

**CONTRACEPTIVE INTENTIONS AND SUBSEQUENT
USE: FAMILY PLANNING PROGRAM EFFECTS
IN MOROCCO**

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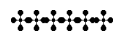
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ABSTRACT

While the extent to which organized family planning programs influence reproductive preferences remains a subject of debate, most observers would grant that such programs play a key role in helping individuals to realize their contraceptive/reproductive intentions. However, few prior studies have quantified the magnitude of this "facilitating" or "enabling" effect of family planning services given demand for contraception. This study takes advantage of panel survey data and linked information on the supply environment for family planning services in Morocco to attempt to bridge this research gap. In the analysis, contraceptive use during the 1992-95 period is related to contraceptive intentions in 1992, individual-, household-, and community-level determinants of contraceptive behavior, and family planning supply factors. Estimation procedures are used that control for unobserved joint determinants of contraceptive intentions and use. While evidence of a significant enabling/facilitating role of family planning services is indeed found, the findings also suggest that family planning program factors influence contraceptive intentions in important ways.

INTRODUCTION

Do organized family planning programs hasten the transition from high to low fertility and, if so, what is the magnitude of their contribution to fertility decline vis-a-vis other determinants of societal fertility levels (e.g., levels of infant mortality, socioeconomic development, education, etc.)? These questions have long been the subject of debate in the international population community (see Freedman, 1997; Bongaarts, 1994 and 1995; Knowles et al., 1994; Pritchett, 1994 for recent contributions to this debate).

At the heart of the debate is the issue of the causal pathways through which family planning programs influence contraceptive use and ultimately fertility. Three possible paths of influence may be distinguished. First, programs might influence fertility preferences (i.e., demand for children) by influencing social norms regarding family size. Secondly, programs might contribute to the conversion of latent demand for fewer children into manifest demand for

contraception by increasing the social acceptability of contraception. Finally, programs might influence the likelihood of contraceptive use given demand by reducing the economic and psychosocial costs of contracepting.

The strength of the empirical evidence regarding the respective causal pathways is varied. The weakest evidence is for family planning program effects on fertility preferences. In making the “demand side” argument, Pritchett (1994) contends that since (1) fertility transitions in developing countries have been driven primarily by changes in fertility preferences/demand for children and (2) factors such as mortality decline, economic development, and increases in education levels appear to account for a large share of societal changes in the level for demand for children, family planning programs have played a relatively limited role in the transition to lower fertility. In a more recent review, Freedman (1997) concluded that while there is some evidence that family planning programs have influenced fertility preferences, the evidence is thin. However, he notes that the lack of supporting evidence is as much the result of the limited number of rigorous studies that have examined this issue than an accumulation of negative findings.

The evidence in support of the second hypothesized path of influence is somewhat stronger. A number of studies suggest that family planning programs have been a catalyst in crystallizing latent demand for smaller families into intentions to contracept, and in some cases large increases in actual contraceptive use (Caldwell et al., 1988; Cleland, 1994; DeGraff, 1991; Koenig et al., 1987; Knodel et al., 1987; Phillips et al., 1996; Robinson and Cleland, 1992; Simmons et al., 1988; Simmons, 1996).

The third possible causal pathway is the least contentious of the three. Since a primary function of family planning programs is to reduce barriers to the use of contraception, one would logically anticipate that the probability of women and/or couples intending to contracept in the

future actually going on to adopt a method would be strongly influenced by the quantity and quality of family planning services available. Most observers would grant that programs play a key role in helping individuals to realize their contraceptive/reproductive intentions.

However, although less contentious, few prior studies have measured the magnitude of this specific "facilitating" or "enabling" effect of family planning services given demand for contraception (Cochrane and Guilkey, 1995, is an exception). As a result, the extent to which family planning programs are effective and/or efficient in carrying out this important role has not been well documented in prior research.

The paucity of prior micro-level research on this issue may be attributed largely to a lack of suitable data. In order to measure these effects well, longitudinal contraceptive use data for a panel of women with known intentions regarding future contraceptive use and linked data measuring the supply environment for family planning services are required. While linked program and household survey data are available in a number of settings due to the efforts of the Demographic and Health Survey (DHS) and The Population Council's Situation Analysis program, few panel surveys with linked family planning program data have been undertaken.¹

The present study takes advantage of an opportunity in Morocco to assess the magnitude of "supply-side" effects on contraceptive use given intentions to contracept. Because the 1995 Demographic and Health Survey (DHS) in Morocco was conducted as a panel survey using a sub-sample of respondents from the 1992 DHS, it is possible to relate contraceptive use during the 1992-95 period to stated intentions to contracept in the 1992 survey. In addition, data were gathered using the DHS Service Availability Module (SAM) protocol in conjunction with the 1992 survey, providing information on the quantity of family planning services available in sample communities (i.e., DHS sample clusters) and limited information on service quality.

DATA AND METHODS

Data

A total of 9,256 women 15-49 years of age were interviewed in the 1992 Morocco DHS-II survey (Ministere de la Sante Publique and Macro International, 1993). In the 1995 Morocco Panel Survey, 107 of the 212 sample clusters in the 1992 DHS-II were randomly chosen and field workers were instructed to revisit the same households chosen for the 1992 survey and interview all women aged 12-46 years in 1992 who had been recorded in the household roster for that survey, along with any new female household members aged 15-40 years (Azelmat et al., 1996). When a household interviewed in 1992 had moved out of the sample cluster prior to the 1995 survey, the 1995 interview was conducted with the new household that resided in the same dwelling. No attempt was made to locate either individuals or entire households that had moved outside the sample cluster during the period between the 1992 and 1995 surveys.

A total of 4,753 women aged 15-49 years were interviewed in the 1995 Panel Survey, of whom 3,168 had also been interviewed in the 1992 DHS-II.² This sample of women was restricted in several ways for the purposes of this study. Excluded from the sample of women considered were 770 women who reported using a contraceptive method at the time of the 1992 survey, 1,435 women who were not married at the time of one or the other survey interview, and 53 women who were not married to the same partner at the time of both surveys. The latter women were excluded on the grounds that changes in marital status or partners may have altered their contraceptive intentions or in other ways confounded the relationship between contraceptive intentions and subsequent use. After these exclusions, data for 910 women remained for analysis.

With the exception of information on contraceptive use during the 1992-95 period (which was obtained from the 1995 Panel Survey), all data used in the study were derived from the 1992 DHS-II and the accompanying Service Availability Module. The questionnaire used in the 1992 survey was a slightly modified version of the standard DHS-II "Model A" questionnaire. A series of individual- and household-level characteristics measured in the survey for each matched study subject was used as control variables in the analyses.

Intentions to use contraception were measured using standard DHS questions. Respondents not using a method at the time of the 1992 survey were asked "Do you intend to use a method to delay or to avoid pregnancy at any time in the future?" Respondents answering "yes" were then asked "Do you intend to use a method within the next 12 months?" Forty-two percent of respondents reported intending to use within the next 12 months, nine percent after 12 months, one percent that they intended to use a method but did not know when, 42 percent that they had no intention to use a method, and three percent were unsure as to their contraceptive intentions. For the purposes of this study, all women reporting an intent to use at some time in the future were considered to have intended to use a method. Women stating no intent to use a method and those who were unsure of their intentions were considered to not have an intent to use.

Information on the supply environment for family planning services and on the characteristics of the communities covered in the survey was obtained from the Service Availability Module implemented in conjunction with the DHS-II.³ For each sample cluster, information was gathered on community infrastructure (e.g., schools, markets, etc.) and on the number and types of facilities offering health and family planning services located within 30 km. of each cluster. The nearest of each type of facility (hospital, public clinic, private clinic, private doctor, and pharmacy) was also visited and information on these facilities and their service

delivery operations obtained. From this information, a series of indicators measuring selected aspects of the family planning service environment in the vicinity of sample clusters were constructed. On the basis of preliminary bivariate analyses, a small number of indicators were chosen for inclusion in the analyses. The operational definitions of these variables are provided in Table 1.⁴

Statistical Methods

The key questions to be addressed in the present study are (1) whether women intending to use contraception and residing in areas where the supply environment for family planning services was favorable/more developed were more likely to have gone on to use a method during the 1992-95 period than women with comparable intentions residing in areas where the service environment was less favorable, and (2) whether the magnitude of “supply-side” effects on contraceptive use are different for women who intended to use contraception than those that did not.

To test these hypotheses, the following equations were estimated:

$$C_{ij} = \alpha_1 + \alpha_2 I_{ij} + \alpha_3 X_{ij} + \alpha_4 Z_j + \alpha_5 P_j + \alpha_6 I_{ij} P_j + \epsilon_{1ij} \quad (1)$$

$$I_{ij} = \beta_1 + \beta_2 X_{ij} + \beta_3 Z_j + \beta_4 P_j + \epsilon_{2ij} \quad (2)$$

where the variable C_{ij} represents whether woman i from community j used a contraceptive method during the 1992-95 period, I_{ij} represents contraceptive intentions at the time of the 1992 survey, P_j represents indicators of the family planning supply environment, $I_{ij} P_j$ represents interactions between these two sets of factors to test whether the impact of the supply environment differs for women who reported in 1992 an intention to contracept in the future than for women who did not report an intention to contracept, X_{ij} represents individual-level and household-level

characteristics, Z_j represents community-level characteristics, and ε_{1ij} and ε_{2ij} represent error terms which may be correlated.

The contraceptive use equation and a contraceptive intentions equation were estimated simultaneously using the bivariate probit procedure. The rationale for the two-equation, bivariate probit model is to avoid the estimation problems that would result if a single-equation model were to be used and there were to be common unobserved determinants of contraceptive intentions and use. In addition, this approach takes into account the hypothesis that the family planning affects contraceptive use both directly (in the contraceptive use equation) and indirectly (in the intentions equation). Further details on and justification for this estimation approach may be found in the Appendix to this article.

Nonresponse Bias

An important methodological concern in panel studies is, of course, that of possible selection bias due to loss of respondents between data collection points (Duncan and Kalton, 1987). In the 1992 survey, 1,324 married women aged 15-46 years who were not using a contraceptive method were interviewed. Of these women, 1,024 were re-interviewed in 1995, yielding a retention rate of 77 percent. Previous assessments of these data revealed that women who were "lost-to-follow-up" indeed differed from those who were successfully interviewed in both survey rounds (Curtis and Westoff, 1996; Strickler et al., 1997). Re-interviewed women tended to be less well educated, older, of higher parity, and more likely to reside in a rural area. However, Curtis and Westoff (1996) demonstrate that re-interviewed and not-re-interviewed women were virtually identical with respect to intentions to use contraception, the key variable for the present study. Nevertheless, it is possible that women who were re-interviewed and those lost-to-follow-up

differed on unobserved determinants of contraceptive intentions and, if so, this might introduce bias of unknown direction and magnitude.

Validity of Responses to Survey Questions on Contraceptive Intentions

A key assumption in the present study is that responses to survey questions on contraceptive intentions provide valid measures of respondents' demand for contraception. If this were not the case, the estimated effects of family planning programs given demand for contraception would also lack validity. However, evidence from prior research indicates strong relationships between reported contraceptive intentions and levels/probabilities of subsequent use on a rather consistent basis (see Tan and Trey, 1994, and Curtis and Westoff, 1996, for reviews of the empirical evidence on this issue). Of particular relevance is the recent study of Curtis and Westoff (1996), who have examined this issue using the same data analyzed in the present study. The authors concluded that in Morocco, as in a number of other settings in which studies have been undertaken, responses to survey questions on intentions to use contraceptives are strong predictors of subsequent contraceptive behavior.

RESULTS

The Family Planning Supply Environment

Table 2 provides a summary of family planning supply characteristics in the communities considered in the study. As may be observed, facilities offering family planning services and/or supplies are readily accessible (at least physically) to residents of urban clusters. All urban clusters had at least one and in most instances several of each of the five primary types of fixed facilities offering family planning services in Morocco (hospitals, public clinics, private clinics,

private physicians, and pharmacies) located within 30 km., with the median distance to the nearest facility offering family planning services being less than 1 km.

Although less so than in urban areas, family planning services are also accessible to residents of rural clusters. All rural clusters had at least one facility offering family planning services located within 30 km., with a median distance to the nearest facility offering family planning services (usually a public clinic) being approximately 7 km. However, hospitals, private clinics, and private physicians are significantly less accessible to rural residents, with the median distance to the nearest of these types of facilities being 49, 72, and 43 km., respectively. The relative deficit of fixed facilities providing family planning services in rural clusters is at least partially offset by the provision of services through community-based distribution (CBD), which covered an estimated 69 percent of rural clusters in 1992.

Summary information on selected aspects of service "preparedness" (in terms of contraceptive supplies, staff training, and facility infrastructure) is also displayed in Table 2. Perhaps the most striking feature of these data is the magnitude of urban-rural differentials on most indicators. These results suggest that urban-rural differentials in physical access to facilities offering family planning services is compounded to some extent by differentials in facility staffing, infrastructure, and contraceptive method availability. However, it should be borne in mind that the SAM data provide little information on the more qualitative aspects of service delivery (e.g., interpersonal relations, information exchange, etc.), and thus may overstate the actual magnitude of urban-rural differences in what is conventionally thought of as service quality (Bruce, 1989).

Contraceptive Intentions and Other Factors Influencing Contraceptive Use

Of the 910 matched women who were not using a contraceptive method at the time of the 1992

DHS-II, 468 (52 percent) reported having used a contraceptive method at some point during the period between the 1992 and 1995 surveys (see Figure 1). As may be observed, the likelihood of having gone on to use a method during the three-year study period was substantially higher among women stating an intention to adopt contraception in 1992 (73 percent) than among women reporting no intention to contracept in the future (30 percent). Among “intenders” in the 1992 survey, women who intended to use within 12 months were the most likely to have used contraception during the 1992-95 period (76 percent), followed by women who intended to use later (67 percent) and women who were uncertain as to their time-frame for use (48 percent) (data not shown).

What might explain the behavior of women who stated no intention to contracept in the future in the 1992 survey interview but who in fact went to adopt a contraceptive method during the 1992-95 period? In just over one-third of such cases, the explanation appears to have been childbearing related; that is, women who reported wanting another child in 1992, went on to have a child during the observation period for the study, and apparently changed their mind about contraception, and initiated use of a method prior to the 1995 survey interview. Among the remaining “non-intenders” who went on to use a contraceptive method during the 1992-95 period, the reasons for having done so cannot be readily ascertained from the data available.

It is noteworthy, however, that among women reporting no intention to contracept in the future in the 1992 survey, 42 percent had previously used a contraceptive method. Among these women, 43 percent went on to adopt a contraceptive method during the 1992-95 period versus only 16 percent among women who had not previously used a contraceptive method. This would suggest that for these women at least, responses to questions on contraceptive intentions were transitory.

Information on differentials in the likelihood of having adopted a contraceptive method during the 1992-95 period by selected respondent background characteristics and family planning supply environment factors is provided in Table 3. Higher likelihoods of having adopted a contraceptive method are observed for fully literate women, those residing in urban areas or in communities with a sewage system (a proxy indicator for community wealth), and whose home had a cement floor (a proxy indicator for household wealth in the Moroccan context). It will be noted, however, that the likelihood of having adopted a contraceptive method varied inversely with age. The higher likelihood of younger as opposed to older women having adopted a method is consistent with the trend toward contraceptive use at increasingly younger ages in Morocco noted in other recent studies (Azelmat et al., 1996). It is also possible that given the relatively high contraceptive prevalence rate in Morocco (estimated at 50 percent of currently-married women in 1995 – Azelmat et al., 1996), some of the older women not using a contraceptive method in 1992 consisted of more traditional women who may oppose family planning or who simply aspired to large families.

A number of family planning supply environment factors were also strongly associated with the likelihood of having used a contraceptive method during the 1992-95 period. Several factors pertain to contraceptive method availability, and more specifically to the availability of oral contraceptives. That the likelihood of having adopted a contraceptive method is associated with the local availability of oral contraceptives is intuitively sensible given the heavy reliance of Moroccan women on this method – an estimated 64 percent of current contraceptive users were using pills in 1995 (Azelmat et al., 1996). Also emerging as statistically significant were several factors pertaining to characteristics of the nearest public clinic. The significance of public clinics is also sensible in Morocco since, other than in large cities, public clinics are the most accessible

type of fixed facility offering contraceptive services and supplies. In the 1995 Panel Survey, 58 percent of oral contraceptive users and 63 percent of users of any modern method identified a public clinic (i.e., health center or dispensary) as their usual source of supply (Azelmat et al., 1996).

Further analyses of these factors indicated a moderate to high degree of correlation among supply-side factors within sample clusters. Accordingly, a smaller set of such factors was retained for the multivariate analysis. These consisted of: (1) method availability at the nearest public clinic, (2) the number of nurses at the nearest public clinic, (3) the level of staff training in family planning at the nearest set of facilities, and (4) the level of infrastructure at the nearest private physician or clinic.

Multivariate Results

As described in the “Data and Methods” section, the net effects of contraceptive intentions and family planning supply-side factors on contraceptive use were estimated using a two-equation statistical model. The multivariate results are displayed in Table 4. Results from two models are shown – the first (Model 1) is an additive or main effects model, while the second (Model 2) allows for interactions between contraceptive intentions and family planning supply factors. Each model has a “contraceptive intentions” equation and a “contraceptive use” equation.

Looking first at the main effects model (Model 1), several factors emerged as having significant positive effects on contraceptive intentions in 1992.⁵ Among these were respondent’s age, literacy (full, but not partial), and presence of a cement floor in the respondent’s home (an indicator of household wealth). Unexpectedly, the presence of a community sewage system, which was included as a proxy indicator for community wealth, had a significant negative effect

when other factors were controlled statistically. This finding may reflect the tendency for older sections of large cities (i.e., “medina”) and newly developed urban fringe areas not to be endowed with public sewage systems. The strong negative effect of older age (i.e., being in the 35-49 age group) is, as discussed earlier, likely attributable to the combination of cohort and selection effects.

Of particular interest for the present study is the fact that three of the four supply-side factors considered also emerged as important net predictors of contraceptive intentions – method availability at the nearest public clinic ($p < .10$), number of nurses at the nearest public clinic, and the level of staff training in family planning at the nearest set of facilities. While these results might indicate a causal relationship between supply-side factors and contraceptive intentions, an alternative explanation should be borne in mind – the possibility that family planning program resources in Morocco have been allocated in a targeted fashion in response to demand for family planning. If so, the actual direction of causation might be from contraceptive demand/intentions to program factors.

The contraceptive use equation also yielded several interesting results. One important finding is that when the other factors considered in the analysis and unobserved joint determinants of contraceptive intentions and use are controlled statistically in the two-equation model, contraceptive intentions fails to emerge as a statistically significant predictor of subsequent contraceptive use. This result is at odds with the observation of significant net effects of contraceptive intentions on subsequent contraceptive behavior in several prior studies (see Curtis and Westoff, 1996, for a review of relevant literature), as well as with the results of preliminary analyses undertaken for the present study using a single-equation statistical model.⁶

The most plausible explanation of this result is that the earlier studies and preliminary

analyses undertaken for the present study failed to adequately control for the effects of unmeasured factors that are important determinants of both contraceptive intentions and use. That such factors have been accounted for by the two-equation model used in the present study is indicated by the Rho statistic shown at the bottom of Table 4. The Rho statistic measures the degree of correlation between the error terms in two regression equations. While this Rho is not statistically significant, we believe the two equation modeling approach is justified for two reasons. First, compared to a one-equation naïve model in which contraceptive intentions has a highly significant effect on actual use (not presented), the presence of unobservable factors substantially reduces the magnitude of the effect of intentions on contraceptive use. Second, the modeling approach allows the family planning supply environment to have both direct and indirect effects on contraceptive use. We revisit this finding in the “Discussion” section.

Among respondent background factors, only respondent’s age and presence of a cement floor emerged as significant predictors of subsequent contraceptive use.⁷ Only one supply-side factor exhibited a significant net effect on the likelihood of contraceptive use – method availability at the nearest public clinic. When considered in light of the empirical results for the contraceptive intentions equation, this would seem to suggest that a broader range of supply environment factors plays a role in influencing intentions to contracept than actual contraceptive use given intentions.

Model 2 addresses the question of whether family planning supply factors influence the likelihood of contraceptive adoption differentially depending upon contraceptive intentions. To investigate this question, interactions between supply-side factors and contraceptive intentions in the contraceptive use equation were included in the model (the model is identical to Model 1 in all other respects). As may be observed, the results are largely unaffected by the introduction of

interactions. Only one of the interactions was statistically significant (and accordingly is the only one shown in Table 4) – the interaction between contraceptive intentions and method availability the nearest public clinic. Although we anticipated that the enabling/facilitating role of family planning supply factors would be reflected in larger effects for contraceptive “intenders,” the multivariate results indicate that women who reported no intention to use a contraceptive method in the 1992 survey were influenced to a greater extent by supply-side factors than women who stated an intention to use.

What might explain this result? While one might be tempted to question the validity of responses to the survey questions on contraceptive intentions, the consistency between stated intentions and subsequent contraceptive behavior observed in this and other studies indicates that the primary explanation must be sought elsewhere. One possible explanation is that women who intend to contracept tend to be sufficiently motivated to avoid further pregnancies that they are able to find alternative sources of supply even when the nearest source proves inadequate to their needs. This explanation is especially plausible in the Moroccan context given the heavy reliance of Moroccan women on oral contraceptives and their wide availability from sources other than public clinics (e.g., pharmacies and home visits/CBD). As such, it may be that limited method availability at public clinics may not pose as significant a burden on potential contraceptive users as it might in other settings.

As to why women stating no intention to contracept in 1992 were significantly more likely to have used a method by the time of the 1995 survey when method availability at the nearest public clinic was high than when it was low, the most plausible explanation would seem to be a supply-side effect on both contraceptive intentions and subsequent use. Because the causal ordering is clear, the empirical results of the contraceptive use equation provide stronger evidence

of such an effect than the results of the contraceptive intentions equation.

Simulation Results

Because the bivariate probit estimation procedure used in the study is non-linear, the magnitude of effects cannot be readily ascertained from the regression coefficients. To provide readers with an appreciation of the magnitude of effects observed in the study, a series of simulations were run. In the simulations, the predicted proportions of women (1) intending to use a contraceptive method in 1992 and (2) going on to use a contraceptive method during the 1992-95 period were compared under alternative scenarios concerning the supply environment for family planning services when the other factors considered in the analyses were held constant at their observed levels.

For the purposes of the simulation exercise, the family planning supply environment was defined in terms of the four supply factors considered in the multivariate analyses (see Table 4). Three “levels” of the supply environment were considered in the simulations. In the “baseline” simulation, each of the four supply factors were set at their observed levels in each sample cluster (i.e., the levels indicated by the 1992 Service Availability Module data). In a second simulation, each supply side factor was set equal to zero, simulating the scenario of a minimal supply environment with respect to these factors. In the final simulation, each of the four factors was set equal to either its theoretical maximum value or (for continuous variables) to the maximum observed in the sample communities in order to assess the hypothetical effects of an optimal family planning supply environment. Simulations were also run to assess the magnitude of effects of interactions between contraceptive intentions and supply-side factors.⁸ The results of the simulation exercise are presented graphically in Figures 2 and 3.

To illustrate how the graphs are read, consider Figure 2, which illustrates the net effects of variations in the family planning supply environment on contraceptive intentions at the time of the 1992 survey. When the four supply-side factors are set at their observed values in each sample cluster, the predicted proportion of women intending to use a contraceptive method at some point in the future in 1992 is .52, which is equal to the observed proportion of study subjects reporting an intention to use a method – see Figure 1. In the hypothetical scenario where all four supply factors were at their minimum levels in each sample community (i.e., no contraceptive methods, nurses, or trained service providers at public clinics and no relevant infrastructure at private clinics), the simulation results suggest that the proportion of women intending to use a contraceptive method in the future in 1992 would instead have been .29. By comparison, in the event of an optimal supply environment in each sample community, the predicted proportion of women intending to use a method in the future rises to .63. As may be readily ascertained from Figure 2, sizeable “supply-side” effects on contraceptive intentions are suggested.

Figure 3 displays the results of simulations of the effect of the family planning supply environment on contraceptive use conditional on intentions to use in the future. The left-most set of bars pertain to all women irrespective of stated contraceptive intentions in 1992. As compared to the “baseline” level of 52 percent of women not using a contraceptive method in 1992 having gone on to use a method during the 1992-95 period, the simulation results indicate that this proportion would have been only 37 percent if there had been only minimal supply environments in each sample community. If each sample community had an optimal supply environment with respect to the four factors considered, it is predicted that 58 percent of women would have gone on to use a method during this period.

The other two sets of bars in Figure 3 indicate the predicted magnitude of effects of

variations in the family planning supply environment on contraceptive use during the 1992-95 period for “intenders” and “non-intenders” in the 1992 survey interview, respectively. As may be observed, the pattern/direction of effects is similar for both groups of women, but substantially larger in magnitude for women reporting no intention to contracept in the future at the time of the 1992 survey.

DISCUSSION

While the question of whether organized family planning programs influence reproductive preferences remains a subject of debate, most observers would grant that such programs play a key role in enabling individuals and couples to realize their childbearing goals by providing accessible, acceptable, and high quality services. Accordingly, the degree to which programs are successful in satisfying existing demand for contraception is more or less universally viewed as an important measure of program performance. The present study sought to add to the limited number of studies that have explicitly measured this enabling or facilitating effect of family planning programs given demand for contraception by taking advantage of the availability of individual-level panel data linked with community-level information on the family planning supply environment in Morocco. In the study, the likelihood of women who were not using a contraceptive method at the time of the 1992 ENPS-II having used a method at some time prior to the 1995 Panel Survey was modeled as a function of contraceptive intentions, background factors, and family planning supply factors.

The empirical results reconfirm the importance of both demand- and supply-side factors as determinants of contraceptive behavior. Women who stated an intention to contracept in the future in the 1992 survey interview were more than twice as likely to have gone on to adopt a

contraceptive method during the 1992-95 period than women stating no such intention. The family planning supply environment was also observed to exert a significant influence on the likelihood of women having adopted a method during the three-year study period. Women who resided in areas with a favorable family planning supply environment were substantially more likely to have gone on to use a contraceptive method during the three-year study period between the two surveys than women less favorably situated with regard to family planning services irrespective of their contraceptive intentions at the time of the 1992 survey.

However, the study produced several unanticipated results. Two of these, we believe, were the result of appropriate modeling of the relationships between contraceptive intentions, family planning supply factors, and contraceptive use. The first is the (net) non-significance of contraceptive intentions as a predictor of subsequent contraceptive use in the two-equation model. Comparison of our findings with earlier studies using single-equation statistical models suggests that common unobserved determinants of both contraceptive intentions and use were responsible for the strong effect of intention on subsequent use observed in the single-equation model. When these unobserved factors were controlled through appropriate multivariate modeling in the present study, the magnitude of this effect was greatly reduced.

What might these unobserved factors be? Several possibilities suggest themselves. At the level of individual women/couples, it might be the case that contraceptive intentions and use are both manifestations of an (unobserved) broader motivation or demand for smaller family sizes and, as such, are merely steps in a behavioral process that begins with latent demand for reduced family sizes and ends with concrete actions being taken to avoid further pregnancies. Such a proposition is consistent with widely accepted theories of fertility behavior (Caldwell et al., 1988). Equally plausible is that the unobserved factors operate at the community level through

community norms and acceptance of modern contraception as a legitimate means of controlling fertility. Such an explanation is consistent with the findings of several recent studies. A recent study in Thailand, for example, demonstrates that patterns of contraceptive choice vary widely by community in a manner that does not reflect community-level variations in the supply environment for family planning services (Entwisle et al., 1996). The authors attribute this to the existence of local networks of women who share information and experiences with other women in the community concerning contraception in general and on specific methods. The importance of local informal “networks” in influencing contraceptive behavior is also demonstrated in a recent study in Kenya (Rutenberg and Watkins, 1997). In all likelihood, unobserved factors operating at both the level of individuals/households and communities are relevant joint determinants of contraceptive intentions and actual use.

A second unanticipated result was that a wider variety of supply-side factors emerged as strong net predictors of contraceptive intentions than of actual use given intentions. Although the study sought to measure the enabling effects of family planning services on contraceptive use given demand for contraception, contraceptive intentions appeared to be more responsive to variations in the supply environment for family planning than did actual contraceptive given contraceptive intentions. This might indicate that supply-side factors influence contraceptive decisions further up the chain of decisions leading to contraceptive use than merely the decision to actually adopt a contraceptive method. Several researchers (Caldwell et al., 1988; Cleland, 1994) have, for example, argued that an important way in which family planning programs influence contraceptive behavior is by helping to convert latent demand for fertility regulation into manifest demand, and based upon our findings, possibly into intentions to contracept.

However, the caution noted earlier about inferring a causal effect of supply-side factors on

contraceptive intentions in the present study bears reiteration – it is possible that the effects observed in the present study could have resulted from family planning program resources being targeted disproportionately at communities with high demand for services during a period prior to the reference period for the present study. In the 1990s, the Moroccan national family planning program has targeted rural areas for improvements in family planning services. However, we are unaware that targeting has been undertaken at the local/community level based upon levels of demand for contraception. Nevertheless, we cannot completely discount the possibility that targeted allocation of program resources may have contributed to the large effects of supply-side factors on contraceptive intentions observed in the study.

The final unanticipated result concerns the differential effect of supply-side factors on contraceptive use for “intenders” and “non-intenders.” Although we had anticipated that the effects of variations in the family planning supply environment would be more pronounced among women intending to contracept, this expectation was not borne out by the empirical findings. Instead, the empirical results suggest that supply-side factors influenced both “intenders” and “non-intenders,” but that the effects appear to have been larger among non-intenders.

One interpretation of this finding is that in a setting like Morocco where family planning is socially accepted and family planning services are relatively widely available, women who aspire to control future fertility tend to be successful in finding alternative sources of services and supplies even when aspects of the local supply environment is not fully satisfactory to their needs. On the other side of the coin, the empirical results for both the contraceptive intentions and use equations suggest that supply-side factors may play an important role in generating demand for contraception (along with increased likelihood of going on to actual use). Although the evidence from the present study is for a relatively small group of women observed over a short period of

time, no other plausible explanation suggests itself as to why women stating no intention to use contraception in the future would have been substantially more likely to have gone on to use a method when the family planning supply environment was favorable than when it was less favorable. Further research is, however, needed to assess the extent to and conditions under which family planning programs can influence reproductive intentions.

NOTES

¹ Of the countries in which DHS and Situation Analysis studies have been undertaken, we are aware of only two instances in which panel surveys of individual women with linked family planning program data are available -- Morocco (which is the subject of the present study) and Peru (see Mensch et al., 1997).

² The remaining, unmatched women consisted of (a) women from households that had replaced the household interviewed in the 1992 survey (that had moved away or for some other reason could not be located), (b) new members of households interviewed in both 1992 and 1995, and (c) women who were considered to have been matched when the data file was developed, but upon further scrutiny were judged by the researchers for this study to have been questionable matches. In the latter category, we excluded n=81 women whose reported ages in the two survey interviews differed by more than five years and/or whose reported number of children ever born differed by more than one child.

³ Data pertaining to the family planning supply environment in 1992 were used in lieu of data pertaining to the 1992-95 period (which could be derived by also considering the 1995 SAM data) were used for two reasons. First, changes in the supply environment for family planning services in Morocco during the reference period for the study were relatively modest in nature, and largely concerned “qualitative” aspects of service delivery (e.g., improved counseling and quality of services) that were not well measured by the SAM protocols. Secondly, many of the changes that did take place occurred late in the period of time considered in the study (i.e., in 1994 and 1995), and thus are unlikely to have had major effects given that the 1995 survey was conducted in May. Nevertheless, it is possible (although we feel it unlikely) that these changes influenced contraceptive behavior in ways that we have not measured.

⁴ The use of indicators pertaining to the nearest facilities as “representing” the supply environment available to residents of sample DHS clusters might be questioned. However, in preliminary analyses we tested a variety of more “global” indicators (e.g., total number of facilities and/or facilities offering family planning services located within 30 km), but these were found to have much weaker statistical relationships with contraceptive behavior than the variables pertaining to the nearest facilities. One possible explanation for this result is that facilities within a given local tend to be relatively homogeneous with regard to services offered and service quality, and thus the characteristics of the nearest facilities actually serve as reasonable proxy indicators for the overall local supply environment.

⁵ The variables included in the models estimated in this study differed from that considered in the Curtis and Westoff (1996) study using the same data in that we eliminated variables that reflected individual “choice” that might be jointly determined along with contraceptive intentions by unobserved factors.

⁶ In preliminary analyses of determinants of contraceptive use during the 1992-95 period

using a single-equation main effects model that included the same independent variables considered in the two-equation model shown in Table 4, the effect of reported contraceptive intentions in 1992 was large and highly significant statistically (coef = .985, $z = 8.960$)

⁷ The community sewage system variable does not appear in the contraceptive use equation because it is being used as an instrumental variable, and thus appears only in the contraceptive intentions equation.

⁸ The contraceptive intentions variable used in the contraceptive use equation in the simulations was the predicted probability of having intending to use a method at the time of the 1992 survey. This was necessary in order to obtain simulation results that were consistent with the bivariate probit results shown in Table 4.

APPENDIX: Justification of the Bivariate Probit Estimation Procedure

The most straightforward method for estimating the impact of contraceptive intentions on actual use would be to use a single-equation univariate probit or logit model similar to equation (1) in the text. However, it is quite possible that contraceptive intentions and subsequent use could have been jointly determined by common factors that were not measured as part of the study, and are therefore unobserved in the analysis. Relevant examples of such unobserved factors include charismatic local family planning program leadership, community-specific cultural norms that are supportive of family planning, etc. If so, the ε_{1ij} term in equation (1) would be correlated with I_{ij} (the effect of contraceptive intentions on subsequent use), and the estimated coefficient for I_{ij} would be biased.

Because of this, it is important to select an estimation strategy that controls for unobserved factors that influence both C_{ij} and I_{ij} . In effect, the idea is to “purge” the contraceptive intentions variable in the contraceptive use equation of the distorting effects of common unobserved determinants of intentions and use, thus yielding consistent estimates of the effects of contraceptive intentions and other factors on contraceptive use.

A frequently used strategy to control for the influence of unobserved variables is to use a two-step procedure. Applying such a procedure in this study would involve first estimating equation (2), using the coefficient estimates to predict the probability that a woman intended to use a contraceptive method at the time of the 1992 survey, and then estimating equation (1) using predicted intentions as an independent variable. This too is incorrect. The problem with applying a two-step procedure in this study concerns the discrete nature of the two dependent variables of concern, I_{ij} and C_{ij} . When both equations are estimated using a logit (or a probit) model, the

procedure yields inconsistent coefficient estimates (Davidson and Mackinnon 1993, and Amemiya 1985). Because of this problem, we use a bivariate probit model to estimate equations (1) and (2). The bivariate model assumes that the error terms ε_{1ij} and ε_{2ij} follow a bivariate normal distribution, and yields consistent parameter estimates (Amemiya, 1985).

While the model's non-linear functional form identifies the coefficients, we nevertheless include in the model an instrumental variable – an argument in the intentions equation but not in the contraceptive use equation. The instrument used is an indicator of whether a modern sewage system was present in the respondent's community. This factor is hypothesized to affect contraceptive use only indirectly through its effect on contraceptive intentions. To determine the appropriateness of this variable as an instrument, we carried out two specification tests. First, we estimated a model using the indicators of both a modern sewage in the community and actual intentions of the woman in the contraceptive use equation. The coefficient estimate of the sewage indicator was not statistically significant ($Z = -1.21$). Second, we conducted Hausman's specification test (Amemiya, 1985) using the log-likelihood value of the bivariate probit model described above, and log-likelihood of model (2) in Table 4. The results of the test yielded similar results.

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REFERENCES

- Amemiya, T. 1985. *Advanced Econometrics*. Boston: Harvard University Press.
- Azelmat, M., M. Ayad, and E.A. Housni. 1996. *Enquete de Panel sur la Population et la Sante (EPPS) 1995*. Calverton, MD: Ministere de la Sante Publique and Macro International, Inc.
- Bollen, K., G. Guilkey, and T. Mroz. 1995. Binary Outcomes and Endogenous Explanatory Variables: Tests and Solutions with an Application to the Demand for Contraceptive Use in Tunisia. *Demography* 32(1): 111-31.
- Bongaarts, J. 1994. The impact of population policies: Comment. *Population and Development Review* 20(3): 616-620.
- _____. 1995. The Role of Family Planning Programs in Contemporary Fertility Transitions. *Research Division Working Paper No. 71*. New York: The Population Council.
- Bruce, J. Fundamental Elements of the Quality of Care: A Simple Framework. *Studies in Family Planning* 21(2): 61-91.
- Caldwell, J., P. Reddy, and P. Caldwell . 1988. *The Causes of Demographic Change: Experimental Research in South India*. Madison, WI: University of Wisconsin Press.
- Cleland, J. 1994. Different Pathways to Demographic Transition. In F. Graham-Smith (ed.) *Population -- The Complex Reality*. Golden, CO: North American Press, pp. 229-247.
- Cochrane, S. and D. Guilkey. 1995. The effects of fertility intentions and access to services on contraceptive use in Tunisia. *Economic Development and Cultural Change* 43(4): 779-804.
- Curtis S. and C. Westoff. 1996. Intention to Use Contraceptives and Subsequent Contraceptive Behavior in Morocco. *Studies in Family Planning* 27(5): 239-250.
- Davidson, R. and J.G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. Oxford University Press.
- DeGraff, D. 1991. Increasing Contraceptive Use in Bangladesh: The Role of Demand and Supply Factors. *Demography* 28(1): 65-81.
- Entwisle, B., R.R. Rindfuss, S.J. Walsh, T.P Evans, and S.R. Curran. 1997. Geographic Information Systems, Spatial Network Analysis, and Contraceptive Choice. *Demography* 34(2): 171-87.

- Freedman, R. 1997. Do Family Planning Programs Affect Fertility Preferences? A Literature Review. *Studies in Family Planning* 28(1): 1-13.
- Knodel, J. A. Chamrathirong, and N. Debavalya. 1987. *Thailand's Reproductive Revolution: Rapid Fertility Decline in a Third-World Setting*. Madison, WI: University of Wisconsin Press.
- Knowles, J. J. Akin, and D. Guilkey. 1994. The impact of population policies: Comment. *Population and Development Review* 20(3): 611-615.
- Koenig, M. J. Phillips, R. Simmons, and M Khan. 1987. Trends in family size preferences and contraceptive use in Matlab, Bangladesh. *Studies in Family Planning* 18(3): 117-127.
- Maddala, G.S. 1983. Limited Dependent and Qualitative Variables in Econometrics. Econometric Society Monographs No.3, Cambridge University Press, Chapter 9: Models with self-selectivity.
- Mensch, B, M. Arends-Kuenning, A. Jain, and M.R. Garate. 1997. Avoiding Unintended Pregnancy In Peru: Does the Quality of Family Planning Services Matter? *International Family Planning Perspectives* 23(1): 21-27.
- Phillips, J. M. Hossain, and M Arends-Kuenning. 1996. The long-term demographic role of community-based family planning in rural Bangladesh. *Studies in Family Planning* 27(4): 204-219.
- Pritchett, L. 1994. Desired fertility and the impact of population policies. *Population and Development Review* 20(1): 1-55.
- Robinson, W. and J. Cleland, 1992. The influence of contraceptive costs on the demand for children. In Phillips, J. and J. Ross (eds.) *Family Planning Programs and Fertility*. Oxford: Clarendon Press. Pp. 106-122.
- Rutenberg, N. and S.C. Watkins. 1997. Conversations and Contraception in Kenya. *Studies in Family Planning* 28(4): 290-307.
- Simmons, R., L. Baqee, M. Koenig, and J. Phillips. 1988. Beyond supply: The importance of female family planning workers in rural Bangladesh. *Studies in Family Planning* 19(1): 29-38.
- Simmons, R. 1996. Women's lives in transition: A qualitative analysis of the fertility decline in Bangladesh. *Studies in Family Planning* 27(5): 251-268.

Figure 1: Proportion of Women Not Using a Contraceptive Method in 1992, by Whether They Used a Method During the 1992-95 Interval and by Intentions Status in 1992.

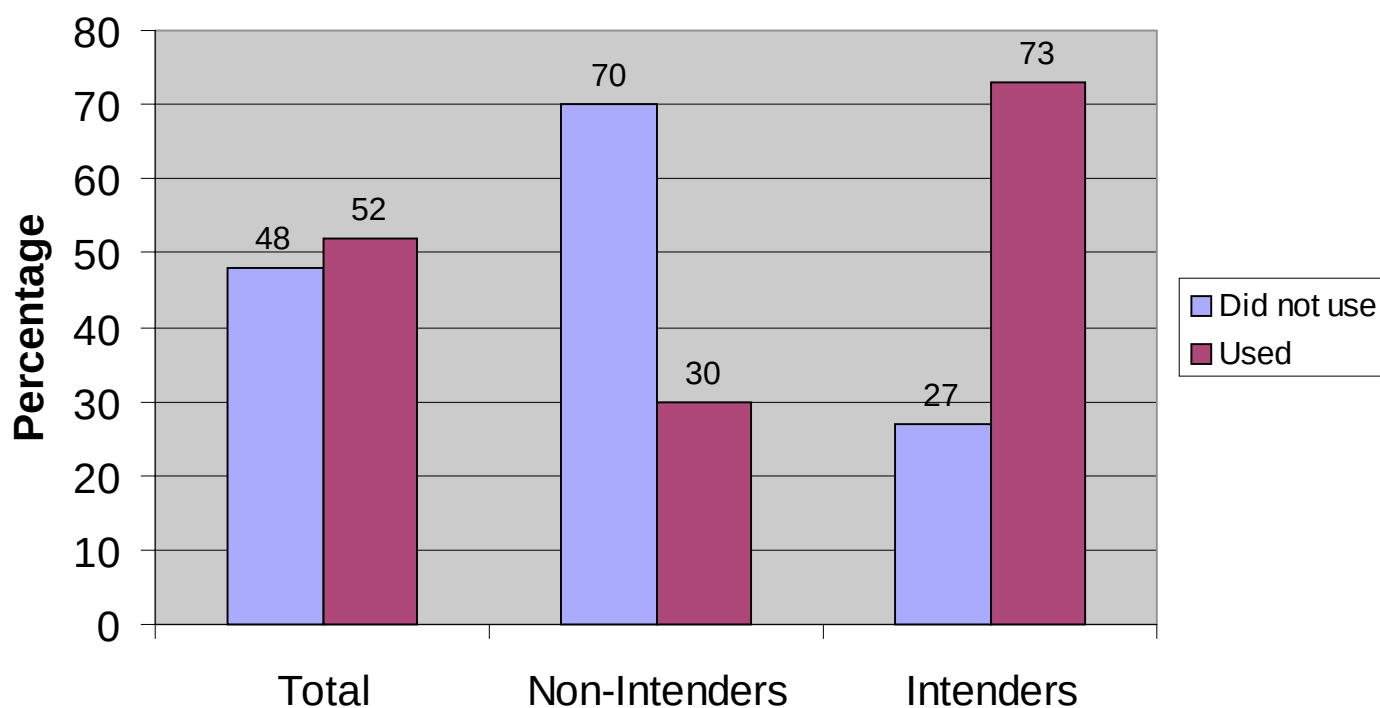


Figure 2: Simulated Effects of Increases in the Family Planning Supply Environment on Intentions to Use Contraception.

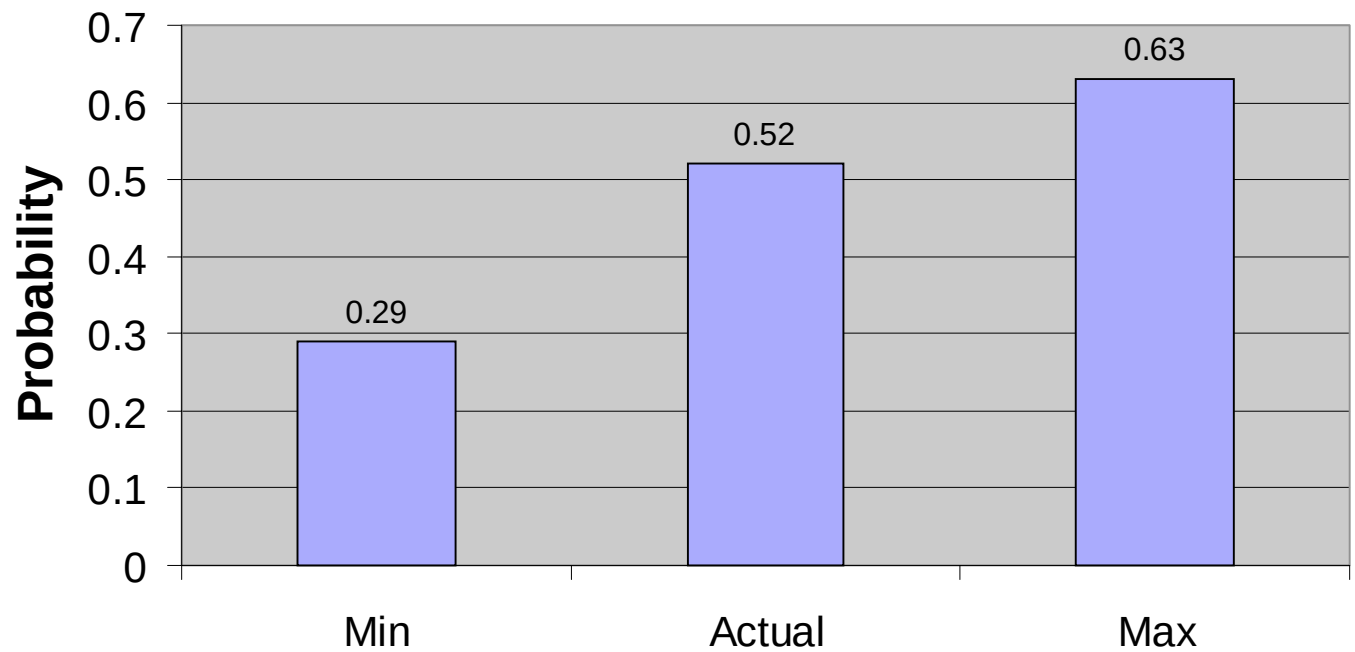


Figure 3: Simulated Conditional Effects of Increases in the Family Planning Supply Environment on Contraceptive Use, by Intentions Status in 1992

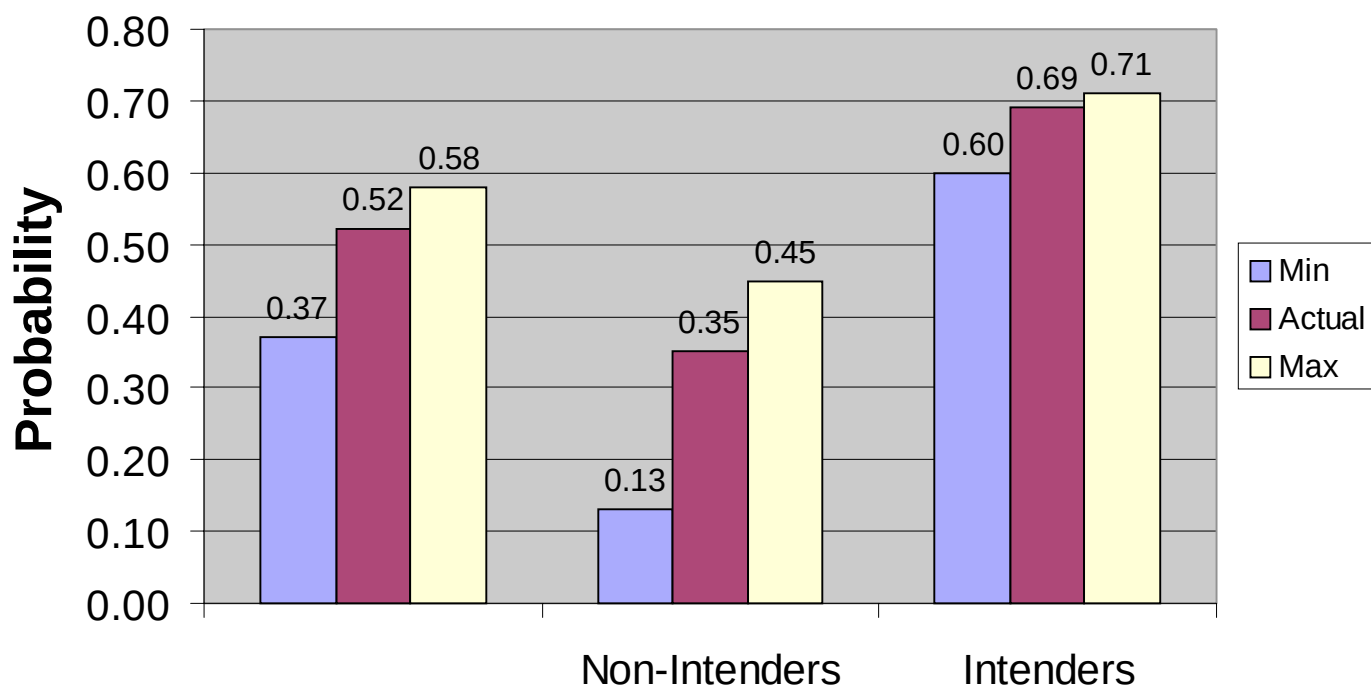


Figure 4: Simulated Total Effects of Increases in the Family Planning Supply Environment on Contraceptive Use During the 1992-95 Interval.

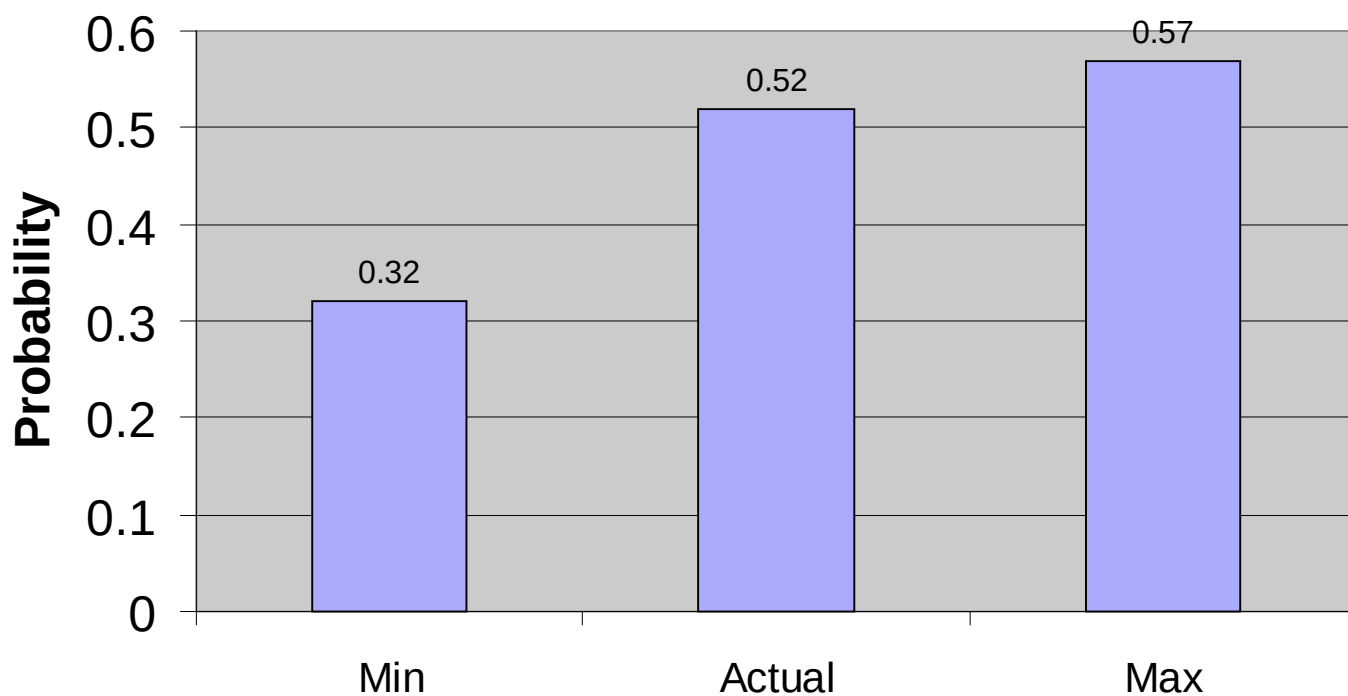


Figure 5: Simulated Total Effect of Increases in Method Availability Index at the Closest Clinic on Contraceptive Use During the 1992-95 Interval, by Intentions Status in 1992.

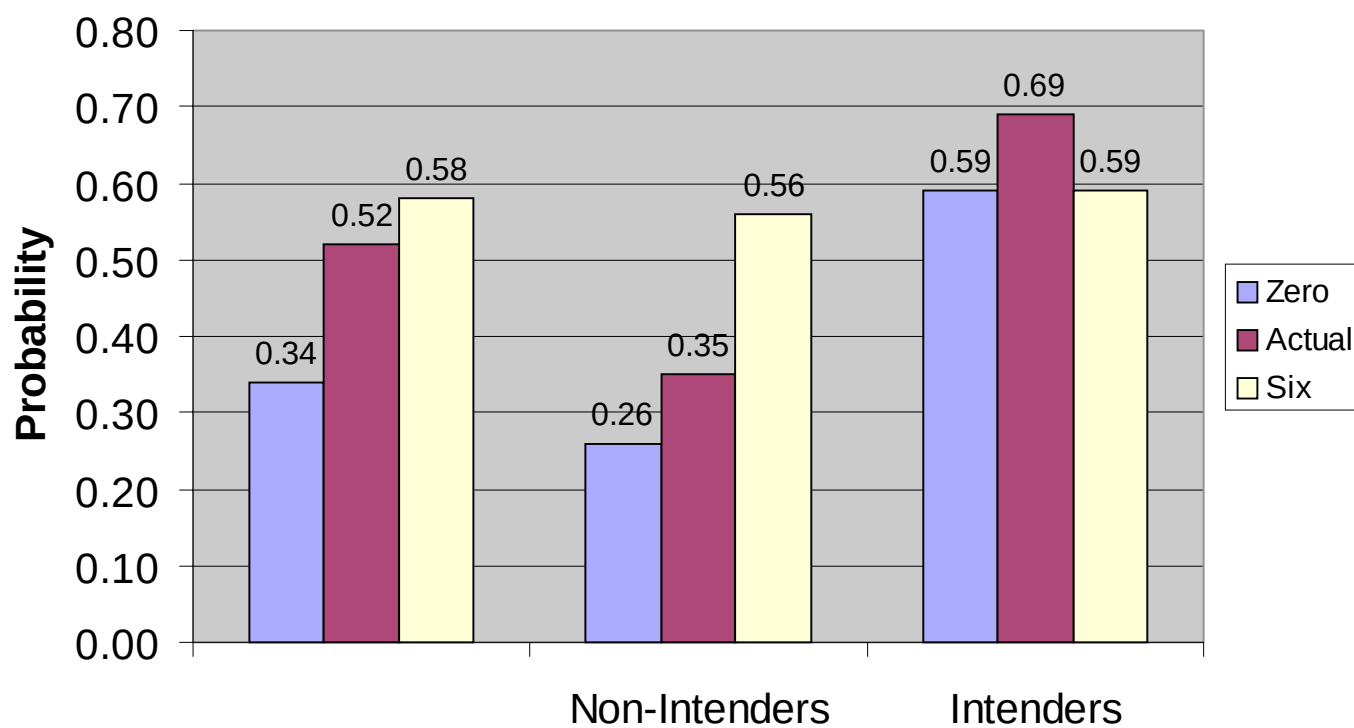


Table 1: Operational Definitions of Family Planning Supply Environment Indicators Used in the Analysis

Variable	Operational Definition
Number of trained nurses at the nearest public clinic	The number of nurses at the nearest public clinic who had received training in family planning
Number of sources of family planning at nearest set of facilities	The number of facilities among the nearest hospital, public clinic, private physician, private clinic, and facilities pharmacy that provided family planning services and/or supplies
Number of sources of pills at nearest set of facilities	The number of facilities among the nearest hospital, public clinic, private physician, private clinic, and pharmacy that provided oral contraceptives
Method availability index - public clinic	For each contraceptive method mandated to be offered at public clinics, a score of “2” was assigned if the method was available on the date of data collection for the Service Availability Module and there had been no “stock-outs” during the previous six months, “1” if the method was either not available on the date of data collection or there had been a stock-out in the previous six months, and “0” if the method was both unavailable on the date of data collection and there had been prior stock-outs. The method scores were then summed to yield a facility-level score
Method availability index - nearest set of facilities	Same as clinic index, except summed across nearest set of facilities to the sample cluster
Training index - nearest set of facilities	Total number of physicians and nurses trained in family planning summed across nearest set of facilities to the sample cluster
Infrastructure index - private physicians and clinics	For the nearest private physician and clinic, each facility was assigned 1 “point” if they had the following: running water, electricity, and a gynecological examination table. The facility scores were then summed to yield a cluster-level score.

Table 2: Summary of Family Planning Supply Environment Indicators For Sample Clusters (N=107).

Indicator	Total	Urban	Rural
Pct. of clusters with specified health facility located within 30 km.			
Hospital	60.0	79.7	25.0
Public clinic	98.0	96.9	100.0
Private clinic	39.0	53.1	13.9
Private doctor	67.0	81.3	41.7
Pharmacy	90.0	100.0	72.2
Median distance (km.) to nearest:			
Hospital	13	3	49
Public clinic	< 1	< 1	7
Private clinic	56	6	72
Private doctor	2	< 1	43
Pharmacy	< 1	< 1	15
Median distance (km.) to nearest facility offering family planning services	< 1	< 1	7
Pct. of clusters with family planning services offered home visits (i.e., CBD)	54.0	45.3	69.4
Mean no. of facilities offering family planning within 10 km. ^a	2.4	3.2	1.0
Mean contraceptive method availability index ^{a,b}	9.5	14.3	7.4
Mean no. of methods available at public clinics ^a	4.8	5.1	4.3
Mean no. of sources of oral contraceptives ^a	2.1	2.4	1.7
Mean no. of trained nurses	2.4	2.4	2.3
Mean staff training index ^{a,b}	1.6	3.0	1.0
Mean facility and equipment index ^{a,b}	3.4	5.4	2.5

^a Indicators pertain to the nearest of each of the major types of facilities (hospitals, public clinics, private physicians, private clinics, and pharmacies) located within 30 km.

^b Index ranges vary. See table 1 for computational details and ranges.

Table 3: Proportion of Women Not Using a Contraceptive Method in 1992 Who Used a Method During the 1992-95 Period, by Selected Characteristics.

Characteristic	Percent Using Method, 1992-95	Characteristic	Percent Using Method, 1992-95
Age		Number of sources of family planning withing 10 K	
24 years or younger	67.8	0-1 sources	41.4
25 - 34 years	56.6	2 sources	58.3
35 years or older	37.8	3-4 sources	70.4
Literacy		Method availability index: public clinic	
Illiterate	49.1	0-2 score	20.1
Partially literate	66.7	3-4 score	62.6
Literate	71.7	5-6 score	56.9
Residence		Method availability index: nearest set of facilities	
Urban	65.7	0-8 score	46.3
Rural	46.3	9-16 score	58.3
		17-24 score	61.0
Cement Floor		Training index: nearest set of facilities	
Yes	62.9	0 trained providers	46.1
No	38.7	1 or more trained providers	61.6
Sewage system in community			
Yes	65.8	Number of nurses	
No	47.2	0 nurses	11.4
		1-2 nurses	53.2
Number of sources of pills		3 or more nurses	61.1
0-1 sources	38.4		
2 sources	56.7	Infrastructure index - private	
3-4 sources	65.5	No	29.9
		Yes	58.3

Table 4: Bivariate Probit Results: Effects of Contraceptive Intentions, Background Characteristics, and Family Planning Supply Factors on Subsequent Contraceptive Use During 1992-95.

Explanatory Variables	Model 3				Model 4			
	Contraceptive Intentions		Contraceptive Use		Contraceptive Intentions		Contraceptive Use	
	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Household/Individual Characteristics								
Contraceptive Intentions			0.515	0.419			1.277	1.122
Woman age 15-24								
Woman age 25-34	-0.135	-1.291	-0.261	-2.341 **	-0.138	-1.308	-0.271	-2.388 **
Woman age 35-49	-0.651	-4.885 ***	-0.715	-2.926 ***	-0.652	-4.891 ***	-0.715	-2.868 ***
Woman illiterate								
Woman partially literate	-0.021	-0.092	0.053	0.200	-0.023	-0.097	0.059	0.226
Woman fully literate	0.341	2.457 ***	0.206	0.976	0.342	2.473 **	0.200	0.974
Cement floor in home	0.250	2.230 **	0.371	2.454 **	0.251	2.258 **	0.347	2.260 **
Community Characteristics								
Urban residence	0.154	0.958	0.054	0.255	0.149	0.920	0.062	0.319
Sewage system in community	-0.495	-3.432 ***			-0.492	-3.418 ***		
Family Planning Supply Factors								
Method availability - public clinic	0.071	1.687 *	0.143	2.676 ***	0.070	1.701 *		
Method availability: intenders							0.070	1.295
Method availability: non-intenders							0.198	3.336 ***
Number of nurses at public clinic	0.101	2.628 ***	-0.009	-0.145	0.101	2.643 ***	-0.014	-0.235
Training index: nearest set of facilities	0.180	2.081 **	-0.060	-0.376	0.180	2.094 **	-0.070	-0.468
Infrastructure index - private clinics	0.121	0.916	0.264	1.433	0.122	0.922	0.258	1.449
Constant	-0.443	-1.940 *	-0.841	-1.608	-0.439	-1.955 **	-1.143	-2.304 **
Rho	0.276	0.405			0.172	0.276		
Chi Square Test of Joint Significance of Supply Factors	31.84		18.75		28.29		21.01	
Prob > Chi Square	0.000		0.009		0.000		0.004	
Pseudo R-square	0.09				0.09			
Log-likelihood value	-1049.31				-1046.85			