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THE DETERMINANTS OF CONTRACEPTIVE USE, REPRODUCTIVE GOALS AND BIRTH SPACING IN RELATION TO MORTALITY, BREAST-FEEDING AND PREVIOUS CONTRACEPTIVE BEHAVIOR

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Contents

		Page
	Abstract	1
I.	Introduction, Sources of Data and Summary of Comparative Findings	2
II.	Previous Pregnancy Outcome, Breast-feeding and Contraception	11
III.	Probability Estimates of Previous Contraceptive Use, Reproductive Plans and Contraceptive Intentions	30
IV.	Additional Analysis According to the Number of Previous Pregnancies	52
V.	Conclusion and Policy Implications	89
Appendix A.	Detailed Interpretation of Regression Results	91
Appendix B.	Appropriateness of Ordinary Least Squares Regression Analysis: A Comparison of Selected Results With Those Obtained Using Logit Analysis	107
References		113

Abstract

Using recent data collected from over 20,000 women delivering at selected maternity hospitals in Africa and the Middle East, we have examined the effects of previous pregnancy outcomes, breast-feeding and contraceptive use on birth spacing, desired fertility and future contraceptive plans. In particular, the relative importance of motivational and biological factors on the length of the pregnancy interval is analyzed.

Following the presentation of comparative demographic profiles of respondents in each of the four data sets, a summary descriptive analysis of the relationships among variables is given. Next, standard linear regression is performed with pregnancy intervals, fertility intentions and contraceptive plans as dependent variables.

Results indicate that breast-feeding has a significant impact on the length of the pregnancy interval, but only if it continues for an extended period. The desire for additional children is affected by the survival status of the last two pregnancies; planned contraceptive use is affected by fertility intentions and the outcome of (only) the most recent pregnancy.

Health programs designed to improve infant and childhood survivorship are likely to have both direct and indirect beneficial effects on contraceptive use and fertility attitudes and behavior.

I. Introduction, Sources of Data and Summary of Comparative Findings

Introduction

It has been argued that declines in infant and childhood mortality are necessary before populations adjust their fertility downward (Omran 1971; Rutstein and Medica 1978; Preston 1978).* It follows that family planning programs will be increasingly successful as mortality declines because more women will want to control the number of births they have. In an environment where infant and child death rates are high, couples may compensate by having extra births in anticipation that some children will die (Chowdhury, Khan & Chen 1978; Knodel 1978). Such a strategy discourages the use of contraception. Couples that actually suffer child loss may replace lost children; such couples will have higher fertility than those whose children do not die. Couples experiencing child loss may delay using contraceptives until a nonsurviving child has been replaced. Reduction in mortality will lessen the impact of these motivations for having children and raise the demand for contraception (Omran 1971). In this report, the effect of child survival on pregnancy intervals, contraceptive use, the desire for additional children and plans for contraceptive use will be assessed. Women with one or more nonsurviving children may be expected to have shorter pregnancy intervals, be less likely to have used contraceptives and less likely to plan to use them, and be more likely to desire additional births.

Pregnancy intervals are affected by both biological and motivational factors. Women who breast-feed will have breast-feeding interrupted if a

*For an excellent summary of the literature on the role of mortality in reducing fertility see Preston (1978).

child dies. For such women, postpartum amenorrhea will be of shorter duration and if contraception is not practiced, pregnancy intervals will be shorter (see Preston 1978). Biological factors would therefore encourage shorter pregnancy intervals for such women. Motivational factors may also contribute to shorter pregnancy intervals. Women who have lost a child will have greater motivation to have another child and hence be less likely to practice contraception. Failure to practice contraception or terminating its use because of an infant death should reduce the length of pregnancy intervals.

Mortality experience affects not only the past use of contraceptives, but it also affects contraceptive plans. Women who have unsuccessful pregnancy outcomes* will be more likely to want additional children and, consequently, less likely to plan to use contraception. In addition, unsuccessful pregnancy outcomes in the past may encourage women to have additional births as a hedge against future mortality. Thus, mortality not only discourages contraceptive use by encouraging women to have another child to replace a lost child, it also encourages them to have extra births on the expectation that some babies born in the future will not survive.

If the replacement effect is an important factor in affecting the desire for additional children and the actual and planned use of contraception, then women experiencing child mortality will want to replace lost children and, consequently, be less likely to use contraceptives. Full replacement would imply that women who have lost one child would want one more child than women who have lost none, women who have lost two, two more

*An unsuccessful pregnancy outcome refers throughout to a spontaneous abortion, stillbirth, or infant or child death following a live birth.

and so on. The loss of the last child should have a larger impact on the desire for additional children than the loss of children of earlier birth orders. Later pregnancies may have already replaced early child losses, whereas less adjustment has likely been made to later child losses and none could have been made in response to the death of the most recently born child.

The impact of planning additional births to compensate for anticipated child losses is difficult to measure. Since the data set analyzed in this report contains information on the number of additional children desired but not (explicitly) on the number of additional births desired, it is therefore not possible to determine whether the number of additional births exceeds the number of additional children desired. Some light, however, may be thrown on the importance of hedging as a factor influencing contraceptive plans. Women with comparable desires for additional children may be expected to have similar contraceptive plans. However, women, who have had child losses may be more likely to expect losses in the future than women whose children have all survived. Such losses may cause women to delay the use of contraception since they want more births than women who have not experienced child loss, even though they want the same number of additional children.

The plan of this report is as follows. First, the data sets and the variables included in the analysis are reviewed. Second, pregnancy intervals are examined by previous pregnancy outcome. Biological and motivational factors including contraceptive use which might explain observed differences are examined. Third, the contribution of a reduction in mortality to the length of the pregnancy interval is assessed. Finally,

factors affecting reproductive plans are studied and their subsequent effects on contraceptive plans are evaluated.

Sources of Data

The data used in this study consists of records of hospital deliveries to women in four countries in Africa and the Middle East: Iran, Egypt, the Sudan and Nigeria. Hospitals in each of these four nations have been participants in IFRP's ongoing Maternity Care Monitoring (MCM) study, from which standardized data sets on the demographic, medical and motivational aspects on fertility and family planning are now available from over 30 countries in the developed and developing world. The data sets utilized in the present study range from fewer than 850 delivery records from the Khartoum North Hospital in the Sudan to nearly twenty thousand from the Queen Farah Maternity Hospital in Tehran. Approximately six thousand records are available from El Galaa Maternity Hospital in Cairo, and half that number from University College Hospital in Ibadan.

Although the thrust of the present study is to examine the interrelationships among contraceptive use, reproductive goals, fertility behavior and child survivorship within each of the four selected centers separately, it may be useful to begin with a comparison of a number of summary characteristics of women from each center (Table 1). It must be remembered that these characteristics pertain to women who report at least one previous pregnancy outcome, a criterion that excludes approximately one fourth of the respondents in Iran and Nigeria, and one third in Egypt and the Sudan.

Table 1. Summary characteristics of the four data sets.

	Iran	Egypt	Sudan	Nigeria
Women with at least 1 previous pregnancy	15300	4135	535	2067
Percent of all women	76.7	64.7	65.1	77.0
Mean age	26.1	29.2	28.9	29.2
Mean age at 1st marriage	16.3	19.0	18.3	na
Percent married by age 20	92.2	63.2	73.2	na
Percent with one or more years schooling	26.8	41.9	40.9	58.8
Percent urban	93.4	91.4	64.5	90.1
Mean parity*	2.78	3.29	4.06	2.75
Mean number of living children*	2.36	2.46	3.83	2.30
Mean child loss* (parity-living children)	.42	.83	.23	.45
Mean number of stillbirths/spontaneous abortions	.28	.62	.47	.55
Percent breast-feeding last live birth**	79.5	86.0	93.8	na
Percent breast-feeding 21 months or longer**	29.9	15.6	5.0	na
Mean number of months breast-fed last live birth**	11.6	11.0	12.7	na
Percent used contraception during last interval	50.0	37.1	17.9	20.1
Mean number of months since last pregnancy ended	38.0	31.1	24.7	na
Percent wanting no more children	67.5	78.2	53.0	19.9
Percent planning to use contraception	91.1	81.7	71.4	68.4
Among women who want no more children	99.7	92.8	88.3	92.2
Among women who want more children	73.1	41.2	52.4	62.5

*Previous to the current delivery.
**Among women with at least one live birth.

Summary Characteristics

Age. It may be seen that the women in the Iranian data set are younger than those from Egypt, the Sudan, or Nigeria. The average age of the women delivering in Tehran is 26 years, three years younger than the women delivering in the selected hospitals in the other three countries. Age at marriage is correspondingly lower in Iran: 16 years, versus 18 in the Sudan and 19 in Egypt.*

Parity and Childhood Mortality. Excluding the result of the current delivery, the Sudanese women have the highest mean parity (4.06 births), followed by those in Egypt (3.29), Iran (2.78) and Nigeria (2.75). Data on childhood mortality may be calculated from information on parity and living children. The data indicate that (previous) mortality is lowest among women delivering in Khartoum (.23 child deaths per woman) and highest in Cairo (.83 child deaths per woman). Such relatively favorable mortality experience in Khartoum is suspect; perhaps among rural women (the Sudanese data set, 35% rural, is the only one with over 10% of the respondents living in rural areas) there is a stronger tendency to omit altogether children who do not survive to a certain age.

Breast-feeding. Breast-feeding is widely practiced among the women in all three centers for which data are available. Nearly 80% of the women in the Iranian sample said they breast-fed their last live-born child. The

*The questionnaire used in collecting the Nigerian data omitted a number of items (particularly those relating to pregnancy intervals and breast-feeding) which are contained in the revised questionnaire used in the other three centers. For this reason, the analysis of the Nigerian data set is significantly more limited in scope.

corresponding proportion in the Egyptian sample is 86%, and in the Sudan, 94%. An interesting finding is that, although women in the Sudan are more likely to have practiced (any) breast-feeding than women from the other locations, they are less likely to have breast-fed for an extended period. Only 5% of the respondents from Khartoum North Hospital said they breast-fed for 21 months or more, compared with 16% at the El Galaa Maternity in Cairo and 30% at the Queen Farah Maternity in Tehran. Although the average breast-feeding periods by women in the three centers are similar (between 11 and 13 months), they are the aggregate results of quite different patterns of breast-feeding practice.

Previous Contraception. Use of contraception in the interval from the previous to the current delivery (the last closed interval) was reported by all women. In Iran, exactly one half of those respondents said they had used a method during the last pregnancy interval. In Egypt, 37% had practiced contraception during the interval, while in the Sudan and Nigeria the proportions were 18% and 20% respectively.

Pregnancy Intervals. The relatively high proportion of women in the Tehran sample with extended breast-feeding or contraceptive use would point to longer pregnancy intervals among such women than among those with less extensive breast-feeding and contraceptive behavior. The data show this to be the case: the average interval among cases reported in Iran is 38 months, over six months longer than reported in Egypt (31 months), and more than a year longer than the average pregnancy interval for the Sudanese women (25 months).

Reproductive and Contraceptive Plans. Women in each of the centers were asked whether they wanted to have additional children and if they planned to practice contraception.* Although responses to such attitudinal questions as these must be interpreted with caution, they indicate that a much greater variation exists among the four centers in the desire for additional children than in the intention to contracept following the current delivery. At El Galaa Maternity in Cairo, over three fourths of the women said they wanted no more children. At the other extreme, at University College in Ibadan, only one fifth of the patients indicated a desire to limit family size to its present level. Two thirds of the women delivering at Queen Farah Hospital in Tehran wanted no additional children, as did slightly over half of those at Khartoum North. It must be remembered that these summary statistics apply to women at different parity distributions in each of the four centers, and furthermore, that cultural differences may result in slight variations in interpretation of, and response to, various questions included on the survey.

The proportion of women who state that they plan to use a method of family planning ranges from a low of 68% in the Nigerian sample to over 90% in Iran. When contraceptive plans are examined according to the desire for additional children, the results are perhaps more meaningful as they likely distinguish between contraception intended for spacing purposes and that for the limitation of family size. Of the women delivering in Tehran, virtually all (99.7%) women who want no more children plan to contracept. Even among those who plan to have additional children, nearly three fourths indicate they desire to exert some control over the spacing of their future

*Presumably, though not explicitly stated, before a subsequent pregnancy.

childbearing by the use of family planning. In each of the other samples, approximately 90% of the women who want no additional children plan to contracept. Among those desiring larger families, 63% of the women in Nigeria, 52% in the Sudan, and 41% in Egypt plan to use a method for spacing their future pregnancies. The above results show that there is greater variation among the centers in the use of contraception for spacing purposes than there is for the limitation of fertility.

It is clear from the foregoing discussion that a comparision of summary characteristics among several populations provides only a superficial view of the similarities and differences which exists among them. The major shortcoming is that it fails to account for the relationships between and among variables which may explain observed differences. The purpose of this research is to examine how past contraceptive use, breast-feeding practices and child mortality affect birth spacing, planned contraception and future reproductive goals. To the extent the data permit, such analyses will be made separately for women delivering in hospitals in each of the four countries.

II. Previous Pregnancy Outcome, Breast-feeding and Contraception

Results from Queen Farah Hospital, Tehran, Iran

A. Pregnancy Intervals

Table 2 presents data on the average length of the last pregnancy interval by previous pregnancy outcome among women who did not breast-feed during the last pregnancy interval. Women whose last pregnancy ended in a live birth and whose last child is still living have, by far, the longest intervals (35.2 months). They are followed by women whose last pregnancy ended in a nonsurviving live birth, women whose last pregnancy ended in a stillbirth, and lastly, women with spontaneous abortions. The average intervals for such women are 21.3, 20.6, and 19.8 months, respectively.

B. Contraception

Table 2 also examines pregnancy intervals by contraceptive use for women who did not breast-feed during the last pregnancy interval. Within categories of pregnancy outcome, women who did not contracept and did not breast-feed have the shortest intervals: differences between contraceptors and noncontraceptors vary from 13 to 22 months. Among women who did not contracept during the interval, those whose last pregnancy ended in a spontaneous abortion have the shortest intervals since they have the shortest periods of postpartum amenorrhea. Women whose last pregnancy was full term but the child died or was stillborn have longer pregnancy intervals. For these groups, biological influences are similar and so these results are expected. Women whose last pregnancy ended in a live birth with the child still alive at the current delivery have the longest intervals. Since

these women neither breast-fed nor used contraception, how then can their longer pregnancy intervals be explained? It is possible that some of these women practiced postpartum abstinence and did not consider such behavior to be contraception. In addition, problems associated with child care may have reduced coital frequency below that of women who were not caring for babies. Coital frequency may also be higher among women experiencing an unfavorable pregnancy outcome because they are trying to have another child as soon as possible.

Table 2. Mean length (in months) of the last pregnancy interval, by outcome of last pregnancy and contraceptive use during the interval, among women not breast-feeding (Iran).

	Contraceptive Use			
Last Pregnancy Outcome	No Contra-ception	Traditional Contra-ception	Modern Contra-ception	Total
Live birth; surviving	23.4 (756)	46.1 (181)	47.4 (573)	35.2 (1510)
Live birth; deceased	17.8 (719)	38.0 (51)	38.2 (101)	21.3 (891)
Stillbirth	17.4 (132)	37.4 (11)	35.6 (16)	20.6 (159)
Spontaneous abortion	15.2 (662)	30.5 (73)	36.9 (130)	19.8 (865)

Number of women given in parentheses.

Among contracepting women, those whose last pregnancy ended in a surviving child have longer pregnancy intervals than women whose child died or was stillborn or whose pregnancy ended in a spontaneous abortion. Women whose last pregnancy ended in a currently surviving live birth probably

practice contraception more consistently than do other women. Women whose last child was born alive but subsequently died may cease practicing contraception or practice it less regularly after the child's death. Unfortunately, the available data are not sufficient to investigate these hypotheses further.

C. Breast-feeding

In general, women who breast-fed and breast-fed for extended periods have longer pregnancy intervals than women who did not breast-feed (Table 3). It is not, however, until breast-feeding has continued for at least 21 months that it begins to have a substantial effect on the length of the interval. This result is difficult to interpret. Breast-feeding will delay ovulation, but the longer breast-feeding is practiced, the more likely it is for menstruation to return. By 18 months, most babies will have breast-feeding supplemented by other foods, and such supplementation will increase the probability that the woman will resume ovulation. It may be that causation also runs in the opposite direction; women may continue to breast-feed until breast-feeding is restricted by pregnancy.*

Another puzzling result is that women who do not breast-feed have longer pregnancy intervals than women who breast-feed for short periods. It may be that women who breast-feed for short periods have breast-feeding

*A similar conclusion was reached using data from the National ince Planning survey for Nepal (1976). Data from the survey indicated that up to durations of breast-feeding of 23 months, the length of birth interval does not vary with the length of breast-feeding, but the mean length of the birth interval does increase substantially among women who breast-feed for 24 or more months.

interrupted by pregnancy. Such women may have higher fecundity than women who do not begin to breast-feed.*

Table 3. Mean length (in months) of the last pregnancy interval, by duration of breast-feeding and contraceptive use during the interval. Restricted to women whose last pregnancy resulted in a live birth, child surviving (Iran).

	Contraceptive Use		
Duration of Breast-feeding	No Contraception	Traditional Contraception	Modern Contraception
None	23.4 (756)	46.1 (181)	47.4 (573)
1-3 months	19.8 (440)	45.5 (128)	48.5 (354)
3-5 months	21.1 (692)	41.0 (169)	46.5 (400)
6-8 months	22.1 (519)	40.1 (146)	49.6 (262)
9-11 months	23.2 (478)	44.4 (121)	49.3 (217)
12-14 months	26.3 (932)	44.1 (252)	48.5 (475)
15-17 months	26.5 (378)	45.7 (124)	51.3 (243)
18-20 months	30.7 (432)	49.7 (171)	50.8 (283)
21+ months	39.8 (1744)	57.6 (876)	60.4 (1860)

Number of women given in parentheses.

*Similar analysis was not performed for women whose child had died, since most of these women did not breast-feed. It is interesting to note that 93.1% of the babies that were breast-fed were still alive at the time of the current birth, whereas only 83.1% of the babies that were not breast-fed were still alive.

D. Contraception and Breast-feeding

How does the length of pregnancy intervals of contracepting women compare with that of breast-feeding women? Table 3 makes these comparisons. Women who breast-feed without contracepting have shorter pregnancy intervals than non-breast-feeding women who contracept. Even when women breast-feed for extended periods, pregnancy intervals are still of shorter duration than for contracepting women. For example, women who use no contraception and breast-feed for at least 21 months have an average pregnancy interval of 39.8 months, while women who use modern methods of contraception (but no breast-feeding) have an average interval of 47.4 months. Breast-feeding, it would seem, delays pregnancy, but contraception is more effective in delaying it.

What if women contracept <u>and</u> breast-feed—how do their pregnancy intervals compare with those of women who only contracept? Breast-feeding, when added to contraceptive use, seems to have little impact on length of the pregnancy interval unless it is prolonged. Women who use modern methods of contraception and breast-feed for 21 months or more have pregnancy intervals 13 months longer than women who did not breast-feed (60.4 vs 47.4). But women who breast-feed for shorter durations, say 12-14 months, have pregnancy intervals only 1.1 months longer (48.5 vs 47.4).

If women used contraception throughout the period that they breast-fed, then breast-feeding should not affect the length of the pregnancy interval. But women may delay contraception or cease contraception (presumably when they desire pregnancy) but continue breast-feeding. If such were the case, breast-feeding practices would affect the length of the

pregnancy interval. Since it is only known whether contraception was practiced and not for how long, it is not possible to examine this hypothesis. It does appear, however, that prolonged breast-feeding, when combined with contraception, does extend the length of the pregnancy interval.

The effects of biological and motivational factors on pregnancy intervals may be studied by following an approach suggested by Knodel (1978). The pregnancy interval between the second and third pregnancies is calculated. If the analysis is confined to women whose second pregnancy ended in a live birth of a child still living, then any differences in the length of the pregnancy interval must be attributed to motivation unless there are systematic differences in breast-feeding. There appear to be no systematic differences in breast-feeding; one can derive from Table 3 that of babies that were still living, approximately 90% in each contraception category were breast-fed. Differences in breast-feeding practices may thus be ignored in studying the factors which cause differences in the length of the pregnancy interval.

Table 4 illustrates that outcomes of previous pregnancies are associated with the length of the third pregnancy interval. Women with two living children have pregnancy intervals, on the average, nine months longer than women whose first child died or whose first pregnancy terminated in a stillbirth or spontaneous abortion. This difference is related to variations in contraceptive use. Women who have two living children are more likely to have used contraception in the last pregnancy interval than women whose first pregnancy ended unsuccessfully. Even among contraceptors, women with two children have longer pregnancy intervals than women with one. It may well be that women with only one living child use

contraception for a shorter period or use it more sporadically. Among the non-contraceptors, women with two living children have longer pregnancy intervals than women whose first pregnancy outcome is not surviving, although the differences are not great. It may be that women with only one living child have a higher coital frequency because they are actively trying to have another child.

Whether motivation is an important variable in explaining pregnancy intervals may also be studied by considering women whose second child died. Women whose first child is still alive have longer pregnancy intervals than women whose first child died. The difference (five months) is smaller than that reported when the comparison was for women whose second child was alive. The smaller difference here is related to the generally lower level of contraceptive use and thus, the greater importance of biological factors in affecting the pregnancy interval. Among noncontraceptors, the very short pregnancy intervals reflect the shorter period of postpartum amenorrhea.

Table 4 also shows that the birth order of nonsurviving children makes a difference in contraceptive and reproductive behavior. Women whose first child is not surviving are more likely to contracept than women whose second child is not surviving. Women who have lost a first child and replaced it with a second birth may more readily accept contraception than women who have lost a second child and, consequently, not had time to replace that

child.* Even among contracepting women, those whose first child died have much longer pregnancy intervals than those whose second child died. Some of this difference is undoubtedly related to differences in breast-feeding practice since the likelihood of breast-feeding is, of course, higher when the child survives, but some may be explained by differences in motivation. In fact, differences in pregnancy intervals among noncontraceptors (25.9 - 18.5 = 7.4) are lower than those among contraceptors (47.4 - 34.3 = 13.1). If biological factors were the only important influence once contraceptive use had been controlled, the first difference should be greater than the second. Therefore, these data indicate that motivational factors play an important role in influencing pregnancy intervals even after contraceptive use is controlled.

We may conclude that both the total number and birth order of surviving as compared to remaining children affects both contraceptive use and pregnancy intervals. The greater the number of surviving children, the higher is the probability that the woman contracepted during the last pregnancy interval and the longer is that interval. Order of survival is important in that the probability of having contracepted is higher and the pregnancy interval is longer if the <u>second</u>, rather than the first, child survived.

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*Then too, with average pregnancy spacing of three years, women with an infant may consider delaying pregnancy until the child is older. It is not clear, however, why women whose first pregnancy ended in a stillbirth or spontaneous abortion are more likely to use contraception than women whose first child died. A possible explanation is that some abortions reported as spontaneous were induced and, therefore, some of the first pregnancies were unwanted. Such women may consequently be more interested in family planning and therefore have higher contraceptive use.

Table 4. Mean length (in months) of the third pregnancy interval, by outcome of the two previous pregnancies and contraceptive use during the interval (Iran).

Previous Pregnancy Outcomes	Contraceptive Use: Not Using Contraception	Contraceptive Use: Using Contraception	Total	Percent Using Contraception
Both surviving	29.5 (1106)	51.3 (1534)	42.1 (2460)	55%
Not live birth/ surviving	26.8 (138)	43.3 (95)	33.5 (233)	41%
Infant death/ surviving	25.9 (194)	47.4 (89)	32.6 (283)	31%
Surviving/ infant death	18.5 (119)	34.3 (32)	21.8 (151)	21%
Surviving/ not live birth	14.8 (112)	26.4 (28)	17.2 (140)	20%
Neither surviving	15.8 (112)	33.2 (9)	17.1 (121)	7%

Number of women given in parentheses.

The effect of biological factors may be assessed by looking at pregnancy intervals of non-contraceptors. These intervals vary from nearly 30 months when both children are alive to approximately 15 months when neither is surviving or if the last pregnancy did not result in a live birth. About three months is probably explained by difference in gestation; women with a second baby who died have a mean pregnancy interval of 18.5 months. Much of the remainder is undoubtedly related to breast-feeding, though some of the difference may be explained by motivation for children affecting coital frequency.

Contraception lengthens the pregnancy interval, but its impact is not easy to establish since contraceptive utilization may vary over the pregnancy interval, and the available data do not measure such changes. The data do indicate, however, that, even controlling for previous pregnancy outcomes, contracepting women have pregnancy intervals at least one year longer than noncontracepting women and sometimes almost two years longer.

Results from El Galaa Maternity Hospital, Cairo, Egypt

A. Pregnancy Intervals

As was found among the Iranian women discussed in the previous section, Egyptian women whose last pregnancy resulted in a live birth with the child still surviving have, by far, the longest pregnancy intervals--nearly 32 months, as compared with those among women in the remaining outcome categories (nonsurviving live birth: 20 mo.; stillbirth: 22 mo.; spontaneous abortion: 18 mo.). With the effects of breast-feeding are controlled by excluding women who breast-fed during the interval, the effects of the last pregnancy outcome (separately for contraceptors and non-contraceptors) may be assessed. Table 5 indicates that women whose last pregnancy resulted in a spontaneous abortion are found to have the shortest intervals, most likely explained by the shorter period of postpartum amenorrhea associated with such an outcome. Even if such women used (modern) contraception, the interval was still far shorter than that of contraceptors in any of the other outcome categories. It is, of course, very possible that the contraception practiced by those with successful outcomes was qualitatively and/or quantitatively different than that used by women with unsuccessful

outcomes. Also, it is likely that coital frequency is higher among those who have recently experienced fetal or child loss.

When pregnancy intervals for women who neither breast-fed nor used contraception during the interval are compared according to outcome category, those with surviving live births are still found to have substantially longer intervals than women with full term, but unsuccessful outcomes. This persisting (although smaller) differential indicates that other factors, in addition to breast-feeding and contraception, are involved. As described above, differences in coital frequency may be occurring.

Table 5. Mean Length (in months) of the last pregnancy interval, by outcome of last pregnancy and contraceptive use during the interval, among women not breast-feeding (Egypt).

Last Pregnancy Outcome	Contraceptive Use: No Contraception	Contraceptive Use: Modern Contraception*	Total
Live birth; surviving	24.5 (139)	39.5 (123)	31.5 (262)
Live birth; deceased	17.7 (144)	28.0 (40)	19.9 (184)
Stillbirth	19.2 (92)	36.2 (15)	21.6 (107)
Spontaneous abortion	17.3 (212)	23.5 (24)	17.9 (236)

*Number of women using traditional methods (6) too small to analyze separately.

Number of women given in parentheses.

B. Contraception and Breast-feeding

In Table 6, the joint effects of contraception* and breast-feeding on pregnancy intervals are presented for women whose last pregnancy resulted in a live birth with the child still surviving. As was the case among women delivering in Tehran, contraception without breast-feeding is associated with longer pregnancy intervals than is breast-feeding with no contraception. The only exception is for noncontracepting women who breast-feed for 21 months or longer, whose average pregnancy interval (42 months) is two months greater than for women who contracept only.

For both contraceptors and noncontraceptors alike, breast-feeding has little effect on the length of the pregnancy interval unless it is for an extended duration. Among women not using contraception during the interval, those who breast-fed for a year or less have pregnancy intervals which are the same as (in some cases less than) those for women who did not breast-feed. Those who breast-fed for 21 months or longer, however, had intervals nearly a year and a half longer than women who did not practice breast-feeding (42 months vs 25 months). Corresponding intervals for contraceptors are greater, although the differential between extended breast-feeding and no breast-feeding (52 months vs 40 months) is less than that for noncontraceptors.

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*As virtually no women in the Egyptian data set are reported to have used traditional methods, the quality of the data on contraception is likely to be lower than that from Iran. It is likely that women who have used traditional methods are reported as non-contraceptors rather than modern contraceptors, although this hypothesis cannot be substantiated.

Table 6. Mean length (in months) of the last pregnancy interval, by duration of breast-feeding and contraceptive use during the interval. Restricted to women whose last pregnancy resulted in a live birth, child surviving (Egypt).

Duration of Breast-feeding	Contraceptive Use*	
	No Contraception	Modern Contraception
None	24.5 (139)	39.5 (123)
1-3 months	21.5 (63)	37.4 (92)
3-5 months	20.0 (95)	44.2 (76)
6-8 months	23.3 (206)	40.6 (85)
9-11 months	24.6 (405)	43.8 (201)
12-14 months	26.6 (217)	43.8 (114)
15-17 months	28.9 (232)	43.7 (169)
18-20 months	36.2 (61)	46.9 (47)
21+ months	41.8 (256)	51.9 (221)

*Number of women using traditional methods (26) too small to analyze separately.

Number of women given in parentheses.

To examine the relative effects of motivation and biological factors on the length of the interval, the analysis was next limited to women completing their third pregnancy at the current delivery. For each woman, the outcomes of both previous pregnancies are known, as is the use of

contraception during the interval. For women with two living children, Table 7 shows that almost one half (48%) used contraception during the interval. At the other extreme, only 11% of the women with no surviving children practiced contraception.

The data set for Cairo is smaller than the data set for Tehran, so we were forced to aggregate some of the pregnancy outcome groups. The categories are divided according to survival status and do not take into consideration at what stage the death occurred: during pregnancy, at birth, or after birth.

Table 7 indicates that of women whose second-born child is surviving, those who also have a first surviving child have a longer third pregnancy interval than women whose first child died. Except for contraceptors, however, the differences are not substantial. The data do indicate, however, that women with two survivors are more likely to contracept (48%) than women with one survivor (26%). Among women with two surviving children, pregnancy intervals vary greatly with contraception (43 - 27 = 16 months) but that among women with only one survivor there are very small differences in the length of the interval (32 - 29 = 3 months). It is likely that contraception is practiced for a shorter time period or more sporadically among mothers of deceased as compared to surviving children.

Among women with a nonsurviving <u>second</u> child, differences in the length of the pregnancy interval by outcome of the first are associated with small differences in the length of the pregnancy interval.

Looking next at women who did not practice any contraception during the interval, Table 7 shows that the survival status of the <u>second</u>

pregnancy is the operative variable: women with favorable outcomes have intervals of from 27 to 29 months; those with non-surviving second pregnancy outcomes report intervals of from 19 to 21 months. Women in the latter category, on the average, breast-feed for shorter periods (or not at all) and are likely to feel the motivation for replacement with greater immediacy than women with surviving second pregnancy outcomes.

Among interval contraceptors with a surviving second pregnancy outcome, these data conform to the general pattern reported by Knodel (1978) of shorter third pregnancy intervals to women whose first outcome did not survive. For noncontraceptors, the significant determinant of the length of the interval is the survival status of the second pregnancy. Although there may be motivational differences which are independent of contraceptive practice (eg, coital frequency), we conclude that the differential use of breast-feeding is primarily responsible.

Table 7. Mean length (in months) of the third pregnancy interval, by outcome of the two previous pregnancies and contraceptive use during the interval (Egypt).

Previous Pregnancy Outcomes	Contraceptive Use: Not Using Contraception	Contraceptive Use: Using Contraception	Total	Percent Using Contraception
Both surviving	27.4 (176)	43.0 (161)	34.7 (337)	48%
1st not surviving/ 2nd surviving	29.0 (92)	31.9 (32)	30.1 (124)	26%
1st surviving/ 2nd not surviving	20.9 (51)	24.0 (21)	21.7 (72)	29%
Neither surviving	18.9 (93)	23.0 (12)	19.3 (105)	11%

Number of women given in parentheses.

Results from Khartoum North Hospital, Khartoum, Sudan

A. Pregnancy Intervals

The comparatively small size of the Sudan data set, and the virtual absence of contraception among nonbreast-feeding women, results in a more restricted analysis of pregnancy intervals. In Table 8, longer intervals are reported for women whose last pregnancy resulted in a stillbirth (22.2 months) than for those with a live birth of a child still surviving (17.0 months). This finding is very difficult to interpret, particularly since women in the remaining outcome categories (infant death; spontaneous abortion) have shorter intervals as expected. Unless there is some direct relationship between stillbirth and a mother's subsequent fecundability (eg, endemic disease or nutritional deficiencies), one must assume that there is misreporting of the limited available data.

Although contraceptive use is extremely low (less than 18% said they used a method during the interval), the proportion who breastfed for some period during the interval is extremely high (94% of those with a live birth). Because of these distributions, there are insufficient cases in the Sudan data set to examine pregnancy intervals according to previous outcome or contraceptive status among women who did not breast-feed.

B. Contraception and Breast-feeding

These same factors (a small sample with very few contraceptors) make it difficult to examine the joint effects of contraceptive use and breast-feeding on pregnancy intervals for women with favorable and surviving previous pregnancy outcomes (Table 9). There are insufficient contraceptors

Table 8. Mean length (in months) of the last pregnancy interval, outcome of last last pregnancy and contraceptive use during the interval, among women not breast-feeding (Sudan).

Last Pregnancy Outcome	Contraceptive Use No Contraception*
Live birth; surviving	17.0 (10)
Live birth; deceased	13.7 (6)
Stillbirth	22.2 (12)
Spontaneous abortion	12.2 (19)

*No traditional contraceptors, and number of women using modern methods (5) too small to analyze separately.

Number of women given in parentheses.

who breast-fed for less than six months or for 18 months or longer to study their pregnancy intervals with respect to non-contraceptors. For women who breast-fed for 6 to 14 months, however, the use of contraception is associated with pregnancy intervals anywhere from six to nine months longer than is no contraception. It is of interest to note that no traditional contraception is reported among women delivering at Khartoum North. In contrast with the contraceptive distributions observed of women delivering in maternity hospitals in Cairo and in Tehran, more modern capital cities of countries further along on the continuum of development than the Sudan, such results suggest that the data reported from Khartoum are less reliable than that available from the other two centers.

Table 9. Mean length (in months) of the last pregnancy interval, by duration of breast-feeding and contraceptive use during the interval. Restricted to women whose last pregnancy resulted in a live birth, child surviving (Sudan).

Duration of Breast-feeding	Contraceptive Use**	
	No Contraception	Modern Contraception
None	17.0 (10)	*
1-5 months	*	*
6-8 months	27.9 (13)	34.1 (10)
9-11 months	23.1 (104)	30.1 (15)
12-14 months	23.5 (140)	32.9 (25)
15-17 months	23.4 (63)	23.0 (15)
18-20 months	28.9 (19)	*
21+ months	30.6 (14)	*

*Less than ten cases.
**No traditional contraceptors.

Number of women given in parentheses.

Results from University College Hospital, Ibadan, Nigeria

As the data from Nigeria were collected on an earlier version of the Maternity Record, certain variables relevant to the present analysis are not available. There is, for example, no information on the survival of the previous live birth, nor are there data on breast-feeding or the length of the pregnancy interval. Notwithstanding these limitations, analyses of the factors associated with contraceptive use and fertility and contraceptive intentions have been made and are presented in Part III.

III. Probability Estimates of Previous Contraceptive Use, Reproductive Plans and Contraceptive Intentions

What are the relative effects of pregnancy outcome, contraceptive use, and breast-feeding practices in prolonging the pregnancy interval? To answer this question, a technique of analysis is used which gives information about the relative contribution of each of these three factors in explaining variations in pregnancy intervals. This technique is known as multiple regression analysis.

Consider first the effect of the previous pregnancy outcome (Table 10). Women in Tehran whose last pregnancy ended successfully (a surviving live birth) have the longest pregnancy intervals: five months longer than women whose last child died, six months longer than women with a stillbirth, and eight months longer than women with a spontaneous abortion.* Therefore, even when contraception and breast-feeding practices are taken into consideration, the previous pregnancy outcome still exerts an effect on the pregnancy interval. This may be because motivation for delaying pregnancy cannot be adequately measured by the limited information on contraceptive practices. Motivation may affect not only contraceptive use, but, as discussed above, coital frequency.

As with Iran, the results for Egypt indicate that women whose last pregnancy ended in a surviving live birth have longer pregnancy intervals than women with unsuccessful pregnancy outcomes. However, the differences are smaller than those calculated for the Iranian sample. Women with a

*Live births but not stillbirths or spontaneous abortions have the effect of increasing parity by 1; this must be incorporated in the calculations.

surviving child have pregnancy intervals four months longer than women whose last child died, four months longer than women with a stillbirth, and five months longer than women with a spontaneous abortion.

What effect does breast-feeding have on lengthening the pregnancy interval? The data in Table 2 for Tehran and Table 5 for Cairo indicate that breast-feeding has little effect on the pregnancy interval unless it is prolonged. These results are confirmed by the regression results in Table 10. Women in Tehran who breast-fed for longer periods (21 months or more) have pregnancy intervals over a year longer than women who did not breast-feed or who breast-fed for short periods (less than six months), and women who breast-fed for moderate periods (12-20 months) have pregnancy intervals 4 months longer than women who did not breast-feed or breast-fed for short periods. Breast-feeding for 6 to 11 months is not associated with any increase in the pregnancy interval.

Women in Cairo who breast-fed for at least 21 months also have pregnancy intervals over a year longer than women who did not breast-feed or breast-fed for short periods. In Cairo, however, women who breast-fed for 6-11 months do have longer pregnancy intervals than women who did not breast-feed or who breast-fed for shorter periods. Women who breast-fed for 12-20 months have longer pregnancy intervals than women who did not breast-feed or breast-fed for less than six months.

What impact does contraception have on the length of the pregnancy interval? Earlier tables indicate that the effect is substantial. Contraception has a major impact on prolonging the length of the pregnancy interval. In Tehran, women who use modern contraceptive methods have pregnancy

Table 10. Regression coefficients (unstandardized B values) of included variables with length of the pregnancy interval.

Variable		Iran	Egypt
Urban residence	(vs rural)	.57	-.31
Age		1.14*	1.40*
Some education	(vs none)	.08	.31
Parity		-1.81*	-1.29*
Child loss		.73	-.58*
Breast-fed 6-11 mos.	(vs < 6 mos.)	.24	1.94*
Breast-fed 12-14 mos.		4.16*	3.66*
Breast-fed 15-20 mos.		4.00*	6.05*
Breast-fed 21+ mos.		13.69*	13.18*
Last outcome: live/surviving	(vs sp. abortion)	9.74*	6.43*
Last outcome: live/deceased		4.12*	2.98*
Last outcome: stillbirth		1.98	1.20
Used traditional contraception	(vs none)	16.36*	-
Used modern contraception		22.46*	12.55*
R^2		.46	.32
Number of women		3035**	4018

*Significant at .05 level.
**20% sample

intervals 22 months longer than women who do not contracept, and women who use traditional methods have intervals 16 months longer than women who do not contracept. In Cairo, women who contracept have longer pregnancy intervals than women who do not contracept—a difference of 13 months. Contraceptive use lengthens the pregnancy interval less in Cairo than in

Tehran. This may occur for two reasons. Women may practice contraception for longer periods in Tehran than in Cairo so that contraceptive use has a greater effect in prolonging the interval in Tehran than in Cairo. It may be that users of traditional methods in Cairo are incorrectly reported as noncontraceptors, so that differences in pregnancy intervals between contraceptors and noncontraceptors are underestimated.

Our findings indicate that the longest pregnancy intervals occur to women who have had successful previous outcomes, breast-feed and practice contraception. But these factors are not independent. If a child is not born alive or dies soon after birth, breast-feeding ceases or is never practiced.

Contraceptive practices, too, depend on pregnancy outcome. Table 11 provides data to show that women with successful pregnancy outcomes are more likely to use contraception than women whose last pregnancy ended unsuccessfully.* Women in Tehran whose last pregnancy ended successfully have a probability of having used contraception in the last pregnancy interval .25 higher than women whose last child died, .26 higher than women whose last pregnancy ended in a stillbirth, and .34 higher than women whose last pregnancy ended in a spontaneous abortion. The effect of a successful pregnancy outcome on subsequent contraceptive use is smaller in Cairo than in Tehran. Women in Cairo whose last child survived have a probability approximately .10 higher than women who had unsuccessful pregnancy outcomes. If traditional contraception is incorrectly reported or coded as

*The additive effects of other variables (parity, child loss) must be included in calculations of probability differences.

"not contracepting," then this would explain the smaller effect of pregnancy outcome on contraceptive use in Cairo than in Tehran.

Table 11. Regression coefficients (unstandardized B values) of included variables with contraceptive use during the pregnancy interval.

Variable		Iran	Egypt
Urban residence	(vs rural)	.05	.14*
Age		.01*	.01*
Education 1-4 yrs.	(vs none)	.12*	.09*
Education 5-6 yrs.		.21*	.09*
Education 7+ yrs.		.18*	.17*
Parity		.02*	.02*
Child loss		-.06*	-.02*
Last outcome: live/surviving	(vs sp. abortion)	.32*	.09*
Last outcome: live/deceased		.13*	.01
Last outcome: stillbirth		.08	.02
R^2		.09	.07
Number of women		2655	3989

*Significant at .05 level.

These results indicate that a program to reduce mortality would play an important role in lengthening pregnancy intervals. First, a reduction in mortality increases the likelihood that women will adopt contraception. Second, women whose last pregnancy ends in other than a live birth do not breast-feed, and children who die in infancy are breast-fed for shorter periods than children who survive. Third, the regression results support a

direct effect of pregnancy outcome on the length of the subsequent pregnancy interval, even controlling for breast-feeding patterns and contraceptive use. In the following section, we discuss the quantitative importance of these three factors.

In Tehran, adoption of contraception increases the pregnancy interval by 22 and 16 months for women using modern and traditional contraceptive methods, respectively. Weighting by the distribution by method (2/3 used modern and 1/3 traditional methods) would result in an increase in the interval due to contraception of 20 months. Confining the comparison to women whose last pregnancy ended in a live birth, if the child survived the pregnancy interval will be increased by the product of the difference in contraceptive use by survival status times the difference in the length of the pregnancy interval by contraceptive use. In Iran, the difference in contraceptive use according to survival status has been shown to be .25, which, when multiplied by 20 months (the increase in the interval as a result of contraception) yields an additional five months through increased contraception. In Cairo, the pregnancy interval is lengthened by only 1 month if the child survived (difference in contraceptive use by survival status times the difference in pregnancy interval by contraceptive status = .10 x 13 months).

Consider next the effect of breast-feeding in lengthening the pregnancy interval. Two factors must be taken into account. First, there is a difference in the probability that surviving children were breast-fed compared to those who died. Second, for children who survive, breast-feeding lengthens the pregnancy interval. In Tehran, 88 percent of the surviving children (from the penultimate pregnancy) were breast-fed, while only 26

percent of those who died were breast-fed. Among surviving children, 13 percent were breast-fed for 12-14 months, 12 percent breastfed for 15-20 months, and 34 percent breast-fed for 21 months or longer. The corresponding distribution among non-surviving children is one percent breast-fed for 12-14 and for 15-20 months, and three percent breast-fed for 21 months or longer. Breast-feeding durations of less than 12 months were found not to have a significant effect on the length of the pregnancy interval (Table 10). The effect of breast-feeding on increasing the length of the pregnancy interval is calculated as the summation of the proportional difference between survivors and non-survivors in each breast-feeding category multiplied by the duration-specific increase in the interval due to breast-feeding. For women in Tehran, the total increase is (.13 - .01) x 4.16 months plus (.12 - .01) x 4.00 months plus (.34 - .03) x 13.69 months, or 5.18 months.

In Cairo, breast-feeding has a significant effect on the length of the pregnancy interval when it extends for six or more months (Table 10). A slightly higher proportion than in Tehran said they breast-fed their last live birth (86% versus 79%), though women in Cairo were only one half as likely to have breast-fed for 21 months or longer (16% versus 30%). Part of the explanation for these differences may be explained by the finding that over two thirds (68%) of the <u>non-surviving</u> children were breast-fed in Cairo, as compared with only 26 percent in Tehran. Adjusting for the relative childhood survival distributions at each breast-feeding duration category, we calculate that breast-feeding increases the pregnancy interval by (.32 - .24) x 1.94 months plus (.12 - .04) x 3.66 months plus (.18 - .07) x 6.05 months plus (.17 - .08) x 13.18 months, for a total of 2.30 months.

Lastly, the direct effect of a successful penultimate pregnancy outcome increases the subsequent pregnancy interval by five months in Tehran. The total effect of improved survival is thus 15 months: five months resulting from the adoption of contraception, five months from increased breast-feeding, and five months as the direct effect of a successful previous outcome. In Cairo, the sum of the three effects is seven months--less than half of the increase noted in Tehran. The increase resulting from the adoption of contraception in Cairo is (only) one month; the effect of increased breast-feeding is two months, and the direct effect of a successful penultimate outcome is four months. Reductions in infant and child mortality will thus have a greater impact in Tehran than in Cairo.

The next section considers the effect of pregnancy outcome on both the desire for additional children and on contraceptive plans (Tables 12 and 13). In both Tehran and Cairo, the more recent pregnancies are found to have a greater impact on the desire for additional children and on contraceptive plans than do earlier pregnancies. In Tehran, for example, a woman whose last two pregnancies (including the current delivery) are surviving live births has a probability of wanting to have more children which is .44 less than that of a woman with no surviving children from the last two pregnancies. If only one of the last two children died, then the probability of wanting additional children is higher than that of a women who has two surviving children but lower than that of a woman whose last two children died.

Table 12. Regression coefficients (unstandardized B values) of included variables with the desire for additional children.

Variable		Iran	Egypt
Urban residence	(vs rural)	.08*	-.09*
Age		-.01*	-.01*
Education 1-4 yrs.	(vs none)	-.05	-.04
Education 5-6 yrs.		-.09*	-.05*
Education 7+ yrs.		-.13*	-.05*
Parity		-.09*	-.06*
Child loss		.08*	.02*
Last outcome: live/surviving	(vs sp. abortion)	-.15*	-.17*
Last outcome: live/deceased		.04	-.02
Last outcome: stillbirth		-.02	-.03
Current outcome: not surviving	(vs surviving)	.17*	.08*
R^2		.16	.19
Number of women		2655	3989

*Significant at .05 level.

Table 13. Regression coefficients (unstandardized B values) of included variables with planned contraceptive use.

Variable		Iran	Egypt
Urban residence	(vs rural)	-.00	.04*
Age		-.00*	-.00
Education 1-4 yrs.	(vs none)	.05*	.01
Education 5-6 yrs.		.04*	.02
Education 7+ yrs.		.08*	.06*
Parity		.01*	.01*
Child loss		-.01	-.01
Last outcome: live/surviving	(vs sp. abortion)	-.02	.02
Last outcome: live/deceased		-.08*	-.01
Last outcome: stillbirth		.05	.01
Used traditional contraception	(vs none)	.07*	-
Used modern contraception		.08*	.07*
Current outcome: not surviving	(vs surviving)	-.16*	-.07*
Wants additional children	(vs no additional)	-.23*	-.49*
R^2		.23	.33
Number of women		2655	3989

*Significant at .05 level

For Cairo, the data indicate that the difference in the desire for additional children between women whose last two children survived and whose last two children died is lower than that in Tehran. The difference in the probability of wanting additional children between these groups is .25 as compared to .44 in Tehran. Infant or child mortality (particularly the survival status of the outcome of the current delivery) has a smaller impact on the desire for additional children in Cairo than in Tehran.

Contraceptive plans are dependent on whether the woman wants additional children. Women who want additional children are less likely to plan to use contraception than women who do not want any additional children. Among women in Tehran, the results indicate that those who want no additional children are .23 more likely to plan to use contraception than are women who want future births. In Cairo, the difference between these two groups is much greater. Women who want no more children have a probability of planning to contracept .49 above that of women who do plan to have additional children.

Since mortality experience affects the probability of wanting additional children, it has an indirect effect on contraceptive plans. The results in the last section indicate that, among women in Tehran who have lost <u>one</u> child, the probability of wanting additional children rises by .27 if the penultimate child is not surviving, and by .17 if the current pregnancy has ended in a death. Such an increase would reduce the probability that a woman plans to use contraception by the increase in the probability that a woman wants additional children times the effect of wanting additional children on contraceptive plans. This effect is equal to (.17) x

(.23), or .04 if the current pregnancy ended in a death, and (.27) x (.23), or .06 if the penultimate pregnancy ended in a death of a child.

Among women in Cairo, the corresponding effect of mortality on contraceptive plans if the last child died is .08 (the increase in the desire for children if the last child has died) multiplied by .49 (the increase in the probability that a woman will plan to contracept if she wants no more children compared to the case in which she wants additional children), which equals .04. The comparable effect for the case in which the penultimate child dies is (.17) x (.49), or .08. Thus, although in Cairo the effect of mortality on plans for additional children is smaller than in Tehran, the impact of the desire for additional children on contraceptive plans is so much greater that the impact of a change in mortality on contraceptive plans is about equal in the two areas.

Mortality has a second effect on contraceptive plans. Even when plans for additional children are taken into consideration, mortality experience still has an effect on contraceptive plans. Women who have already lost a child may expect to lose additional children. Because of this, their desire for additional births is likely to exceed their desire for additional children; they hedge against future mortality loss by planning extra, compensating, births. In addition, spacing considerations may affect contraceptive plans. Women whose last pregnancies have (just) ended unsuccessfully (even though they may not want any more additional children than women whose last baby survived) may want to become pregnant immediately or in the near future, whereas women whose last baby survived are more likely to want to delay pregnancy.

The results indicate that women who have lost a child (and who want more children) are less likely to plan to use contraception than women who have not experienced child loss, implying that these women are hedging against future child losses. Among them, women who have lost their last child are less likely to plan to use contraception than those who lost their penultimate child.

In Tehran, the probability that a woman will plan to contracept if the last child (result of the current delivery) has died is .16 lower than that of a woman whose last child is surviving. The corresponding difference for the penultimate child is .07. Spacing considerations would appear to be the dominant factor in affecting contraceptive plans. Adding the direct and indirect effects together, one arrives at a probability difference of .20 (.16 plus .04) in planned contraception according to the survival status of the current pregnancy, and a difference of .13 (.07 plus .06) according to the survival status of the penultimate pregnancy.

The greater impact on contraception plans caused by the death of the current as compared to the penultimate child is probably an indication of the importance of spacing considerations in affecting contraceptive plans. The results are in general agreement with the results on reported contraceptive use during the last pregnancy interval, particularly if we consider the death of the current rather than the penultimate child.

In the regression on contraceptive use during the interval for Iranian women, the effect of penultimate child survival was to raise the probability of use by .25. For these same women, the regression on contraceptive plans indicate that current child survival has an impact of .20.

In Cairo, the probability that a woman will plan to contracept if the last child died is .07 below that of a woman whose last child survived. The corresponding difference for the penultimate child is .04. As with Tehran, spacing considerations appear to be the dominant factor. Adding the direct and indirect effects, we get a probability difference of .11 according to the survival status of the current pregnancy (.07 plus .04), and a difference of .12 according to that of the penultimate pregnancy (.04 plus .08).

As with the results for Tehran, results for Cairo on the impact of child survival on plans are in general agreement with the results of mortality on actual use. In the regression on contraceptive use during the interval, the effect of having a child survive was to raise contraceptive use by .10. The regression on contraceptive plans indicates that the outcome of the current pregnancy has an impact of .11. The results therefore indicate that child mortality affects both past and planned contraceptive use, but that the impact of mortality on both actual and planned use of contraception is much greater in Tehran than in Cairo.

Conclusion. These results indicate that a reduction in child mortality may have a substantial impact in increasing the proportion of women who use contraception. These Iranian and Egyptian women are of low socioeconomic background and have had no or very little education. Many of them, however, practiced contraception during the last pregnancy interval (50% in Tehran and 37% in Cairo), and many more indicate that they want to use some method of family planning. One important reason why many women did not previously contracept or do not plan to contracept is due to the fact that one or more of their children have died. If the probability of a

spontaneous abortion or stillbirth were reduced and the survival prospects for infants improved, then contraceptive use would increase. Programs to improve maternal and child health should therefore be effective in increasing contraceptive use.

Statistical Analysis: Sudan

Our initial intent was to perform similar analyses using data from the Khartoum North Hospital in Khartoum, Sudan. However, it soon became apparent that the quality of the data was too poor to allow further data analyses. Some of the deficiencies in the data have already been pointed out in an earlier section, and we merely summarize them here.

1. The level of infant and childhood mortality (calculated from reported data on parity and living children) is much lower than for the other three hospitals, indicating underreporting of infant and child deaths. Since the analyses are mainly concerned with the relationship of child survival to child desires and contraceptive use, this finding indicates that regression results would be unreliable. Therefore, such an analysis is not presented.

2. No women are reported to be using traditional methods of contraception. While this deficiency is not as severe as the first, it does indicate that there would be some problems in interpreting results of a regression analyses.

Statistical Analysis: Nigeria

Use of Contraception During the Pregnancy Interval. The variable that has the strongest impact on previous contraceptive use among women in the Nigeria data set is education. The effect is particularly strong at the upper end of the educational distribution. The probability that a woman with seven to 12 years of education used contraception in the last pregnancy interval is 22% above a woman with no education, and the probability that a woman with more than 12 years of education used contraception is 39% above that of a woman with no education.

A woman's prior reproductive history exerts the expected effects on the probability that she used contraception. The higher a woman's parity and the lower the number of infant and child deaths, the greater the probability that she used contraception in the last pregnancy interval. Each additional birth increases the probability that she used contraceptives by 4.1%. Each infant death decreases it by 4.6% and each child death by 6.7%. The effects of infant and child mortality on prior use of contraception are thus somewhat stronger than that of parity.

Unfortunately, the information available for the penultimate pregnancy is limited. All that is known is whether a child was born alive or whether the pregnancy ended with a stillbirth or a spontaneous abortion. It is not known if a live-born child is still alive. The results do indicate, however, that a woman whose last pregnancy ended in a live birth has a probability 3.4% higher of having contracepted in the last pregnancy interval than a woman whose last pregnancy ended in a stillbirth or spontaneous abortion.

Desire for Additional Children. The desire for additional children is strongly influenced by the woman's level of education. The probability that a woman with seven to 12 years of education wants additional children is 7% below that of women with no education.

Higher parity women are less likely to want additional children than women with fewer live births. Each additional birth reduces the probability that a woman will want additional children by 12%. On the other hand, women who have had children that have died are more likely to want additional children than women who have not had a child die. Each infant death increases the probability that a woman wants additional children by 6.7% and each child death increases it by 6.2%. Thus, a reduction in infant and child mortality would decrease the proportion of women who want additional children.

If the penultimate child was born alive, the probability that a woman wants additional children is 7.3% less than if the pregnancy ended unsuccessfully. This gives the unexpected result that a later live birth has a smaller negative effect on the probability of wanting additional children than does an earlier one. Why this should be so is not at all clear.

If the current pregnancy outcome is unsuccessful, the probability that a woman wants additional children is 8.7% higher than if the outcome is a surviving live birth.

Planned Contraceptive Use. The effect of education on contraceptive plans is smaller than its influence on past contraceptive use, but the direction of the effect is the same. Not until education reaches seven

years or more does it affect the probability that women will plan to use contraception. Further increases in education, as compared to the results for actual contraceptive use, do not increase the probability that a woman plans to use contraception. Women with at least seven years of education are 7% more likely to plan to contracept than are women with no schooling. As expected, women who want more children are much less likely to plan to use contraception than women who want no more children. The difference in probabilities is 19%.

In addition, women for whom the current pregnancy does not end in a live birth are 20% less likely to plan to use contraception than women whose pregnancy ended in a live birth (and the child was still alive when she left the hospital).

These results may indicate one or both of the following. First, women hedge by having extra births because they anticipate childhood mortality, and this effect is stronger for women who have already suffered child loss. Second, many women use contraception not only to limit, but also to space their pregnancies.

Women who have lost their last born child are more likely to want a child right now than women whose last child is still alive. Women whose last child has died will consequently be less likely to use contraception than women whose last child survived, even if family size goals are the same.

Women who have used contraception in the past are more likely to plan to contracept than women who have never practiced contraception. The type of contraception used previously makes little difference in current plans,

since women who used traditional contraceptives are only slightly less likely to plan to contracept than women who used modern contraceptives.

Contraceptive Use and Plans Among Women with Exactly One Previous Pregnancy: Because of limited information in the Nigerian data set on the outcome Because of limited information in the Nigerian data set on the outcome of the penultimate pregnancy, separate analysis was performed on a subset of women whose penultimate pregnancy outcome was known. This group is composed of 448 women who had had exactly one pregnancy previous to the current delivery. This pregnancy may have ended in a surviving live birth (74.6%), a nonsurviving live birth (6.9%), or a stillbirth or spontaneous abortion (18.5%).

The average age of these women is just under 25 years. Thirty percent have had no education; the remaining women are equally divided among those with one to six years, seven to twelve years, and over twelve years of education. As compared to the overall data set of Nigerian women from which this subset was drawn, women with exactly one previous pregnancy are younger and better-educated.

During the pregnancy interval antecedent to the current delivery, 15% of the women reported using contraception at some time: 11% used pills or IUDs, and 4% used (only) traditional methods. Of the current deliveries, 4.7% resulted in stillbirths or neonatal deaths (spontaneous abortions are excluded). Almost all of the women (98%) want more children, although 61% say they plan to use contraception. It is clear, at least for low parity women, that contraception is used almost entirely to space rather than to limit births.

Contraceptive Use. The only two important factors influencing contraceptive use during the interval for such women are education and previous pregnancy outcome. Not until a woman has at least seven years of education does education affect contraceptive use. Women with seven to 12 years of education have a 10% higher probability of having used contraception than women with no education, and women with more than 12 years of education have a 30% higher probability of having used contraception than women with no education. (The probability for women with one to six years of education is not significantly different from that for women with no education.)

Women with a living child are 11% more likely to have used contraception than women whose child died or whose first pregnancy ended in a stillbirth or spontaneous abortion. Since virtually all the women want additional children, it may be concluded that these women used contraception for spacing purposes and not the limitation of births.

Contraceptive Plans. The most important variables affecting contraceptive plans are education, previous pregnancy outcome, past contraceptive use, and the desire for additional children.

If the first-born child is still alive, the mother is more likely to plan to use contraception. However, the outcome of the second (current) pregnancy has a much greater impact on contraceptive plans. These results indicate that spacing is an important motive for using contraception. An alternative explanation is that women whose children have died or whose pregnancies have ended unsuccessfully expect more deaths in the future and compensate by delaying contraception until they have had sufficient births

to realize their family size goals on the expectation that some additional children will not survive.

IV. Additional Analysis According to the Number of Previous Pregnancies (Tehran; Cairo)

The next step in the analysis was to disaggregate the data according to the number of previous pregnancies, and examine the effects of pregnancy outcome on contraceptive use, both current and planned, and the desire for additional children.

Tehran. Table 14 presents information on the background characteristics of women delivering babies at Queen Farah Hospital, Tehran. Women who have had more pregnancies are older and less educated than women with fewer pregnancies. Past use of contraceptives is directly associated with gravidity, as are contraceptive plans though the latter association is weak. The percentage of women who have lost a child, either through fetal loss or a child or infant death, rises with gravidity. However, the probability of having at least one surviving child increases with gravidity so that of women who have had one pregnancy, only 87% have a living child as compared with 99% for women with three pregnancies.

Previous Contraceptive Use

Child survival. Differences in the outcome of previous pregnancies have a significant effect on the probability that a woman contracepted during the last pregnancy interval. Pregnancy outcomes are divided into groups based on the number of surviving children and order of survival. Previous pregnancies may have ended in stillbirths or spontaneous abortions, or live born infants may not be alive at the time of the most recent delivery. Order of survival is distinguished according to whether the last

Table 14. Demographic and social characteristics of women delivering babies at Farah Hospital in Tehran, Iran, by previous number of pregnancies.

Characteristic	Previous Pregnancies 1	2	3
Proportion previously contracepting	.39	.50	.57
Proportion desiring additional children	.54	.39	.25
Mean number of additional children desired[1]	.70	.39	.21
Proportion planning to contracept	.86	.90	.93
Previous pregnancy outcomes[2]			
Proportion of women with:			
All children living	.87	.72	.60
One living child, one dead child; last child alive	-	.15	-
One living child, one dead child; last child dead	-	.09	-
Two living children, one dead child; last child alive	-	-	.22
Two living children, one dead child; last child dead	-	-	.08
One living child, two dead children; last child alive	-	-	.04
One living child, two dead children; last child dead	-	-	.04
All children dead	.13	.04	.01
Current pregnancy outcome:			
Proportion resulting in neonatal death	.02	.02	.02
Mean Age	21.0	23.4	26.1
Percentage with some education	.42	.32	.26
Proportion of all previous pregnancies that resulted in a living son	.45	.48	.49
Proportion of all pregnancies that resulted in a living son	.52	.50	.50
Number of women	3671	2950	2212

[1]Women desiring additional children but uncertain of the actual number were excluded in this case, therefore: N = 2935, 2420, 1901

[2]Within the category "dead child," the following are included: (1) a live-born child that subsequently died; (2) a stillbirth; and (3) a spontaneous abortion.

pregnancy (prior to the current one) ended in a death and the number of nonsurviving previous outcomes. Outcomes for all but the last pregnancy therefore are divided into categories based on the number surviving but not the order of survival (Table 15).

Table 15. Regression coefficients of previous pregnancy outcome and other variables on contraceptive use in the preceding pregnancy interval for women delivering babies at Farah Hospital in Tehran, Iran.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome			
All children living	.32*	.42*	.36*
One child dead; last child alive	-	.23*	.28*
One child dead; last child dead	-	.06	.09
Two children dead; last child alive	-	-	.14
Two children dead; last child dead	-	-	.00
(excluded category is all children dead)			
Education			
1-4 years	.15*	.19*	.18*
5-6 years	.22*	.21*	.15*
>7 years	.17*	.12*	.19*
(excluded category is zero years of education)			
Age	.02*	.02*	.02*
Urban residence	.07*	.06	.04
Proportion of pregnancies resulting in a living son	.04*	.05*	.13*
Constant	-.53	-.32	-.29
Adjusted R^2	.13	.13	.10
Number of women	3671	2950	2212

*Significant at the .05 level.

Considering first women who have had exactly one previous pregnancy, we find that women with a surviving child have a probability 32% above that of women without a surviving child of having contracepted during the interval between pregnancies. The adjusted rate* of contraceptive use is 0.11 (or 11%) if the woman does not have a surviving child and 0.43 if she has a surviving child. For women with two previous pregnancies, the adjusted probability that a woman contracepted during the last pregnancy interval varies as follows:

Two surviving children	.56
First child dead, second alive	.37
First child alive, second dead	.20
No surviving children	.14

Not only is the number of children a factor influencing contraceptive use but also the order of survival influences past contraceptive behavior. Of women with two previous pregnancies but one surviving child, those whose second child is alive are much more likely to have contracepted than women whose first child is still alive. Women with two living children are the most likely (and those with none, the least likely) to have contracepted during the closed interval.

*The results of multiple regression may be described not only in terms of regression coefficients but also in terms of "adjusted rates of contraceptive use." There is an adjusted rate of contraceptive use corresponding to every dummy variable. Each adjusted rate is interpreted as an estimate of what contraceptive use would have been had these women been "average" in terms of all other sets of dummy and continuous variables in the multiple regression. Thus, in the following example, the net regression coefficients for all sets of variables except previous pregnancy outcome are used to standardize the rate of contraceptive use. Then, adjusted rates of contraceptive use by pregnancy outcome for women who are average with respect to all other variables can be compared. The procedure used to calculate these rates is described in Bowen and Finegan (1969).

It is likely that considerations regarding the spacing of children account, at least in part, for these results. Women with one surviving child may want the same number of additional children, no matter what the order of survival, but women whose second child died may want a child sooner than women whose first child died. Earlier results indicated that the length of the last pregnancy interval was dependent on the outcome of the last pregnancy. Women with a second child alive had a pregnancy interval approximately ten months longer than women whose first child was alive. For both interval contraceptors and non-contraceptors, the pregnancy interval was longer for those women whose second child was alive.

Among women with three pregnancies, the adjusted probability of having contracepted during the last pregnancy interval is as follows:

3 surviving children	.63
2 surviving children and last is still alive	.55
2 surviving children and last is not alive	.36
1 surviving child and last is still alive	.41
1 surviving child and last is not alive	.27
No surviving children	.27

Both the number of surviving children and the order of survival affect contraceptive use. Among women at least one of whose children have died, differences in the number of surviving children do not result in large variations in contraceptive use. For such women, the number of surviving children is not important in affecting contraceptive behavior. When the last child is still alive, the probability of having contracepted during the last interval is higher, and there are larger differences associated with number of surviving children than when the last child has not survived. The results therefore do indicate a tendency for contraceptive use to increase with the number of surviving children.

Holding constant the number of surviving children, women whose last child is still alive are more likely to have contracepted than women whose last child has died. It appears that spacing considerations are important in affecting the decision to contracept.

Putting aside these subtleties, the outstanding result is that gravidity three women who are fortunate enough to have had all their children survive have a probability .36 above that of women whose children all have died of having contracepted (.63-.27). Clearly, at least in the crudest sense, mortality reduction can increase contraceptive use.

Sex Composition. Not only does the number and order of successful pregnancy outcomes affect contraceptive use, but also the preference for sons is important in affecting contraceptive use.

We measure sex composition as the percentage of women with some given number of living sons. If women desire sons more than daughters, or at least wish to reach some target number of sons, then increases in the proportion of women who have some given number of sons should increase the use of contraception.*

For women who have had exactly one pregnancy, the value of sons = .45. This corresponds to a sex ratio of .52 (.45/.87) since only 87% of the

*This measure is used in preference to a series of categorical variables that measure the number of sons or the sex distribution of a family because it is necessary to include a category "no living sons." Inclusion of this category is impossible since this is a category in the pregnancy outcome variable. If included here, linear dependence would result. The measure actually used suffers from the deficiency that the variable, sons, is not strictly continuous since children come in discrete units. Also, there may be nonlinearities in the effect of changing numbers of male children on the use of contraception.

women have a living child. If this child is a boy, then the mother's likelihood of having contracepted is .04 higher than that of a woman who did not have a surviving son (the probability of having contracepted would be .41 if she had a boy and .37 if she did not have a boy). Of women who have had two pregnancies, the probability of having contracepted during the last pregnancy interval is as follows:

2 sons	.53
1 son	.50
No sons	.47

Lastly, for those with three pregnancies, the probability of having contracepted in the last pregnancy interval is as follows:

3 sons	.63
2 sons	.59
1 son	.54
No sons	.50

Within gravidity categories, an increase in the number of sons increases the probability that the woman contracepted during the last pregnancy interval.

Clearly, the desire for additional sons is a factor depressing contraceptive use. Consequently, women who have been "successful" in having sons are more likely to have contracepted than women who have fewer or no sons.

Other variables. Women with some education are more likely to have contracepted than women with no education, but among women who have some education, there is no consistent relationship between education and contraceptive use.

Women in urban areas are more likely to have contracepted than women in rural areas, but this variable is statistically significant only for women with one or two previous pregnancies.

Older women are more likely to have contracepted than younger women, and the effect of age is stronger for women with one previous pregnancy than for women with two or three. For women with one pregnancy, each additional year of age raises the probability that a woman contracepted by .022, so a difference in age of ten years implies a difference in contraceptive use of .22. At higher gravidities, each additional year of age raises the probability of having contracepted by .015, so a difference in age of ten years implies a difference of .15 in the probability of having contracepted.

Desire for Additional Children

Child survival. Previous pregnancy outcome has a very strong effect on the desire for additional children. Regressions were computed for three gravidity groups: 2, 3 and 4. These are done using the same groups as for the previous series of regressions, but now women at gravidity 1 are asked about their plans following the second birth, and so on (Table 16).

The pregnancy classification for the first n-1 pregnancies is the same as that used in the "past contraceptive use" regressions, but an additional variable is added to measure the outcome of the current pregnancy. Consider first women who have had exactly two pregnancies. The adjusted

Table 16. Regression coefficients of previous and current pregnancy outcome and other variables on the desire for additional children for women delivering babies at Farah Hospital in Tehran, Iran.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome			
All children living	-.36*	-.48*	-.35*
One child dead; last child alive	-	-.31*	-.23*
One child dead; last child dead	-	-.21*	-.22*
Two children dead; last child alive	-	-	-.07
Two children dead; last child dead	-	-	-.07
(excluded category is all children dead)			
Current pregnancy outcome:			
Baby died	.16*	.19*	.15*
Education			
1-4 years	-.14*	-.03	-.11*
5-6 years	-.11*	-.04	-.07*
>7 years	-.13*	-.13*	-.11*
(excluded category is zero years of education)			
Age	-.01*	-.01*	-.01*
Urban residence	.05	.08*	.07
Proportion of pregnancies resulting in a living son	-.05*	-.10*	-.15*
Constant	1.09	.95	.73
Adjusted R^2	.10	.10	.07
Number of women	3671	2950	2212

*Significant at the .05 level.

probability that a woman wants at least one additional child varies as follows:

Both children alive	.49
First alive, second dead	.65
First dead, second alive	.85
Both dead	1.01*

As the number of living children increases, the probability that a woman wants additional children falls. But of women with one living child, those whose first child is living are less likely to want additional children than women whose second child is living. It is not clear why the order of death should affect the desire for additional children.

Consider next women with exactly three pregnancies. The probability that a woman wants at least one additional child is as follows:

All three alive	.42
Two alive, one dead	.48 to .58
One alive, two dead	.68 to .80
All three dead	.99

Clearly, the strongest effect is that of survival. The greater the number of surviving children, the less likely is the woman to want additional children. This effect is strong and consistent irrespective of the order of survival. There are variations associated with order of survival, but there is no consistent relationship between order of survival and the probability of wanting additional children.

*This was the only instance in which the predicted probability fell outside the 0-1 range, and indicates a shortcoming of the regression procedure (see Appendix B).

Last, consider women who have had four pregnancies. The probability that a woman wants some additional children varies as follows:

All four alive	.18
Three alive, one dead	.30 to .34
Two alive, two dead	.46 to .47
One alive, three dead but last alive	.53
One alive, three dead but last dead	.62
All four dead	.69

There are clear differences in the probability that a woman wants at least one additional child by the number of surviving children. An increase in the number of surviving children decreases the probability that a woman wants additional children. Order of survival has almost no effect on the probability that the mother wants additional children except in the case in which only one of the four children is alive.

Considering all three gravidity groups, it is clear that an increase in the number of surviving children decreases the probability that a woman wants additional children. The order of survivorship, however, appears to have no systematic effect on the desire for additional children. Women do attempt to replace children who have died (later regressions will determine if replacement is total or partial), but the replacement effect is not related to order of survivorship. For women at higher parities, where women were close to reaching or at their desired family size, it has been hypothesized that the death of the last child would have a larger impact on the desire for additional children than the death of earlier children. Earlier deaths could have already been made up. But the analysis does not support the hypothesis that the death of the last child has a greater effect on the desire for additional children than earlier deaths.

Sex Composition. The sons variable used is the same for regressions on the past use of contraception except that the variable is constructed using information through the outcome of the current pregnancy. For women with two pregnancies, the probability of wanting additional children is as follows:

2 sons	.51
1 son	.54
No sons	.57

An increase in the number of sons decreases the probability that a woman wants additional children such that an increase in the number of sons by one decreases the probability that a woman wants additional children by .03, or 3%.

Of women with three pregnancies, the probability of wanting at least one additional child varies as follows:

3 sons	.33
2 sons	.37
1 son	.40
No sons	.44

Having one additional son decreases the probability that a woman wants additional children by approximately .04, or 4%.

Consider next women with four pregnancies. The probability that a woman wants additional children varies as follows:

4 sons	.18
3 sons	.22
2 sons	.26
1 son	.30
No sons	.34

Each additional son decreases the probability that a woman wants additional children by .04, or 4%.

The effect of having an additional son on the probability that a woman wants additional children varies very little by the number of pregnancies:

Two pregnancies	.03
Three pregnancies	.04
Four pregnancies	.04

It therefore would appear that it is the number of sons, independent of the number of daughters, that affects the demand for additional children. Women who have no sons or few sons are more likely to want to have additional children than women who have many sons.

Education. In general, women who have some education are less likely to want additional children than women who have no education. But there are no consistent differences in desire for additional children by education for women who have some education. Moreover, among women who have had two previous pregnancies, education does not exert a negative effect on the desire for additional children until education has reached at least seven years.

Age and Residence. The older the woman, the less likely she is to want additional children. Urban women are more likely to want additional children than rural women. The latter result is unexpected, although the aggregation of slum and nonslum areas within the urban/rural residence categories may obscure any actual differences.

Number of Additional Children Wanted*

The next series of regressions considers the number of additional children women wanted. Some women who want additional children were unable to say how many additional children they wanted, and such women are excluded from the regressions (Table 17). In addition, since the code for such an answer was (8), any woman who actually wanted eight (or more) additional children has been excluded from the regressions. This latter problem does not appear to be serious since there are few women who want a large number of additional children.

Child survival. For women who have completed two pregnancies, the number of additional children varies as follows:

Both children alive	.57
First alive, second dead	.91
First dead, second alive	1.56
Both dead	1.90

Women who have had two children who have died want more additional children than women whose children all survived or one of whose children survived. However, only if it is the first child who has died do the results imply complete replacement. The death of the most recent child has a smaller impact on the number of additional children wanted. Why this should be so is not clear.

*Since all women did not answer this question, the analysis in this section is based on a nonrandom sample of women.

Consider next women with three pregnancies. The number of additional children desired varies as follows:

Three living children	.26
Two alive, one dead	.57 to .63
One alive, two dead but last dead	.90 to .94
One alive, two dead but last alive	1.55
All three dead	1.86

Table 17. Regression coefficients of previous and current pregnancy outcome and other variables on the actual number of additional children desired for women delivering babies at Farah Hospital in Tehran, Iran.**

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome:			
All children living	-.99*	-1.29*	-.72*
One child dead; last child alive	-	-.96*	-.58*
One child dead; last child dead	-	-.92*	-.60*
Two children dead; last child alive	-	-	-.26
Two children dead; last child dead	-	-	-.30*
(excluded category is all children dead)			
Current pregnancy outcome:			
Baby died	.34*	.31*	.19*
Education			
1-4 years	-.16*	.04	-.07
5-6 years	-.17*	.00	-.07
>7 years	-.20*	-.15*	-.06
(excluded category is zero years of education)			
Age	-.02*	-.02*	-.01*
Urban residence	.11	.08	.03
Proportion of pregnancies resulting in a living son	.13*	.11*	.10*
Constant	2.01	1.90	1.18
Adjusted R^2	.15	.14	.06
Number of women	2935	2420	1901

*Signicant at the .05 level.
**Women that reported desiring additional children, but were uncertain of the actual number were excluded.

As the number of living chilren increases, the number of additional children desired falls. But one additional nonsurviving child is generally associated with an increase in the desire for additional children of less than one. The only exception is in the difference between families with one as compared with two living children and the last child is alive. Moreover, order of death sometimes but not always affects the number of additional children wanted.

Among women with four pregnancies, the number of additional children desired varies as follows:

Four living children	.12
Three alive, one dead	.25 to .32
Two alive, two dead	.44 to .58
One alive, three dead	.73 to..84
All dead	1.04

As the number of living children increases, the desire for additional children falls, but differences in the number of surviving children are associated with much smaller differences in the desire for additional children. Order of survival makes little difference in the number of additional children desired for such women.

These results suggest that an increase in the number of surviving children increases the number of additional children desired, but there is usually less than full replacement. If mortality were to fall, these results imply that births would also fall, but the decline in births would be smaller than the fall in deaths and population growth would rise.

Sex Composition and Other Variables. At all gravidities, an increase in the number of sons decreases the number of additional children wanted, but the effect is small.

The effects of other variables--age, residence and education--are similar to those reported for regressions in which the dependent variable was the desire for at least one additional child.

Contraceptive Plans

The variable of greatest significance in affecting contraceptive plans is the desire for additional children. Women who want additional children are considerably less likely to plan to contracept than women who do not want additional children (Table 18). Differences for women in the three pregnancy groups between women who do and do not want additional children are as follows:

	Does Not Want Additional Children	Wants Additional Children	Difference
Two pregnancies	.96	.76	.20
Three pregnancies	.99	.76	.23
Four pregnancies	.99	.73	.26

The effect of not wanting additional children on contraceptive plans becomes stronger as gravidity rises.

Previous pregnancy outcome, however, is still important, indicating that either spacing or the fear that some additional children will die affects contraceptive plans. The influence of the outcome of the last pregnancy as a factor affecting contraceptive plans becomes less important as gravidity increases. Thus, the difference in contraceptive plans

Table 18. Regression coefficients of previous and current pregnancy outcome and other variables on contraceptive plans for women delivering babies at Farah Hospital in Tehran, Iran.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome:			
All children living	.15*	.14*	.19*
One child dead; last child alive	-	.15*	.20*
One child dead; last child died	-	.17*	.22*
Two children dead; last child alive	-	-	.19*
Two children dead; last child dead	-	-	.20*
(excluded category is all children dead)			
Current pregnancy outcome:			
Baby died	-.30*	-.18*	-.08*
Education			
1-4 years	.11*	.05*	.04
5-6 years	.09*	.04*	.03*
>7 years	.09*	.08*	.01
(excluded category is zero years of education)			
Age	-.01*	-.01*	-.01*
Urban residence	.03	.01	.00
Proportion of pregnancies resulting in a living son	.00	.00	.03
Proportion previously contracepting			
Modern method	.10*	.11*	.10*
Traditional method	.09*	.11*	.11*
Proportion of additional children desired	-.19*	.23*	.26*
Constant	.87	.93	.86
Adjusted R^2	.21	.23	.27
Number of women	3671	2950	2212

*Significant at the .05 level.

between women whose last pregnancy ended in a death as compared to women who left the hospital with a live child is as follows:

Two pregnancies	.30
Three pregnancies	.18
Four pregnancies	.08

Why should the effect of the last pregnancy become less significant in influencing plans, given that we have already controlled for the desire for additional children? One possibility is that women of lower gravidity want to replace a child more quickly than women of higher gravidity. Also, such women may be more firmly committed to having additional children. Women of higher gravidity may have desired the last pregnancy less than did women of lower gravidity. Thus, women of higher gravidity may plan to contracept because they are less certain they want additional children.

Previous pregnancy outcome is important in influencing contraceptive plans only insofar as a woman has at least one living child. Across all previous pregnancy outcome groups (thus excluding the outcome of the current pregnancy), women who have at least one live child have a probability 14 to 22 percent above that of women with no living children of planning to contracept. Apparently, the desire for children among the latter group is so strong that pregnancy outcome is important even controlling for the desire for additional children. Even among women with three pregnancies, those with two nonsurviving children are no less likely to plan to use contraception than women who have three living children.

If a woman has used contraception in the past, she is more likely to plan to contracept following the current delivery. The method of contraception used in the past, however, does not affect contraceptive plans. Moreover, the effect of previous contraceptive use on contraceptive plans is similar across all gravidity groups; women who have used contraception during the last pregnancy interval have a probability about ten percent higher of planning to contracept than women who did not contracept.

The effect of education on contraceptive plans becomes less important as gravidity increases. For example, women who have just had a second child and have had some education are more likely to be planning to contracept than corresponding women with no education. But once a woman has some education, additional years of schooling do not affect contraceptive plans.

Residence has no measurable effect on contraceptive plans. Women reporting their residence as urban are no more likely to say they plan to contracept than women reporting their residence as rural.

Surprisingly, the younger the woman the more likely she is to report that she plans to contracept, since earlier it was reported that the older the woman the more likely it was that she had contracepted during the last pregnancy interval. A possible interpretation of this finding might be that a greater proportion of older women no longer feel that they need to be protected against unwanted pregnancy. However, as all women have just completed a pregnancy—and thus may be assumed still to be fecund—such an interpretation is difficult to defend. It may be that, among younger women, the desire to use contraception for spacing purposes accounts for this unexpected, although weak, relationship.

Cairo. The following section examines the effects of pregnancy outcome on contraceptive use, both current and planned, and on their desire for additional children for women delivering babies at El Galaa Hospital, Cairo, Egypt. It is similar to the preceding section on Tehran in that the data has been disaggregated by number of preceding pregnancies. The variables are described only briefly in this section since they have been described more fully in the preceding section.

Background characteristics of the women are presented in Table 19. Women with more pregnancies are older and less educated than women with fewer pregnancies. Past contraceptive use is positively associated with gravidity, as are current contraceptive plans. The proportion of pregnancies that have ended in a neonatal death rises with gravidity. In addition, the percentage of women who have had at least one unsuccessful pregnancy outcome rises with gravidity, but so does the percentage of women having at least one living child. Thus, only 67 percent of the women with one pregnancy have a living child, while 94 percent of the women with three pregnancies have a living child.

In comparison to women in Tehran, women in Cairo are older and better educated, but they were less likely to report that they had contracepted during the previous pregnancy interval. Women in Cairo were also less likely to report that they had had successful pregnancy outcomes. A smaller percentage of the women in Cairo than in Tehran had all pregnancies end in a surviving child and a larger percentage report that they have no surviving children.

Table 19. Demographic and social characteristics of women delivering babies babies at El Galaa Hospital in Cairo, Egypt by previous number of pregnancies.

Characteristic	Previous Pregnancies 1	2	3
Proportion previously contracepting	.24	.35	.40
Proportion desiring additional children	.47	.29	.19
Mean number of additional children desired	.67	.40	.29
Proportion planning to contracept	.68	.77	.82
Previous pregnancy outcomes*			
Proportion of women with:			
All children living	.67	.50	.41
One living child, one dead child; last child alive	-	.22	-
One living child, one dead child; last child dead	-	.14	-
Two living children, one dead child; last child alive	-	-	.23
Two living children, one dead child; last child dead	-	-	.11
One living child, two dead children; last child alive	-	-	.09
One living child, two dead children; last child dead	-	-	.10
All children dead	.33	.14	.06
Current pregnancy outcome:			
Proportion resulting in neonatal death	.07	.08	.10
Mean Age	23.8	25.9	27.6
Percentage with some education	.53	.50	.49
Proportion of all previous pregnancies that resulted in a living son	.36	.44	.49
Proportion of all pregnancies that resulted in a living son	.53	.51	.51
Number of women	916	649	545

*Within the category "dead child," the following are included: (1) a live born child that subsequently died; (2) a stillbirth; and (3) a spontaneous abortion.

Women in Cairo are, however, less likely to report that they want additional children than are women in Tehran. Thus, in all three gravidity groups, women in Tehran are more likely to report that they want at least one additional child than are women in Cairo, although they are less likely to have experienced any child losses and more likely to have at least one surviving child.

The percentage of women planning to contracept is lower in Cairo than in Tehran. Thus, at all three gravidity groups, women in Cairo have experienced greater infant and child mortality than women in Tehran, are less likely to want more children, and are less likely to have used and plan to use family planning.

Previous Contraceptive Use

Child survival. Differences in the outcome of previous pregnancies have a significant effect on the probability that a woman contracepted during the last pregnancy interval. Pregnancy outcomes are divided into the same categories as those described for Tehran (see Tables 15 and 20).

Considering first women who have had exactly one pregnancy, those with a surviving child have a probability .20 above that of women without a surviving child of having contracepted during the last pregnancy interval. The adjusted rate of contraceptive use is .11 if the child does not survive and .31 if the child survives. Compared to the women in Tehran, women in Cairo are less likely to have contracepted if they have a surviving child, but not if the outcome was other than a surviving child.

Table 20. Regression coefficients of previous pregnancy outcome and other variables on contraceptive use in the preceding pregnancy interval for women delivering babies at El Galaa Hospital in Cairo, Egypt.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome			
All children living	.20*	.35*	.31*
One child dead; last child alive	-	.19*	.30*
One child dead; last child dead	-	.22*	.24*
Two children dead; last child alive	-	-	.14
Two children dead; last child dead	-	-	.19
(excluded category is all children dead)			
Some education	.10*	.12*	.13*
(excluded category is no education)			
Age	.01*	.01*	.02
Urban residence	.10*	.18*	.13
Proportion of pregnancies resulting in a living son	-.01	-.00	.04
Constant	1.18	1.27	1.47
Adjusted R^2	.08	.10	.08
Number of women	916	649	545

*Significant at the .05 level.

For women with two pregnancies, the adjusted probability that a woman contracepted during the last pregnancy interval varies as follows:

Two surviving children	.46
First child dead, second alive	.29
First child alive, second dead	.33
No surviving children	.11

The number of surviving children, but not the order of their survival, affects past contraceptive behavior. Women with one surviving child, whether it is the first or the second, have similar rates of contraceptive use. These results contrast with those for Tehran where it was found that

the order of survival was an important determinant of contraceptive use. In addition, as with women with one pregnancy, adjusted rates in Tehran are higher than in Cairo if all children have survived.

Among women with three pregnancies, the adjusted probability of having contracepted during the last pregnancy interval is as follows:

Three surviving children	.46
Two surviving children and last is still alive	.44
Two surviving children and last is not alive	.38
One surviving child and last is still alive	.29
One surviving child and last is not alive	.30
No surviving children	.15

As with women with two pregnancies, only the number of surviving children, and not the order of survival, affects contraceptive use. Thus, women with two surviving children have a higher probability of having contracepted than those with none or one (though differences may not always be statistically significant). Controlling for the number of living children, order of death does not appear to affect contraceptive use. Contraceptive use is higher if the last child is alive when there are two survivors. However, once a woman has two surviving children (including the previous birth), a third survivor does not increase the probability of having contracepted during the interval.

Results for Cairo indicate, as they did for Tehran, that an increase in the number of surviving children increases the probability of having contracepted in the last pregnancy interval. But, unlike the results for Tehran, the results for Cairo indicate that order of survival does not strongly affect the decision to contracept. More importantly, for most outcome groups, contraceptive use is lower in Cairo than in Tehran.

Sex composition. Results for Cairo indicate that variations in the sex distribution of the children does not affect contraceptive use. These results contrast with those for Tehran where it was found that an increase in the number of sons, holding the number of pregnancies constant, increased the probability that a woman used contraception during the interval. We may conclude that if there is any sex preference among the women sampled in Cairo, it is not reflected in contraceptive behavior.

Other variables. Women in urban areas are more likely to have contracepted than women reporting their residence as rural. As with Tehran, this variable is significant only for women at gravidities one and two.

Older women are more likely to have contracepted than younger women. For women with one pregnancy, each additional year of age raises the probability that a woman contracepted by .01, so that a difference in age of ten years implies a difference in contraceptive use of .10. This is a much smaller difference than that found for women delivering in Tehran.

Women with some education are more likely to have contracepted than women with no education.* The results indicate that differences for Cairo between women with some and no education are smaller than those reported for women in Tehran.

Desire for Additional Children

Child survival. Previous pregnancy outcome has a very strong effect on the desire for additional children. As with Tehran, regressions were

*Women with some education were combined into one group since initial results indicated no regular association between education and the various dependent variables once a woman had at least one year of education.

computed for three gravidity groups: 2, 3, and 4 (number of previous pregnancies plus current pregnancy) (Table 21). Consider first women who have had exactly two pregnancies. The adjusted probability that a woman wants at least one additional child varies as follows:

Both children alive	.32
First alive, second dead	.49
First dead, second alive	.72
Both dead	.89

As the number of living children increases, the probability that a woman wants additional children falls. Considering only those with exactly one living child, women are less likely to want additional children if it is the first child who is surviving than if it is the second child. Similar results were found for corresponding women in Tehran. In addition, it is interesting to note that for each of the outcome groups, the probability that a woman wants additional children is lower in Cairo than in Tehran.

Consider next women with exactly three pregnancies. The probability that a woman wants at least one additional child varies as follows:

All three alive	.05
Two alive, one dead	.17 to .25
One alive, two dead and last dead	.30 to .37
One alive, two dead and last alive	.60
All three dead	.72

Clearly, the strongest effect is that of survival. The greater the number of surviving children, the less likely it is that the woman will want additional children. This effect is strong and consistent throughout the survival groupings. The only unexpected result is the very high probability of wanting to have more children among women who have just had their

Table 21. Regression coefficients of previous and current pregnancy outcome and other variables on the desire for additional children for women delivering babies at El Galaa Hospital in Cairo, Egypt.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome:			
All children living	-.39*	-.55*	-.51*
One child dead; last child alive	-	-.42*	-.45*
One child dead; last child dead	-	-.35*	-.53*
Two children dead; last child alive	-	-	-.25*
Two children dead; last child dead (excluded category is all children dead)	-	-	-.32*
Current pregnancy outcome:			
Baby died	.17*	.12*	.12*
Some education (excluded category is no education)	-.09*	-.04	-.09*
Age	.00	-.01	-.01
Urban residence	-.08	-.09	-.16*
Proportion of pregnancies resulting in a living son	-.09*	-.03	-.08
Constant	.73	.96	.91
Adjusted R^2	.16	.19	.16
Number of women	916	649	545

*Significant at the .05 level.
**Women that reported desiring additional children, but were uncertain of the actual number, were excluded.

first surviving child, which contrasts with the much lower probability of wanting additional children among women who have one surviving child from an earlier pregnancy. Again, the probability that a woman wants to have additional children is lower for the group of women in Cairo than in Tehran.

Last, consider women who have had four pregnancies. The probability that a woman wants at least one additional child varies as follows:

All four alive	.10
Three alive, one dead	.08 to .22
Two alive, two dead	.20 to .36
One alive, three dead	.41 to .61
All four dead	.73

There are clear differences in the probability that a woman wants at least one additional child associated with the number of surviving children. An increase in the number of surviving children decreases the probability that a woman wants additional children. There is some overlap between outcome groups when order of survival is considered, but the general tendency is for more favorable outcomes to be associated with a lower probability of wanting additional children. As before, the probability that a woman wants additional children is generally lower than that for women in Tehran.

Considering all three gravidity groups, it is clear that, as with Tehran, an increase in the number of surviving children decreases the probability that a woman wants additional children. Order of survivorship appears to have no systematic effect on the desire for additional children. In the next section, we will attempt to determine whether women plan to replace all children who have died or only some of those children.

Sex Composition. An increase in the number of sons, as a proportion of all pregnancies, decreases the probability that a woman wants additional children, but this variable is only significant for women with two pregnancies. Thus, the data indicate some preference for sons, but one which appears to be weaker than indicated by the data for women in Tehran.

Other variables. Women with some education have a lower probability of wanting additional children than women who have no schooling. This result is similar to that found for Tehran, where it was found that variations in years of education within the group of women with some education had no additional effect on desire for children.

In Cairo, a woman's age does not appear to be related to the desire for additional children. This finding is in contrast to that from Tehran, where it was found that older women were less likely to want additional children than younger women.

Women reporting their residence as urban were less likely to want additional children than women reporting their residence as rural. These results differ from those for Tehran where it was found that residence was generally unimportant in influencing the desire for additional children.

Number of Additional Children Wanted

The next series of regressions considers the number of additional children women wanted (Table 22). Unlike Tehran, there were very few women (less than 1%) who were unable to give an exact answer concerning the number of additional children that they wanted.

Child survival. For women with two pregnancies, the adjusted number of additional children that a woman wants varies as follows:

Both children alive	.44
First alive, second dead	.85
First dead, second alive	1.04
Both dead	1.45

Table 22. Regression coefficients of previous and current pregnancy outcome and other variables on the actual number of additional children desired for women delivering babies at El Galaa Hospital in Cairo, Egypt.**

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome:			
All children living	-.61*	-.81*	-.61*
One child dead; last child alive	-	-.60*	-.56*
One child dead; last child dead	-	-.50*	-.65*
Two children dead; last child alive	-	-	-.26
Two children dead; last child dead	-	-	-.34*
(excluded category is all children dead)			
Current pregnancy outcome:			
Baby died	.41*	.26*	.26*
Some education	-.16*	-.10*	-.19*
(excluded category is zero years of education)			
Age	.01	-.02	-.00
Urban residence	-.32*	-.16	-.30*
Proportion of pregnancies resulting in a living son	-.13*	-.07	-.07
Constant	1.21	1.58	1.10
Adjusted R^2	.16	.18	.13
Number of women	908	643	540

*Significant at the .05 level.
**Women that reported desiring additional children, but were uncertain of the actual number, were excluded.

As with Tehran, women who have had two children who have died want more additional children than women whose children all survived or one of those children survived. In all groups, however, the number of additional children desired is smaller in Cairo than in Tehran. The results do not imply complete replacement. For each child that has died, the number of additional children desired rises between .4 and .6, which is well below replacement.

Consider next women with three pregnancies. The number of additional children desired varies as follows:

Three living children	.17
Two alive, one dead	.38 to .47
One alive, two dead and last dead	.64 to .73
One alive, two dead and last dead	.98
All three dead	1.24

As the number of living children increases, the number of additional children desired decreases. In all cases, however, a difference of one in the number of survivors is associated with a smaller difference in the desire for additional children, implying less than complete replacement. Again, within any survivorship group, the number of additional children desired is smaller than it was in the group of women from Tehran.

Last, consider women with exactly four pregnancies. The number of additional children desired varies as follows:

Four living children	.16
Three alive, one dead	.12 to .42
Two alive, two dead	.39 to .51
One alive, three dead	.69 to .77
All dead	1.03

As before, the general tendency is for an increase in the number of survivors to be associated with a decrease in the number of additional children that a woman wants. The results always imply far less than complete replacement. Unlike earlier results, these data do not imply fewer additional children desired to women in Cairo than in Tehran. However, it should be kept in mind that a large number of women in Tehran were unable

to answer the question on the number of additional children that they desired making comparison difficult.

Sex composition. An increase in the number of sons, at all gravidities, decreases the number of additional children wanted—but the effect is small and statistically significant for women with one previous pregnancy.

The effects of other variables—age, residence, and education—are similar to those reported for regressions in which the dependent variable was the desire for at least one additional child.

Contraceptive Plans

As with Tehran, the variable of greatest significance in affecting contraceptive plans for women in Cairo is the desire for additional children. Women who want additional children are considerably less likely to plan to contracept than women who do not want additional children (Table 23). Differences in planned contraceptive use for women in the three pregnancy groups between women who do and do not want additional children are as follows:

	Does Not Want Additional Children	Wants Additional Children	Difference
Two pregnancies	.88	.46	.42
Three pregnancies	.91	.41	.50
Four pregnancies	.90	.44	.46

The effect on contraceptive plans of not wanting additional children, compared to wanting them, is about twice as strong for the group of women in Cairo as in Tehran.

Previous pregnancy outcomes are also important in affecting the probability that women plan to contracept. The general tendency is for women who have had more successful pregnancy outcomes to be more likely to plan to contracept than women who have had fewer successful outcomes. Though there are differences between the results for Cairo and Tehran, the pattern is similar: women in both cities are more likely to plan to contracept the lower the level of child loss.

Table 23. Regression coefficients of previous and current pregnancy outcome and other variables on contraceptive plans for women delivering babies at El Galaa Hospital in Cairo, Egypt.

Variables	Previous Pregnancies 1	2	3
Previous pregnancy outcome:			
All children living	.07*	.11*	.17*
One child dead; last child alive	-	.10*	.24*
One child dead; last child dead	-	.05	.15*
Two children dead; last child alive	-	-	.04
Two children dead; last child dead	-	-	.12
(excluded category is all children dead)			
Current pregnancy outcome:			
Baby died	-.18*	-.04	-.14*
Some education	.03	.04	.07*
(excluded category is zero years of education)			
Age	-.00	-.00	-.00
Urban residence	.13*	.03	.11*
Proportion of pregnancies resulting in a living son	-.00	.02	.01
Proportion previously contracepting	.10*	.08*	.06*
Proportion of additional children desired	-.41*	-.51*	-.46*
Constant	.78	.93	.69
Adjusted R^2	.28	.38	.38
Number of women	916	649	545

*Significant at the .05 level.

If a woman has contracepted during the last pregnancy interval, she is more likely to plan to contracept than if she did not contracept during the last interval. However, the effect of past use on future plans becomes smaller as gravidity increases. This specifying relationship was not found in Tehran.

Education generally does not have a significant effect on contraceptive plans in Cairo whereas it did in Tehran. Results for age and residence are also somewhat different. In Cairo (but not in Tehran), women who reside in urban areas were more likely to plan to contracept than are rural women. Age has no effect on contracept plans in Cairo, but in Tehran the younger the woman the more likely she was to report that she planned to contracept.

Summary of Iran and Egypt Gravidity-Specific Analyses

Survival of children is an important determinant of previous contraceptive use, desire for additional children and of contraceptive plans. Women who have had the most favorable pregnancy outcomes have the highest rate of contraceptive use, are less likely to want additional children and are more likely to plan to contracept than women who have had one or more pregnancies end in spontaneous abortion or stillbirth or who have had children die.

The proportion of women who reported that they had previously contracepted in Tehran was much higher than it was in Cairo, with the difference about 0.15 at all gravidities. Part of this difference may be explained by the higher levels of mortality of the women hospitalized for delivery in

Cairo than in Tehran. If women in Cairo had had the more favorable survival rates favoring the children of women in Tehran, then contraceptive use would have risen from .24 to .28 for women at gravidity one, from .35 to .41 for women at gravidity two, and from .40 to .43 for women at gravidity three.

These results suggest that contraceptive use would be higher for the women hospitalized for delivery in Cairo if their pregnancies had ended more successfully. However, their rates of contraceptive use would still be lower than that of women in Tehran. This is because women in Tehran whose children have experienced comparable rates of mortality are more likely to have contracepted than women in Cairo.

The proportion of women who report that they want additional children and the number of additional chilren wanted is lower for the women in Cairo than in Tehran. Child survivorship is an important determinant of the desire to have additional children for both groups of women. Child survivorship is lower in Cairo than in Tehran, but the desire to have additional children is higher in Tehran than in Cairo. If the children of women in Cairo experienced the more favorable mortality rates of the children of women in Tehran, their desire for additional children would be even lower, and differences between Cairo and Tehran greater.

Last, the desire for additional children and pregnancy outcomes both affect contraceptive plans. Women who have had more children die are more likely to want additional children than women none of whose or fewer of whose children have died, and women who want no more childen are more likely to plan to contracept than women who want more children. Moreover,

even controlling for the desire for additional children, mortality still has an influence on contraceptive plans. It is likely that both child spacing considerations and insurance against future child losses probably explain the relationship between contraceptive plans and mortality, controlling for child desires.

Women in Tehran are more likely to plan to contracept than women in Cairo, even though women in Tehran are more likely to report that they want additional children than are women in Cairo. The primary reason for this difference is that among women who plan to have additional children, planned contraceptive use is much higher in Tehran than in Cairo. Differences are much smaller for women who do not plan to have additional children.

V. Conclusion and Policy Implications

We have shown how pregnancy intervals are affected by contraceptive use, breast-feeding practices, and the outcomes of previous pregnancies. We have further discussed the effects of and interrelationships among all of these factors on reproductive goals and future contraceptive plans. That these associations are complex is abundantly evident from the foregoing analyses.

The results obtained in this study may be useful in the formulation and implementation of maternal and child health programs in the developing world. For example, policies designed to reduce infant and childhood morality will have greater impact on lengthening the interval between pregnancies (thus lowering the birth rate); (1) the stronger the relationship between child survivorship and subsequent contraceptive use, and (2) the greater the prevalence and duration of breast-feeding. Similarly, improved child survivorship will lower the probability that women will want additional children; outcomes of more recent pregnancies have greater impact in this association than the outcomes of earlier pregnancies.

Viewed from a policy perspective, the findings of this study suggest that, particularly in developing societies with high levels of infant and childhood mortality and political-cultural barriers to the widespread acceptance of modern contraception, programs aimed at improving childhood survivorship are likely to have both direct and indirect effects on the use of family planning and fertility behavior. In addition to the individual, family and societal benefits to be gained immediately as a consequence of improved survivorship, our findings strongly indicate that future

reproductive and contraceptive behavior will be favorably affected by health programs that reduce the level of mortality of infants and children in the developing world.

Appendix A. Detailed Interpretation of Regression Results: Chapter II (Tables 10-13)

Length of the Pregnancy Interval (Iran)

Introduction

The variables included in the equation explain almost 46% of the variance in the length of the pregnancy interval (Table 10). The most important variables are age, contraceptive use, breast-feeding, and parity. Residence and education do not have a significant effect on the pregnancy interval.

Pregnancy History

1. Last pregnancy outcome. Women whose last pregnancy (previous to the current delivery) ended in a live birth and the child is still living have pregnancy intervals almost 8 months longer than women whose last pregnancy ended in a spontaneous abortion (outcome effect = 9.7 months; parity effect = -1.8 months). Therefore, even when contraception and breast-feeding are included in the regression, pregnancy outcome still has an effect on the pregnancy interval—clearly a larger effect than can be accounted for by variations in postpartum amenorrhea. Motivational factors, as discussed in the text, may account for some of this difference.

Women who have experienced child deaths excluding the penultimate have longer pregnancy intervals than women who do not, but this effect is small. Each additional death increases the interval by .7 months.

Women whose last pregnancy ended in a child death have pregnancy intervals almost three months longer than women with spontaneous abortions

(outcome effect = 4.1 months; parity effect = -1.8 months; child loss effect = .7 months).

Women with stillbirths have longer pregnancy intervals than women with spontaneous abortions, but these differences are not significant.

2. Previous pregnancies. The more births a woman has previously had, the shorter her pregnancy interval will be. This effect has, however, only a small effect on the length of interval. Each additional birth decreases the interval by not quite two months. These results indicate that women who have more children space their births closer together, suggesting that women with more children may be more fecund than women with fewer children.

Women who have experienced child deaths excluding the penultimate have longer pregnancy intervals than women who do not, but this effect, too, is small—each additional death increases the interval by .7 months.

Other Variables

1. Age. Older women have longer pregnancy intervals than younger women. Each additional year adds 1.1 month to the pregnancy interval, so that a woman aged 30 has a pregnancy interval about a year longer than one aged 20. These results are in accord with declining fecundity with age.

2. Contraceptive use. Contraception increases the length of the pregnancy interval; women using traditional contraception have pregnancy intervals 16 months longer than women who do not use contraception, and women who use modern contraception have intervals 22 months longer than women who do not use contraception.

3. Breast-feeding. Analysis indicates that breast-feeding, unless it was prolonged, did not affect the length of the pregnancy interval. Not until breast-feeding is continued for at least one year does it have significant effect on the length of the pregnancy interval. Women who breast-feed at least one year but less than 21 months have pregnancy intervals about four months longer than women who do not breast-feed or breast-fed for less than one year. Women who breast-feed for long periods, 21 months or longer, have pregnancy intervals almost 14 months longer than women who do not breast-feed or breast-feed for short periods.

Use of Contraception during the Pregnancy Interval (Iran)

Introduction

The variables included in the equation explain about 9% of the variance in contraceptive use during the last pregnancy interval (Table 11).

Pregnancy History

1. Last pregnancy outcome. Women whose last pregnancy ended in a surviving live birth are more likely to have used contraception than women whose last pregnancy ended in a death. Compared to women whose last pregnancy ended in a spontaneous abortion, their probability of having used contraception is 32% higher. Women whose last child was born alive but later died are more likely to have used contraception than women whose last pregnancy ended in a spontaneous abortion. The probability difference is 9% (outcome effect = .13; parity effect = .02; child loss effect = -.06). Women whose last pregnancy ended in a stillbirth are no more likely to have

used contraception than women whose last pregnancy ended in a spontaneous abortion.

These results indicate that women whose last pregnancy ended in a live birth, with the child currently surviving, are more likely to have used contraception than women with other pregnancy outcomes.

2. Previous pregnancies. Higher parity women are more likely to have used contraception than low parity women. Each additional birth increases the probability that the women used contraception by 3%. As births increase, it is not surprising to find that the motivation to use contraception increases.

Child loss reduces the use of contraception. Each nonsurviving child reduces the probability of contraceptive use during the interval by 6%.

Other Variables

1. Education. Women with some education are more likely to have contracepted than women with no education. Educated women are more likely to want smaller families and to have information about contraception, factors indicating greater use among educated women.

2. Age. Older women are more likely to have used contraception, even when parity is controlled, than younger women. A one year increase in age increases the probability of past use of contraception by .013--so that women aged 30 have a probability 13% higher than women aged 20 of having used contraception during the last interval.

3. Residence. Residence is found to be unrelated to contraceptive use.

Desire for Additional Children (Iran)

Introduction

The variables included in the equation explain 16% of the variance in desire for additional children (Table 12).

Pregnancy History

1. Current pregnancy outcome. Women whose current child dies at birth or before the mother leaves the hospital have a 17% higher probability of wanting additional children than women who leave the hospital with a living child.

2. Last (penultimate) pregnancy outcome. Women whose penultimate pregnancy ended in a surviving live birth have a probability 24% less of wanting an additional child than women whose last pregnancy ended in a spontaneous abortion. Women whose last pregnancy ended in a nonsurviving live birth or a stillbirth have a probability of wanting additional children which is not statistically different from that of women whose last pregnancy ended in a spontaneous abortion. The penultimate outcome thus exerts a greater impact on desired additional children than does the outcome of the current pregnancy.

3. Previous pregnancies. Women who have had more births are less likely to want additional children than lower parity women. Each additional birth decreases the probability that a woman wants additional

children by 9%. Women who have lost children are more likely to want additional children than women whose children are all surviving. Each death increases the probability that a woman will want additional children by 8%.

These effects are almost equal in magnitude, though opposite in sign. It would appear that surviving children, regardless of the number of births and deaths, is the important variable affecting pregnancy plans.

Other Variables

1. Education. Women with more education are less likely to want additional children than women with less education. Women with 1-4, 5-6, and seven or more years of education are 5, 9, and 13% less likely, respectively, to want additional children than women who have no education.

2. Age. The older the woman, the less likely she is to want additional children. Each additional year of age decreases the probability that she wants additional children by .008, so that a woman of 35 has a probability 8% below that of a woman of 25 of wanting additional children—a weak effect.

3. Residence. Urban residence has an unexpected effect. Women in urban areas are 8% more likely to want additional children than women in rural areas.

Planned Contraceptive Use (Iran)

Introduction

The most important variables affecting planned contraceptive use* are the outcome of the current pregnancy and the desire for additional children. The variables included in the equation explain 23% of the variance in planned contraceptive use (Table 13).

Pregnancy History

1. Current pregnancy outcome. Women whose current pregnancy ended in other than a surviving live birth have a probability 16% below that of women whose pregnancy ended in a live birth of planning to use contraception.

2. Last (penultimate) pregnancy outcome. The results of the penultimate pregnancy exerts a smaller impact on planned contraceptive use than does that of the current pregnancy. The death of a live-born child reduces the probability that a woman will plan to use contraception 8% below that of women whose last pregnancy ended in a spontaneous abortion. Other birth outcomes as compared to the base case do not exert a statistically significant effect on contraceptive plans.

3. Previous pregnancies. Each birth increases the probability that a woman will plan to use contraception by 1%, and each infant or child death reduces it by the same amount.

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*Induced abortions are excluded because the motivation to use contraception will be different for this group than other women whose pregnancies have not ended in a live birth.

Other Variables

1. Education. Women with some education are more likely to plan to use contraception than women with no education. Probabilities are about equal for women with 1-4 and 5-6 years of education, but the probability is much greater for women with at least seven years of education.

2. Age. Older women are only very slightly less likely to plan to use contraception than younger women. This effect is surprising. However, since attained parity is controlled in the regression, age probably serves as a proxy for traditionalism rather than measuring fertility.

3. Residence. Residence has no effect on planned contraceptive use.

4. Previous contraceptive use. Women who used contraception in the last pregnancy interval are more likely to plan to use contraception than women who did not contracept. Differences between women who used modern and traditional contraception are small; for both groups, the probability of planning to use contraception is about 7% higher than for women who did not use any contraception.

5. Desire for additional children. Women who want additional children are less likely to plan to use contraception than women who do not want additional children. The probability difference between the two groups is 23%.

Length of the Pregnancy Interval (Egypt)

Introduction

The most important variables affecting the length of the pregnancy interval are age, parity, previous pregnancy outcome, breastfeeding, and contraceptive use. Residence and education do not produce a significant effect. All of the variables included in the equation explain 32% of the variance in the length of the pregnancy interval (Table 10).

Pregnancy History

1. Last pregnancy outcome. Women whose penultimate pregnancy resulted in a surviving live birth have a pregnancy interval 5.1 months longer than women whose penultimate pregnancy resulted in a spontaneous abortion. Women whose penultimate pregnancy resulted in a live birth but the child subsequently died have a pregnancy interval 1.1 months longer than women whose last pregnancy ended in a spontaneous abortion. Thus, a live birth increases the pregnancy interval one to five months, depending on whether the child is still living or has since died. A stillbirth increases the interval by 1.2 months.

2. Previous pregnancies. Parity has a negative effect on the length of the pregnancy interval. For each additional live birth, the pregnancy interval decreases by 1.3 months. Child death (excluding the penultimate) also has a negative effect on the length of the pregnancy interval, although this effect is smaller than that for parity. For each additional death, the interval decreases by .6 months. In short, women with more live births have shorter pregnancy intervals than women with fewer live births,

and women experiencing more child deaths have shorter pregnancy intervals than women experiencing fewer or no child deaths.

Other Variables

1. Age. Age has a positive effect on the length of the pregnancy interval. For each additional year of age, the pregnancy interval is increased by 1.4 months. Thus, older women have longer pregnancy intervals than younger women.

2. Contraceptive use.* The use of contraceptives increases the length of the pregnancy interval. Women using contraceptives have pregnancy intervals 12.6 months longer than women using no contraceptives.

3. Breast-feeding. Breast-feeding has a positive effect on the length of the pregnancy interval. The longer a woman breast-feeds, the greater the impact on the pregnancy interval. Women who breast-feed for six to 11 months increase the length of the pregnancy interval by 1.9 months above that of women who do not breast-feed or breast-feed for shorter periods. Breast-feeding for 12 to 14 months and 15 to 20 months increases the interval by 3.7 months and 6.1 months, respectively. Breast-feeding for 21 months or more increases the length of the pregnancy interval by 13.2 months.

*Modern and traditional contraceptives are combined for this analysis.

Use of Contraception during the Pregnancy Interval (Egypt)

Introduction

The most important variables affecting the use of contraceptives during the pregnancy interval are residence and education. All of the variables included on the equation explain 7% of the variance in contraceptive use during the last pregnancy interval (Table 11).

Pregnancy History

1. Last pregnancy outcome. The outcome of the pregnancy preceding the current delivery produces a significant effect on past contraception only when the last pregnancy resulted in a live birth and the child is still living. When this is the case, the probability of having used contraceptives increases by 11% above that of women whose last pregnancy ended in a spontaneous abortion.

2. Previous pregnancies. When the penultimate child is excluded, parity has a positive effect on past contraceptive use, and child death has a negative effect. For each live birth, the probability that a woman used contraceptives increases by 2%. For each child death, this probability decreases by 2%. Therefore, each live birth increases, and each child death decreases, the probability of contraceptive use. These effects, though equal in magnitude, are opposite in sign.

Other Variables.

1. Residence. Urban women are more likely to contracept than women who reside in rural areas. Urban residence increases the probability of

having used contraceptives during the last pregnancy interval by 14%. This effect is probably due to the greater availability of contraceptives in urban areas.

2. Education. Women with some education are more likely to have used contraceptives than women with no education; this probability increases with education. One to four and five to six years of education increase the probability of having used contraceptives during the last pregnancy interval by 9%, and seven or more years of education increases the probability by 17%. This effect leads to the conclusion that educated women have more information on the use and availability of contraceptives than women with no schooling and/or more motivation to use contraceptives.

3. Age. Age has a positive effect on contraceptive use. For each year of age, contraceptive use increases by 1%. Thus, older women are more likely to have used contraceptives during the last pregnancy interval than younger women.

Desire for Additional Children (Egypt)

Introduction

The most important variables affecting the desire for additional children are residence, age, education, parity and pregnancy outcome. All of the variables included in the equation explain 19% of the variance in desire for additional children (Table 12).

Pregnancy History

1. Current pregnancy outcome. Women who have unsuccessful current outcomes have a higher probability of wanting additional children than women whose child is still living. The probability difference is 8%.

2. Last (penultimate) pregnancy outcome. Women whose last pregnancy outcome resulted in a live birth and the child is still living are 23% less likely to want additional children than women whose last pregnancy resulted in a spontaneous abortion. A stillbirth decreases the probability of wanting additional children by 3%, and a live birth but subsequent death decreases the probability by 6% compared to a spontaneous abortion. As was found in Tehran, the penultimate outcome exerts a greater impact on a woman's desire for additional children than does the outcome of the current pregnancy.

3. Previous pregnancies. Parity has a negative effect on the desire for additional children; child mortality has a positive effect. Higher parity women are less likely to want additional children than lower parity women. The probability that a woman wants additional children decreases by 6% for each birth. Women experiencing child deaths are more likely to want additional children than women who have not experienced any child deaths. The probability that a woman wants additional children increases by 2% for each child death. Thus, live births decrease the desire for additional children and child deaths increase the desire for additional children.

Other Variables

1. Residence. Urban residence exerts a negative influence on the desire for additional children. Women living in urban areas are 9% less likely to want additional children than women living in rural areas.

2. Age. Older women are less likely to want additional children than younger women. For each year, the desire for additional children decreases by .01; 30 year-old women are thus 10% less likely to want more children than 20 year-old women.

3. Education. Educated women are less likely to want additional children than women with no education. Women with one to four years of education are 4% less likely to want additional children, and women with five or more years of education are 5% less likely to want additional children, than women with no schooling.

Planned Contraceptive Use (Egypt)

Introduction

The most important variables affecting planned contraceptive use are desire for additional children, outcome of the current pregnancy, and previous contraceptive use. All of the variables included in the equation explain 33% of the variance in planned contraceptive use (Table 13).

Pregnancy History

1. Current pregnancy outcome. A successful pregnancy outcome is associated with an increased probability that a woman will plan to

contracept. When the current pregnancy results in other than a live birth, the probability of planned contraception decreases by 7%.

2. Last (penultimate) pregnancy outcome. The outcome of the penultimate pregnancy is found to have no significant effect on planned contraception.

3. Previous pregnancies. Parity has a positive influence on planned contraceptive use and child death has a negative influence. For each additional birth the probability that a woman will plan to contracept increases by 1%. For each additional child death the probability that a woman will plan to contracept decreases by 1%, although the latter association is not statistically significant.

Other Variables

1. Residence. Urban residence has a positive affect on planned contraceptive use. Women living in urban areas are 4% more likely to plan to use contraceptives than women living in rural areas.

2. Education. Educated women are more likely to plan to use contraceptives than women with no education. The probabilities of planned contraceptive use are small and not statistically significant for women with one to four and five to six years of education. However, women with seven or more years of education have a probability of planned contraceptive use 6% higher than women with no education.

3. Age. Age has no effect on planned contraceptive use.

4. Previous contraceptive use.* Previous contraception positively affects planned contraception. Women who used contraceptives on the last pregnancy interval are 7% more likely to plan contraception than women who did not use contraceptives in the last pregnancy interval.

5. Desire for additional children. Desire for additional children has a great impact on planned contraception. Women who want additional children are 49% less likely to plan contraception than women who do not want additional children. Contraception for spacing purposes is thus far less common than is contraception to limit family size.

*Modern and traditional contraceptives are combined for this analysis.

Appendix B. Appropriateness of Ordinary Least Squares Regression Analysis: A Comparison of Selected Results with Those Obtained Using Logit Analysis

A frequent criticism of ordinary least squares (OLS) regression is that it is not suitable for regression models in which the dependent variable is dichotomous and highly skewed. In such instances, since the dependent variable is not normally distributed jointly with the independent variables, the parameters estimated by the model, eg, regression coefficients, may not be consistent (see Hermalin, et al, 1979; Nerlove and Press, 1973).

Many of the dependent variables of the regression analyses in the present report are dichotomous and highly skewed. We have noted previously, for example, that the proportion of women who want additional children is as low as 22 percent in Egypt, yet over 80 percent in Nigeria. Those who plan to use contraception account for 82 percent of the women delivering in Egypt, and 91 percent of those delivering in Iran. Such observed distributions of the dependent variable suggest that ordinary least squares may not yield appropriate probabilities based on known values of the independent variables in the regression equation.

To test the appropriateness of OLS regression in such a context, we have calculated adjusted probabilities relating to fertility and contraceptive intentions using both OLS regression and a recently available logit analysis procedure. The comparative analysis is made for the subsample of 545 Egyptian women with exactly three pregnancies previous to the current delivery. The distributions of the dichotomous dependent variables are

presented in Table 19: 19 percent desire to have additional children, and 82 percent plan to use contraception.

The initial step in the calculation of comparable adjusted probabilities is to obtain the logit coefficients for the same variables for which OLS regression coefficients are available. These coefficients (not presented) are then used in the calculation of adjusted probabilities, as shown in Tables A1 and A2. It is of interest to note, in the comparison of the results obtained using the two methodological procedures, that independent variables previously found to be significant ($p < .05$) using ordinary least squares regression are found to be significant in the logit procedure; those not significant in one prove to be not significant in the other.

Although this agreement in statistical significance is encouraging, it does not tell us whether the two procedures yield similar adjusted probability estimates of being in category i of the dichotomous dependent variable according to various possible levels of the independent variables. Using the respective regression coefficients, these probabilities may be calculated and compared.

Table A1 presents estimated probabilities of desiring additional children, for selected levels of independent variables included in the regression model, as calculated using OLS and logit procedures. Values may be interpreted as the likelihood that a woman at a <u>given</u> category of one independent variable and "<u>average</u>" on all the others will desire to have more children. The extremely close agreement in probability estimates may be observed in the table. Probabilities calculated from the logit analysis

are only slightly lower than those derived though OLS regression; the differences are consistent and hardly large enough to fault one procedure in favor of the other.

In Table A2, an OLS-logit comparison is offered on the probability that a woman will plan to use contraception following the current delivery. While the agreement is not as striking as was found in the first example, it may be argued that OLS does not result in inconsistent or inefficient probability estimates relative to those produced by logit regression. We have already noted that the desire for additional children is by far the most important single variable in predicting planned contraceptive use. On this variable, the magnitudes and differences in estimated probabilities calculated through OLS (.45 for those desiring additional children vs .91 for those not desiring additional children) are not substantially different from the corresponding values derived from the logit procedure (.50 vs .94).

We have demonstrated empirically, using two regression models discussed in the main body of this report, that in instances of highly skewed and dichotomous dependent variables, estimated probabilities calculated through ordinary least squares regression are very close to those obtained from a considerably more sophisticated--and complex to program and interpret--procedure using logit analysis. While the above strongly suggests that OLS is an appropriate procedure in the analysis of the data for the present study, a critic could reply that this Appendix merely shows

that both OLS and logit regression are similarly inappropriate models to account for the relationships among the included variables. The present authors feel it is beyond the scope of this research to further evaluate the relative applicability of the methodological procedures used herein.

Table A1. Adjusted probability* of desiring additional children, according to survival status of previous pregnancies and the outcome of the current pregnancy: OLS versus logit regression estimates (Egyptian Women with 3 pregnancies previous to the current delivery).

	Estimated Probability of Desiring at least 1 Additional Child	
	OLS	Logit
Previous pregnancy outcomes		
All living	.12	.11
2 living; 1 dead (last alive)	.18	.16
2 living; 1 dead (last dead)	.09	.08
1 living; 2 dead (last alive)	.37	.38
1 living; 2 dead (last dead)	.30	.30
All dead	.63	.62
Current pregnancy outcome		
Surviving	.18	.15
Not surviving	.31	.28

*An estimate of the probability of desiring additional children for women in specified categories of child survivorship who are "average" with respect to all remaining variables in the regression equation.

N = 545

Table A2. Adjusted probability of planned contraceptive use, according to survival status of previous pregnancies, outcome of the current pregnancy, previous contraceptive use, and the desire for additional children: OLS versus logit regression estimates (Egyptian Women with 3 pregnancies previous to the current delivery).

	Estimated Probability of Planned Contraceptive Use	
	OLS	Logit
Previous pregnancy outcomes		
All living	.83	.90
2 living; 1 dead (last alive)	.90	.96
2 living; 1 dead (last dead)	.81	.87
1 living; 2 dead (last alive)	.70	.78
1 living; 2 dead (last dead)	.78	.86
All dead	.66	.77
Current pregnancy outcome		
Surviving	.83	.91
Not surviving	.69	.75
Previous contraception		
Used	.86	.94
Not used	.79	.87
Desire for additional children		
Yes	.45	.50
No	.91	.94

N = 545

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