998 GDHS).

Knowledge of contraception is high in Ghana; 93 percent of women and 95 percent of men know at least one modern method (1998 GDHS). In spite of this high level of knowledge, contraceptive use remains low, with 22 percent of all women using any method of contraception and only 13 percent relying on a modern method.

Adolescent RH (ARH) is receiving increased attention in Ghana. Nearly one-half (45 percent) of the population is under age 15; those ages 15–24 represent another 20 percent. Teenage pregnancy, in particular, is a prominent social and health issue. Adolescent pregnancy is related to early initiation of sexual activity and nonuse of contraception.

According to 1998 GDHS, the age-specific fertility rate (ASFR) for adolescents 15–19 was 119 in 1993 and 90 in 1998. Furthermore, clear differences exist between the ASFR for married and unmarried young people in Ghana. For example, the ASFR for married women age 19 was 241; for unmarried women age 19, it was 49 (1998 GDHS).

Although the decline in the ASFR for adolescents mirrors the decline observed in the overall level of fertility, certain sociocultural, biological, and demographic factors continue to pose challenges in addressing the RH needs of Ghana's young people, such as the following:

- ***Early age at menarche.*** The impact of early age at menarche (13.8 years) is that young women are capable of conceiving at younger ages than in the past.
- ***Age at first marriage.*** The median age at first marriage for young women in Ghana remained much the same from 1988–1993, increasing only a few percentage points in 1993 (18.3 years in 1988 to 18.9 years in 1993). The more recent trend toward later age at first marriage (median age of 19.3 years in 1998) provides grounds for hope for reducing adolescent fertility, provided the number of premarital pregnancies can be prevented by increasing access to and use of family planning (FP) services for young people. There are, however, notable regional variations in the median age at first marriage; earlier years were observed in the Northern than in the Southern sections of Ghana.
- ***Early age at first sex and increasing indulgence in premarital sex.*** Anecdotal evidence suggests that premarital sex is widespread among young people in Ghana. Adolescents are becoming sexually experienced prior to marriage. Age at first sex was found to be as early as 10 in a study conducted by Nabila and Fayorsey (1996) of adolescents in Accra and Kumasi. The 1998 GDHS puts the median age at first sex at 17.5 years for young people ages 20–24. Among young females aged 15–19 years, 38 percent are sexually experienced (1998 GDHS).

- **Early age at first pregnancy and birth.** According to the 1998 GDHS, approximately one-third (32 percent) of women age 19 have started childbearing. More revealing is that nearly one-half (48 percent) of births to women under age 20 are reported as either mistimed or unwanted. Clearly, there is a large unmet need for FP in the 15–19 age group.
- **Common abortion.** Sexual activity among adolescents results in abortions and miscarriages. According to the 1998 GDHS, pregnancy loss among adolescents ages 15–19 due either to spontaneous or induced abortions is 38.9 percent. A recent survey of youth conducted by the Ghana Social Marketing Foundation (GSMF) and the Johns Hopkins University Center for Communication Program (JHU/CCP) reports that among sexually active youth, 58 percent consider abortion among their peers to be common, and 40 percent report knowing unmarried teenage friends who have had an abortion (Ghana Youth Survey, 1998.)
- **Low use of contraceptives.** Lack of knowledge about sexual and RH issues, and especially FP, has contributed to an increase in adolescent pregnancies. According to the 1998 GDHS, current use of modern contraceptives was only 4.8 percent among all adolescent females ages 15–19. A large segment of adolescents still use traditional rather than modern FP methods (3.8 percent in 1998). However, among unmarried females ages 15–19, use of FP is higher (12.6 percent).

III. Policy Environment for ARH

The policy environment for ARH can perhaps best be characterized as one in which opinion leaders and stakeholders are aware of the situation, but decisive actions and policies have not been forthcoming.

Subsequent to the development of *Reproductive Health Service Policy and Standards* in 1996, the National Population Council (NPC) developed the draft *Adolescent Reproductive Health Policy*. The policy formulation process was similar to that of the *Reproductive Health Service Policy and Standards* and was highly participatory. Prior to development of the *Adolescent Reproductive Health Policy*, the Population Impact Project (PIP) completed an ARH assessment for Ghana, which examined socioeconomic, cultural, and political factors affecting adolescent health and welfare and implications for adolescents. A directory of institutions working with adolescents was also compiled. The assessment recommended the formulation of a unified policy on adolescents and provided information for organizations interested in undertaking adolescent programs (Nabila et al., 1997).

The *Adolescent Reproductive Health Policy* is seen as an extension of the *Reproductive Health Service Policy and Standards* formulated by the Ministry of Health (MOH). Although this seems a natural development, the *Adolescent Reproductive Health Policy* does not explicitly mention its connection to the *Reproductive Health*

Service Policy and Standards, but notes that it responds to the government's responsibility toward young people as noted in Ghana's 1992 Constitution and 1994 *National Population Policy*. Moreover, the *Adolescent Reproductive Health Policy* is not an operational policy, addressing issues in addition to health such as employment and education, and does not concentrate on services. In this sense, it may be viewed as a multisectoral policy.

The draft *Adolescent Reproductive Health Policy* contains a number of specific targets, many of which may be overly ambitious. However, it is partially the purpose of this study to look at the consistency and reasonableness of some of these targets, which include the following:

- Reduce by 50 percent the proportion of adolescents who marry before age 18 by 2010 and 80 percent by 2020.
- Reduce by 50 percent the proportion of females under 20 who give birth by 2010 and 80 percent by 2020.
- Inform and educate 80 percent of out-of-school adolescents on sexual and RH issues.
- Educate and motivate an additional 30 percent of school dropouts from second cycle institutions in order that they can enter vocational and technical training institutions.
- Increase by 50 percent the proportion of women ages 15–19 with secondary and higher education of the eligible population by 2010 and 80 percent by 2020.

Gaps and Constraints in ARH Programs in Ghana

In order for adolescents to be fully integrated into the society, they must be able to manage their sexual and their reproductive lives responsibly and in an informed manner through education and the provision of services that meet their developmental needs. However, these needs and rights are not being fully met by existing programs. The inadequacies contributing to unmet RH needs of adolescents include, among others, the following:

- Inadequate RH services.
- Inadequate information, educational, and communication (IEC).
- Inadequate school health services.
- Deficient capacity-building and resource mobilization techniques in ARH programs.
- Inadequate research, monitoring, and evaluation techniques in ARH.
- Unacceptance among Ghanaians that adolescents have a right to be provided RH information and services.
- Inadequate financial and logistical support for population/FLE.

IV. The ARH Model

Why Make Adolescent and Young Adult RH Projections?

ARH issues are often controversial because they tend to be judged morally. For this reason, the potential for promoting constructive policy discussion and consensus building is greatly enhanced by the database approach called for by use of the ARH Model. A key aspect of the policy process is recognizing that a problem exists and placing that problem on the policy agenda. Population-based projections may be used to illustrate the magnitude of RH outcomes, such as numbers of pregnancies to unmarried adolescents and young adults. Assumptions underlying the projections may be varied to illustrate the likely effect of alternative policy scenarios. A database approach neutralizes discussion of a potentially controversial issue by focusing on actual demographic and epidemiological results, which may be modified by changing the underlying assumptions.

Overview of the Model

The ARH Model is a population-based projection model that may be used to illustrate the impacts of policies and programs designed to improve the RH of young people. It may also be used in advocacy efforts to enhance awareness-raising capacity. Because alternative scenarios can be generated, it likewise is an effective tool for goal setting and planning purposes. The model projects the number of pregnancies, abortions, and live births occurring to young people between 10–24. In addition, it estimates the number of future sexually transmitted disease (STD) infections (including HIV infections), AIDS cases among adolescents and young adults, and AIDS deaths occurring to individuals who were infected with HIV during their adolescent or young adult years. Results of these projections can be used in policy presentations intended to enhance knowledge of youth RH among policymakers. Such presentations are also useful for building support for effective youth RH policies and programs.

Application of the ARH Model requires making assumptions about the future course of adolescent reproductive behavior, including levels of sexual activity, timing of marriage, and STD and pregnancy prevention practices. Assumptions about other ARH characteristics can also be entered for variables related to STD incidence and HIV prevalence. However, a demographic projection must be prepared before the ARH Model can be used. DemProj, one of the SPECTRUM system of policy models, is used to make the demographic projections, which are modified by the ARH Model to account for the impact of changes in adolescent and young adult fertility on future population size and dynamics.

The ARH Model is designed to produce useful information for policy formulation and dialogue relevant to the RH of youth. The focus is on generating information that is useful for policy awareness raising, goal setting, and planning purposes, rather than detailed research into the underlying processes involved.

Use of Models

Policy models are designed to answer a number of “what if” questions (“what if” refers to factors that can be changed or influenced by public policy). For example, one might consider the demographic implications 20 years hence of postponing all births until a woman is at least age 20. The corollary question, what would it take to postpone those births, may also be addressed by considering the levels of change that would be required in terms of postponed sexual activity and contraceptive use. Among the policy strategies commonly addressed by policy models are the following:

- ***Advantages to taking actions earlier rather than later.*** Population-based projection models may be used to show that little in a country remains constant while policy decisions are stalled and that many negative outcomes can accumulate during a period of policy inaction.
- ***Evaluation of costs versus benefits of a course of action.*** Population-based projection models may be used to show the economic efficiency of a set of actions (e.g., whether certain outcomes are achieved more effectively than under a different set of actions), or simply whether the cost of a single set of actions is acceptable for the benefits gained.
- ***Recognition of interrelatedness.*** Population-based projection models can show how making a change in one area of population dynamics (e.g., postponed marriage) may imply changes in a number of other areas (such as the number of out-of-wedlock adolescent pregnancies and abortions).
- ***Complexity of social change.*** Population-based projection models can demonstrate that simplistic explanations bear little relation to how the “real world” operates; for example, by illustrating the impact of high rates of HIV infections and the growing numbers of AIDS deaths on population growth and momentum.
- ***Exponential nature of population change.*** A straight line rarely describes social or physical behavior. Population-based projection models may be used to show that all social sectors based on the size of population groups are heavily influenced by the exponential nature of growth over time.
- ***Importance of population composition to social program needs and outcomes.*** The sex and age composition of a population has broad-ranging consequences for social welfare, crime rates, disease transmission, political stability, and so forth. Population-based projection models demonstrate the degree to which a change in age and sex distribution can affect a range of social indicators.
- ***Magnitude of effort required to “swim against the tide.”*** A number of factors can make the success of a particular program harder to achieve. For example, population momentum means that, in most developing countries, simply maintaining current contraceptive rates will require serving the growing numbers who use contraceptives. Population-based projection models can illustrate the need for extra effort—even if simply to keep treading water.

Project Background and Support

The ARH Model was developed with support from USAID's POLICY Project and FOCUS on Young Adults Project. The POLICY Project is designed to create a supportive environment for FP/RH programs through the promotion of a participatory process in the development of policies that respond to client needs. The FOCUS on Young Adults Project is dedicated solely to young adult RH. The project aims to raise awareness about young adult RH issues; to strengthen institutional capacity among cooperating agencies, funding organizations, and national institutions in order to address young adult RH needs; and to identify effective approaches in providing young adult RH information and services.

In addition to Ghana, the ARH Model application has been applied to Mali and is being applied to Nigeria and Ethiopia under a grant from the Packard Foundation.

V. ARH Model Application in Ghana

The ARH Model requires data that describes the characteristics of adolescent and young adult sexual behavior and fertility regulation, including the use of contraceptives. The purpose of this section is to describe the inputs required and their sources. Each of the required variables is discussed below.

Demographic Projection

Since the ARH Model is population-based, a demographic projection must first be prepared. The last population census in Ghana was in 1984, and the base year selected for the model application was 1998, the year of the GDHS. To estimate the 1998 base-year population by age and sex, the United Nations Population Division projections were used for Ghana and modified to include the 1998 GDHS estimate of total fertility. Table 1 shows the base-year estimates for the demographic projection.

Table 1
Estimated 1998 Population of Ghana

Age	Male	Female	Total
0-4	1,486,516	1,435,707	2,922,223
5-9	1,430,778	1,392,757	2,823,535
10-14	1,261,993	1,247,438	2,509,431
15-19	1,038,466	1,031,621	2,070,087
20-24	838,283	836,403	1,674,686
25-29	711,173	713,349	1,424,522
30-34	587,432	594,229	1,181,661
35-39	495,219	505,743	1,000,962
40-44	402,469	414,858	817,327
45-49	323,776	338,193	661,969
50-54	257,365	273,225	530,590
55-59	200,102	217,680	417,782
60-64	151,207	169,657	320,864
65-69	108,488	126,175	234,663
70-74	71,824	86,498	158,322
75-79	41,833	52,643	94,476
80+	26,510	34,743	61,253
Total	9,433,434	9,470,919	18,904,352

Using the base population as estimated, a standard cohort component population projection is prepared using DemProj. Standard inputs include

- TFR;
- Age pattern of fertility;
- Male and female life expectancy at birth; and
- Assumption about international migration.

These data, which were largely taken from the 1998 GDHS, are presented in the Appendix.

Proximate Determinants

For years, factors that directly affected fertility levels were called “intermediate fertility variables.” These variables were intermediate between major social forces, such as urbanization, education, and childbearing, and included factors that determine whether a conception transpires and whether that conception ends in a live birth. As better measures and a greater understanding of this set of factors evolved, the variables were reduced in number and labeled as “proximate determinants of fertility,” or variables which directly impinge on fertility outcomes.

With the increased availability of internationally comparable data, demographers have found that the most important variables affecting TFR are the (1) proportion of

women in sexual union; (2) duration of the period of inability to conceive following a birth; and (3) level and quality of contraceptive practice. Less important variables include the underlying capability to conceive, level of induced abortion, and prevalence of pathological sterility.

In the ARH Model, the following six variables are used as proximate determinants:

- Recent sexual activity (“sexually active”)
- Contraceptive use
- Method effectiveness
- Postpartum insusceptability
- Abortion rate
- Infecundability

Three of these determinants are uniquely defined for the ARH Model: recent sexual activity, current contraceptive use, and contraceptive method effectiveness.

Recent Sexual Activity

The sexually active adolescent and young adult population is defined as the percentage of women of a specific age group (e.g., 15–19, 15–24, or 10–24, depending on the setting) who have had sexual intercourse within the past 30 days. This percentage tends to be lowest in the youngest ages, but increases quickly as adolescents approach the age of marriage.

The percentage of young women who had ever had sex was used as the parameter for sexual activity. In Ghana, percentages of unmarried young women ages 15–24 who have had sex are shown in Table 2. Married women are assumed to have had sex.

Table 2
Unmarried Women Who Have Had Sex

Age	Unmarried	Had Sex	%
15	212	13	6.13
16	169	35	20.71
17	133	43	32.33
18	163	75	46.01
19	110	59	53.64
20	96	65	67.71
21	78	60	76.92
22	77	60	77.92
23	48	39	81.25
24	49	47	95.92

Contraceptive Use

Contraceptive use is defined as the percentage of sexually active women of a specific age group currently using some form of contraception. The type of contraception may be modern (e.g., pill, IUD, condom, sterilization, or injectable), or traditional (e.g., withdrawal, rhythm, or periodic abstinence).

An attempt was made to estimate one-year, age-specific, contraceptive use rates for married and unmarried women ages 15–24. However, due to the small number of women in the GDHS sample, this was not feasible. Therefore, we estimated contraceptive prevalence rates for the 15–19 and 20–24 age groups as shown in Table 3.

Table 3
Contraceptive Use by Method and Age (%)

	Married		Unmarried Sexually Active	
	15–19	20–24	15–19	20–24
Pill	3.3	3.3	3.6	2.6
IUD	0.0	0.4	0.4	0.0
Injectable	0.0	2.7	0.4	0.0
Condom and Vag.	5.7	3.8	8.4	8.3
All Modern	9.0	10.1	12.9	10.9

The prevalence rate for unmarried sexually active women is slightly higher in each age group than the rate for married women, which is consistent with the notion that younger married women are less interested in avoiding pregnancy and may indeed be under social pressures to conceive.

Method Effectiveness

Method effectiveness is defined as the proportion of contraceptive users who do not become pregnant during one year of continuous method use. The ARH Model uses an overall average of effectiveness for all methods of contraception used. This measure can also be described as the extent by which contraceptive practice lowers fecundity. Both a population's ability to conceive and the extent of contraceptive method failure determine method effectiveness in a population.

Method effectiveness was computed by weighing the effectiveness of each method by the percentage of sexually active users using each method. Estimates of contraceptive method used are usually derived from national surveys, including the DHS, and estimates of average effectiveness are taken from international estimates.¹ The EVALUATION Project recently reviewed a large number of studies of method effectiveness (Stover et al., 1997). That review found that method failure rates ranged

¹ Measures of contraceptive effectiveness may vary between young people and more mature, experienced method users. However, for the purposes of ARH Model applications, it is simplest to use standard measures for contraceptive effectiveness.

from approximately 4–20 percent for the pill, 1–8 percent for the IUD, and 11–40 percent for barrier methods. Failure rates for Norplant and injectables were found to be nearly zero. Based on these results, effectiveness rates that were used in Ghana are shown in Table 4. While method failures normally do not make a large demographic impact, they can constitute a significant proportion of pregnancies at a given time.

Table 4
Method Effectiveness by Type of Contraceptive

Method	Effectiveness (%)
Pill	92
IUD	96
Barrier	81
Norplant	100
Injectable	100
Sterilization	100

Source: Stover et al., 1997.

Overall contraceptive effectiveness was then calculated for married and unmarried women ages 15–24. These method-effectiveness coefficients were used with the method mix distribution data by age, shown in Tables 5a and 5b, to calculate an overall contraceptive use effectiveness rate for single years of age.

Table 5a
Method Mix of Married Women by Age

Age	Pill	IUD	Inject.	Vag.	Condom	Norplant	LAM	All Modern
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.347	0.000	0.000	0.000	0.653	0.000	0.000	1.000
17	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000
18	0.194	0.000	0.000	0.206	0.406	0.000	0.194	1.000
19	0.485	0.000	0.268	0.000	0.247	0.000	0.000	1.000
20	0.371	0.000	0.267	0.000	0.362	0.000	0.000	1.000
21	0.213	0.000	0.173	0.000	0.440	0.000	0.173	1.000
22	0.413	0.000	0.261	0.000	0.217	0.000	0.109	1.000
23	0.202	0.139	0.017	0.000	0.468	0.069	0.104	1.000
24	0.157	0.000	0.488	0.157	0.074	0.000	0.124	1.000

Table 5b
Method Mix of Unmarried Women by Age

Age	Pill	IUD	Inject.	Vag.	Condom	Norplant	LAM	All Modern
15	0.493	0.000	0.000	0.000	0.507	0.000	0.000	1.000
16	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000
17	0.434	0.000	0.000	0.000	0.566	0.000	0.000	1.000
18	0.161	0.000	0.000	0.000	0.839	0.000	0.000	1.000
19	0.338	0.000	0.063	0.134	0.465	0.000	0.000	1.000
20	0.250	0.000	0.000	0.132	0.618	0.000	0.000	1.000
21	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000
22	0.463	0.000	0.000	0.000	0.537	0.000	0.000	1.000
23	0.612	0.000	0.000	0.000	0.388	0.000	0.000	1.000
24	0.000	0.000	0.000	0.316	0.684	0.000	0.000	1.000

The resulting overall age-specific, use-effectiveness coefficients were calculated, as shown in Table 6, based on the method mix and standard effectiveness rates above.

Table 6
Overall Contraceptive Effectiveness by Age and Marital Status

Age	Married	Unmarried
15		0.864
16	0.848	0.810
17	0.810	0.858
18	0.675	0.828
19	0.914	0.859
20	0.902	0.838
21	0.726	0.810
22	0.817	0.861
23	0.785	0.877
24	0.820	0.810

Postpartum Insusceptibility

Postpartum insusceptibility is the period after birth when women are not exposed to the risk of pregnancy either because of postpartum amenorrhea or postpartum abstinence. The ARH Model requires an estimate of the average duration of postpartum insusceptibility, expressed in months. Estimates of postpartum insusceptibility are usually derived from national surveys, including the DHS. The simplest option is to use the aggregated values for median duration of postpartum insusceptibility reported in the DHS, which for 1998 Ghana was 14 months.

Abortion Rate

The abortion rate is the average number of induced abortions a woman will have at a particular age. However, the 1998 GDHS collected information only on pregnancy wastage, not on induced abortion. This was used to prepare special tabulations of the pregnancy loss rates per woman for the model. From the questions in the GDHS, we calculated the age at the time of loss within a specified period (48 months). Following this, we summarized the total number of losses to the specific age groups (15–24), divided by the exposure, first for all women, then married women, and finally unmarried women. These are reported in Table 7.

Table 7
Pregnancy Losses per Woman

Age	Married	Unmarried
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0.03	0
16	0.04	0
17	0.05	0
18	0.03	0.01
19	0.05	0
20	0.07	0.02
21	0.09	0.04
22	0.12	0.01
23	0.12	0.04
24	0.16	0.04

Infecundability

Infecundability is a measure that captures all women of reproductive age who have suffered primary infertility due to either natural or pathological causes. Because natural sterility is not likely to change much, the major effect will be from pathological sterility. In practice, this variable is likely to be significant only in societies with high levels of pathological sterility resulting in significant infertility and subfecundity. This effect is most pronounced in certain regions of sub-Saharan Africa, where primary and secondary infertility are caused by STDs. The extent of sterility is gauged by the percentage of women who are childless at the end of their reproductive period. In countries where estimates of primary sterility are not available, the best proxy is usually the percentage of married women who remain childless at ages 45–49. This presumes a strong prevailing norm that all married women attempt to have at least one child. The 1998 GDHS reported that 2.5 percent of women 45–49 were childless.

Fertility Rates and Marriage

The ARH Model also requires data on the ASFR and percentage of women who are married. The ASFR is defined as the number of live births occurring to every 1,000 women of a specific age. The ARH Model only requires base-year ASFRs. Future ASFR projections are then made within the model in order that projection outputs can be modified. The model bases these calculations on the base-year rate coupled with information entered on proximate determinants.

Table 8 shows the single year of age. ASFRs were calculated from the 1998 GDHS data. This rate, like the percentage of sexually active, tends to be lowest in the youngest ages, however increases quickly as adolescents approach marriage age. As expected, the ASFR for married adolescents is higher than the ASFR for unmarried adolescents.

Table 8
ASFR

Age	Married	Unmarried
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	107	8
16	119	14
17	171	20
18	238	20
19	241	45
20	231	49
21	231	45
22	247	17
23	225	52
24	232	18

Percentage of Women Who Are Married

The percentage of married women is defined as specific age group that is currently married. Once again, this percentage tends to be lowest in the youngest ages, but increases quickly with age. Estimates of marital status were derived from the 1998 GDHS.

Table 9
Percentage Married

Age	%
10	0
11	0
12	0
13	0
14	0
15	1.6
16	7.2
17	12.8
18	19.0
19	30.3
20	54.4
21	54.4
22	60.7
23	68.4
24	71.5

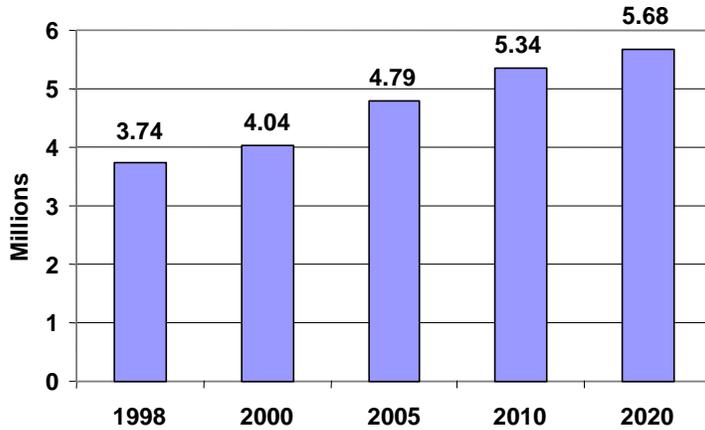
IV. Results of the ARH Model

As described, the ARH Model can be used as a kind of laboratory to examine the likely course of events under various scenarios. This section examines four scenarios. The “base” scenario reflects a no-change environment and merely extrapolates the past into the future, with no change in any of the critical parameters. The other three scenarios are built on the basis of some of the targets of the *Adolescent Reproductive Health Policy*.

Base Projection

In the base projection, parameters presented in the previous section are held constant and include all the main proximate determinants of fertility. In the base projection, the population of young Ghanaians ages 15–24 is projected to grow from 3.74 million in 1998 to 5.68 million in 2020 (see Figure 1).

Figure 1: Total Population Ages 15–24



Pregnancies

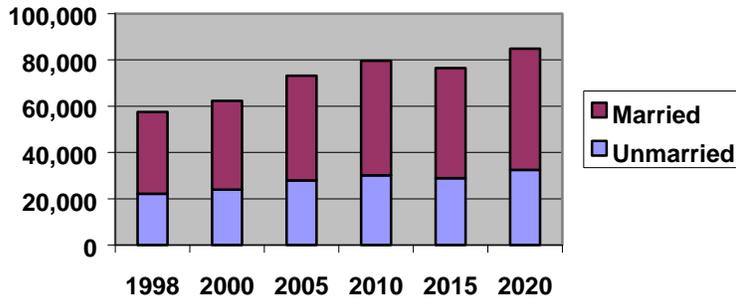
On the basis of ASFRs and percentage of women who are sexually active, the number of pregnancies to married and unmarried young women under age 24 is expected to increase from 256,000 to 398,000 by 2020 (see Table 10).

**Table 10
Number of Pregnancies by Age and Marital Status**

Year	15–19			20–24			15–24		
	Unmarried	Married	Total	Unmarried	Married	Total	Unmarried	Married	Total
1998	22,105	35,446	57,551	20,983	177,898	198,881	43,088	213,344	256,432
2000	23,895	38,387	62,282	22,596	191,221	213,818	46,492	229,608	276,100
2005	27,912	45,293	73,205	27,477	232,685	260,162	55,389	277,978	333,367
2010	30,088	49,593	79,682	31,795	271,363	303,158	61,883	320,957	382,840
2015	28,922	47,555	76,477	33,706	291,485	325,190	62,628	339,040	401,668
2020	32,506	52,431	84,937	32,675	280,959	313,634	65,181	333,390	398,571

Also, the number of pregnancies to women under age 19 is expected to reach nearly 85,000, of which 32,000 (nearly 38 percent) will be to unmarried women 15–19 (see Figure 2).

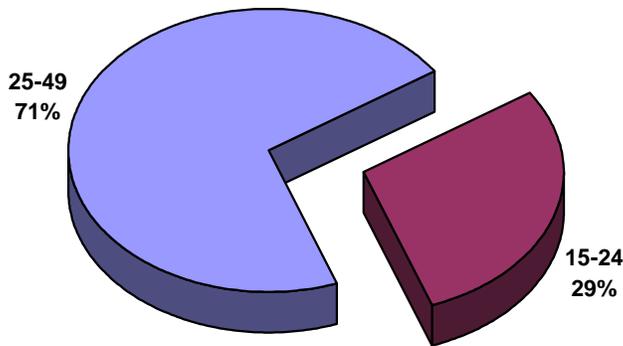
Figure 2: Pregnancies Ages 15-19



Births

Pregnancies of the relatively young population of adults entering reproductive age results in a relatively large number of births. Figure 3 shows that births to young adults constitute almost 30 percent of all births in Ghana.

Figure 3: Distribution of Births by Age, 1998



The base projection in Table 11 shows that if current rates of marriage, contraceptive use, and sexual activity continue, the total number of births in Ghana will increase from 620,000 in 1998 to more than one million per year by 2020. Of these, births to women ages 15–19 will increase from 48,000 to 71,000 by 2020, whereas births to women ages 20–24 are projected to increase from 142,000 to 223,000.

Table 11
Projected Births by Age

Year	15–19	20–24	25–49	Total
1998	48,374	142,095	429,848	620,317
2000	52,357	152,824	445,547	650,728
2005	61,578	18,5940	217,220	464,738
2010	67,090	216,338	581,310	864,737
2015	64,393	231,480	659,392	955,264
2020	71,421	223,424	741,667	1,036,512

Also of interest is the number of births by marital status. Table 12 shows these projections for the two age groups. Of the 15–19 age group, 18,000 of 48,000 (37 percent) of pregnancies are to unmarried women.

Table 12
Projected Births by Age and Marital Status

<i>Year</i>	15–19			20–24		
	<i>Unmarried</i>	<i>Married</i>	<i>Total</i>	<i>Unmarried</i>	<i>Married</i>	<i>Total</i>
1998	18,004	30,371	48,374	13,467	128,627	142,095
2000	19,465	32,892	52,357	14,514	138,310	152,824
2005	22,759	38,820	61,578	17,645	168,295	185,940
2010	24,568	42,522	67,090	20,355	195,983	216,338
2015	23,622	40,770	64,393	21,468	210,012	231,480
2020	26,491	44,930	71,421	20,851	202,573	223,424

Pregnancy Loss

The earlier section on inputs to the ARH Model showed that the number of pregnancies lost to miscarriages and abortions per woman ranged from 10 per 1,000 for unmarried women age 18, to 160 per 1,000 for married women age 24. Given the number of pregnancies, Table 13 shows that the number of pregnancy losses of women ages 15–19 will increase from 9,177 in 1998 to 13,516 in 2020. Total pregnancy losses of women under 24 may reach 103,726 by 2020.

Table 13
Projected Numbers of Pregnancy Losses

<i>Year</i>	15–19			20–24			15–24		
	<i>Unmarried</i>	<i>Married</i>	<i>Total</i>	<i>Unmarried</i>	<i>Married</i>	<i>Total</i>	<i>Unmarried</i>	<i>Married</i>	<i>Total</i>
1998	4,101	5,075	9,177	7,516	49,271	56,787	11,617	54,346	65,963
2000	4,430	5,494	9,925	8,083	52,911	60,993	12,513	58,405	70,918
2005	5,154	6,474	11,627	9,832	64,390	74,222	14,986	70,864	85,849
2010	5,521	7,071	12,592	11,440	75,381	86,821	16,961	82,452	99,413
2015	5,300	6,785	12,084	12,238	81,473	93,711	17,538	88,257	105,795
2020	6,015	7,501	13,516	11,824	78,386	90,210	17,838	85,887	103,726

Users of Contraceptives

The number of contraceptive users is projected from the prevalence rates presented earlier. Recall that for young adults ages 15–24 the rate of contraceptive use is estimated to be a little higher among sexually active unmarried women than among married women. Moreover, the prevalence rate among married women ages 20–24 is lower than among women ages 15–19. These parameters combine to project a larger number of contraceptive users among women ages 15–19 compared with women 20–24.

Figure 4 shows the percentage distribution by age group for 1998 contraceptive users. The 15–19 age group makes up 26 percent and the 20–24 age group 18 percent of all users. Hence, 44 percent of users are under 24.

Figure 4: Percent Distribution of Users by Age

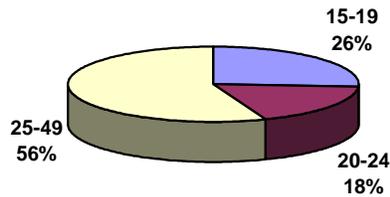


Table 14 presents the number of users projected from 1998–2020 for three age groups. The number of contraceptive users in the 15–19 age group is larger than the number in the 20–24 age group, largely because of age distribution, in which there are more women in the younger group, and the marital and age-specific contraceptive prevalence rates (CPRs). Recall that unmarried prevalence is higher than marital, especially in the teenage years. This finding, combined with the fact that few teenagers are married, computes to a larger number of unmarried 15–19 contraceptive users.

**Table 14
Projected Number of Contraceptive Users by Marital Status**

Year	15–19			20–24			25–49	Total
	Unmarried	Married	Total	Unmarried	Married	Total		
1998	114,897	12,646	127,543	35,080	52,108	87,188	272,222	486,953
2000	123,962	13,689	137,651	37,778	56,035	93,813	288,704	520,168
2005	143,407	16,107	159,513	45,958	68,178	114,136	333,624	607,273
2010	152,186	17,561	169,747	53,191	79,368	132,559	384,045	686,350
2015	146,945	16,829	163,774	56,421	85,000	141,421	441,400	746,595
2020	168,017	18,674	186,690	54,601	82,024	136,624	498,007	821,322

Policy Scenarios

As discussed, a model's utility derives in large measure from its ability to be used to make projections on the basis of various changes in parameters that reflect policy changes. In this way, a model can be a useful tool in advocacy because it can illustrate the impacts of proposed policies. This section presents, as an illustration, some applications of proposed policy targets in the ARH area.

The *Adolescent Reproductive Health Policy* specified a number of specific targets. This section examines two of them:

1. Reduce by 50 percent the proportion of adolescents who marry before age 18 by 2010 and 80 percent by 2020.
2. Increase by 50 percent the proportion of women ages 15–19 with secondary and higher education of the eligible population by 2010 and 80 percent by 2020.

Reduction in Marriage

The model simulates the targets by changing the values of appropriate parameters. In the case of the first target, which is concerned with reducing the proportion of married women, we lowered the marriage rate parameters by 50 percent for 2010 and 80 percent for 2020 for the age group under 18 (see Table 15).

Table 15
Percentage Married Under Policy Scenario

Age	1998	2005	2010	2020
15	1.6	1.1	0.8	0.3
16	7.2	5.1	3.6	1.4
17	12.8	9.1	6.4	2.6
18	19	13.5	9.5	3.8
19	30.3	30.3	30.3	30.3
20	54.4	54.4	54.4	54.4
21	54.4	54.4	54.4	54.4
22	60.7	60.7	60.7	60.7
23	68.4	68.4	68.4	68.4
24	71.5	71.5	71.5	71.5

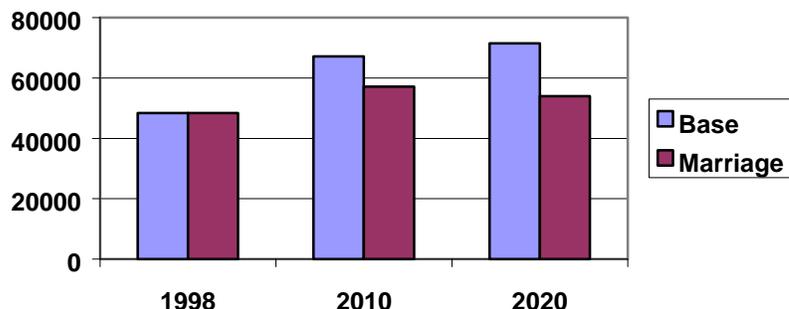
Results of the simulation are shown in Table 16 and Figure 5. Decreasing the number of women under 18 who are married will decrease births overall, because the ASFR of married women is higher than that of unmarried women. Consequently, married women will have fewer births. Conversely, reduction in the number of married women results in more unmarried women and more births to unmarried women.

Table 16
Results of Simulations: Births to 15–19 Year Olds by Marital Status

Unmarried 15–19				
<i>Year</i>	<i>Base</i>	<i>Marriage</i>	<i>Education</i>	<i>Both</i>
1998	18,004	18,004	18,004	18,004
2000	19,465	19,611	19,389	19,535
2005	22,759	23,355	22,436	23,023
2010	24,568	25,672	23,964	25,041
2015	23,622	24,965	18,787	19,849
2020	26,491	28,142	16,182	17,173
Married 15–19				
<i>Year</i>	<i>Base</i>	<i>Marriage</i>	<i>Education</i>	<i>Both</i>
1998	30,371	30,371	30,371	30,371
2000	32,892	31,436	32,892	31,436
2005	38,820	32,869	38,820	32,869
2010	38,820	32,869	38,820	32,869
2015	38,820	32,869	38,820	32,869
2020	44,930	25,799	44,902	25,785
All Women 15–19				
<i>Year</i>	<i>Base</i>	<i>Marriage</i>	<i>Education</i>	<i>Both</i>
1998	48,374	48,374	48,374	48,374
2000	52,357	51,048	52,282	50,972
2005	61,579	56,224	61,255	55,892
2010	67,090	57,165	66,487	56,534
2015	64,393	52,182	59,557	47,067
2020	71,421	53,940	61,084	42,957

Figure 5 shows the projection of births to women ages 15–19. Reducing the marriage rate can reduce annual births in the 15–19 age group to 53,000 by 2020, compared with 71,000 in the base run. Cumulative births avoided in the 15–19 age group as a result of delaying marriage would amount to 213,000.

**Figure 5: Projected Births to Women 15-24
Under Base and Marriage Scenarios**



Increased Education

The second scenario simulates the impact of increased education of females on fertility. There is a large body of literature on the relationship between female education and fertility, but much of it is oriented toward marital fertility. The ARH Model cannot directly take this into account. Thus, a research approach was undertaken, which explored whether a relationship between education and one of the proximate determinants could be established. In particular, the relationship between education and sexual activity or first sex was explored.

International cross-sectional data show a relationship between current school attendance and sexual activity. In all African countries reported in Table 17, the percentage of young women who have had sex is higher among those not currently in school than among those still in school. This pattern holds for both age groups shown.

**Table 17
Percentage of Females Having Had Sex by School Attendance Status**

<i>Country</i>	Ages 15–16		Ages 17–18	
	<i>In School</i>	<i>Out of School</i>	<i>In School</i>	<i>Out of School</i>
Kenya	15	47	27	72
Ghana	14	48	54	75
Zambia	18	52	32	85
Namibia	19	48	39	82
Benin	24	27	40	64
Cameroon	29	70	67	87
Burkina Faso	15	26	41	67
Zimbabwe	3	31	6	52
Uganda	14	48	21	81

Source: Various DHS data

At the individual country level, we applied a hazard model to DHS data in which the dependent variable was age at first sex or current age for those who had not yet had sex. Independent variables included current school attendance, socioeconomic status, and rural–urban residence. This research as carried out for several African and Latin American countries, but is not reported here; we only show the results for Ghana. However, patterns were generally the same as those shown in Table 18, which shows the results of the Weibull hazard model. The smaller the coefficient, the stronger the impact of the independent variable. Hence, women ages 15–16 are less likely to have had sex if in school than out of school. For older women, the relationship still holds but is not as strong.

Table 18
Survival Regressions for Sexual Debut: Ghana, 1993 DHS

	Ages 15–16	Ages 17–18	Age 19
In School	0.26	0.5	0.66
Wealth	0.66	0.79	0.81
Rural–Urban	0.68	1.0	0.75

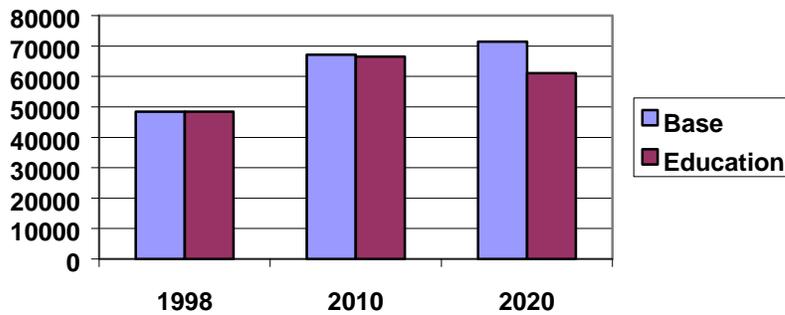
These regression results were used to simulate the impact of increased school attendance for the sample population, then applied to the model. Table 19 shows the model coefficients for sexual activity (have had sex) by age for the base year and under the assumptions of the policy scenario.

Table 19
Simulated Impact of Education on Percentage of Women Having Had Sex by Age and by Proportion in School

	1998	2010	2020
<i>% in School</i>	48	50	80
Age	%	%	%
15	6.13	5.99	3.88
16	20.71	20.23	13.09
17	32.33	31.59	20.44
18	46.01	44.95	29.09
19	53.64	52.40	33.91
20	67.71	67.45	63.54
21	76.92	76.63	72.19
22	77.92	77.62	73.13
23	81.25	80.94	76.25
24	95.92	95.55	90.02

Results of this policy simulation are reported in Table 19 and Figure 6. The education scenario reduces births, but not by as much as the marriage policy simulation. Cumulative births averted to the 15–19 age group are about 59,000 during the projection period.

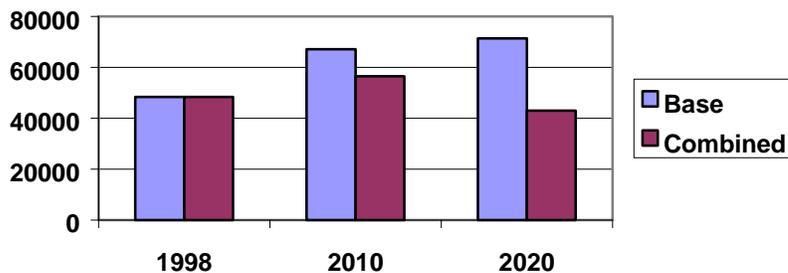
**Figure 6: Projected Births to Women 15-24
Under Base and Education Scenarios**



Combined Policies

In addition, we implemented both policies simultaneously. As expected, the policies are additive; that is, their independent effects can be combined. Indeed, a small amount of synergy between them can be observed. The combined policy births of women ages 15–19 will decline to 42,000 by 2020 compared with 71,000 in the base scenario. Cumulatively, this amounts to one-quarter of one million (255,177) births averted. Figure 7 compares the base and combined scenarios.

**Figure 7: Projected Births to Women 15-24
Under Base and Combined Marriage and
Education Scenarios**



VII. Conclusion

In 1998, nearly 30 percent of all births were to women ages 15–24. In the 15–19 age group, 37 percent of all births were to unmarried women. If current conditions continue, births to women under 25 will increase from 142,000 to more than 223,000 by 2020, with more than 70,000 births to teenagers. Pregnancy losses among the under-25 age group will be 103,000 by 2020.

Results of the application of the ARH Model using Ghanaian data should be useful in guiding policy dialogue and program implementation. Based on the 1998 GDHS, analysis shows a positive behavioral attitude among unmarried Ghanaian adolescents regarding the use of contraceptives. The CPR for sexually active unmarried adolescent females ages 15–19 is higher than the rate for their married counterparts of the same age and higher, which is indeed consistent with the notion that younger married women are less interested in avoiding pregnancy and may be under social pressure to conceive. This finding justifies ongoing efforts to target unmarried sexually active adolescent females in extending RH information and services.

A second programmatic issue related to this finding is that among the 15–19 age group, condoms are the contraceptive method of choice, which has clear implications in the fight against HIV/AIDS and STI. Additionally, the analysis based on DHS data from several African and Latin American countries shows the positive efforts of increasing female school enrollment. DHS data show that age at first sex increases with continued schooling. Programmatic efforts should therefore be directed at ensuring increased access to education for young women. Increased resources in support of bringing pilot adolescent RH programs to scale will also lend support to this effort.

Using these ARH model findings, a sample of policy changes were introduced based on the draft *Adolescent Reproductive Health Policy*. It should be emphasized that the draft policy is being reviewed and may change. Indeed, the ARH Model will be one tool that may be used in examining the policy targets.

Targets in the policy are to decrease the proportion of females who were married before age 18 and to increase the proportion of females in school. Results of the model simulations confirm that both policies will have the expected effect of reducing the number of births to women under 20. However, the marriage policy will actually raise slightly the number of births to unmarried adolescents because there will be more unmarried young women. The overall effect, however, is to lower births in the under-20 age group.

The model shows that the education policy reduces births among unmarried young women; however, the policy has no effect on married women because in this model education has only one channel of effect, which is through age at sexual initiation.

Appendix Demographic Inputs

Fertility by Age and TFR

Age	
15-19	450.45
20-24	960.96
25-29	1,031.03
30-34	915.915
35-39	715.715
40-45	395.395
45-49	80.08
TFR	4.55

Life Expectancy at Birth

Male	54.6
Female	57.5

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