

The Demographic Impact of the Family Planning—Health Services Project in Matlab, Bangladesh

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Demographic research has shown that fertility has declined in a variety of settings where there has been concomitant proliferation of contraceptive use. This has suggested to many observers that organized contraceptive service programs have contributed to the observed trends.¹ Yet the causal role of contraceptive service programs in inducing and sustaining fertility reduction in developing countries continues to be the subject of discussion and debate, principally because establishing causality requires rigorous experimental designs. Field experiments appropriate for a test of service program effects require large-scale field operations, treatment and control areas, and accurate longitudinal demographic data—conditions that can rarely be met in practice.² This report analyzes the demographic effects of a study in Matlab Thana of Bangladesh that meets these conditions.

The Family Planning—Health Services Project Hypothesis

The Family Planning—Health Services Project (FPHSP) was launched by the Cholera Research Laboratory (CRL)³ in October 1977 and continues to the

present. The FPHSP followed an earlier study, the Contraceptive Distribution Project (CDP).⁴ Although these studies differed in their service strategies, they shared an underlying hypothesis—namely, that contraceptive service programs can increase the prevalence of contraceptive use by fulfilling a latent demand for services. According to this hypothesis, meeting this demand will change fertility significantly by increasing the prevalence of birth spacing and limitation behavior.

The Matlab Setting

Matlab was selected for contraceptive field experiments because of the demographic data resources of the CRL. In 1963, a demographic surveillance system (DSS) was established for evaluating cholera vaccines. At the time the FPHSP was launched in 1977, the DSS encompassed 149 villages and a population of approximately 168,000. Since research had shown that the DSS data are complete and accurate, contraceptive service effects could be evaluated by simply tabulating vital data for the Matlab area and updating census data for 1974 with birth, death, and migration data for successive years. Since the population under surveillance was large and the mobility of families is limited, it was possible to designate treatment and comparison areas.

The value of Matlab as a social research laboratory is greatly enhanced by features of the geographic and social setting that mitigate the prospect of confounding effects from social or economic change. The geography of the area tends to insulate treatments from one another and from the outside world. Matlab is a totally rural, riverine area intersected by tributaries of the Gumoti and Megna rivers. As such it is largely inaccessible by road or other forms of modern transportation and communication and is therefore an area where the potentially contaminating effects of

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intervillage trade and contact are less than would prevail in most other rural areas of Asia.

The social setting in Matlab can also be viewed as relatively free of potentially contaminating factors. In much of Asia rural populations have been increasingly exposed to nontraditional economic institutions and values in recent years. Mass communication and transportation, for example, have penetrated most rural areas of South East Asia, with effects on values and aspirations that greatly complicate the assessment of the net effects of contraceptive services. While it would be incorrect to posit that conditions in Matlab have been altogether static in recent years, there is no evidence of systematic economic, social, or political improvements of the sort that would contribute significantly to demographic change. In fact, most analysts stress the worsening of conditions in rural Bangladesh: landlessness has grown markedly in recent years;⁵ illiteracy, though high, has not declined;⁶ and health conditions, while improved in this century owing to control of infectious diseases, may have deteriorated over the past decade from the combined effects of political crises and famine.⁷ The changes that have occurred are therefore not of a sort that demographers regard as prerequisites or corequisites of demographic transition.⁸ Even if change were occurring, it is reasonable to argue that trends would affect treatment and comparison areas similarly.⁹ Since the pre-experimental population was noncontracepting and dramatic socioeconomic development is lacking, the prospect that secular fertility changes would confound results is remote. Matlab is thus in many respects an ideal site for testing the latent-demand hypothesis.

Experimental Design

The FPHSP design was intended to address issues that arose from an earlier study, the CDP. The CDP employed largely illiterate and elderly female workers, who distributed pills and condoms to women in their homes.¹⁰ After an initial three-month period of success, prevalence declined. Demographic effects were limited to the first project impact year.¹¹ Since the project was initially successful, the CDP findings suggested an unfulfilled demand. Since effects were temporary, however, the CDP findings suggested that a residual unfulfilled demand for contraception persisted in 1977 despite two years of CDP services—a demand that could be better served by a wider battery of methods and more intensive follow-up and care of users. Certain operational problems of the CDP approach underscored this conclusion. Although workers were knowledgeable about their vil-

lages, they were too old to have practiced co-acceptation, and they were not trained to deal with side effects. Thus they lacked credibility as family planning workers and were only infrequently relied upon for contraceptive advice. This situation was exacerbated by their relatively low social status among villagers, who accorded them too little prestige for them to be effective agents of social change.

The limitations of the CDP led to a restructuring of contraceptive research in Matlab into the Family Planning-Health Services Project (FPHSP).¹² CDP treatments were partitioned into cells of the FPHSP and subsequently collapsed into new treatments. The populations of village groups of the new design are shown in Table 1.

Although the FPHSP work began in October 1977, CDP household distribution activity continued in CDP treatment areas until March 1978, when fieldworkers provided acceptors with a six-month supply and advised them to contact local government family planning workers for their future supplies. In the remaining half of the CDP distribution area and in half of the comparison area, a new FPHSP field structure was developed.¹³ Literate, young, married village workers were recruited, most of whom were members of influential families. All were recruited from households in the village in which they were to work. These female village workers (FVWs) were given six weeks of intensive training in contraception, field visitation methods, and basic reproductive physiology. In the first 12 months of the project weekly meetings were convened to train FVWs in the treatment of minor ailments, basic nutrition, tetanus toxoid injection methods, and other MCH work.

The administrative system incorporated two forms of supervision: technical supervision for treatment and referral of MCH/FP problems, and administrative supervision to ensure that work was being done on schedule at all levels. This system involved recruitment of lady family planning visitors (LFPVs), who were government-certified paramedics with 18 months of formal training, and male supervisors, senior health assistants (SHA). One SHA and one LFPV were assigned to districts of 20 villages, each encompassing a population of 20,000. SHAs served as male motivators and community organizers. One medical officer was assigned to the project, to supervise tubectomies in Matlab,¹⁴ conduct medical rounds in the field, and train paramedics continuously.

Day-to-day management of the FPHSP was conducted by an administrator-paramedic and two assistants. Field staff were accountable to them for both service and research activities.

This service system was maintained continuously over the period October 1977 to October 1981.

TABLE 1 Populations of village groups in the CDP-FPHSP experimental design

	FPHSP villages					
	Treatment			Comparison		
	Number of villages	1974 ^a population	1978 ^b population	Number of villages	1974 ^a population	1978 ^b population
Former CDP treatment	39	42043	44682	54	43742	45020
Former CDP comparison	31	42731	44668	25	39134	40576
Total FPHSP ^c	70	84774	89350	79	82876	85596

^aMidyear population, 1974. ^bYear-end population. ^cNote that the DSS surveillance area was contracted to 149 villages in 1978 owing to cost constraints. Thus CDP cell populations do not correspond to the presentation of CDP treatments in Stinson et al., in this issue.

The overall goal of the FPHSP service system was to shift from the emphasis of the CDP on contraceptive technology to an emphasis on comprehensive contraceptive care, to include frequent and regular visits to all women whether contracepting or not, a wide choice of methods conveniently available, and ancillary health services. The initial emphasis was on comprehensive family planning services rather than MCH. The most important change was the addition of Depo Medroxyprogesterone Acetate (DMPA) to the battery of methods available in the village. At the subcenters paramedics inserted Copper T intrauterine devices and performed menstrual regulation.¹⁵ The principal link between health and family planning services was a three-tiered referral system for the detection and treatment of side effects. All FVWs treated minor side effects and referred more serious problems to LFPVs, based in stationary subcenters, for treatment. LFPVs, in turn, were trained to conduct further referral to the physician in the Matlab clinic.

Methodology

The most salient feature of the methodology that follows is its simplicity: direct unadjusted fertility measures can be used owing to the availability of accurate and complete census and vital data for the period from 1968 to the present.¹⁶ The DSS system has included birth, death, and migration registration since 1966 and marriage registration since 1975. Although intervillage migration is recorded in the field, only migration into and out of the surveillance areas is computerized. Thus information is not available on local migration, most notably among younger women who migrate for marriage. Resulting biases, if any, accumulate with time, but they are likely to be con-

centrated among women under age 20 or 25. A critical assumption of the research reported below is that net migration across treatment boundaries was sufficiently inconsequential to permit reliable birth rate comparisons.

This study presents quarterly and annual births for various village groups¹⁷ for the period between mid-1974 and mid-1980.¹⁸ The number of births was obtained from the vital registration data, although it should be noted that 1980 figures are preliminary.¹⁹ The denominator was estimated for each period after mid-1974 by the *lexis* method of advancing a portion (in this case one-tenth) of each age group for each semester,²⁰ adjusting for deaths and net migration. Because project impact assessment begins at mid-years, all annual rates are expressed in July to June project years (PY). Denominators for annual birth rates of each PY use the estimated December 31st population, while midquarter denominators were interpolated for quarterly rates.

Three fertility measures are emphasized in this analysis. The first is the general fertility rate (GFR), which is calculated by dividing total births during a particular time period by the estimated number of women aged 15 to 44. Quarterly rates were annualized by multiplication. Since younger women typically have higher fertility rates than older ones, this measure is only appropriate if the areas and time periods being compared have approximately the same age distribution, as they do in this study.²¹ Since project effects seemed to vary by age, we also calculated age-specific rates for women aged 15 to 29 and for women 30 and over. Five-year age-specific rates were calculated by year but not by quarter, owing to marked random fluctuation in quarterly rates for small populations. The total fertility rate (TFR) is not used extensively because the computational assumption of equal numbers of women in

each five-year age group spuriously accentuates fertility impact if effects are pronounced among women aged 35 and over.

Results

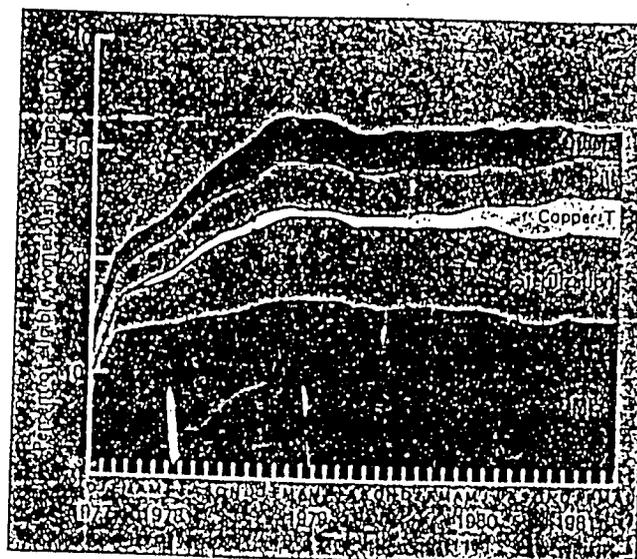
Trends in Contraceptive Use Prevalence

Introduction of the FPHSP system was followed by a dramatic rise in contraceptive prevalence from 10 percent in October 1977 to 34 percent by the end of 1978, where use prevalence has remained to date. This trend in prevalence is illustrated in Figure 1. Contraceptive use was initially dominated by DMPA, but as alternative methods were developed—most notably tubectomy and the Copper T—the proportion of users protected by DMPA declined. But more significant, perhaps, than the declining proportion of DMPA users is the finding that absolute prevalence of DMPA has been roughly constant. Thus, as more methods were added to the cafeteria, more women were protected. This suggests that a wider choice of methods contributes to overall levels of contraceptive protection.

The Demographic Impact of the FPHSP

Table 2 presents fertility measures for the FPHSP for four years prior to the program and for two years in which program effects are possible. Since services were launched in the fourth quarter of 1977, July of 1978 was the earliest date for which effects were possible.

FIGURE 1 Trends in prevalence of contraceptive use among married women of reproductive age by method, FPHSP treatment area, 1977-81



The data in Table 2 demonstrate that fertility patterns and levels were similar prior to PY 1976. By PY 1976 and PY 1977 treatment area fertility was approximately 8 percent lower than control area fertility, although age-specific rates show no consistent trend over time. We thus conclude from the table that fertility levels were essentially similar before the FPHSP, although minor differences arose in 1976 and 1977. We analyze the differences below.

The PY 1978 data contrast markedly with the level and pattern of fertility in the preproject period. Overall fertility in the treatment area was 25 percent lower than comparison area rates, a difference that

TABLE 2 Age-specific fertility rates, total fertility rates (TFR), and general fertility rates (GFR) for the comparison and treatment areas of the FPHSP, preproject and project periods

Age group	Preproject period									Project period								
	1974 ^a			1975 ^a			1976 ^a			1977 ^a			1978 ^a			1979 ^a		
	T	C	% diff.															
15-19	152.1	155.1	- 1.9	114.7	122.8	- 6.6	171.9	181.3	- 5.2	135.6	161.0	-15.8**	125.5	146.1	-14.1**	148.3	156.1	- 5.0
20-24	259.8	260.4	- 0.2	186.1	185.4	+ 0.4	303.0	337.6	-10.2*	232.2	248.6	- 6.6	216.1	269.0	-19.7**	235.6	308.6	-23.7**
25-29	275.4	267.9	+ 2.6	188.1	207.8	- 9.5	291.7	331.6	-11.1**	241.9	259.6	- 6.8	185.3	236.1	-21.5**	215.7	281.7	-23.4**
30-34	213.9	231.2	- 7.5	181.1	184.8	- 2.0	315.6	328.2	- 3.8	236.4	274.4	-13.8**	184.5	253.7	-27.3**	168.7	260.5	-35.2**
35-39	122.4	122.1	+ 0.2	91.2	100.5	- 9.2	170.2	156.8	+ 8.5	150.8	151.6	- 2.5	95.6	186.3	-48.7**	114.1	199.9	-42.9**
40-44	46.1	53.9	-14.5	41.9	47.9	-12.5	64.7	72.7	-11.0	69.9	70.2	- 0.4	29.4	66.3	-55.6**	41.0	66.1	-37.9**
TFR	5.4	5.5	- 1.8	4.0	4.3	- 5.4	6.6	7.0	- 6.2	5.3	5.8	- 8.7	4.2	5.8	-27.8	4.6	6.4	-28.1
GFR	185.4	186.6	- 0.6	138.5	145.0	- 4.5	225.2	239.9	- 6.2*	180.2	198.6	- 9.3*	147.3	196.5	-25.0**	164.1	217.8	-24.7**

T = FPHSP treatment area. C = FPHSP comparison area. ^aAll years are project years (July to June) of the specified year. *Statistically significant at $p < .05$. **Statistically significant at $p < .01$. TFR differences were not tested.

FIGURE 2. Quarterly GFRs in FPHSP treatment and comparison areas, 1974-80

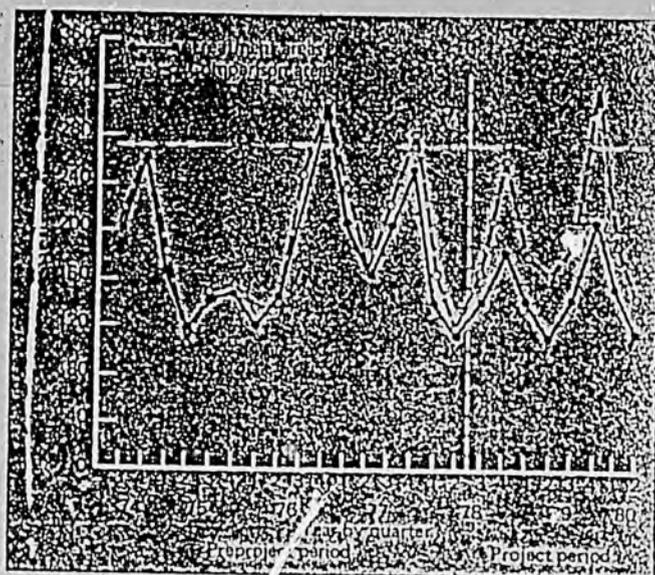
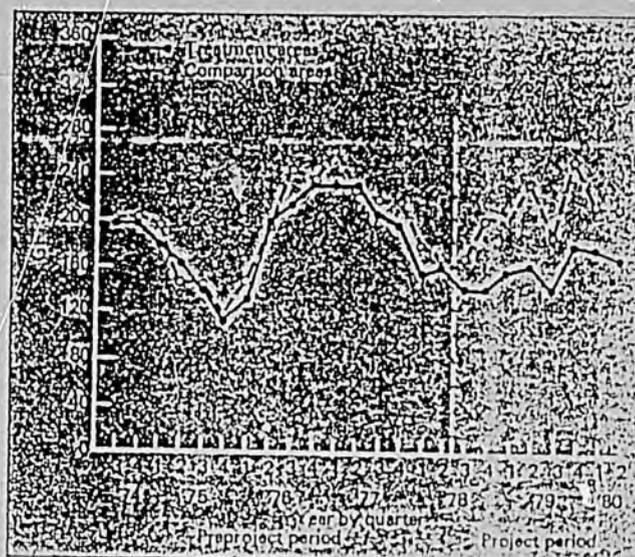


FIGURE 3. Quarterly seasonally adjusted GFRs in FPHSP treatment and comparison areas, 1974-80



accrued principally from marked reductions in fertility among women aged 30 and over. Among women aged 30-34 in Table 2, the birth rate is 27 percent lower in the treatment area than in the comparison area. Among women 35 and over the treatment area fertility level is nearly 50 percent lower—a differential that was unprecedented in recent years. The data thus suggest that fertility effects of the FPHSP were significant, substantially so among women aged 30 and over. The data, moreover, demonstrate a direct relationship between age and program impact: between-treatment differentials (i.e., percent difference between the CDP and FPHSP treatment and comparison areas) range over all age groups and increase monotonically with age.

The time series in Figures 2-5 further elucidate the impact of the FPHSP. Figure 2 depicts the GFR time series for the FPHSP areas. Fertility levels were closely comparable across the FPHSP treatment and comparison areas prior to the time of CDP impact. The timing of the onset of lower FPHSP treatment area fertility suggests that a differential impact of the CDP across the areas apportioned to treatments of the FPHSP may have contaminated the FPHSP. Thus FPHSP fertility may have been lower at the outset than it would have been in the absence of the CDP because areas where the CDP was most effective were assigned to the treatment area of the FPHSP. The trajectory of the GFR over time nevertheless suggests that a more pronounced differential emerged during the FPHSP and that the magnitude of the differential was unprecedented in recent years.

As Figure 2 illustrates, natural fertility in rural Bangladesh is subject to marked seasonal variation that can obfuscate the short-term effects of fertility control.²² We therefore compute seasonally adjusted fertility rates in order to elucidate FPHSP effects in the context of long-term fertility trends. These seasonally adjusted rates are depicted in Figure 3.²³ The Figure 3 time series shows more clearly than Figure 2 the hypothesized contaminating effect of the CDP and the pronounced effect of the FPHSP in the project period. Viewed in terms of the long-range cycles in fertility, the FPHSP impact period commenced at a time when fertility was unusually low owing to the "ripple effect" of the 1974 famine. An unusually large proportion of women were at risk of conception in 1975 owing to the low fertility in that year. Birth rates were therefore high in 1976, which, in turn, reduced the proportion of women at risk of conception in the subsequent year. Although the FPHSP did not reduce fertility below the already low 1978 levels, it averted a rise in treatment area fertility that would have occurred in the absence of FPHSP services. This is illustrated in Figure 3 by the sustained increase in comparison area fertility over the 1978 to 1980 period.

Figure 4 shows that the FPHSP had a sustained effect on fertility among women under age 30 that was not restricted to the peak fertility season. Figure 5 shows the more pronounced impact of the program among women aged 30 and over and the tendency of the program to dampen seasonal fertility swings among older women. This is not surprising since seasonality is a natural fertility phenomenon.²⁴

FIGURE 4 Quarterly fertility rates among women aged 15-29 in FPHSP treatment and comparison areas, 1974-80

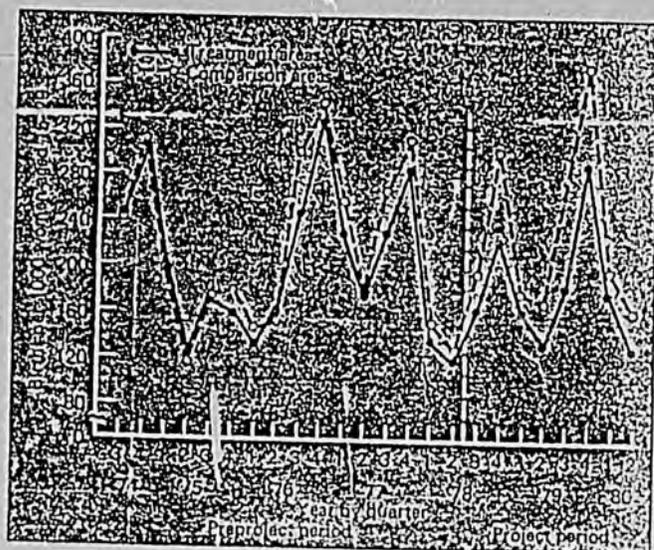
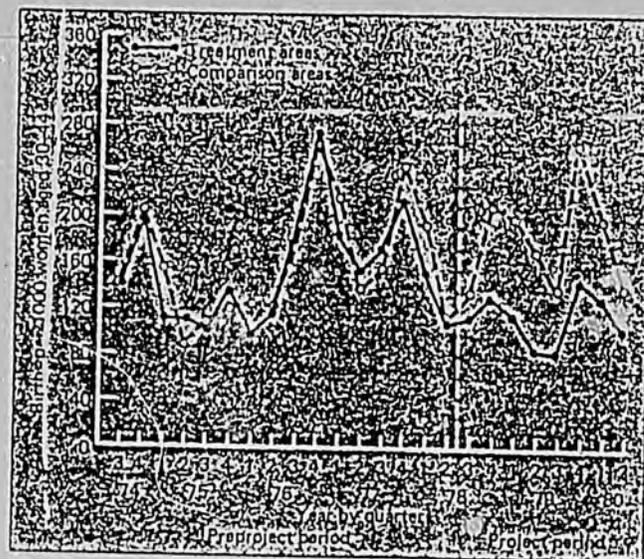


FIGURE 5 Quarterly fertility rates among women aged 30-44 in FPHSP treatment and comparison areas, 1974-80



Adjustment for Contamination

Figures 2-5 show fertility trends that are consistent with the hypothesis that the CDP contaminated the FPHSP. It is therefore appropriate to model the fertility levels for the project periods of the CDP and the FPHSP for the four cells of the CDP-FPHSP design. The objective of modeling is to adjust the effects of one project for concomitant effects of the other. Since seasonality is pronounced, it is also useful to examine net effects of services controlling for fertility cycles unrelated to service activities. A model that achieves this is the following:

$$Y_t = \phi_1 Y_{t-1} + \dots + \phi_p Y_{t-p} + \alpha + \sum \beta_i + \gamma + \delta \quad (1)$$

where,

Y_t = the general fertility rate at time t ,

ϕ_i = a lag coefficient for time lag i for p specified lags,

α = an intercept equivalent to the mean GFR for quarter 4,

β_i = seasonality effects,

γ = the additive effect of the CDP, and

δ = the additive effect of the FPHSP.

The sample for estimation of (1) consists of 64 quarterly observations of GFRs for the four village groups of the CDP-FPHSP design over the 1976-80 period. Estimation uses the method of Box and Jenkins.²⁵

The estimated parameters of this model are reported in Table 3. Coefficients attest to the predominant independent effects of seasonal variation. This suggests that variation in natural fertility determi-

nants such as the timing of marriage, coital frequency, spouse separation, and the like accounts for substantially more of the variation in Matlab fertility than variables defining the presence or absence of FPHSP or CDP conditions. Tests on coefficients nevertheless suggest that both service strategies had fertility effects, substantially so among couples in the FPHSP areas. Over 80 percent of the variance is explained by the regression, the unexplained portion being secular trends or "famine ripple" effects discussed above.

The expected GFRs in Table 3 show the predicted Y under different conditions. The intercept row (202.8) is the predicted GFR when all independent variables are set at their means—the sample grand mean of the GFRs. The GFR for the seasons is the predicted GFR when all seasonal effects are set at their means and CDP and FPHSP effects are zero. Thus the CDP and FPHSP coefficients express the additive effect of services adjusting for seasonality. The predicted CDP GFR (203.0) represents an 8.3 percent impact on fertility, on the average.²⁶ The FPHSP GFR, 172.7, represents a net decline of 22 percent. Thus the coefficients suggest an effect of the FPHSP that is nearly three times the effect of the CDP.

Additional regressions were estimated to test the hypothesis that program effects are subject to seasonal variation. Since interaction terms were insignificant, regressions fail to support the hypothesis that treatment effects vary with fertility seasonality.²⁷ Effects of programs are thus additive: contraceptive services have altered the level of fertility but not the seasonal variation in fertility.

TABLE 3 First-order autoregressive analysis of the relative impact of the CDP and the FPHSP

Coefficient name	Coefficient	Standard error	t ratio	Predicted GFR
ϕ	-0.5	0.1	-4.4**	--
Intercept*	290.5	9.3	31.1**	202.8 ^a
Quarter 1 effect	-87.7	7.4	-11.8**	221.4 ^a
Quarter 2 effect	-129.8	8.2	-15.8**	203.0 ^a
Quarter 3 effect	-80.8	6.8	-11.9**	172.7 ^a
CDP effect	-18.4	11.0	-1.7*	
FPHSP effect	-48.7	11.8	-4.5**	

Multiple R = 0.910
 $R^2 = 0.828$
 $F = 55.92^{**}$ d.f. = $K/N - K - 1/58$
 * $p < .05$ (one tail)
 ** $p < .001$ (one tail)
 $N = 64$

^aSince quarter 4 is omitted, the intercept is the quarter 4 mean. ^bGFR = \bar{Y} = the grand mean. ^cGFR = $\bar{Y} = \alpha + \sum \beta_i \bar{X}_i$ ^dGFR = $\bar{Y} = \alpha + \sum \beta_i \bar{X}_i + \gamma$

We conclude, in summary, that both projects had a net effect on fertility. Seasonality has more pronounced effects than contraceptive services—effects that are dampened in absolute, but not relative terms by widespread fertility control. The FPHSP, under the assumptions employed, reduced fertility by an amount ranging between 22 and 25 percent in its first two project years.

Implications

Much of the international literature on population policy in the past decade has been addressed to a debate on the efficacy of contraceptive service programs.²⁸ Two positions have achieved prominence in this debate, although it could be argued that a third has emerged in recent years.

The first position holds that the effects of contraceptive services are a consequence of prior changes in reproductive motives. In this view contraceptive service effects are an outcome of social and demographic changes that influence reproductive motives. Once motives have been affected by social change, fertility limitation behavior will change, because traditional alternatives to contraception exist wherein some measure of fertility control can be exercised. Modern contraception can substitute for traditional birth planning behavior, but it can never induce demographic change.²⁹

The second position holds that contraceptive services have effects because a latent demand exists for efficient birth planning methods. In this view there are gradations in reproductive motives such that convenient, inexpensive, and effective services can to some extent obviate the need for strong fertility

control motives. In the absence of widespread birth limitation behavior, service programs can initiate fertility change.³⁰

A third view emerges from the study of contemporary demographic trends: namely, that contraceptive service programs do not initiate fertility change, but can nevertheless satiate a growing demand for fertility control more efficiently than traditional means and can stimulate diffusion of contraceptive innovation in traditional societies. Thus as demographic changes occur, fertility declines are more pronounced in the period following the introduction of services than in the prior period.³¹

The data from the Matlab contraceptive services studies support the second position. The findings appear to show that contraceptive services can initiate a fertility change in a poor rural traditional population. Thus it appears that an unmet demand for contraception exists in rural areas of Bangladesh that can be served by an intensive field program.

Six policy implications emerge from this research with specific relevance to Bangladesh.

First, fertility can be significantly reduced in Bangladesh by making contraceptives readily available to households. Effects are likely to be temporary, however, unless distribution involves trained workers who systematically follow-up users and attend to their needs. Since poverty and chronic ill health are widespread in rural Bangladesh, users are incapable of distinguishing side effects from other illnesses and cannot afford treatment for minor ailments. Although rural couples will experiment with new contraceptive technology, they will not sustain its use unless both real and perceived contraceptive and health problems are attended to by trained and sympathetic village-based paramedics.

Second, a user-oriented program with a wide choice of methods, skilled counseling, rigorous follow-up and treatment of side effects, and ancillary health services will be substantially more effective than one based on one or two methods distributed by unskilled workers. Moreover, effects can be sustained over time. It is difficult, in an analysis of the FPHSP, to determine the extent to which the project's success relates to family planning strategies (home-administered DMPA, follow-up, improved training, etc.) or to ancillary health services (treatment and referral of side effects, MCH care, etc.). It is useful to note, however, that dramatic increases in prevalence were attained prior to development of MCH services. Thus integration of MCH with family planning seems to have improved program performance through its direct effects on family planning care. A health service approach has enabled ICDDR,B workers to provide couples with a wider choice of methods and better contraceptive care than would be possible in a vertical family planning campaign. (The question of whether comprehensive MCH services aimed at reducing morbidity and mortality can indirectly affect fertility is a question to be addressed in future research.)

Third, seasonality of fertility is pronounced even in areas served by the FPHSP. This feature of fertility needs investigation and recognition in policy planning. Intensive campaigns, for example, will be much more effective if launched in the months from December to March than in April to November. Intensive education and promotional campaigns should coincide with seasons when conception rates are high. More research should be addressed to developing our understanding of natural fertility dynamics and their policy implications.

Fourth, trends in reproductive motives require further research. We have no evidence that reproductive motives have been affected by the two projects. We have observed that use prevalence in Matlab has remained constant at 34 percent for three years. This prevalence of use agrees well with the preproject proportion of women who said they were either using a method or would use one in future if contraceptives were provided. While this may suggest that we have met the existing demand for contraception in Matlab and that, by so doing, our project has had substantial fertility effects, we must study this question formally to determine whether reproductive motives have changed *after* acceptance of contraception. We recognize that further increases in the impact of the FPHSP may require changes in reproductive motives. Whether such motives can be influenced by health service interventions or other policies is thus a critical question to be investigated in Matlab in the next few years.

Fifth, more research is needed on the determinants of program success. Several villages in Matlab have use prevalence rates exceeding 50 percent; others have rates of less than 10 percent. The question of why the project succeeded in some villages but failed in others is an important research issue.

Sixth, the success of the Matlab experiment presents a challenge to researchers and administrators to discover ways in which project results can be translated into further action. In particular, it must be recognized that the ability of the ICDDR,B to train, field, supervise, and support a comprehensive contraceptive service program is the principal difference between the program in the FPHSP service and comparison areas. This operational ability needs careful scrutiny, with a view toward implementation of its elements elsewhere in Bangladesh. Future research should test implementation in the context of the government service system, and focus on identifying and understanding the critical barriers to replicating the Matlab experience.

The Matlab contraceptive service experiments demonstrate that rural Bangladesh holds considerable promise for achieving demographic development and that effective services can produce substantial fertility declines. The paucity of evidence of demographic effects resulting from the national program may thus relate more strongly to incomplete program implementation than to an absence of motivation among rural Bangladeshi couples to limit or space births.

References and Notes

- 1 See, for example, W. P. Mauldin and B. Berelson, with a section by Z. Sykes, "Conditions of fertility decline in developing countries, 1965-75," *Studies in Family Planning* 9, no. 5 (May 1978): 89-147.
- 2 A critical review of family planning experiments and their limitations is found in D. J. Hernandez, "The impact of family planning programs on fertility in developing countries: A critical evaluation," *Journal of Social Research* 10 (1981): 32-66.
- 3 In 1979, the CRL became the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).
- 4 The CDP is discussed in M. Rahman, W. H. Mosley, A. R. Khan, A. I. Chowdhury, and J. Chakraborty, "Contraceptive distribution in Bangladesh: Some lessons learned," *Studies in Family Planning* 11, no. 6 (June 1980): 191-201; and its effects are assessed in Wayne S. Stinson, James F. Phillips, Makhliur Rahman, and J. Chakraborty, "The demographic impact of the Contraceptive Distribution Project in Matlab, Bangladesh," in this issue.
- 5 M. Alamgir, "Some aspects of Bangladesh agriculture: Review of performance and evaluation of policies," *Bangladesh Development Studies* 2 (1975): 737-818.

- 6 Bangladesh Bureau of Statistics, *National Volume: 1974 Bangladesh Population Census Report* (Dacca: Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, 1977).
- 7 See, for example, G. T. Curlin, L. C. Chen, and S. B. Hussain, "Demographic crisis: The impact of the Bangladesh civil war (1971) on births and deaths in a rural area of Bangladesh," *Population Studies* 30 (1976): 87-105.
- 8 A useful review of the development situation in Bangladesh and its demographic consequences appears in W. B. Arthur and G. McNicoll, "An analytic survey of population and development in Bangladesh," *Population and Development Review* 4, no. 1 (March 1978): 23-80. Recent research in Indonesia has shown that areas with the greatest economic adversity are those most receptive to contraception: R. Freedman, Siew-Ean Khoo, and B. Supraptillah, "Modern contraceptive use in Indonesia: A challenge to conventional wisdom," *International Family Planning Perspectives* 7, no. 1 (1980): 3-15. Clearly the social and economic context of the Matlab study bears further investigation.
- 9 The question of possible contaminating effects of social and economic change in Matlab is difficult to assess because this has not been the subject of systematic investigation over time. Tabulation of the Matlab CRL census of 1974 has shown, however, that across-treatment socioeconomic status differentials were inconsequential: J. F. Phillips, S. Bhatia, and A. I. Chowdhury, "Differentials in social and economic characteristics of treatment and comparison areas of the Family Planning-Health Services Project, 1974 Cholera Research Laboratory Census, Matlab," unpublished manuscript, 1981.
- 10 Rahman et al., cited in note 4.
- 11 Stinson et al., cited in note 4.
- 12 A comprehensive review of the FPHSP is found in S. Bhatia, W. H. Mosley, A. S. G. Faruque, and J. Chakraborty, "The Matlab Family Planning-Health Services Project," *Studies in Family Planning* 11, no. 6 (June 1980): 202-212. Although the project has included maternal and child health services, only tetanus immunization and oral therapy for diarrhea have been fully implemented. Workers were trained to advise pregnant women on delivery practices, to provide nutritional information, and to train households on hygiene and sanitation. Since health work is mainly oriented to the treatment and care of contraceptive users, however, the approach is more one of comprehensive family planning services delivery than an integrated health service approach.
- 13 See Bhatia et al., cited in note 12, and J. F. Phillips, P. Clauquin, and J. Chakraborty, "A case study in the integration of health with family planning services in Matlab Thana, Bangladesh," paper presented at the Regional Seminar on Evaluation of Schemes and Strategies for Integrated Family Planning Programmes with Special Reference to Increased Involvement of Local Institutions (United Nations: ESCAP, Bangkok, June 1981).
- 14 All tubectomies are performed by paramedics in Matlab, with a physician attending.
- 15 Menstrual regulation (MR) is not actively promoted in the field. Rather, it has served primarily as a backup method for contraceptive failures. Accordingly, only 250 MRs were performed in three years.
- 16 This census and vital data system is known as the Demographic Surveillance System (DSS). A useful review of the DSS appears in Cholera Research Laboratory, *Demographic Surveillance System—Matlab, Vol. 1, Methods and Procedures* (mimeographed, March 1978); and K. M. A. Aziz, "The methodology of vital events registration in rural Bangladesh," in *Statistics—The Essential Tool for Research and Planning*, proceedings of the First National Statistical Conference of the Bangladesh Statistical Association, March 1977, pp. 98-101.
- 17 Births to women under 15 or over 44 were added to the adjacent age groups.
- 18 In mid-1978, 84 villages were dropped from surveillance. Only the included villages are used in FPHSP tabulations. Thus FPHSP analyses of 1974-78 data use the reduced DSS area villages to ensure comparability with tabulations of post-1978 data.
- 19 Mortality and migration data for 1980 are incomplete. Incomplete mortality data introduced only minor spurious reductions in 1980 rates, however, because mortality among women in the childbearing ages is low. The 1980 data presented below are nevertheless tentative and subject to revision.
- 20 Denominators for five-year age groups are somewhat distorted by age heaping and by discontinuities in the size of individual age groups. We advanced a constant one-tenth of each five-year age group per semester, although a graduated method using a parabolic curve would have been more valid. Most analyses in this paper are based on 15-year age groups or on the general fertility rate, and it is doubtful whether results would have been significantly affected by this refinement.
- 21 Age differentials do not affect our areal comparisons, but the fall in the median age by approximately 15 months from 1974 to 1979 has a slight impact on chronological comparisons.
- 22 Seasonality was first documented in J. Stoeckel and A. K. M. A. Chowdhury, "Seasonal variation in births in rural East Pakistan," *Journal of Biosocial Science* 4 (1972): 107-116, and has been observed in other areas of Bangladesh. See, for example, the reports of fertility dynamics in Campanigonj in N. Alam, A. Ashraf, and A. H. Khan, "Land, famine, and fertility," a report from the Research and Evaluation Unit of Campanigonj Health Project (Dacca: Christian Commission for Development in Bangladesh, 1980, mimeo). Becker has analyzed and modeled seasonal variation for the 1968-74 period and found a corroborating pattern in which peaks and troughs varied 40 percent from the mean, a level of variation that is "more pronounced than social, economic, or geographic differentials that have been observed in the Bangladesh population": S. Becker, "Seasonality of fertility in Matlab, Bangladesh," *Journal of*

Biosocial Science 13, no. 1 (1979): 97-105. Seasonality of coital behavior is the most frequently cited explanation for this pattern (see H. D. Gupta, "Climate and conception rates in Punjab India," *Indian Journal of Public Health* 19 (1975): 122; and K. M. A. Aziz, *Sex Socialization and Philosophies of Life in Relation to Fertility Behavior: An Anthropological Approach*, Ph.D. dissertation, Rajshahi University, 1981), although seasonality in spouse separation contributes to the observed pattern; L. C. Chen, S. Ahmed, G. Geschie, and W. H. Mosley, "A prospective study of birth interval dynamics in rural East Pakistan," *Population* 28 (1974): 277-297. The harvest season, which precedes the peak conception period, reduces nutritional adversity, thereby increasing fecundability at a time when coital frequency is relatively high owing to the cool weather at that time of year; S. L. Huffman, A. K. M. A. Chowdhury, W. H. Mosley, and J. Chakraborty, "Nutrition and post partum amenorrhea in rural Bangladesh," *Population Studies* 32, no. 2 (1978): 251-260.

23 In Figure 3 seasonality was adjusted by the following procedure: Let F define an adjustment factor for quarter i of age group m . Then

$$F_{im} = \frac{\sum_{i=1}^4 \sum_{j=2}^6 B_{ijm}}{\sum_{j=2}^6 B_{ijm}} \quad (2)$$

where B_{ijm} is the number of births to mothers aged m in quarter i of year j annualized by multiplying by four. The adjusted GFR was calculated using quarterly factors for each age group as follows:

$$GFR_{ij} = \frac{\sum_{m=4}^9 F_{im} B_{ijm}}{P_{ij}} \cdot 100 \quad (3)$$

where the GFR_{ij} is the adjusted general fertility rate for quarter i of year j and P_{ij} is the number of women 15-44 at risk in midquarter i of year j . An implicit assumption of this approach is that seasonality is multiplicative: high fertility generates high seasonality. A useful discussion of alternative factors is found in C. Chatfield, *The Analysis of Time Series: An Introduction* (London: Chapman and Hall, 1980).

- 24 As Figure 1 shows, contraceptive use prevalence is not seasonal in Matlab.
- 25 G. E. P. Box and G. M. Jenkins, *Time Series Analysis, Forecasting and Control* (San Francisco: Holden-Day, 1976).
- 26 Stinson et al. (in this issue) have shown that a single fertility-impact estimate for the two years of the CDP is inappropriate because effects occurred in the first year only. The lasting impact of the CDP was thus nil.
- 27 Second-order interactions with age were not tested. It is possible that program effects are seasonal among women over age 30.
- 28 A useful review of positions in this debate can be found in R. Freedman and B. Berelson, "The record of family planning programs," *Studies in Family Planning* 7, no. 1 (January 1976): 1-40. Positions in the debate are well represented by Amy Ong Tsui and Donald J. Bogue, "Declining world fertility: Trends, causes, implications," *Population Bulletin* 33, no. 4 (Washington, D.C.: Population Reference Bureau, 1978), and a critical review of that paper in Paul Demeny, "On the end of the population explosion," *Population and Development Review* 5, no. 1 (March 1979): 141-162.
- 29 J. Blake and P. Das Gupta, "Reproductive motivation versus contraceptive technology: Is recent American experience an exception?" *Population and Development Review* 1, no. 2 (December 1975): 229-250.
- 30 D. J. Bogue, "The end of the population explosion," *The Public Interest* 7 (Spring 1967): 11-20.
- 31 Mauldin and Berelson, cited in note 1.