CHAPTER 7

Effects of Mass Media on Contraception and Fertility in African Countries

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1. INTRODUCTION

Although the diffusion of attitude and knowledge about family limitation is often emphasized and the potential for rapid diffusion through modern communication systems in developing countries is suggested in historical fertility research (e.g., Knodel and van de Walle 1979), the role of mass media in the diffusion process is relatively unexplored. Moreover, the role of mass media may not be limited to the diffusion of attitude and knowledge of family limitation, but it can include the change in the world view or the value system which indirectly affects fertility behavior as well as social behavior as a whole.

According to Gerard (1984), the cultural models peculiar to each risk (birth, death, marriage, etc.) link the vital events to individual elements and constitute the social logic surrounding the phenomenon concerned. They are the product of the collective consciousness or the collective unconscious and cannot be observed directly. He indicates that cultural models provide the key to any action designed to influence the risk as follows:

> ...the modification of cultural models in the desired direction obliges the individual to adapt his usual behaviour, which he finds increasingly incompatible with the new structure, or rather with the new vision of the world that he has developed almost unconsciously. Provided it is perfectly controlled, intervention at the collective level would make it possible to direct demographic processes at will and, to do so while formally maintaining full respect for individual freedom.

Therefore, Gerard's notion of cultural models at the collective level to be affected by interventions seems to underlie what Bourdieu (1980) calls 'strategy' at the individual level, which is defined below. Gerard treats IEC (Information, Education and Communication) activities as a technique of persuasion which is a type of intervention at the individual level. However, it seems to me that IEC activities also have the potential as a type of intervention at the collective level affecting cultural models.

Among various channels of mass media, radio is one of the most prevalent in developing countries, particularly in Sub-Saharan Africa (Robey et al. 1992). In spite of its high potential as a means of socioeconomic development policies and family planning programs (Bogue 1979), particularly IEC activities (Guilluly and Moore 1986), relatively little attention has been paid to it.

In the area of family planning research, the potential of mass media had been emphasized in the late 1960s and the early 1970s (e.g., Berelson 1967, Bogue 1967a and 1967b, Snyder 1967, Schramm 1971, Ross et al. 1972, Rogers 1973, Wilder 1973, UNESCO 1975). There were a large number of empirical works on the effects of mass media including radio during this period (e.g., Park 1968, Bailey 1973 cited in Gerard 1984, many works summarized in Sweeney 1977), but there were relatively few in the subsequent decade (e.g., Bertrand et al. 1982, Pinenda et al. 1983). There was a decline in the research interests in IEC activities through mass media due to the plateauing of contraceptive acceptance (Kim 1988).

However, there is a renewed interest in IEC activities through mass media including radio since the mid-1980s due to various changes including program shifts and theoretical developments (Kim 1988) as well as data availability. The literature survey on the effects of radio by Gilluly and Moore (1986) was published in 1986. Empirical analyses of survey data to assess the effect of mass media have resumed to appear in recent years (e.g., Piotrow et al. 1990, Adamchak and Mbizvo 1991, Faria and Potter 1991), including those based on the Demographic and Health Surveys (DHS) (e.g., Olaleye and Bankole 1992 and Westoff 1992 cited in Robey et al. 1992). Other analyses of DHS data sets

include media-related independent variables in their equations (e.g., Molyneaux et al. 1990, Cochrane and Guilkey 1991).

My recent logit analyses of the Zimbabwe DHS data set revealed that the wife's exposure to family planning messages in the mass media, after controlling for the wife's age, age at marriage, urban/rural residence, education and labor force participation, increases the odds of knowing the source of contraceptive methods by eight times; that it increases the odds of ever use of modern contraceptives relative to never use by 1.8 times; and that it increases the odds of current use of modern contraceptives relative to non-use by 1.3 times. However, the household's ownership of a radio has not been controlled for because the exposure to family planning messages is not necessarily through radio (Kojima 1992b). These results suggest the high potential of mass media in Zimbabwe where program efforts in IEC activities have been actively carried out (Boohene and Dow 1987, Chikara 1990) and, possibly, in other African countries.

This study is an extension of my recent studies (Kojima 1992b and 1993) and attempts to explore the effects of two variables specifically related to radio on contraception and fertility in five African countries for which information on these variables is available in the DHS data set. They are the household's possession of a radio and the wife's exposure to family planning messages on the radio. After an analytical framework is presented, logit models are applied to the DHS data sets from Egypt, Morocco, Tunisia, Kenya and Zimbabwe, which have information on the two radio-related variables.

2. ANALYTICAL FRAMEWORK

Figure 1 presents the analytical framework for the determinants of contraception and fertility. It shows the mechanism through which mass media including radio may affect contraception and fertility. This framework is based on the analytical framework for the study of fertility determinants presented by Bulatao and Lee (1983) and that for the study of nuptiality determinants devised by Dixon (1970) as well as that for the study of determinants of first marriage by postnuptial residence type developed by myself (Kojima 1992a).

In this framework, fertility is determined by proximate determinants and fertility regulation including contraception. They are, in turn, determined by the joint fertility decision made by the couple and, possibly, other household members in African context (Kojima 1993). Each spouse or household member is hypothesized to have fertility strategy which is determined by his/her contraception strategy and by the following three intervening variables: the availability of other fertility regulation (than contraception), the feasibility of having children and the desirability of children. Contraception strategy is determined by the following three intervening variables: the availability of contraception, the feasibility of contraception and the desirability of contraception. These two sets of intervening variables are determined by macro-level conditions including cultural models, mass media, micro-level characteristics (of a person, a couple or a household) including the ownership of a radio and the exposure to family planning radio messages, and the micro-level contraception and fertility history.

The term 'strategy' is used here in the sense defined by Pierre Bourdieu: i.e., the series of actions which are organized by the *habitus* (the system of dispositions which acts as a mediation between structures and practice) and objectively adjusted to the situation without strategic calculation (Kojima 1992a). Therefore, his definition of strategy is different from the standard definition of the term.

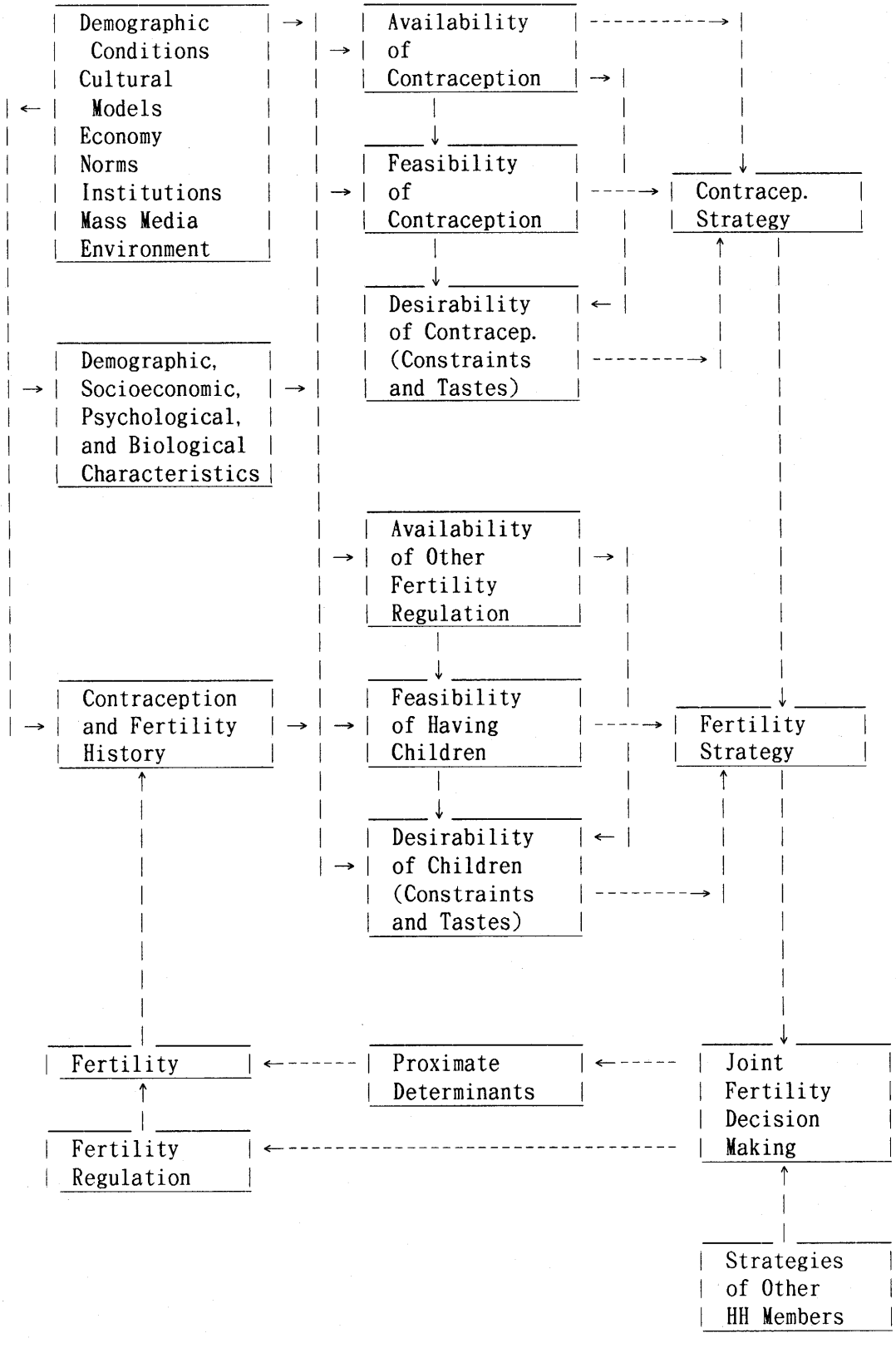
Although Bourdieu does not specifically define 'fertility strategy', he includes it as a part of the system of biological, cultural and social reproduction strategies (Kojima 1990). In Kabylia (Algeria) the objective of fertility strategy is to produce as many sons as possible and as fast as possible through early marriage (Bourdieu 1980). This may be true in other African societies. On the other hand, Bourdieu does not use the term 'contraception strategy'. It can be defined as the series of actions regarding contraception which are organized by the *habitus* and objectively adjusted to the situation without strategic calculation. These definitions may be more in line with Gerard's (1984) theoretical argument about interventions to affect cultural models at the collective level, which is presented above.

In this study, I would like to test the following two simple hypotheses: that the household's ownership of a radio has positive effects on knowledge, attitude and practice regarding modern contraceptives and, thus, fertility reduction; and that the wife's exposure to family planning radio messages has similar positive effects. While the ownership is expected to affect them through its effect on the whole system of reproduction strategies, the exposure is expected to affect them through its effect on contraception and fertility strategies.

3. DATA AND METHOD

The data used in this study derive from the DHS individual recode files for the following five African countries: Egypt (1988/89), Morocco (1987), Tunisia (1988), Kenya (1988/89) and Zimbabwe (1988/89). These countries are selected because their DHS data sets

Figure 1 Framework for the Analysis of Determinants of Contraception and Fertility



include the variables for the household's ownership of a radio and the wife's exposure to family planning messages on the radio even though there are minor differences in the definition. Although these variables have been included in the 1990 Nigeria DHS (Robey et al. 1992), I cannot analyze their effects because the data sets for the DHS-II have not yet been available when this study was carried out.

In order to clarify the differences in the definitions of two variables, the questions and answers in the questionnaires are presented in Table 1. As for the possession of a radio, the definition is virtually the same across countries except for Egypt where the possession of a radio/cassette has been asked. More diversity is found in the wife's exposure to family planning radio messages. The questions for Egypt and Kenya are the most specific about radio, but those for other three countries include the exposure through other channels of communication. Therefore, we should take note of this fact when interpreting the results.

The percentage distribution of these variables are presented at the top of Table 2. Those households with a radio (a radio/cassette for Egypt) are the majority in all the countries except Zimbabwe where they are a 44% minority. Those wives without exposure to family planning messages are a one-third minority in Tunisia and Kenya while they are a 91% majority in Zimbabwe.

As shown by the remaining part of Table 2, the control variables consist of the wife's age (4 categories), the wife's age at marriage (3), urban/rural residence (2), the wife's education (3), the husband's education (3), the wife's labor force participation (2), and the husband's occupation (5). The characteristics of each spouse are included because the fertility decision is hypothesized to be jointly made as shown by the analytical framework in Figure 1. Naturally, the percentage distribution of each variable differs across countries due to the differences in the level of economic development as well as demographic, social, cultural, and environmental conditions.

Although the analytical framework includes the block for contraception and fertility history, the number of children is not controlled for partly because it is to some extent incorporated in age and age at marriage and partly because the inclusion of this variable can cause conceptual and statistical problems for the models explaining the number of children at the start of contraception and the ideal number of children.

Table 3 shows the percentage distribution of dependent variables used in this study. The dependent variables for binomial logit models are the following four: the knowledge of any contraceptives, the knowledge of a source for contraceptives, the utilization of a government source for contraceptives (among those who are current users of modern contraceptives) , and the plan to use a traditional method (among those intending to use a contraceptive method). There is not much difference in the percentage of those who know a method, those who know a source for contraceptives and those intending to use a traditional method while Egypt distinguishes itself in the percentage of current modern contraceptive users whose last source is government-related.

The dependent variables for multinomial logit models are the following six trichotomous variables: the ever use of contraceptives, the current use of contraceptives, the use pattern of contraceptives, the use and intention of future use of contraceptives, the number of children at the start of contraceptive use, and the ideal number of children (non-numeric answers are grouped together with the answers of six or more children). The analyses are limited to currently married women aged 15-49 in order to facilitate cross-national comparison. Kenya distinguishes itself from other countries in the percentage distribution, with less use of modern contraceptives, later start of use and a larger ideal family size.

To examine the effects of the two radio-related independent variables on contraception and fertility, binomial and multinomial logit models (the CATMOD procedure in the SAS package) are used. They are most suitable for dichotomous and trichotomous dependent variables (Aldrich and Nelson 1984). For ease of computation, only categorical variables are used. Dummy coding is used to facilitate the interpretation of results.

While binomial logit model produces only one set of coefficients for the odds of one choice against the other, multinomial logit model with trichotomous dependent variables produces two sets of coefficients: the first one is for the odds of the first choice against the third and the second one is for the odds of the second choice against the third. These coefficients represent the effects of each independent variable on the natural log of odds (log-odds). Therefore, the antilog of each coefficient represents the multiplicative effect of each variable (or category) on the odds.

4. RESULTS OF LOGIT ANALYSES

1) Interaction Effects

It is conceivable that the wives who have a radio in the household and are exposed to family planning radio messages are more likely to have a positive attitude toward family planning than expected from the effect of each attribute. Therefore, the effects of interaction between the two dichotomous independent variables are examined.

Table 4 shows the differences in the log likelihood and the degrees of freedom between the model with

Table 1 Definitions of Radio-Related Independent Variables

Country	Definition (Question and Answer)
	a. The household's ownership of a radio
Egypt	Are any of the following items found in the dwelling unit: A radio with cassette recorder ? (Yes, No)
Morocco	Do you possess in your household: A radio ? (Yes, No)
Tunisia	Do you possess in your household: A radio ? (Yes, No)
Kenya	Does your household have: A radio ? (Yes, No)
Zimbabwe	Does your household have: A radio ? (Yes, No)
	b. The wife's exposure to family planning radio messages
Egypt	How many times did you hear a family planning show or message on the radio during the past month ? (Once, Two or Three Times, More Than Three Times)
Morocco	In the last month, have you heard any information about family planning on the radio, on TV or in reunions ? Have you heard once or several times ?
Tunisia	In the last month, have you heard any information about family planning on the radio, on TV or in reunions ? Have you heard once or several times ?
Kenya	In the last six months, have you heard or read about family planning: On the radio ? (Yes, No)
Zimbabwe	In the last month, have you heard or read any information about family planning ? (Yes, No)

(Note) The author's translation from French for Morocco and Tunisia.
(Source) Egypt (1989: 205,229), Maroc (1089: 129, 134), Tunisie (1989: 162, 167), Kenya (1989: 127, 134) and Zimbabwe (1989: 139, 152).

Table 2 Percentage Distribution of Independent and Control Variables

Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Ownership					
Yes	63.2	83.1	75.6	61.1	43.8
No	36.8	16.9	24.4	38.9	56.2
Exposure					
Once	2.4	7.1	7.9	65.4*	9.0*
Twice+	29.6	19.6	56.5	-	-
No	68.0	73.3	35.7	34.6	91.0
Age					
15-19	5.0	5.1	1.6	6.2	6.8
20-29	36.2	36.2	34.0	41.7	40.6
30-39	35.8	35.3	41.0	33.1	34.3
40-49	23.0	23.4	23.4	19.0	18.3
Age at Marriage					
-14	17.1	20.5	3.8	16.9	12.0
15-19	49.8	53.9	44.0	56.8	58.9
20+	33.1	25.6	52.2	26.3	29.1
U/R Residence					
Urban	49.9	41.5	58.5	24.1	29.5
Rural	50.1	58.5	41.5	75.9	70.5
W's Education					
No Education	48.8	82.9	56.6	50.6	18.5
Primary	32.4	9.9	31.2	19.2	60.6
Secondary+	18.8	7.2	12.2	30.2	20.9
H's Education					
No Education	33.2	69.4	40.8	47.6	18.1
Primary	39.9	16.2	34.0	33.9	51.3
Secondary+	26.9	14.4	25.2	18.5	30.6
W's LFP					
Working	12.3	6.0	10.4	11.1	34.4
No Work	87.7	94.0	89.6	88.9	65.6
H's Occupation					
Farmer	16.6	32.1	6.9	27.1	13.2
Agri.Worker	10.5	3.3	8.7	6.7	12.6
White Collar	17.1	12.6	17.6	20.1	14.4
Blue Collar	27.4	16.0	50.3	19.4	34.4
Others	28.4	36.0	16.5	26.7	25.4

(Note) *Percentage for once and more.

(Source) DHS Individual Recode Data Files for each country.

Table 3 Percentage Distribution of Dependent Variables

Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Know. Method					
Yes	98.3	97.5	99.0	92.7	97.8
No	1.7	2.5	1.0	7.3	2.2
Know. Source					
Yes	96.1	94.3	96.3	91.3	96.0
No	3.9	5.7	3.7	8.7	4.0
Last Source					
Government	25.2	72.4	76.7	67.4	88.1
Others	74.8	27.6	23.3	32.6	11.9
Future Method					
Traditional	0.8	5.1	5.5	4.3	4.5
Others	99.2	94.9	94.5	95.7	95.5
Ever Use					
Modern	58.5	53.9	61.7	31.4	63.0
Traditional	1.5	5.0	6.6	12.9	16.0
Never	40.0	41.1	31.8	55.7	21.0
Current Use					
Modern	35.7	29.0	40.4	18.9	36.1
Traditional	2.4	6.9	9.4	7.0	7.0
No	61.9	64.1	50.2	74.1	56.9
Use Pattern					
Current	38.1	35.9	49.8	25.9	43.1
Previous	21.9	23.0	18.5	18.5	35.9
Never	40.0	41.1	31.8	55.7	21.0
Use and Intention					
Current	38.1	35.9	49.8	25.9	43.1
Intention	30.3	22.5	25.2	40.0	28.8
No Intention	31.6	41.6	25.0	34.2	28.1
No. of Kids at Start					
0	1.4	6.3	3.6	4.8	4.1
1-4	58.6	52.5	64.7	39.1	74.9
5+	40.0	41.2	31.8	56.1	21.0
Ideal No. of Kids					
0-2	38.9	19.8	23.8	7.7	7.0
3-5	42.2	44.6	62.4	60.8	44.2
6+/Non-Numeric	18.8	35.7	13.8	31.5	48.9

(Source) DHS Individual Recode Data Files for each country.

Table 4 Differences in Goodness-of-Fit Measures between Models with and without Interaction

Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Know. Method					
L.L.	0.13	0.67	2.93	0.20	2.17
d.f.	1		1	1	1
Know. Source					
L.L.	1.00	2.49	0.00	0.54	2.33
d.f.	1	1	1	1	1
Last Source					
L.L.	0.38	0.45	0.40	0.31	0.29
d.f.	1	1	1	1	1
Future Method					
L.L.	0.19	0.27	2.85	0.30	0.68
d.f.	1	1	1	1	1
Ever Use					
L.L.	4.14	0.86	3.71	1.51	8.31*
d.f.	2	2	2	2	2
Current Use					
L.L.	1.77	9.02*	5.97	4.36	3.23
d.f.	2	2	2	2	2
Use Pattern					
L.L.	4.24	0.38	2.79	6.75*	4.48
d.f.	2	2	2	2	2
Use and Intention					
L.L.	2.92	1.90	4.60	2.71	4.31
d.f.	2	2	2	2	2
No. of Kids at Start					
L.L.	4.14	0.11	3.04	0.26	2.87
d.f.	2	2	2	2	2
Ideal No. of Kids					
L.L.	2.92	2.80	1.47	1.32	1.38
d.f.	2	2	2	2	2

(Note) *: $p<.05$.

(Source) DHS Individual Recode Data Files for each country.

interaction and the model without interaction for each country. The goodness-of-fit measures suggest that most of the models with interaction are not significantly different from those without it at the 5% level. Among ten models for each country, only the models for ever use of contraceptives in Zimbabwe and for current use of contraceptives in Morocco, and for use pattern in Kenya present significant interaction effects.

This result seems to be somewhat inconsistent: the interaction has a negative effect on the ever use of traditional methods in Zimbabwe while it has a weak positive effect on the current use of traditional methods in Morocco. Moreover, after the inclusion of interaction, the standard errors for radio-related variables sometimes become too large due to the small number of cases in the cell. Therefore, only the models without interaction are discussed below.

2) Binomial Logit Models

Table 5 shows the results of binomial logit models. The ownership of a radio has a significant and positive effect on the knowledge of a contraceptive method only in Egypt. The exposure to family planning radio messages has a significant and positive effect in all the countries except Zimbabwe. Considering the relatively large coefficient for Zimbabwe, this may be partly due to the smaller number of cases. The coefficients suggest that the exposure raises the odds of knowing a contraceptive method by three times in Tunisia, by five times in Egypt and Kenya and by seventeen times in Morocco.

Both the ownership of a radio and the exposure to family planning radio messages have a significant and positive effect on the knowledge of a source for contraceptives in Egypt and Zimbabwe while only the exposure has a significant and positive effect in Morocco, Tunisia and Kenya. The coefficients suggest that the exposure raises the odds of knowing a source by three times in Tunisia, by five times in Egypt, Kenya and Zimbabwe and by nine times in Morocco.

The ownership of a radio has a significant and negative effect on the utilization of a government source for contraceptives among current users of modern contraceptives in Egypt and Tunisia while the exposure to family planning radio messages has no significant effects. In these countries radio owners are 70% as likely as non-owners to have used a government source. This may be related to their high level of family planning program efforts in these countries as assessed by Mauldin and Ross (1991).

While the ownership of a radio has a weak positive effect on the intention to use traditional methods among those planning to use a contraceptive method in Kenya, the exposure to family planning radio messages has a weak positive effect in Morocco. This result seems to contradict our intuition although the significance levels are somewhat low. This may be related to the lower social setting of these countries as assessed by Mauldin and Ross (1991).

3) Multinomial Logit Models

Tables 6 through 8 present the results of multinomial logit models with trichotomous dependent variables. According to Table 6, both the ownership of a radio and the exposure to family planning radio messages have a significant and positive effect on the odds of ever use of modern contraceptives relative to never use of contraceptives in all the countries except Zimbabwe where only the exposure has a significant and positive effect. The coefficients suggest that the exposure raises the odds by 1.5 times to twice. The effect of the exposure may incorporate a part of the effect of the ownership in Zimbabwe because Table 4 suggests that there is a significant effect of interaction on ever use of contraceptives there.

In Morocco and Tunisia the two independent variables also have significant and positive effects on the odds of ever use of traditional methods relative to never use of contraceptives, which is also inconsistent with our intuition. While the exposure also has a significant and positive effect in Kenya, the ownership has a weak negative effect in Zimbabwe. The positive effects of the two radio-related variables are the largest in Kenya.

As for the current use, both the ownership of a radio and the exposure to family planning radio messages have a significant and positive effect on the odds of current use of modern contraceptives relative to non-use of contraceptives in Morocco and Kenya. The exposure to family planning radio messages has a positive effect on the odds of use of modern contraceptives relative to non-use of contraceptives in all the countries except Zimbabwe, which may be partly due to the smaller number of cases for this country. The coefficients suggest that the exposure raises the odds by 1.2 to 1.9 times.

The exposure also has a significant and positive effect on the odds of current use of traditional methods relative to non-use of contraceptives in Morocco and Kenya while it has a significant and negative effect in Zimbabwe. Therefore, the exposure to family planning messages tends to encourage the use of both modern and traditional contraceptives in Morocco and Kenya, it tends to encourage the use of modern methods and to discourage the use of traditional methods in Zimbabwe. The positive effects of the two radio-related variables are also the largest in Kenya.

Table 7 shows that the use pattern of contraceptives

Table 5 Effects of the Ownership of a Radio and the Exposure to Family Planning Radio Messages on Contraceptive Knowledge, Attitude and Practice: Binomial Logit Models

Country / Independent Variables	Knowledge: Any Method	Knowledge: A Source	Last Source Government	Future Method Tradtional Method
Egypt	(N=7938)	(N=7938)	(N=2852)	(N=1963)
Ownership	.524**	.428***	-.332***	-.948
Exposure	1.693***	1.655***	-.052	.629
Morocco	(N=5407)	(N=5407)	(N=1339)	(N=1220)
Ownership	.223	.086	-.018	-.118
Exposure	2.812***	2.199***	.185	.476#
Tunisia	(N=4012)	(N=4012)	(N=1615)	(N= 853)
Ownership	.265	.090	-.353*	.499
Exposure	1.198**	1.123***	.208	.085
Kenya	(N=4526)	(N=4526)	(N= 854)	(N=1613)
Ownership	-.134	-.058	.219	.543#
Exposure	1.698***	1.566***	-.145	-.143
Zimbabwe	(N=2640)	(N=2640)	(N= 951)	(N= 726)
Ownership	.483	.667*	.222	-.124
Exposure	1.033	1.724#	-.086	-.989

(Note) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
(Source) DHS Individual Files for each country.

Table 6 Effects of the Ownership of a Radio and the Exposure to Family Planning Radio Messages on Contraceptive Use by Method: Multinomial Logit Models

Country / Independent Variables	Ever Use: Modern vs Never	Ever Use: Traditional vs Never	Current Use: Modern vs No	Current Use: Traditional vs No
Egypt	(N=7938)		(N=7938)	
Ownership	.218***	.167	.084	.286
Exposure	.383***	.058	.188***	.124
Morocco	(N=5407)		(N=5401)	
Ownership	.246**	.387*	.284**	.131
Exposure	.539***	.405**	.389***	.387**
Tunisia	(N=4012)		(N=4012)	
Ownership	.147#	.351#	.004	.150
Exposure	.500***	.438**	.460***	.191
Kenya	(N=4526)		(N=4526)	
Ownership	.341***	-.001	.374***	.090
Exposure	.680***	.732***	.622***	.551***
Zimbabwe	(N=2640)		(N=2640)	
Ownership	.119	-.281#	.144	-.195
Exposure	.516*	-.142	.234	-1.348*

(Note) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
(Source) DHS Individual Recode Data Files for each country.

are also heavily affected by the two radio-related variables. The exposure to family planning radio messages has a significant and positive effect on the odds of current use relative to never use in all the five countries while the ownership of a radio has a significant and positive effect only in Egypt, Morocco and Kenya. The coefficients suggest that the exposure raises the odds by 1.4 to 2.1 times. The exposure also has a significant and positive effect on the odds of previous use relative to never use in all the five countries while the ownership has a significant and positive effect only in the three North African countries. The positive effects of the two radio-related variables are also the largest in Kenya.

Similar patterns are found for the use and intended use. The exposure to family planning radio messages has a significant and positive effect on the odds of current use relative to no intention of future use in all the countries except Zimbabwe while the ownership of a radio has a significant and positive effect in Egypt, Morocco and Kenya. The coefficients suggest that the exposure raises the odds by 1.5 to 2.5 times. The exposure also has a significant and positive effect on the odds of intention of future use relative to no intention of future use in Egypt, Morocco and Kenya while the ownership has a positive effect in Egypt but a weak negative effect in Kenya. The positive effects of the exposure are the largest in Kenya.

Table 8 shows that the two radio-related variables also have significant effects on the number of children at the start of contraceptive use and the ideal number of children which are more closely related to the actual family size. The ownership of a radio has a significant and positive effect on the odds of starting contraception at the parity of 0 relative to starting contraception at the parity of 5+ in Egypt, Tunisia and Zimbabwe while the exposure to family planning radio messages has a significant and positive effect in Morocco and Kenya. This may be partly because the effect of the ownership incorporates a part of the effect of the exposure in the first three countries as suggested by Table 4: there is a weak interaction between the two radio-related variables in these countries. The coefficients suggest that the exposure raises the odds by 1.8 times in Morocco and by 1.6 times in Kenya.

Both the ownership of a radio and the exposure to family planning radio messages have a significant and positive effect on the odds of starting contraception at the parity of 1-4 relative to starting contraception at the parity of 5+ in all the countries except Zimbabwe where only the exposure has a significant and positive effect. The coefficients suggest that the exposure raises the odds by 1.5 to 2.1 times.

Similar patterns are found for the ideal number of children. The exposure to family planning radio messages has a significant and positive effect on the odds of favoring 0-2 children relative to favoring 6+ children (and non-numeric answers) and the odds of favoring 3-5 children relative to favoring 6+ children in all the countries except Zimbabwe, suggesting the potential effectiveness of radio messages in family planning programs. The coefficients suggest that the exposure raises the first odds by 1.3 to 1.9 times and the second odds by 1.3 to 1.7 times. The ownership of a radio also has a significant and positive effect on the odds of favoring 0-2 children relative to favoring 6+ children in Kenya. In Zimbabwe the ownership has a significant and positive effect on the odds of favoring 3-5 children relative to favoring 6+ children.

4) The Effects of Frequency of Exposure

As for the three North African countries, the effects of the frequency of exposure are examined because the information is available as shown by Tables 1 and 2. Although the results are not presented in the form of tables, multiple exposure has a significant and positive effect on the knowledge of a contraceptive method in Egypt and Tunisia while single exposure has a significant and positive effect in Morocco. As for the effects on the knowledge of a source for contraceptives, multiple exposure has a more significant and larger effect than single exposure in these three countries.

The frequency of exposure has no significant effects on the use of a government source as expected from Table 5. The frequency of exposure has no significant effects on the intended use of traditional methods in Egypt and Tunisia as expected from Table 5. On the other hand, single exposure has a significant and positive effect in Morocco while multiple exposure does not have a significant effect. This can explain why the exposure has a weak and positive effect in Morocco as shown by Table 5.

While only multiple exposure has a significant and positive effect on ever use of modern methods relative to never use in Egypt, both single and multiple exposure have a significant and positive effect in Morocco and Tunisia where multiple exposure has a larger effect than single exposure. In these two countries multiple exposure has a significant and positive effect on ever use of traditional methods relative to never use while single exposure has no significant effects. A similar pattern is found for current use of modern and traditional contraceptives relative to non-use.

Only multiple exposure has a significant and positive effect on current and previous use relative to never use in Egypt while both single and multiple exposure have a significant and positive effect in other two countries. Only multiple exposure has a significant and positive

Table 7 Effects of the Ownership of a Radio and the Exposure to Family Planning Radio Messages on Contraceptive Use Pattern: Multinomial Logit Models

Country	Use Pattern		Use & Intention	
Independent Variables	Current vs Never	Previous vs Never	Current Use vs No Intention	Intention vs No Intention
Egypt	(N=7938)		(N=7938)	
Ownership	.200***	.238***	.180**	.174**
Exposure	.369***	.383***	.405***	.402***
Morocco	(N=5407)		(N=5407)	
Ownership	.312***	.194*	.284**	.111
Exposure	.591***	.437***	.589***	.471***
Tunisia	(N=4012)		(N=4012)	
Ownership	.114	.283*	-.031	-.114
Exposure	.552***	.366***	.479***	.122
Kenya	(N=4526)		(N=4526)	
Ownership	.312***	.111	.197#	-.162#
Exposure	.754***	.625***	.922***	.637***
Zimbabwe	(N=2640)		(N=2640)	
Ownership	.069	-.011	.090	.032
Exposure	.443#	.442#	.212	.136

(Note) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
(Source) DHS Individual Recode Data Files for each country.

Table 8 Effects of the Ownership of a Radio and the Exposure to Family Planning Radio Messages on Family Size Norm: Multinomial Logit Models

Country	No. of Children at Start		Ideal No. of Children	
Independent Variables	0 vs 5+	1−4 vs 5+	0−2 vs 6+/Non−Num.	3−5 vs 6+/Non−Num.
Egypt	(N=7937)		(N=7938)	
Ownership	.570*	.212***	-.050	-.013
Exposure	.105	.380***	.544***	.523***
Morocco	(N=5392)		(N=5407)	
Ownership	.007	.280***	-.018	.086
Exposure	.606***	.504***	.648***	.531**
Tunisia	(N=4012)		(N=4012)	
Ownership	.706*	.151#	.133	.061
Exposure	.262	.505***	.292*	.297**
Kenya	(N=4487)		(N=4526)	
Ownership	.235	.225**	.321*	.111
Exposure	.492*	.719***	.366*	.470***
Zimbabwe	(N=2636)		(N=2639)	
Ownership	.703**	-.005	.250	.261*
Exposure	-.056	.481*	.153	.280

(Note) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
(Source) DHS Individual Recode Data Files for each country.

effect on current and intended use relative to no intention in Egypt and a significant and positive effect on current use in Tunisia. Both single and multiple exposure have a significant and positive effect on current and intended use relative to no intention in Morocco, but the coefficients are somewhat larger for single exposure than for multiple exposure.

In Egypt only multiple exposure has a significant and positive effect on starting contraception at the parity of 1-4 relative to starting at the parity of 5+ while single exposure does not have a significant effect. In Morocco both single and multiple exposure have a significant and positive effect on starting contraception at the parity of 0 and 1-4 relative to starting at the parity of 5+ and the coefficients for starting at the parity of 1-4 relative to starting at the parity of 5+ is larger for multiple exposure than for single exposure. In Tunisia both single and multiple exposure have a significant and positive effect on starting contraception at the parity of 1-4 relative to starting at the parity of 5+ and the coefficient is larger for multiple exposure than for single exposure.

Only multiple exposure has a significant and positive effect on the ideal family size of 0-2 and 3-5 relative to the ideal family size of 6+ in Egypt and Tunisia. In Morocco, however, both single and multiple exposure have a significant and positive effect on the ideal family size of 0-2 and 3-5 relative to the ideal family size of 6+ and the coefficients are larger for multiple exposure than for single exposure.

5. DISCUSSION

In sum, the results are generally as expected. The household's ownership of a radio and the wife's exposure to family planning radio messages independently improve the knowledge, attitude and practice concerning contraceptives, especially modern methods. In spite of the general similarities, Zimbabwe presents somewhat different patterns possibly because of cultural differences and possibly because of lower percentage of wives with the ownership and the exposure. The more frequent exposure tends to improve the knowledge, attitude and practice concerning modern contraceptives in North Africa.

The results of this study suggest that both socioeconomic development policies and family planning programs with a special emphasis on mass media, especially radio, may have significant effects on fertility control in developing countries. The results may also suggest that the free or subsidized distribution of a radio among households can lead to socioeconomic development with controlled fertility even without family planning campaigns on the radio.

In order to assess the potential target for the free or subsidized distribution of radio as well as the potential target for family planning radio campaigns, the determinants of the household's ownership of a radio and the wife's exposure to family planning radio messages are examined using the models with the control variables defined above. Table 9 shows the results of binomial logit models for determinants of the ownership while Tables 10a and 10b present the results of binomial logit models for determinants of the exposure excluding and including the independent variable for the household's ownership of a radio.

According to Table 9, age tends to have a significant and positive effect on the odds of having a radio in all the countries except Zimbabwe. The coefficients suggest that those wives aged 15-19 are one third to two thirds as likely as those aged 40-49 to have a radio in Egypt, Tunisia and Kenya. Therefore, the free or subsidized distribution of a radio to young couples at the beginning of childbearing period can be effective as a fertility control measure in these countries.

On the other hand, age at marriage has no significant effects on the ownership of a radio. Urban residence has a significant and positive effect in all the countries except Morocco. The coefficients suggest that urban residents are 1.5 to 4.5 times as likely as rural residents to have a radio. Therefore, the free or subsidized distribution of a radio to rural residents can be an effective fertility control measure in these countries. This may be particularly relevant to Zimbabwe where the coefficient is very large and the effect of age is not significant.

Both the wife's and the husband's education has a significant and positive effect on the ownership of a radio in all the countries. The effect of the wife's education is larger than that of the husband's in all the countries except Egypt. Egypt is also exceptional in exhibiting a smaller effect of primary education relative to secondary education. Therefore, the free or subsidized distribution of a radio to non-educated and less educated couples possibly through adult education can be an effective fertility control measure.

The wife's labor force participation has the opposite effects on the ownership of a radio in North Africa and Sub-Saharan Africa. Working wives are one half to three fourth as likely as non-working wives to have a radio in Morocco and Tunisia while they are 1.5 times as likely to have a radio in Kenya and Zimbabwe. This is probably because working wives in the Islamic countries belong to the less affluent social strata due to the religion's discouragement of wives' outside work while working wives in Sub-Saharan African countries may bring an extra income to buy a radio. Therefore, the free or subsidized distribution of a radio to non-

Table 9 Determinants of the Ownership of a Radio: Binomial Logit Models

Independent Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Intercept	.150#	1.833***	1.142***	-.115	-1.548***
Age					
15-19	-.435***	-.271	-1.060***	-.577***	-.023
20-29	-.435***	-.426***	-.814***	-.486***	.018
30-39	-.217***	-.437***	-.478***	-.236*	-.173
40-49	0.000	0.000	0.000	0.000	0.000
Age at Marriage					
-14	-.086	-.133	-.214	-.026	-.111
15-19	0.000	0.000	0.000	0.000	0.000
20+	-.044	-.041	.068	-.028	-.062
U/R Residence					
Urban	.486***	.037	.631***	.393***	1.502***
Rural	0.000	0.000	0.000	0.000	0.000
W's Education					
No Educ.	0.000	0.000	0.000	0.000	0.000
Primary	.145*	.827***	.617***	.557***	.559***
Secondary+	.721***	1.648***	1.087***	1.087***	1.043***
H's Education					
No Education	0.000	0.000	0.000	0.000	0.000
Primary	.287***	.478***	.304**	.494***	.333*
Secondary+	.935***	1.118***	.753***	.897***	.616***
W's LFP					
Working	-.124	-.709***	-.301*	.455***	.365***
No Work	0.000	0.000	0.000	0.000	0.000
H's Occupation					
Farmer	-.049	-.422***	-.329#	-.505***	-.371*
Agri.Worker	-.345***	-.674***	-.721***	-.767***	-.119
White Collar	.075	.339#	.502*	.262*	.278#
Blue Collar	.084	.294*	-.513***	-.269**	-.267*
Other	0.000	0.000	0.000	0.000	0.000
− 2 L.L.	960.1***	530.4	551.3	839.9**	863.5***
d.f.	753	584	536	732	686
N	7946	5446	4012	4533	2642
Odds	1.712	4.926	3.094	1.569	.779

(Note) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
(Source) DHS Individual Recode Data Files for each country.

Table 10a Determinants of the Exposure to the Family Planning Radio Messages: Binomial Logit Models without the Ownership

Independent Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Intercept	-1.476***	-1.228***	.314**	-.369**	-4.236***
Age					
15-19	-.095	-.397*	-.909**	-.035	-.514
20-29	.094	.032	-.286**	.166#	-.380#
30-39	.002	.056	-.036	.126	-.396#
40-49	0.000	0.000	0.000	0.000	0.000
Age at Marriage					
-14	-.094	.056	-.093	.068	.069
15-19	0.000	0.000	0.000	0.000	0.000
20+	-.036	-.086	-.058	.033	-.169
U/R Residence					
Urban	.404***	.270***	.519***	.226*	1.256***
Rural	0.000	0.000	0.000	0.000	0.000
W's Education					
No Education	0.000	0.000	0.000	0.000	0.000
Primary	.364***	.364***	.415***	.737***	.892**
Secondary+	.901***	.556***	.390**	1.254***	1.200***
H's Education					
No Educ.	0.000	0.000	0.000	0.000	0.000
Primary	.263***	.266**	.205*	.386***	.993**
Secondary+	.431***	.452***	.235*	.636***	1.120**
W's LFP					
Working	-.212*	-.333*	-.100	.397**	-.409**
No Work	0.000	0.000	0.000	0.000	0.000
H's Occupation					
Farmer	-.226*	-.477***	-.033	-.273**	.048
Agri,Worker	-.349**	-.068	-.242#	-.400**	-.589
White Collar	.051	.179#	-.031	.056	.356#
Blue Collar	.131#	.064	-.208*	-.300**	.016
Other	0.000	0.000	0.000	0.000	0.000
− 2 L.L.	1623.5***	876.9***	1132.9***	1963.0***	621.8
d.f.	1176	749	756	1064	956
N	7938	5407	4012	4526	2640
Odds	.470	.364	1.804	1.888	.099

(Notes) #: p <.10; *: p <.05; **: p <.01; ***: p <.001.
This model implicitly include the variable for the radio ownership for the computation of −2 times log likelihood and degrees of freedom.

(Source) DHS Individual Recode Data Files for each country.

Table 10b Determinants of the Exposure to the Family Planning Radio Messages: Binomial Logit Models with the Ownership

Independent Variables	Egypt	Morocco	Tunisia	Kenya	Zimbabwe
Intercept	-1.886***	-1.878***	-.282*	-1.417***	-4.785***
Age					
15-19	-.023	-.375*	-.777**	.257	-.466
20-29	.162*	.068	-.175#	.463***	-.348
30-39	.032	.093	.034	.288**	-.357
40-49	0.000	0.000	0.000	0.000	0.000
Age at Marriage					
-14	-.076	.069	-.059	.085	.142
15-19	0.000	0.000	0.000	0.000	0.000
20+	-.030	-.085	-.068	.063	-.185
U/R Residence					
Urban	.342***	.270***	.432***	.073	.868***
Rural	0.000	0.000	0.000	0.000	0.000
W's Education					
No Education	0.000	0.000	0.000	0.000	0.000
Primary	.348***	.322**	.334***	.609***	.721*
Secondary+	.834***	.502***	.288*	.970***	.949**
H's Education					
No Education	0.000	0 .000	0.000	0.000	0.000
Primary	.221**	.233**	.163#	.206*	.956**
Secondary+	.308**	.396***	.147	.292*	.991**
W's LFP					
Working	-.199*	-.300*	-.059	.264#	-.499**
No Work	0.000	0.000	0.000	0.000	0.000
H's Occupation					
Farmer	-.219*	-.437***	.015	-.059	.144
Agri. Worker	-.296**	.009	-.124	-.056	-.534
White Collar	.046	.161	-.057	-.071	.311
Blue Collar	.122#	.045	-.137	-.221*	.085
Other	0.000	0.000	0.000	0.000	0.000
Radio Ownership					
Has Radio	.689***	.732***	.816***	2.057***	1.470***
No Radio	0.000	0.000	0.000	0.000	0.000
− 2 L.L.	1478.6***	822.7*	1030.1***	1159.2*	552.4
d.f.	1175	748	755	1063	955
N	7938	5407	4012	4526	2640
Odds	.470	.364	1.804	1.888	.099

(Note) #: $p < .10$; *: $p < .05$; **: $p < .01$; ***: $p < .001$.
(Source) DHS Individual Recode Data Files for each country.

working wives possibly through women's groups can be an effective fertility control measure in Kenya and Zimbabwe.

The effects of the husband's occupation are not always in the same direction, either. The husband being a farmer has a significant and negative effect on the ownership of a radio in all the countries except Egypt where it has a non-significant and negative effect. Similarly, the husband being an agricultural worker has a significant and negative effect in all the countries except Zimbabwe where it has a non-significant and negative effect. On the other hand, the husband being a white-collar worker has a significant and positive effect on the ownership in all the countries except Egypt where it has a non-significant and positive effect.

As for the first three occupations, the effects on the ownership of a radio are in the same direction across countries. But they are not in the same direction for the husband being a blue-collar worker. It has a significant and positive effect on the ownership in Morocco, but it has a significant and negative effect in Tunisia, Kenya and Zimbabwe. Therefore, the free or subsidized distribution of a radio as a part of agricultural extension service may be effective as a fertility control measure in all the countries. In Tunisia, Kenya and Zimbabwe the free or subsidized distribution of a radio to blue-collar workers as a fringe benefit may be also effective.

Tables 10a and 10b present the results of binomial logit models for determinants of the wife's exposure to family planning radio messages excluding and including the independent variable for the household's ownership of a radio. According to the comparison of goodness-of-fit measures, the inclusion of the variable for the ownership of a radio in the equation increases the model fit significantly in all the countries, especially in Kenya. Actually, this is also apparent from the very significant and large coefficient for the ownership of a radio in Kenya presented in Table 10b. The coefficients suggest that the ownership raises the odds of exposure by eight times in Kenya, by four times in Zimbabwe and by twice in the North African countries.

The effects of other independent variables on the exposure to family planning radio messages presented in Table 10a are often similar with those found in Table 9 for the ownership of a radio, but their significance level and magnitude are often reduced after controlling for the ownership of a radio as shown by Table 10b. The effect of the wife's age increases its significance in some but decreases in others after the inclusion of the variable for the ownership in the equation. Age tends to have a positive effect on the exposure in Tunisia and Zimbabwe. Ages 20-29 come to have a significant and positive effect in Egypt and Kenya after controlling for the ownership. This may suggest that IEC activities are well-focused in these two countries or that this age group pay more attention to family planning messages on the radio.

The wife's age at marriage has no significant effects on the exposure to family planning radio messages. Urban residence has a significant and positive effect in all the countries except Kenya where it loses its significance after controlling for the ownership of a radio due to the extremely high significance level. Therefore, IEC activities should be focused on rural residents.

Both the wife's and the husband's education have a significant and positive effect on the exposure to family planning radio messages in all the countries, but the significance level and the magnitude of effects are reduced after controlling for the ownership of a radio in all the countries, particularly in Sub-Saharan African countries. Therefore, IEC activities should focus on couples without education.

The wife's labor force participation has a significant and negative effect on the exposure to family planning radio messages in Egypt, Morocco and Zimbabwe while it has a significant and positive effect in Kenya. Therefore, it has the opposite effects on the ownership and the exposure in Zimbabwe. This may be because the wife's labor force participation increases the income to buy a radio but decreases the time to listen to the radio in Zimbabwe. The negative effect of labor force participation may be also due to work-related time constraints in Egypt and Morocco. Its positive effect in Kenya may be related to socioeconomic conditions or cultural attributes of working wives which are not captured by other independent variables in the equation. Therefore, IEC activities should focus on working wives in Egypt, Morocco and Zimbabwe while it should focus on non-working wives in Kenya possibly with the help of women's groups.

The effects of the husband's occupation on the exposure to family planning radio messages are often reduced after the inclusion of the variable for the ownership of a radio. The husband being a farmer has a significant and negative effect on the exposure in Egypt and Morocco while his being an agricultural worker has a significant and negative effect in Egypt. The husband being a blue-collar worker has a significant and positive effect on the exposure in Egypt while it has a significant and negative effect in Kenya. Therefore, IEC activities should focus on the wives of men in agricultural occupations in Egypt, the wives of farmers in Morocco, and the wives of blue-collar workers in Kenya.

These results for determinants of the household's ownership of a radio and the wife's exposure to family planning radio messages suggest that there is still a

large potential for fertility control through the free or subsidized distribution of a radio or through the family planning campaigns on the radio in African countries. Because both measures seem to be relatively cost-effective (Gilluly and Moore 1986), they might as well be tried in countries where they are not implemented extensively.

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