1. Introduction

The need for the study of fertility cannot be overemphasized because of its great impact on both population growth rate and on social, economic and cultural parameters. This is especially true in the Arab region, which until very recently has been characterized by a rapid population growth rate of 3.4% per year. Fortunately, new evidence suggests that fertility levels have begun to decline in the region. However, the pace and intensity of such a change has by no means been uniform. A wide variations have been observed in the declines in the levels of fertility in the 22 members of the League of Arab states resulting in TFRs ranging from 2.5 for Lebanon to 7.4 for Yemen (Rashad, 1999).

Taking this into account, one cannot but classify countries of the Arab world according to the onset of and progress in their fertility transitions. The first category of countries comprises of Lebanon and Tunisia, which have both experienced early and gradual fertility declines having today the lowest TFRs in the Arab region. Following closely these two countries are Bahrain, Algeria, Morocco, Syria, Qatar and Egypt, characterized by early but interrupted fertility change. The third category of countries, which includes the United Arab Emirates, Sudan, Libya and Jordan, has experienced late but rapid declines in TFR. For instance, Sudan and Libya have managed, within ten years, to nearly catch up with the declines in fertility that took almost two decades for other countries in the region to attain. The last group of countries having very high TFR includes, Iraq, Saudi Arabia, Kuwait, Oman and Yemen. Although, declines have started to occur in these countries, the reduction in fertility in Yemen has been much slower (Rashad, 1999). Various explanations can be given to Yemen's lagging behind for the onset of its fertility transition.

2. Country Background

Yemen has been relatively under represented in the demographic and health literature. Thus, not much is known about the demographic and health transitions and socio-economic conditions prevailing in the country, particularly prior to its unification. The lack of information on population and health characteristics has been the main impediment to researchers in the field to undertake such studies. This situation is, however, changing now because of the availability of various databases that provide a wealth of information on population and health characteristics in Yemen. This offers an opportunity to analyze the available data, especially, in order to investigate the prevailing fertility levels and its trends in the country.

A turning point in the history of Yemen has been the unification of the Yemen Arab Republic (North Yemen) and the People's Democratic Republic of Yemen (South Yemen) on May 22, 1990. This, in turn, resulted in the democratization of the country and the establishment of political parties. However, caught in the desire for change, the leaders disregarded the deep-rooted nature of the political systems, cultural norms and interests of the elite. These coupled with the economic recession resulting from Yemen's pro-Iraqi stance triggered the stage of unrest in Yemen in 1994. While President Salih was able to put an end to this internal conflict within few months, it still remains to be seen if this integration will grow into a united and progressive entity (Kostiner, 1996; al-Suwaidi, 1995).

According to the 1991- 1992 Yemen Demographic and Maternal and Child Health Survey (YDMCHS), Yemen had a TFR of 7.7 children per woman. This fertility rate is not only the highest in the Arab region but also one of the highest in the world. A number of factors can be accounted for Yemen's exceptionally high fertility, including early age at marriage, low celibacy, closely spaced births and a

large reproductive life span. Yemen is also characterized by rapid population growth rates, with a rate of growth exceeding 3.4% per annum and an infant mortality rate (IMR) of 110 per 1000 live births in 1991 (ESCWA, 1999). This scenario appears even more gloomy when we look at the country's slowing economy, high unemployment rates, low levels of urbanization and women's poor socioeconomic status. Actually, Yemen's HDI (0.36), a measure of overall progress in human development, is one of the lowest in the world according to statistics published by the UNDP in 1997 (ESCWA, 1999; CSO, 1998; 1994). This makes it clear that the pace of human development in Yemen is extremely low, which has caused high fertility in the country.

Bearing Yemen's political and socioeconomic profiles in mind, it is difficult to conceive that the country with the highest fertility rate in the region, might have actually started its transition to low fertility. However, by 1997, the latest YDMCHS provides evidence of a decline in TFR to 6.5 children per woman, an impressive reduction of 1.2 births within 5 years. An important factor behind this decline may be related to the great efforts undertaken by the Yemeni government to address the issue of high fertility and its related determinants and consequences. This concern prompted the 1991 National Population Strategy, which, among other goals, was aimed at reducing TFR from 8.4 to 6.0 per woman and to increase contraceptive prevalence by 35% by the year 2000. Accordingly, these measures will put up in motion the "so desired" fertility decline in Yemen (ESCWA, 1999; CSO, 1994).

However, based on new data collected between 1991 and 1995, several of these objectives have proven to be too optimistic. One particular study that illustrates the previously stated is the article by Bahobeshi and Zohri (1995) on the analysis of the proximate determinants of fertility in Yemen using the 1991-92 YDMCHS data.

The authors have found out that the so much announced Yemeni fertility decline as well as the targets of achieving a TFR of 6 children per woman and a 35% increase in contraceptive use in Yemen by the year 2000 are not only too optimistic but also unrealistic.

These observations as well as other evidences based on data obtained from both governmental and international agencies have raised the need to review the 1991 population plan. This was necessary to draw a more realistic planning process to ensure a continuous fertility transition in Yemen. The new drafted plan has included more modest goals, like reducing TFR from 7.7 in 1992 to 6 in the year 2000 and to increase contraceptive use from 6% in the 1990s to 22% by the year 2000. The last population plan undertaken by the government not only envisaged more realistic targets but also hoped accelerated fertility decline in Yemen. Specifically, the government's decisive steps to increase contraceptive availability and utilization, to enhance female educational levels as well their active involvement in the social, cultural and economic arena are thought to be the key factors for bringing fast decline in fertility (ESCWA, 1999; CSO, 1998).

Keeping the above background in view, this paper tries to study the factors, which have been responsible for the recent fertility decline in Yemen by taking into account the last governmental intervention. To be specific, the objectives of the present study are as under:

* To study levels and trends in fertility in Yemen during 1992 and 1997;
* To find fertility differentials by residence and woman's education in Yemen; and
* To ascertain the role of each of the proximate determinants for fertility transition in Yemen by decomposition of the change in the TFR during 1992 and 1997.

3. Data and Methods

The present study is based on the analysis of secondary data obtained from the 1991-92 and 1997 Yemen Demographic and Maternal and Child Health Surveys (YDMCHSs). Both surveys are nationally representative and have been implemented to allow analysis for Yemen as a whole and separately by rural-urban areas and by North-West and South-East regions. For the analysis, both the household and individual files have been used to obtain the necessary data.

To meet the objectives, Bongaarts (1982) model of "the Proximate Determinants of Fertility" has been applied. Bongaarts formulae for estimating TFR and the corresponding indices are easy to use and sensitive enough to determine the nature and pace of fertility change and its determinants. Also, the relative importance of each of these determinants in influencing fertility levels can be assessed from the model.

Bongaart Model

Factors influencing fertility can be classified into two groups, namely, proximate determinants, and socioeconomic variables. The former is of interest because of their direct impact on fertility. They consist of a set of biological and behavioral factors through which social, economic and cultural conditions affect fertility. In other words, in the absence of these determinants, human fertility may reach a theoretical maximum of total fecundity (TF), accounting to an average of 15.3 births per woman (Bongaarts, 1978). Thus, fertility differentials between regions and across time within the same region can always be traced to changes in one or more of the proximate determinants.

While Davis and Blake (1956) were the first to identify a set of 11 proximate determinants known as “Intermediate Fertility Variables”, their classification did not get wide acceptance because it was not easily incorporated in fertility analysis. In view of that, Bongaarts (1978) reclassified this list of determinants into seven variables, including marriage pattern, contraceptive use, induced abortion, lactation infecundability, spontaneous abortion, frequency of coitus and sterility. However, after various studies, Bongaarts realized that some of these factors are more relevant than others in determining the magnitude of fertility change. In fact, only four of them (proportion married, contraceptive use and effectiveness, induced abortion and postpartum infecundability) are the most important in explaining fertility variation, accounting for up to 96% of fertility change in some populations (Bongaarts, 1982; 1978).

The fertility-inhibiting effects of the most important determinants are quantified in Bongaarts model by four indices, each of which assuming a value between 0 and 1. When the index is close to 1, the proximate determinant will have a negligible inhibiting effect on fertility, whereas when it takes a value 0, it will have a large inhibiting effect. It is important to note that since abortion is unacceptable in Yemen because of religious considerations, the index of abortion has been taken as 1, and, therefore, its contribution to fertility decline is nil.

Bongaarts (1982) symbolized these 4 indices as follows:

Cm is the index of proportion married

Cc is the index of contraception

Ca is the index of induced abortion

Ci is the index of postpartum infecundability

The main equation of the model is:

TFR= Cm*Cc*Ca*Ci*TF

Where,

TFR: Total Fertility Rate

TF: Total Fecundity

Regarding the estimation of the 4 indices, Bongaart proposed the following treatments:

(A) Index of Marriage:

Cm= ∑{m(a)*g(a)}/ ∑g(a)

Where,

m(a): Age specific proportions currently married

g(a): Age specific marital fertility rate

or,

Cm= TFR/ TM

Where,

TM: Total marital fertility rate

(B) Index of Contraceptive Use:

Cc= 1 - 1.08* u*e

Where,

u: Proportion currently using contraception among married women of reproductive age

e: Average use effectiveness of contraception

1.08: Sterility correction factor

(C) Index of Postpartum Infecundability:

Ci = 20/ 18.5 + i

Where,

i: Average duration (in months) of postpartum infecundability caused by breastfeeding or postpartum abstinence

Having obtained the indices, it is possible to calculate the various levels of fertility by means of multiplication with the corresponding indices. The model relating fertility to the intermediate variables takes the following form:

Total Fecundity (TF) = 15.3

Total Natural Marital Fertility (TN) = TF*Ci

Total Marital Fertility (TM) = TN* Cc*Ca

Total Fertility Rate (TFR) = TM* Cm

These are the four different types of fertility levels identified from which the impact of the proximate determinants can be obtained. With the inhibiting effects of all proximate determinants present, a population's actual fertility level is measured by TFR. If the fertility-inhibiting effect of delayed marriage and marital disruption is removed without other changes in fertility behaviour, fertility will increase to a level of TM. If all practices of contraception and induced abortion are also eliminated, fertility will increase to a level of TN. Removing lactation and postpartum abstinence will, in turn, increase fertility to TF (Bongaarts, 1982).

- **<u>Decomposition of a change in fertility between two points in time</u>:**

Any change in a population fertility level can be the result of a change in one or more of the proximate determinants. Thus, it is possible to say that the decomposition of a trend in the TFR is based on the following equation, which links the TFR to the fertility-inhibiting effects of the four principal proximate variables:

$$\mathbf{TFR = Cm*Cc*Ca*Ci*TF}$$

Let 1997 and 1992 be the first and last years of the time period for which decomposition is done. Then, with a change in the TFR from TFR_{1992} in the year 1992 to TFR_{1997} in the year 1997 and with simultaneous changes in the indexes from Cm_{1992} to $Cm_{1997,}$ from Cc_{1992} to $Cc_{1997,}$ from Ca_{1992} to $Ca_{1997,}$ from Ci_{1992} to Ci_{1997} and from TF_{1992} to TF_{1997} between the years 1992 and 1997, the ratio TFR_{1997}/TFR_{1992} can be expressed as,

$$\mathbf{TFR_{1997}/TFR_{1992} = Cm_{1997}/Cm_{1992} * Cc_{1997}/Cc_{1992} * Ca_{1997}/Ca_{1992} * Ci_{1997}/Ci_{1992} * TF_{1997}/TF_{1992}}$$

Proportional change in TFR between the years 1992 and 1997

$P_f = TFR_{1997}/TFR_{1992} - 1$

Proportional change in TFR due to a change in the index of marriage between the years 1992 and 1997

$P_m = Cm_{1997}/Cm_{1992} - 1$

Proportional change in TFR due to a change in the index of contraception between the years 1992 and 1997

$P_c = Cc_{1997}/Cc_{1992} - 1$

Proportional change in TFR due to a change in the index of induced abortion between the years 1992 and 1997

$P_a = Ca_{1997}/Ca_{1992} - 1$

Proportional change in TFR due to a change in the index of postpartum infecundability between the years 1992 and 1997

$P_i = Ci_{1997}/Ci_{1992} - 1$

Proportional change in TFR due to a change in the remaining proximate variables- natural infecundability, spontaneous intrauterine mortality, and permanent sterility- between the years 1992 and 1997

$P_r = TF_{1997}/TF_{1992} - 1$

Therefore**,**

$$\mathbf{P_f = P_m + P_c + P_a + P_i + P_r + I}$$

Where,

I is the interaction factor

Thus, the proportional change in TFR between 1992 and 1997 is "equal to the sum of the proportional fertility changes due to the different proximate determinants plus an interaction term" (Hussein & Shawky, 1995).

4. Results and Discussion

- **Levels and Differentials in Fertility**

Table 1 presents age-specific fertility rates and other fertility indicators calculated from the data obtained from both the 1991-92 and 1997 YDMCHSs. As can be seen from the table, the crude birth rate in Yemen for 1997 was 42.5 births per

[Table 1 about here]

1,000 population, with clear differentials by rural-urban place of residence. The general fertility rate (GFR), a measure of the number of children per 1,000 women aged 15-44, has gone down from 238 in 1992 to 206 per 1,000 women in 1997. Differentials in GFR have been noted by residence and female level of education, being the level of GFR higher among females living in rural areas and among those with little or no education. As for the total fertility rate (TFR), it has gone down from 7.7 to 6.5 births per woman between 1992 and 1997. Differences by residence also exist in TFR, with TFRs being much higher in rural areas (7.0) than in urban ones (5.0). TFR is also affected by the level of education of women, with a TFR of 6.9 births for illiterate women compared to 3.1 births for women who completed secondary level.

The age-specific fertility rates (ASFRs) indicate that the highest rate is for women aged 25-29. Also, as it can be observed from table 1, a substantial proportion of women continue to bear children in later years of their reproductive span , with ASFR rising from 105 births per 1,000 in age-group 15-19 to 301 births per 1,000 in age-group 25-29.

[Figure 1 about here]

As it is clear from these results, the trends in CBR, GFR, TFR and ASFRs have shown a decline during the five-year period under consideration.

- **The role of the four proximate determinants on the fertility decline in Yemen**

The indices of marriage, contraceptive use, induced abortion, postpartum infecundability, TFR and TF as obtained from using Bongaarts model for the years 1992 and 1997 are presented in Table 2. In analyzing these findings, it should be kept in mind that the lower the value of an index, the higher the percentage reduction in the TFR due to that index.

[Table 2 about here]

As it can be seen from table 2, TFR has declined by 1.2 births from 7.7 to 6.5 between 1992 and 1997. The most important index in explaining this fertility drop is the index of postpartum infecundability, followed by the indices of contraception and marriage. Postpartum infecundability has had a large effect in reducing fertility at both times, but it has not exhibited as much of a decrease between the two periods as Cc. As for the index of contraceptive use (Cc), it appears that this factor has changed most significantly over the intervening period, going down from 0.926 to 0.707. This decline in the index of contraception (Cc) may be an important factor in explaining the drop in fertility witnessed in Yemen between the years 1992 and 1997. In fact, the

percentage currently using contraception has increased from 7.7% in 1992 to 19.6% in 1997. It may be noted as well that contraceptive use effectiveness has augmented between these two years, increasing from 6.9% in 1992 to 15.9% in 1997. Conversely, between the years 1992 and 1997, the index of marriage has remained constant at 0.707. Thus, postponement of marriage as a factor in fertility decline is of less significance in explaining the decline in TFR in the year 1997 than either postpartum infecundability or contraceptive use. Finally, as expected, induced abortion is least important as a fertility-reducing factor in Yemen. It may be mentioned that Muslims predominantly inhabit Yemen and in societies where Islam is practiced, abortion is forbidden.

- **Decomposition of the role of the four major determinants on fertility decline between 1992 and 1997 in Yemen**

The decomposition of the change in Yemen's TFR between 1992 and 1997 is given in table 3. In the first column, percentage change in TFR is presented for each of the determinants responsible for that change. In the next column, the decomposition results are given as distributions and, in the final column, the decomposition of the absolute change in TFR is presented taking into account the contributions made by various proximate variables.

[Table 3 about here]

Results in table 3 indicate that the TFR in Yemen declined by 15.84% or 1.22 points between 1992 and 1997. The decomposition analysis suggests that 10.5% decline in fertility is due to increase in contraceptive utilization and 5.5% is due to an increase in postpartum infecundability. The contribution of marriage is nil because

during this period decline in fertility due to marriage postponement has remained constant. That is why there is a negligible impact of the proportion of married women on fertility decline. Thus, it is clear that change in contraceptive use is generally the main factor responsible for fertility change in Yemen.

In case of absolute change in TFR, there was a decline in TFR of 1.22 births per woman within the years 1992 and 1997. By decomposing the contribution of the four proximate determinants, it is possible to see that 0.8 and 0.4 births have been averted due to increase in both contraceptive utilization and duration of postpartum infecundability, respectively. Again, changes in marriage pattern, which is largely due to a decline in proportion of women married, contributed very little to the fertility decline witnessed in Yemen within the five-year period under observation.

5. Conclusion and Recommendations

The estimated indices for the years 1992 and 1997 have yielded an implied total fecundity rate of 16.89 and 16.83, respectively. In other words, on average a Yemeni woman according to 1997 data, whose marriage remained intact throughout her reproductive age span, used no contraception, not gone for induced abortion and did not breastfeed, had the potential to produce 16.83 children. However, the four proximate determinants of fertility have played an important role in reducing fertility from potential level (TF) to actual level (TFR), being the joint impact of these determinants on fertility decline higher in 1997 than in 1992. Estimated TFR according to Bongaarts formula is 6.5 births per woman for the year 1997, representing both a 10.3 percent decline from TF and a 1.2 percent decline in fertility since 1992; hence, the goal of reducing TFR to 6 births per woman for the year 2000 seems realistic.

As we have seen from this study, the strongest reduction in fertility has been caused by the factor "contraceptive utilization". The Yemeni government has paid great attention in increasing both the availability and utilization of contraception, especially among women with greater need. According to the 1997 YDMCHS, 84% of currently married women have heard of at least one contraceptive method, representing a substantial increase in contraceptive knowledge as compared to data from the 1991-92 YDMCHS (60%). However at this point, it is convenient to emphasize the great discrepancies that exist by region, residence, and level of education, with women living in Mountainous and rural regions and those with little or no education being less likely to know of contraceptive methods. As for the use and effectiveness rates, it is clear from the results obtained in the 1997 YDMCHS that these have almost doubled since 1992. In fact, the contraceptive prevalence rate is 21%, which is more than double the proportion in 1991-92 (CSO 1998; 1994). Thus, the target of achieving a 22% and 36% increase in contraceptive utilization by the years 2000 and 2006 is reasonable enough under the present scenario. However, here as well, there are differences by region, residence, level of education and family size that need to be taken into account, being contraceptive utilization higher among women living in Plateau and Desert regions and urban areas, having secondary and higher education and among those with 3 or more children. Among the modern methods, the majority used the pill followed by the IUD. Also, 8% of women rely on prolonged breastfeeding as a traditional method of contraception (CSO, 1998; 1994). An important recommendation concerning further promotion of family planning methods is to take into account prevailing differentials in contraceptive knowledge and utilization in Yemen, for the purpose of promoting region-specific policies that may lead to higher contraceptive use.

The second factor responsible for the fertility decline in Yemen is that related to postpartum infecundability, with an increase in duration from 9.96 months in 1992 to 11.63 months in 1997. However, the present analysis shows that the fertility-inhibiting effect of postpartum infecundability is declining in Yemen. Despite a drop in the Ci index between the years 1992 and 1997, still the distribution of change in TFR caused by an increase in contraceptive practice is higher than that caused by an increase in the duration of postpartum infecundability, 66% versus 35%, respectively. Thus, at this point it seems imperative to devote more efforts to encourage prolonged breastfeeding, which will, in turn, increase the duration of postpartum infecundability, or at least limit further decline in the contribution of this factor affecting the fertility transition.

While non-marriage (celibacy) was the second most important determinant of fertility change in 1992, the impact of marriage postponement on the fertility decline witnessed in Yemen in 1997 was virtually nil. A plausible explanation for this is that the marriage index (Cm) has remained constant between 1992 and 1997. Because childbearing and family formation are restricted within marriage in Yemen, greater efforts must be undertaken by the government to increase the age at first marriage and, therefore, augment the contribution of Cm as a fertility-inhibiting factor. Also here region-specific policies that concentrate in improving women's social status may have a great impact in increasing age at which women enter the institution of marriage.

In conclusion, as it has been seen throughout this paper, there is a need to manipulate the proximate determinants of fertility in order to have further and faster fertility drop in Yemen, particularly among those living in rural and Mountainous areas and among illiterate women. While not much can be done to increase the

contribution of induced abortion to fertility decline because of religious and cultural prescriptions that forbid this practice; however, governmental policies can concentrate on effectively and efficiently increasing contraceptive utilization and its effectiveness, on encouraging breastfeeding and on rising the age of marriage.

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TABLE 1.- TRENDS IN FERTILITY RATES IN YEMEN

Age Group	YDMCHS 1991-92[1]	Census 1994[2]	YDMCHS 1997[1]
15-19	102	66	105
20-24	283	283	279
25-29	315	346	301
30-34	284	315	258
35-39	258	258	196
40-44	172	143	105
45-49	120	73	54
TFR 15-49	7.7	7.4	6.5
TFR 15-44	7.1	7.1	6.2
GFR	238	U	206
CBR	40	47	42.5

U= Unknown (not available)
[1] Rates are for the 36-month period preceding the survey
[2] Rates are for the 12-month period preceding the census
Source: YDMCHS, 1997

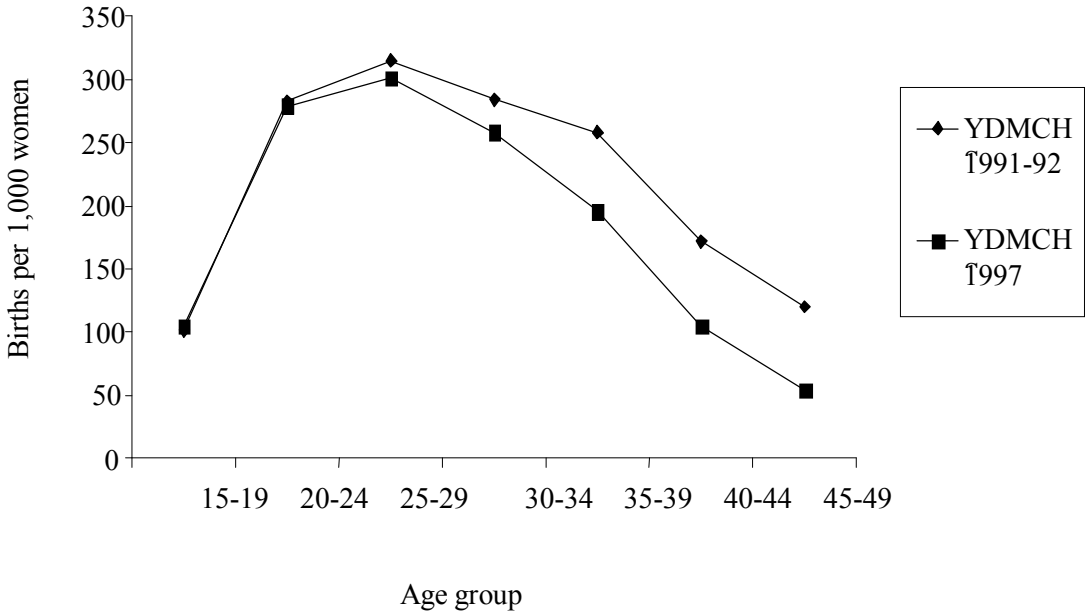

Figure 1.- Age-Specific Fertility Rates in Yemen, 1992 and 1997

Source: Table 1

TABLE 2.- ESTIMATES OF SELECTED FERTILITY MEASURES, PROXIMATE DETERMINANTS AND INDEXES OF PROXIMATE DETERMINANTS FOR YEMEN 1992 AND 1997

	1992	1997
Total Fertility Rate (TFR)	7.700	6.480
Total Marital Fertility Rate (TM)	10.840	9.310
Proportion Currently Using Contraception (u)	0.077	0.196
Contraceptive Use-Effectiveness (e)	0.069	0.159
Total Abortion Rate (TA)	0.000	0.000
Duration of Postpartum Infecundability (i)	9.955	11.624
Index of Marriage (Cm)	0.707	0.707
Index of Contraception (Cc)	0.926	0.707
Index of Induced Abortion (Ca)	0.990	0.990
Index of Postpartum Infecundability (Ci)	0.703	0.664
Total Fecundity Rate (TF)	16.890	16.830

TABLE 3.- DECOMPOSITION OF THE CHANGE IN THE TOTAL FERTILITY RATE FOR YEMEN BETWEEN 1992 AND 1997

Factors responsible for fertility change	Percentage of change in TFR	Distribution of percentage of change in TFR	Absolute change in TFR
Proportion of Women Married	- 0.063	– 0.395	- 0.005
Contraceptive Practice	- 10.467	– 66.070	- 0.806
Practice of Induced Abortion	0.000	0.000	0.000
Duration of Postpartum Infecundability	- 5.543	– 34.990	- 0.427
Other Proximate Determinants	- 0.355	– 2.242	- 0.027
Interaction	+ 0.588	+ 3.713	+ 0.046
Total	– 15.840	100.0	- 1.22