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THE INFLUENCE OF MATERNAL & CHILD HEALTH SERVICE UTILIZATION & ACCESS TO PRIVATE SECTOR FAMILY PLANNING SERVICES ON SUBSEQUENT CONTRACEPTIVE USE

A Multicountry Study

David R. Hotchkiss, Jeffrey J. Rous, Eric E. Seiber & Andrés A. Berruti
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*The Influence of Maternal & Child Health Service Utilization
& Access to Private Sector Family Planning Services on
Subsequent Contraceptive Use: A Multicountry Study*

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Baby with mother in Bolivia by Armando Waak. Copyright A. Waak/Pan American Health Organization.

ABSTRACT

Does utilization of modern MCH services influence the likelihood of subsequent contraceptive use among women in developing country settings? Does access to private-sector family planning services have an impact on contraceptive use? The answers to these questions have important implications for family planning service delivery strategies. However, the available empirical evidence on these issues is inconclusive. This study re-examines the relationship between the intensity of MCH use and contraceptive use issue in five countries, and the relationship between access to private-sector family planning services and contraceptive use in two countries. The study is based on household survey data and data on the supply environment for health and family planning services gathered during the 1990s in Morocco, Tanzania, Bolivia, Guatemala, and Indonesia. A full-information maximum-likelihood estimator is used to control for the possible endogeneity of health care and contraceptive choices. The findings indicate a substantial and apparently causal relationship between the intensity of MCH-service utilization and subsequent contraceptive use, and between access to private-sector family planning services and modern contraceptive use. Policy simulations indicate that sizeable increases in contraceptive prevalence might be realized by increasing the coverage and intensity of use of MCH services, and by improving access to high quality private-sector services.

KEY WORDS

Service integration, private sector, access, maternal and child health, contraceptive use.

RECOMMENDED CITATION

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Executive Summary

EXECUTIVE SUMMARY

Does utilization of modern maternal and child health (MCH) services influence the likelihood of subsequent contraceptive use among women in developing country settings? Does access to private-sector family planning services have an impact on contraceptive use?

The answers to these questions have important implications for family planning service delivery strategies. If the likelihood of adopting contraception were to be related to the intensity of utilization of MCH services or to physical proximity of private family planning services, sizeable gains in contraceptive prevalence might be realized through efforts to increase the utilization intensity of MCH services or the population coverage of private-sector family planning services.

There are several reasons to expect a relationship between MCH service and contraceptive use. First, women who utilize MCH services are exposed to counseling and promotional efforts regarding family planning (to the extent, of course, that such activities are undertaken as part of MCH service delivery). Secondly, the development of trust in/satisfaction with modern health sector services might engender more favorable views of the formal service delivery system and, thus, help overcome uncertainties and myths regarding modern contraception. This role is likely to be especially important in traditional societies where deliberate fertility control remains controversial. Thirdly, in settings where MCH and family planning services are integrated (which is the case in many settings, if only to the extent that services are offered at common facilities), service integration may reduce the time-related costs of obtaining contraceptive services and supplies. Finally, the patient referral mechanisms present in many programs might facilitate follow-through on contraceptive intentions by reducing administrative barriers to family planning services.

The main reason to expect that physical proximity to private-sector family planning facilities may have an impact on contraceptive use is that the quality of services offered through the private sector may be higher than what is offered through the public sector. Specifically, it is thought that high-quality services can raise the demand for contraceptive services.

The purpose of this study is to examine the relationships between MCH service utilization and contraceptive use in five countries and private sector access

and contraceptive use in two countries where data is available on private sector facilities. We use full-information, maximum-likelihood regression techniques to control for the effects of unobserved heterogeneity that might otherwise bias our estimates. The analysis is carried out at the level of the individual woman, with contraceptive-use status modeled as a function of

- 1 the availability, quality, and packaging of public and private MCH and family planning services;
- 2 community- and individual-level determinants of health service and contraceptive use; and
- 3 intensity of prior MCH service use.

Contraception is viewed as a means of enabling women and couples to realize their reproductive intentions. The data for the analysis comes from household surveys linked with service-availability surveys. Having data collected at the facility level is important as it allows us to measure the influence of the accessibility to and quality of MCH and family planning services, variables which are under the control of health policy makers.

In three of the five countries (Morocco, Guatemala, and Indonesia) the results of the analysis suggest that the intensity of MCH service use is indeed positively associated with subsequent contraceptive use among women — even after controlling for observed and unobserved individual-, household-, and community-level factors. This result lends support to the proposition that — at least in the context of these three countries in which our data was collected — the intensity of MCH service per se use does have a “causal” impact on subsequent contraceptive use, even after controlling for factors that “predispose” sample women to use both types of services. This finding is important as it suggests that investing in programs that are effective in improving the use of MCH services can be a viable policy strategy not only to improve MCH service use, but also to improve the use of family planning services. Strategies that could be used to raise MCH service utilization rates include efforts to strengthen the integration of MCH and family planning services, improve MCH service access and quality, strengthen the role of the private sector, and influence health care seeking behavior through health education and communication programs.

Information on proximity to any family planning facility was available in all five countries, but was not associated with contraceptive use in any of them. However, in both countries where information on proximity to private sector facilities was available (Guatemala and Bolivia) proximity to private sector facilities was strongly associated with contraceptive use, even after controlling for physical proximity to any family planning services and observed and unobserved factors at multiple levels. These effects were observed in urban and rural areas. In Guatemala, being within two kilometers (km) of Asociación Pro Bienestar de la Familia de Guatemala (APROFAM), a full-service private-sector family planning non-governmental organization, was positively associated with contraceptive use. In Bolivia, being within 15 km of a private facility offering family planning significantly increased the likelihood of contraceptive use. We also conducted simulations that predicted that universal access to APROFAM clinics would increase modern contraceptive prevalence by 26 percent in Guatemala. In Morocco, the availability of pills at pharmacies, an indicator measuring the “readiness” of the private sector to provide family planning services, was positively associated with a higher likelihood of modern versus traditional method use in rural areas.

The data collected in the service-availability surveys does not permit us to examine the mechanisms through which proximity to the private sector influences contraceptive use. We can hypothesize that the higher quality of services offered through the private sector may explain these findings. Further investigation of the quality of private and public sector facilities in Guatemala and Bolivia would be useful.

These findings emphasize the need to devote greater attention to the measurement of the availability and quality of private and public providers, service integration, and non-facility-based program implementation. Although facility-based survey instruments, like the service availability surveys used in this study, represent an important step forward in efforts to systematically measure the health care supply environment, our findings suggest that key dimensions of community environments, including the extent to which health care services are integrated and the availability of services offered by the private sector, remain unmeasured.

1 Introduction

INTRODUCTION

Does utilization of modern maternal and child health (MCH) services influence the likelihood of subsequent contraceptive use among women in developing country settings and, if so, how is the relationship between MCH service and contraceptive use influenced by the supply environment for health and family planning services? The answers to these questions have important implications for family planning service delivery strategies. If the likelihood of adopting contraception were to be related to the degree of exposure to MCH services, sizeable gains in contraceptive prevalence might be realized through efforts to increase the population coverage and utilization intensity of MCH services. Understanding this relationship is especially important in view of the renewed emphasis on strengthening the integration of reproductive health care following 1994's International Conference on Population and Development in Cairo (Hardee and Yount, 1995).

There are several reasons to expect a relationship between MCH service and contraceptive use. First, women who utilize MCH services are exposed to counseling and promotional efforts regarding family planning (to the extent, of course, that such activities are undertaken as part of MCH service delivery). Secondly, the development of trust in/satisfaction with modern health sector services might engender more favorable views of the formal service delivery system and, thus, help overcome uncertainties and myths regarding modern contraception. This role is likely to be especially important in traditional societies where deliberate fertility control remains controversial. Thirdly, in settings where MCH and family planning services are integrated (which is the case in many if not most settings, if only to the extent that services are offered at common facilities), service integration may reduce the time-related costs of obtaining contraceptive services and supplies. Finally, the patient referral mechanisms present in many programs might facilitate "follow-through" on contraceptive intentions by reducing administrative barriers to family planning services.

Although the case for anticipating a relationship between MCH service and contraceptive use is compelling, this relationship is not well understood. The bulk of the available empirical evidence comes from experimental studies on the effects of integration of family planning into general health services that were

conducted in the early 1980s (Blumenfeld, 1983; Faruquee, 1982; Phillipps *et al*, 1984; Rahman *et al*, 1980; Reinke, 1985; Taylor *et al*, 1983). These studies, however, were conducted in conjunction with vigorously implemented pilot programs; thus the degree to which the findings may be generalized to national-level programs is uncertain. In addition, this body of studies produced largely inconclusive results. Indeed, Simmons and Phillips (1987) note that the adoption of the integrated service delivery modality for family planning services in developing country settings appears to have been driven as much by political expediency (given the controversial nature of family planning in many settings) as by solid empirical evidence that service integration was more effective than vertical family planning programs in reaching women with a need for family planning services.

We are aware of only one study that has investigated this issue since the 1980s. Using household data from Morocco in conjunction with data on the supply environment for health and family planning services gathered in 1992, Hotchkiss *et al* (1999) use econometric modeling techniques to investigate whether women who use MCH services are more likely to later use modern family planning services. In addition to controlling for observed individual-, household-, and community-level factors, the authors also were able to control for unobserved factors that might otherwise bias parameter estimates. The results of the study suggest that women with a greater intensity of MCH service use are more likely to use family planning services than other women, after controlling for other determinants of service utilization, and that sizeable increases in contraceptive prevalence might be realized by increasing the accessibility to and quality of MCH services.

There also is considerable interest in investigating the relationship between access to private sector services and contraceptive use. An earlier study showed that access to family planning services had a small impact on contraceptive use (Tsui and Ochoa, 1992). This study, however, did not differentiate between access to high-quality or low-quality services. Studies indicate that the quality of services may be as important or more important than access (Seiber and Bertrand, 2002). While private sector providers can be quite heterogeneous, they tend to offer better quality services than public sector providers in some countries (Bitran, 1995). We examine the relationship between access to private sector services and contraceptive use.

The purpose of the present study is to re-examine the relationship of MCH service use to subsequent contraceptive use and the role of the supply environment for health and family planning services. The analysis is conducted in four additional countries—Tanzania, Bolivia, Guatemala, and Indonesia. The study is of particular interest to family planning program decision makers because, if the use of MCH services is found to have an important influence on contraceptive use, then investing in MCH programs emerges as a viable policy strategy to further improve the use of family planning services. With the exception of Hotchkiss *et al* (1999), previous studies were not able to properly investigate this issue because they lacked a strong statistical methodology for identifying the magnitude of the relationship between MCH use and contraceptive use, and the role of the service supply environment in influencing the relationship.

Like Hotchkiss *et al* (1999), we use full-information, maximum-likelihood (FIML) regression techniques to control for the effects of unobserved heterogeneity that might otherwise bias our estimates. The analysis is carried out at the level of the individual woman, with contraceptive use status modeled as a function of (1) the availability, quality, and packaging of public and private MCH and family planning services; (2) community- and individual-level determinants of health service and contraceptive use; and (3) intensity of prior MCH service use. Contraception is viewed as a means of enabling women and couples to realize their reproductive intentions. The data for the analysis comes from household surveys linked with service-availability surveys. Having data collected at the facility level is important, as it allows us to measure the influence of the accessibility to and quality of MCH and family planning services, variables that are under the control of health policy makers.

After this introductory section, we describe in section 2 the data and statistical methods used in the analysis in section 2. In section 3, we present descriptive and multivariate results, and a series of policy simulations that predicts the impact of improvements in MCH service use and the MCH supply environment on the probability of using a modern contraceptive method. Finally, in section 4, we summarize the findings and present a discussion of the policy implications of our results on the design of programs designed to improve the use of family planning services.

2 Data & Methods

DATA & METHODS

DATA

For each of the countries analyzed, two types of data sources are used. The primary source is the Demographic and Health Survey (DHS). The surveys used in the analysis, listed in Table 1, vary in terms of sample size (from 1,539 to 13,841 women of reproductive age), timing (1992 to 1996), and information on reproductive behavior (four contain detailed reproductive health histories for each woman, while one survey — Tanzania — does not). Each of the samples, with the exception of Guatemala, is nationally representative. The surveys provide detailed information on the outcome variables of interest for a probability sample of women of reproductive age, as well as on many of the hypothesized determinants of health service and contraceptive use measured at the level of households and individual women.

Information from each DHS described above was linked to information on the health care supply environment that was obtained by a service-availability survey. These surveys, also listed in Table 1, were carried out in conjunction with the DHS. Typically, the surveys were conducted in the following way. For each sample cluster, the closest of each type of public facility (i.e., hospital, health center, and dispensary) was visited and information on these facilities and their service delivery operations obtained. In the case of Morocco, Bolivia, and Guatemala, private health care facilities were also visited. In Guatemala, however, the service availability information was derived from the 1997 Providers Census conducted in four highland departments. The census allowed a considerably richer representation of the supply environment for the women in those departments, but its use required that women from other departments be excluded from the analysis. Each survey typically includes detailed information on staff training and the availability of services, infrastructure, equipment and supplies, and medical personnel. For all but two of the surveys, information on distances in kilometers (km) between the sample community and each health facility included in the service availability survey was reported by survey enumerators. In the case of Tanzania, geo-coordinate data from the 1991/92 Tanzania Service Availability Survey (TSAS91/92), which sampled the same facilities that were included in the TSAS96, was used. In the case of Guatemala,

Cartesian distances were calculated from geo-coordinate data collected for the clusters in the 1995/6 DHS and for the facilities in the 1997 Providers Census.

Table 1 also provides information on the total number of women of reproductive age that were interviewed in each country. We initially restricted this sample to married, non-pregnant women at the time of the survey who report at least one live birth during the previous five years (since information on MCH service use was gathered only in connection with births occurring during the five years prior to the survey). The last column of Table 1 lists the total number of observations for each country after making these restrictions.

CONCEPTUAL MODEL & ESTIMATION PROCEDURES

Several statistical estimation issues must be addressed in carrying out the analysis at the level of individual women, the most crucial of which is the endogeneity of health care and contraceptive behaviors. As MCH service and contraceptive use are individual “choice” variables that have some and perhaps many common determinants, treating MCH service use as an exogenous predictor of contraceptive use in multivariate statistical models would result in biased parameter estimates (Maddala, 1992). For example, consider the effect of parental attitudes toward children, which are unobserved to the researcher. Couples with a greater preference for a large family may be more likely to use MCH services and less likely to use contraceptive methods. Not accounting for this would result in an estimated effect that is biased downward (i.e. underestimating the true effect of MCH service use on contraceptive use). It also is possible that unobserved factors might bias parameter estimates in the opposite direction. For example, high-quality services may influence women in a given community to use modern contraceptive methods and MCH services. To overcome this complex problem of unobserved heterogeneity, we used a full-information FIML estimation procedure that controls for unobserved determinants of contraceptive and MCH service use.

The economic demand model guiding the study assumes that individuals and households make family planning and health care decisions to maximize their

TABLE 1. Summary of data used in the analysis

Country	Year(s)	Name of DHS Survey	Name of Service Availability Survey	Number of women interviewed	Number of women included in analysis
Morocco	1992	Enquête Nationale sur la Population et la Santé ^a	ENPS-II, Service Availability Module ^a	9,256	3,267
Tanzania	1996	Tanzania Demographic and Health Survey ^b	Tanzania Demographic and Health Survey, Facility Interview ^c	8,120	3,398
Guatemala	1995–96	Encuesta Nacional de Salud Materno Infantil ^d	Guatemala Health Service Provider Survey 1997 ^e	3,109	1,539
Bolivia	1994	Encuesta Nacional de Demografía y Salud ^f	Encuesta Nacional de Demografía y Salud, Service Availability Module ^f	8,603	4,020
Indonesia	1994	Demographic and Health Survey ^g	Demographic and Health Survey, Service Availability Module ^g	28,168	13,841

a *Ministère de la Santé Publique [Morocco], Secrétariat Général — DPSI, Service des Etudes et de l'Information Sanitaire and Macro International Inc., 1993, Enquête Nationale sur la Population et la Santé (ENPS-II) 1992, Columbia, Maryland.*

b *Bureau of Statistics [Tanzania] and Macro International Inc., 1997, Tanzania Demographic and Health Survey 1996. Calverton, Maryland: Bureau of Statistics and Macro International.*

c *Bureau of Statistics, Planning Commission [Tanzania] and The Evaluation Project, University of North Carolina at Chapel Hill.*

d *Instituto Nacional de Estadística [Guatemala], Ministerio de Salud Pública y Asistencia Social, Agencia para el Desarrollo Internacional, Fondo de las Naciones Unidas para la Infancia and Macro International Inc., 1996, Encuesta Nacional de Salud Materno Infantil 1995, Calverton, Maryland.*

e *Macro International Inc., 1997, Guatemala Health Service Provider Survey 1997, Calverton, Maryland.*

f *Instituto Nacional de Estadística [Bolivia] and Macro International Inc., 1994, Encuesta Nacional de Demografía y Salud 1994, Calverton, Maryland.*

g *Central Bureau of Statistics [Indonesia] and State Ministry of Population/National Family Planning Coordinating Board and Ministry of Health and Macro International Inc., 1995, Indonesia Demographic and Health Survey 1994. Calverton, Maryland.*

total level of welfare. It also assumes that current contraceptive use status is determined, at least in part, by the extent of past MCH service utilization.

The statistical model estimated in the study takes the following form:

$$\ln\left(\frac{\text{prob}(C_{ij} = k)}{\text{prob}(C_{ij} = 1)}\right) = \alpha_k M_{ij} + \beta_k X_{ijk} + \gamma_k Z_j + \rho_{1k} \omega_{ij} + \rho_{2k} v_j \quad (1)$$

$$M_{ij} = \delta X_{ij} + \zeta Z_j + \rho_3 \omega_{ij} + \rho_4 v_j + \mu_{2ij} \quad (2)$$

where equation (1) uses the multinomial logit specification to estimate the log odds that woman i ($i=1, 2, \dots, N$) in community j ($j=1, 2, \dots, J$) was using contraceptive method k (where $k=1$ for women not using contraception at the time of the survey, $k=2$ for women using a traditional contraceptive method, and $k=3$ for women using a modern contraceptive method). M_{ij} represents a continuous variable indicating the woman's past intensity of MCH service utilization. Contraceptive use and MCH service use are assumed to be determined by observed exogenous individual/household-level (X_{ij}) and community-level (Z_j) characteristics, including the availability and quality of family planning and MCH services.

As a result, equation (2) is included to denote the individual/household- and community-level determinants of M_{ij} . The primary parameter of interest in the present study is α , the impact of MCH service utilization on the propensity of women to adopt a contraceptive method at a later point in time.

In addition, health care and contraceptive choices are assumed to be determined by other, unmeasured factors. These unobserved factors might affect a woman's desire to have additional children as well as her propensity to use MCH services. Examples include individual-specific factors (ω_{ij}) (such as a woman's fecundability, preferences, and level of time preference) or community-specific factors (v_j) (such as group norms and aspects of the supply environment for MCH), and/or family planning services that were not measured in the survey protocols. The μ_2 term represents an error term, which is assumed to be independent and normally distributed. An analogous random error term specific to family planning utilization is implicit in the specification of equation (1) and is assumed to follow a negative extreme value distribution.

As intensity of MCH care utilization is endogenous, a simple maximum-likelihood estimation of equation (1) would result in biased parameter estimates. To avoid this problem, we used a full-FIML strategy in which the parameters of the two equations are estimated jointly. To estimate unconditional probabilities of using contraception, one needs to make a distributional assumption about ω and v or use a non-parametric estimator along the lines suggested by Heckman and Singer (1983) or Mroz and Weir (1990). We used a non-parametric, discrete factor approach to approximate the distribution of the unobserved variables, ω and v , that can cause omitted variable bias, and to estimate the effect of ω and v on both choice variables. Using Monte Carlo experiments, Mroz (1999) showed that discrete factor approximations can provide reliable estimates in simple models with continuous and discrete random variables. Details on the construction of the likelihood function are in Appendix A. As exclusion restrictions, we included in the MCH service-use equation, but not in the contraceptive-use equation, variables that measure the quantity and quality of MCH services available. Note, however, that because of the model's non-linearity, exclusion restrictions are not necessary to identify the coefficients in the model.

An important specification issue in the present analysis concerns the nature of the causal relationship between the two outcome variables in the model. While the above specification assumes that the primary causal pathway runs from MCH service to contraceptive use, it is also possible that the contraceptive use influences subsequent use of MCH services. To investigate the sequencing of these two outcome variables, we investigated how frequently women who report having a birth in the five years prior to the survey used a contraceptive method prior to their first birth. The results suggest only 6.5 percent first used a contraceptive method prior to their first birth. Because of this finding, we chose to model the primary causal pathway as being from MCH service to contraceptive use.

VARIABLE SPECIFICATION

Tables C1 through C5 in Appendix C provide detailed country-specific information on the construction of the variables used in the analysis. As pointed out in the section that describes the data used in the analysis, the administration of the standard DHS in each

country made it possible to construct almost identical individual and household variables. The manner in which the service availability survey was administered, however, varies considerably across the five countries, making it impossible to measure the health care supply environment in each country in the same way. Below, we provide a general description of the indicators used in the regression models.

DEPENDENT/OUTCOME VARIABLES

CONTRACEPTIVE USE: The outcome variable for the contraceptive use equation is a polytomous variable with three categories:

- respondents who have not used a contraceptive method between the time of their last birth and the time of the survey
- respondents who have used a traditional contraceptive method, but not a modern method, between the time of their last birth and the time of the survey (i.e., rhythm, withdrawal, calendar)
- respondents who have used any form of modern contraception (i.e., oral contraceptives, intrauterine devices (IUDs), condoms, or sterilization)

Two reference categories are used in the presentation of the contraceptive use equation results — women in the initial category (non-users of contraception) and women who have used a traditional contraceptive method. In the case of Tanzania, a reproductive health history was not included in the DHS, which prevented us from determining whether the woman used contraception between the time of her last birth and the time of the survey. As a result, the outcome variable measures current use of contraception.

INTENSITY OF MCH SERVICE USE: For each country analyzed, the outcome variable for the MCH care equation was an index indicating the intensity of MCH care utilization. For the purposes of this study, MCH services were defined as consisting of ante- and post-natal care, delivery attendance, and immunizations. "Points" were awarded for each birth according to the number and types of services used. For example, in Tanzania, the following schedule was used to construct the index:

Antenatal care

<i>Had one or more visits</i>	1
<i>Initiated care during first trimester</i>	3
<i>Initiated care during second trimester</i>	2
<i>Initiated care during third trimester</i>	1
<i>Had a tetanus injection</i>	1

Delivery

<i>Delivery at health facility</i>	1
<i>Trained practitioner attended delivery</i>	1

Immunization

<i>Has vaccination card</i>	1
<i>Vaccinations (each of nine possible vaccinations worth $\frac{2}{9}$)</i>	2

Theoretical maximum 10

In the Guatemala and Bolivia DHS, women were asked whether their child received eight rather than nine vaccinations. For those countries, each vaccination was worth $\frac{1}{4}$ rather than $\frac{2}{9}$.

If a respondent had only one live birth in the past five years, we used the MCH index of that child. If a respondent had more than one birth, the average of the child-specific indices was used. The index consists of real numbers and has a theoretical range of 0 to 10, with 0 indicating no use of MCH services and 10 indicating maximum service utilization. The range of the MCH index observed from our Tanzania data was 0 to 9. For each country-specific analysis, this variable also is included as an independent variable in the contraceptive use equation.

**INDEPENDENT VARIABLES:
ACCESSIBILITY AND QUALITY OF SERVICES**

MCH SERVICE ACCESSIBILITY: Two types of variables measured at the cluster or community level were included in the MCH use equation as measures of MCH service accessibility. First, indicators on the distance to the nearest health facility, of any type, offering MCH services were used. For Guatemala and Bolivia, we also were able to measure the distance to the closest private facility, which allowed us to test the hypothesis that physical access to privately-provided health care services has a different affect on service

utilization than physical access to government-run services. Second, indicators were constructed on the total number of facilities within a specified distance that offer four MCH services (antenatal care, birth delivery, postnatal care, and immunization). For example, in Tanzania, two indicators were used. The first of these variables measures whether the community has access to one or two facilities that offer these services; the second measures whether the community has access to three or more facilities that offer these services. The reference group consists of communities that do not have physical access to a facility that offers all four services.

FAMILY PLANNING SERVICE ACCESSIBILITY: Cluster-level variables measuring physical access to family planning services were included in the contraceptive use equation. We tested continuous variables indicating the distance to the nearest facility offering family planning services and dummy variables indicating whether the cluster was within a specified distance of public or private facilities offering family planning services. Unfortunately, none of the service-availability surveys included information on the availability of community-based distribution.

INTEGRATION OF MCH AND FAMILY PLANNING SERVICES: A dummy variable measures whether women in the community had access to at least one facility that offered a full package of family planning services and MCH care (including antenatal, birth delivery, postnatal, and immunization services). This variable was included in the model to assess the additional influence of service integration at a single facility within the community on contraceptive use.

CONTRACEPTIVE METHOD AVAILABILITY: To measure contraceptive method availability at the community level, a facility-level index was computed for the nearest of each of the facility types located within a specified distance of the community. For example, in Tanzania, the distance used was 30 km; we measured the availability of oral contraceptives, IUDs, injections, and condoms (the principal methods used by Tanzanian women). For each method, every visited facility was assigned a score of 0 if it did not offer the method, 1 if it did offer the method but experienced stock-outs during the previous six months, or 2 if the facility offered the method without stock-outs over the previous six months. The facility-level indices were then aggregated for each community to create a cluster-level index. Typically, we tested a number of

alternative index definitions when estimating the country-specific models.

MCH STAFFING: To measure the availability of trained MCH service delivery staff at health facilities in each community, we constructed continuous staffing indices by summing the number of health care practitioners who were reported to work for facilities that were included in the service availability survey. For example, in Tanzania, a simple index was created by summing the number of nurses, trained midwives, and MCH aides found at the nearest of each of the three types of facilities within 30 km, and then summing across facilities nearest to each community. For each country analysis, this index was included in the MCH use equation. Again, many alternative definitions were tested when estimating the country-specific models.

FAMILY PLANNING STAFFING: Comparable indices pertaining to family planning service providers — the number of nurses, trained midwives, and MCH aides trained in family planning service provision in each community — also were computed. This measure was included in the family planning model.

MCH SERVICE EQUIPMENT: Indices were constructed to measure the adequacy and availability of equipment used to delivery MCH services. The overall index was derived by summing across items within each facility that reports offering MCH services and then across facilities within each cluster. Examples of the types of items included in the index are a sterilizer, a thermometer, disposable syringes, disposable needles, an examination couch, and a stethoscope. See Tables C1 through C5 in Appendix C for detailed definitions of these variables. The types of equipment used to construct the indices varied considerably across countries and the range in the number of items used was five items in Morocco to 35 in Tanzania.

FAMILY PLANNING SERVICE EQUIPMENT: Similar indices were used to measure the availability of equipment thought to be important to the delivery of family planning services. The details on the construction of the indices used for each of the countries analyzed are in Tables C1 through C5 in Appendix C.

INDEPENDENT VARIABLES: COMMUNITY CHARACTERISTICS

Unlike the service availability surveys, the DHS surveys did not include information on community

infrastructure and services (other than characteristics of the health care supply environment). As a result, we included only one non-health care characteristic — urban/rural status — as a community-level determinant in the MCH service and contraceptive use (in addition to those pertaining to the supply environment for such services). This variable was a dummy, indicating whether the respondent lived in an urban area at the time of the survey (rural residence is the reference or excluded category in the regressions).

INDEPENDENT VARIABLES: INDIVIDUAL & HOUSEHOLD CHARACTERISTICS

DEMOGRAPHIC VARIABLES: Three types of demographic variables are included in both equations to control for their effects:

- dummy variables indicating the age of the respondent (15 to 19 years of age is the reference category)
- a continuous variable indicating the number of adult females residing in the household (used as a proxy measure for the availability of alternative child caretakers)
- the number of individuals residing in the household

In addition, for Morocco and Tanzania, a dummy variable was included on whether the respondent was in a polygamous marriage (monogamous marriage is the reference category).

EDUCATIONAL ATTAINMENT: Two sets of dummy variables pertaining to the education level of the respondent and her spouse were included in both equations to control for differences in educational background and permit testing of the hypothesis that demand for modern contraception and MCH care increases with higher levels of schooling. For female respondents and their husbands, dummy variables indicating whether the respondent had completed one to six or seven-plus years of education were constructed (or, in the case of Morocco, one to three or four-plus years of education), with women and husbands with no formal education serving as the reference category in the regressions.

HOUSEHOLD WEALTH AND INCOME: The DHS does not include questions on household income or on the value of household assets. To account for the effects

of such factors on MCH service and contraceptive use decisions, household-level wealth indices were constructed. This index were calculated by summing dichotomous indicators of the following variables:

- whether the household had a non-dirt floor
- whether the household had electricity
- whether the household had a flush toilet
- whether the household owned a radio
- whether the household owned a motorcycle or car
- whether the household used water from a piped source

The index has a range of 0 to 5 and households received one “point” for each condition present or item owned.

4 Findings

FINDINGS

ACCESS TO AND USE OF MCH AND FAMILY PLANNING SERVICES

Table 2 provides descriptive information on the use of MCH and family planning services among the sample used in this analysis — currently married women who report having at least one birth in the past five years and who report not being pregnant at the time of the survey. The first block in the table, which describes utilization of MCH services that were associated with the last birth, suggests moderate to high levels of utilization among women in Tanzania, Guatemala, and Indonesia, and low levels of utilization in Morocco and Bolivia. The overall sample mean for the MCH service-use index, a composite measure covering a variety of MCH-related services, ranges from 2.7 among rural women in Bolivia to 8.4 among urban women in Indonesia.

The results on the use of particular types of MCH services reveal several interesting findings. First, the percentage of women making one or more prenatal care visits is relatively high in each country. The exceptions to that finding are Bolivia, where only 51 percent of urban women and 29 percent of rural women report having had prenatal care from a trained provider, and Morocco, where 63 percent of urban women and 21 percent of rural women report having received prenatal care. Second, as expected, there appear to be large urban-rural differentials in the percent of women who report receiving trained assistance during their last delivery. In Guatemala, however, a surprisingly high percentage of rural women report having had trained assistance (81 percent), making the urban-rural differential considerably more narrow than in the other countries. This number includes the use of “trained traditional birth attendants” (38 percent of women who report having had trained assistance). Third, with respect to immunization coverage, the percent of women who report that their last child was fully immunized is at moderate levels in Morocco, Indonesia, and Tanzania, but at low levels in Guatemala and Bolivia.

The middle portion of Table 2 shows the results on the use of modern contraceptive methods at the time of the survey among women who report having a birth in the five years prior to the survey. As expected, contraceptive utilization is extremely low among

women from Guatemala and Bolivia (both urban and rural). For example, in rural areas, only 6.3 percent of Guatemalan women and 5.5 percent of Bolivian women reported using a modern method at the time of the survey. The percentages are higher among women in urban areas, but still relatively low (15.5 among Guatemalan urban women and 20.4 among Bolivian urban women). In Guatemala, the leading method of choice was reported to be sterilization; in Bolivia, the most commonly used method was reported to be the IUD. The low contraceptive prevalence rates observed in both countries are generally attributed to similar factors. When compared to the rest of Latin America, both countries exhibit particularly widespread poverty, relatively high rates of infant mortality, a generally low status of women, and have large, marginalized indigenous populations. Finally, both countries exhibit especially strong links between the state and the Catholic Church compared to other Latin American countries.

In Tanzania, the only sub-Saharan African country analyzed, the results suggest low to moderate levels of current use of modern contraceptives since the last birth, large urban/rural differentials in use, and a rather narrow method mix. Overall, the percentage of woman currently using a modern method was just over 20 percent — 40 percent in urban areas and 15 percent in rural areas. The method mix among contraceptive users is quite narrow, with nearly 46 percent of woman currently using a modern method choosing oral contraceptives and 36 percent choosing injections. While most women currently using a method chose a reversible method since the last birth, a significant proportion chose sterilization (5.6 percent). The method mix was found to be quite similar in urban versus rural areas. With the adoption of the National Population Policy in 1992, Tanzania’s family planning program expanded rapidly during the 1990s. From 1991 to 1996, the prevalence rate of current use of family planning among women of reproductive age doubled from 6 percent to 12 percent. In 1996, most women who use the most commonly used methods — pills and injectables — report obtaining these methods from government providers (77 percent and 88 percent, respectively) while women who are currently using condoms report obtaining supplies from the private sector (77 percent).

In Indonesia, a country that is known to have a strong family planning program, 59 percent of urban women and 50 percent of rural women reported

Table 2. Summary statistics on MCH service use and family planning use^a

Service-use measure	Morocco		Tanzania		Guatemala		Bolivia		Indonesia	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Percentage of^b	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
Women making one or more prenatal visits	63.1	21.2	94.2	93.4	89.4	84.3	50.9	29.3	96.0	81.1
Women making first visit in first trimester	44.7	10.3	14.4	10.8	57.7	43.0	30.7	13.7	70.5	44.1
Women receiving tetanus immunization	75.5	86.6	96.7	90.8	62.4	49.3	38.8	23.9	76.9	59.8
Women with delivery attended by trained personnel	67.8	16.2	85.8	47.0	95.9	80.7	48.9	20.3	81.0	30.4
Children at least partially immunized	66.3	55.0	92.3	85.7	84.4	76.6	61.0	53.2	87.2	69.8
Children fully immunized	61.6	43.1	54.6	47.4	31.1	28.5	21.7	16.6	55.7	40.7
<i>Mean MCH service-use index</i>	<i>6.9</i>	<i>3.8</i>	<i>8.1</i>	<i>6.7</i>	<i>7.2</i>	<i>5.9</i>	<i>4.5</i>	<i>2.7</i>	<i>8.4</i>	<i>5.7</i>

Percentage of women who are currently using a modern contraceptive method, by age group

Age group	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
All ages	71.3	40.9	40.1	14.5	16.5	6.3	20.4	5.5	59.3	49.8
15–19	73.2	42.9	29.6	5.5	9.7	2.2	12.5	3.8	64.2	45.3
20–24	78.3	45.2	41.8	13.8	12.5	4.8	16.1	2.5	59.3	54.7
25–29	78.5	42.1	41.7	14.3	19.0	8.8	22.6	6.1	59.9	52.3
30–39	69.8	39.5	39.2	16.8	20.2	8.2	25.3	7.7	60.6	47.6
40–49	55.2	37.3	45.5	14.6	12.1	2.7	9.4	3.7	44.2	40.5

Percentage distribution of women who are currently using a modern contraceptive method, by type of method

Method	<i>n</i> =764	<i>n</i> =695	<i>n</i> =293	<i>n</i> =388	<i>n</i> =56	<i>n</i> =75	<i>n</i> =456	<i>n</i> =97	<i>n</i> =2106	<i>n</i> =4467
Pill	87.2	94.4	44.0	47.7	17.9	22.7	22.2	15.5	30.9	39.3
IUD	13.7	5.0	4.8	2.3	12.5	14.7	44.7	40.2	19.2	14.2
Injection	0.9	1.0	36.2	36.6	16.1	18.7	5.7	8.3	41.4	42.5
Norplant	–	–	1.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0
Condom	5.5	1.6	9.2	7.0	8.9	9.3	7.5	10.3	4.1	0.9
Sterilization	2.4	2.7	4.8	6.2	44.7	37.7	18.6	25.8	4.0	2.4

a Base: currently married/living together, non-pregnant women.

b For last birth only.

using a modern method at the time of the survey. As indicated in the bottom block of Table 2, injections and pills were the leading methods of choice among urban and rural groups.

We present descriptive statistics on the accessibility to and quality of MCH and family planning services in Table C6 through C10 in Appendix C. Unlike the household surveys used in this analysis, the service-availability surveys did not include a standardized set of questions. As a result, the health care supply environment could not be measured in a consistent manner across the countries analyzed. As may be observed, in each country, health facilities offering MCH and family planning services and/or supplies are more readily accessible (at least physically) to residents of urban clusters than rural ones. The mean distance to the closest facility offering MCH or family planning services was typically 1.0 km or less. In rural areas, the mean distance to facilities offering these services ranged from 2.6 km in Guatemala to 12.7 km in Bolivia.

Unfortunately, the service-availability surveys did not include questions regarding the extent to which MCH and family planning services are integrated. We did compute a measure of “physical” integration, however, by counting the number of facilities within 30 km that offer a full set of MCH services (antenatal, birth delivery, postnatal, and immunization services) and family planning services. The results are in Tables C6 through C10 in Appendix C.

Table 3 presents descriptive information on the remaining country-specific characteristics used as independent variables in the FIML regression model.

MULTIVARIATE RESULTS

The results of the FIML model are displayed in Tables 4 and 5. We first describe the results of the MCH service equation, displayed in Table 4, and then describe the results of the contraceptive use equation, displayed in Table 5.

Of particular interest to policy makers are the effects of the variables that measure the MCH service supply environment. The effects of a number of indicators of the physical accessibility of MCH services were tested; the results suggest that physical accessibility to services influences service use in four of the five

countries analyzed. The type of indicator of physical access that was found to be statistically significant, however, varied across the countries. With respect to the distance to the closest health care facility, a proxy for the time and travel costs associated with service utilization, the effect was found to be statistically significant in Morocco and Indonesia, but not in Tanzania, Guatemala, and Bolivia. In Tanzania, however, the number of facilities within 30 km offering MCH services was found to affect MCH service use (as indicated by the parameters associated with the two dummy variables in the third column). In addition, in Guatemala and Morocco, an index of the number of MCH services offered among the closest of each type of health facility was found to be significant. Bolivia was the only country in which none of the indicators of physical access to MCH services was found to influence MCH service use.

The inclusion of private facilities in the service-availability surveys administered in Bolivia and Guatemala provided an opportunity to test whether physical access to private facilities affected MCH service use. The results of the dummy indicators, displayed in columns 4 and 5, indicate that the availability of private services, at least in Bolivia and Guatemala, were not found to influence MCH service use, after controlling for the availability of services offered by the government and for other determinants of MCH service use. We were unable to test for the effect of these variables in the other countries because the service-availability survey did not collect information from private providers. We test for the influence of the private sector on the use of family planning services later in this section.

The effects of the variables that measure the service “readiness” of health care facilities are displayed in the bottom of Table 4. While the results indicate that structural aspects of quality can have important effects on MCH service use, the limited number of variables measuring “readiness” that are significant indicates that the types of questions typically included in the service-availability surveys do not provide information that adequately portrays the aspects of MCH services that matter to women. In Guatemala and Indonesia, the availability of infrastructure and equipment was found to have a beneficial and a statistically significant effect on MCH service use. In Tanzania, the availability of immunizations was the only factor found to be significant. In Morocco, the number of trained MCH staff was found to be

Table 3. Summary statistics on individual-, household-, and community-level characteristics

Independent variables	Morocco		Tanzania		Guatemala		Bolivia		Indonesia	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Individual-level										
Percentage of women between	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
15–19 years	1.9	3.9	7.4	6.1	–	–	6.8	7.4	2.6	4.6
20–24 years	16.4	16.5	27.7	23.1	21.2	26.3	23.4	18.3	19.5	22.5
25–29 years	22.6	22.1	29.7	24.3	29.4	20.9	25.9	23.0	32.9	27.3
30–39 years	48.9	42.9	29.2	33.7	30.6	32.6	36.4	36.0	39.3	37.3
40–49 years	10.2	14.7	6.1	12.8	9.7	12.5	7.6	15.4	5.7	8.3
Percentage of women	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
Currently married or living together	95.7	97.4	85.7	76.4	90.9	92.7	86.6	89.2	97.6	97.1
Currently in polygamous marriage	4.3	3.9	14.3	23.6	3.5	4.8	8.8	3.8	2.4	2.9
Percentage of women with	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
No education	56.8	93.4	15.3	32.8	35.0	53.04	6.4	26.9	5.6	16.8
1–6 years of education (1–3 years for Morocco)	5.6	2.9	13.3	16.5	40.6	44.4	41.6	60.3	38.2	59.0
7+ years of education (4+ years for Morocco)	37.6	4.3	71.4	50.7	24.4	2.6	52.0	12.8	56.2	24.2
Household-level										
Percentage of husbands with	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =319	<i>n</i> =1165	<i>n</i> =2137	<i>n</i> =1656	<i>n</i> =3656	<i>n</i> =10121
No education	37.9	78.2	6.7	21.4	15.7	32.4	1.7	8.5	2.7	11.7
1–6 years of education (1–3 years for Morocco)	4.5	5.1	12.9	20.9	50.8	61.1	30.8	63.1	32.0	56.1
7+ years of education (4+ years for Morocco)	57.6	16.7	80.3	57.7	33.5	6.5	67.5	28.4	65.4	32.3
Mean of number of adult females in household	1.7	1.8	1.6	1.5	1.5	1.4	1.4	1.2	1.1	1.1
Mean of number of household members	6.9	8.8	6.3	7.0	NA	NA	5.8	6.1	5.8	5.6
Mean household asset index ^a	3.9	2.0	1.8	0.5	3.5	2.2	3.7	1.5	3.8	1.8
Percentage of women living in households with	<i>n</i> =1248	<i>n</i> =2019	<i>n</i> =727	<i>n</i> =2671	<i>n</i> =340	<i>n</i> =1199	<i>n</i> =2240	<i>n</i> =1780	<i>n</i> =3674	<i>n</i> =10167
Good floor material	96.7	45.9	65.1	11.2	46.8	21.4	71.6	25.0	78.1	35.5
Electricity	84.2	17.8	33.3	2.0	84.4	49.1	87.8	23.2	92.9	39.3
Flush toilet	90.5	17.28	5.4	0.7	47.1	3.6	42.7	3.8	66.3	34.0
Radio	90.4	83.4	68.6	38.6	85.3	74.4	89.6	69.8	74.0	49.8
Motorcycle	18.5	11.7	2.5	0.9	62.4	28.1	78.5	14.4	31.4	12.8
Car	17.1	6.7	5.5	0.5	19.4	3.2	36.4	7.1	8.9	1.4
Piped drinking water	93.1	19.3	28.2	2.3	90.9	69.0	82.5	30.6	27.0	3.6
Community-level										
Percentage living in urban areas	38.2	–	21.4	–	22.1	–	55.7	–	26.5	–

^a Sum of number of items (the maximum differs slightly from one country to the next). See Tables C1 through C5 in Appendix C for details.

important, while in Bolivia, none of the indicators was found to be statistically significant.

The parameter estimates of the individual- and household-level variables on MCH service use are largely as anticipated on the basis of the underlying economic demand model and findings from prior studies. In each of the five countries, positive and statistically significant effects on MCH service utilization are observed for the respondent's level of education, the husband's level of education, and the household wealth index. In Bolivia, however, the effects of these three variables were not found to be statistically significant. The magnitude of effects of years of schooling is particularly noteworthy. For the respondent and her husband, the effect of having seven or more years of schooling (four or more in Morocco) is larger than the effect of having only one to six years of schooling (one to three in Morocco). In addition, for respondents, the effect of having one to six years of schooling (one to three in Morocco) on MCH service use is significantly greater than the effect of having no formal schooling.

The other demographic variables considered — the marital status of the respondent, the number of adult females in the household (used as a proxy measure for the presence of alternative child caretakers) and household size (used as a measure of household structure) — were not found to have statistically significant effects on MCH service use. Although the parameter estimates of the presence of female adults are non-significant, in the instances in which the effect is negative (Morocco, Tanzania, and Bolivia) the results might indicate a lower use of facility-based health care services in the presence of other caretakers for pregnant women and children in the household.

The final variable considered in the MCH service-use equation, the urban/rural status of sample women, also had a significant effect in the expected direction in three of the five countries. In Morocco, Tanzania, and Indonesia, women residing in urban communities were found to have used MCH services more intensively in connection with recent births than residents of rural communities. That an urban-rural differential persists, even after the effects of community-level differentials in education and the supply environment for MCH services were controlled statistically, might be indicative of a broader social awareness/acceptance of the importance of such

services for the health of women and children in urban than in rural areas. The differential might also show an ability and willingness to invest more household resources in the health care of their children in urban than in rural households.

We turn next to the results of the determinants of contraceptive use, displayed in Table 5. For efficiency of presentation, we show the effects of the independent variables on the probability of choosing using a modern method versus no method or a modern method versus a traditional method, but not the effects on the probability of choosing a traditional method versus no method. One of the primary variables of interest in this study is the effect of the intensity of MCH service utilization. In Morocco, Guatemala, and Indonesia, the variable had a positive and statistically significant effect on the likelihood of subsequent adoption of a modern contraceptive method when the other factors included in the regressions were statistically controlled. In Tanzania, MCH service use was not found to influence the likelihood of using a modern method versus a traditional or no method. It should be remembered that in Tanzania, however, we were only able measure current use of family planning and not whether a modern method was used by the women between the time of her last birth and the time of the survey. To test whether it makes a difference to current use or use since the last birth, we estimated the model based on the Moroccan data using both types of variables. The results suggest that MCH service intensity has a statistically significant effect on whether a woman ever used a modern method since the last birth, but not on current use. If we had similar information in the Tanzanian DHS, these results suggest that MCH service use may have been an important determinant of contraceptive use in that country. In Bolivia, the intensity of MCH service use had the opposite effect as anticipated, and the parameter estimate was found to be statistically significant. The explanation for this finding is unclear.

Among the other variables included in the contraceptive-use equation are characteristics of the family planning supply environment. As discussed in the previous section, these included measures of the physical accessibility of family planning facilities — the distance to the closest facility of any type and distance to the closest private facility — and measures of the "readiness" of family planning facilities — the availability of contraceptives in stock, the number of

Table 4. Full-information, maximum-likelihood results on the determinants of MCH service use

Explanatory Variable	Morocco	Tanzania	Guatemala	Bolivia	Indonesia
Age					
20–24 years	0.848 (1.110)	0.109 (1.094)	0.224 (1.386)	-0.255*** (-2.867)	0.303*** (3.113)
25–29 years	0.097 (1.321)	0.025 (0.254)	0.395** (2.350)	-0.204** (-2.292)	0.484*** (5.018)
30–39 years	0.062 (1.010)	0.112 (1.130)	0.485*** (3.008)	-0.265*** (-3.086)	0.331*** (3.392)
40–49 years	-0.026 (-0.340)	0.271** (2.372)	0.211 (1.108)	-0.333*** (-3.548)	0.047 (0.399)
Currently in polygamous marriage	-0.019 (-0.171)	0.073 (1.261)	–	–	–
Currently married or living together	–	–	–	0.006 (0.125)	0.077 (0.646)
Respondent's education					
1–6 years (1–3 years for Morocco)	0.749*** (4.601)	0.194*** (2.657)	0.217** (2.328)	0.042 (0.890)	0.745*** (7.394)
7+ years (4+ years for Morocco)	1.248*** (14.522)	0.410*** (6.522)	0.471*** (2.684)	0.082 (1.429)	1.209*** (11.312)
Husband's education					
1–6 years (1–3 years for Morocco)	0.156 (1.589)	0.108 (1.384)	0.359*** (3.123)	–	0.176 (1.570)
7+ years (4+ years for Morocco)	0.384*** (6.191)	0.158** (2.280)	0.597*** (4.528)	–	0.468*** (4.246)
Household size	–	-0.005 (-0.479)	-0.028 (-1.250)	–	-0.054*** (-4.468)
Number of adult females in household	-0.020* (-1.920)	-0.009 (-0.248)	0.059 (0.736)	-0.029 (-1.234)	0.015 (0.251)
Household assets index	0.144*** (5.918)	0.160*** (5.486)	0.176*** (4.370)	0.001 (0.049)	0.231*** (14.534)
Urban residence	0.562*** (3.222)	0.465*** (4.648)	0.067 (0.448)	0.024 (0.425)	0.301*** (5.012)
Sewage system in community	0.169 (1.102)	–	–	–	–
Distance to nearest health facility	-0.020*** (-7.429)	-0.009 (-1.398)	0.085 (1.452)	-0.001 (-0.317)	-0.019** (-2.201)
Private facility within 2 km	–	–	-0.135 (-0.799)	–	–
Private facility within 5 km	–	–	-0.077 (-0.594)	–	–
Private facility within 15 km	–	–	–	-0.061 (-1.201)	–

Table 4. continued

Explanatory Variable	Morocco	Tanzania	Guatemala	Bolivia	Indonesia
No. of MCH services available (aggregate)	0.017** (2.740)	–	-0.122*** (-3.742)	–	–
1 or 2 facilities offering MCH services	–	0.311* (1.707)	–	–	–
3 or 4 facilities offering MCH services	–	0.500** (2.276)	–	–	–
No. of facilities offering MCH and FP ^a	0.088 (0.180)	-0.136** (-2.194)	–	–	–
No. of trained MCH staff	0.001*** (3.310)	–	–	–	0.000 (1.125)
Infrastructure and equipment index (MCH)	-0.016 (-0.870)	0.001 (0.314)	0.116*** (4.530)	0.002 (1.444)	0.011*** (3.919)
Immunization index	–	0.018*** (4.004)	–	–	–
Constant	-0.848	7.459***	0.570	2.702***	12.655***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *T*-statistics shown in parentheses.

a Dummy variable for Morocco.

family planning staff, and the availability of equipment necessary for service delivery. Of the variables measuring physical accessibility of family planning facilities, distance to the closest facility of any type was not found to be a statistically significant determinant of contraceptive use in any of the countries studied. In the two countries where we had information on access to private health care clinics, however, proximity to private facilities was an important determinant of family planning use. In Guatemala, proximity to an APROFAM clinic showed robust results for traditional and modern method users. In the Guatemalan context, the local International Planned Parenthood Federation affiliate, Asociación Pro Bienestar de la Familia de Guatemala (APROFAM), is of particular interest because of its status as the largest provider of contraceptive services in the country. For the regions considered in this study, APROFAM had a full-service clinic in the municipal capital of each of the four departments. Interestingly, the effect of having access to a high-quality private facility had a limited geographic scope. Women with an APROFAM clinic within two km of their community were more likely to use traditional and modern methods, but this effect did not hold for women with an APROFAM clinic within two to five km.

In Bolivia, having a private facility within 15 km of the community also was a statistically significant factor influencing the probability of using a family

planning method. In our analysis, proximity to private family planning services is indicated by a dummy variable that measures whether a private facility, pharmacy, or private doctor offering family planning was located within 15 km of the community. In addition to pharmacies, private providers consist of facilities operated by non-governmental and religious organizations and for-profit medical doctors.

At the time of the survey in 1994, the private sector in Bolivia was the source of 66 percent of supplies among current users of a modern family planning method. Pills, injections, condoms, and vaginal methods are distributed mainly in pharmacies, while doctors are the primary supplier for IUDs. Pharmacies were the most frequently available private source of supplies or services in urban and rural areas, as 80 percent of urban women and 23 percent of rural women were found to be within 15 km of a pharmacy. In urban areas, private doctors (59 percent of women), for-profit private clinics (47 percent of women), and non-governmental organization (NGO) facilities (7 percent of women) were the next most frequently available sources of supplies or services. In rural areas, however, private doctors (10 percent), private for-profit clinics (4 percent), and facilities operated by religious organizations (4 percent) were the next most frequently available source of care.

Table 5. Full-information, maximum-likelihood results on the determinants of contraceptive use

Explanatory Variable	Morocco		Tanzania		Guatemala		Bolivia		Indonesia	
	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method
Age										
20–24 years	0.042 (0.240)	0.452 (1.130)	0.801*** (3.186)	0.096 (0.213)	0.325 (0.534)	0.619 (0.642)	0.160 (0.593)	-0.041 (-0.148)	0.469*** (3.940)	-1.094 (-1.471)
25–29 years	0.062 (0.380)	0.045 (0.140)	0.859*** (3.417)	0.134 (0.296)	0.536 (0.900)	-0.043 (-0.047)	0.480* (1.803)	0.031 (0.114)	0.307*** (2.618)	-1.729** (-2.353)
30–39 years	-0.006 (-0.050)	-0.580** (-2.180)	1.199*** (4.772)	-0.025 (-0.055)	0.912 (1.570)	-0.394 (-0.444)	0.751*** (2.868)	0.269 (0.982)	0.227* (1.938)	-1.932*** (-2.604)
40–49 years	-0.119 (-0.700)	-0.992*** (-3.100)	1.609*** (5.506)	0.098 (0.193)	0.739 (1.100)	0.187 (0.176)	-0.329 (-0.951)	-0.823** (-2.316)	0.039 (0.278)	-2.136*** (-2.837)
Currently in polygamous marriage	-0.292 (-1.310)	0.227 (0.510)	-0.278** (-2.067)	-0.041 (-0.191)	–	–	–	–	–	–
Currently married or living together	–	–	–	–	–	–	2.041*** (9.596)	0.438* (1.900)	2.011*** (12.755)	-1.198 (-1.178)
Respondent's education										
1–6 years (1–3 years for Morocco)	0.600 (1.570)	1.458** (2.360)	0.665*** (3.873)	0.113 (0.379)	-0.045 (-0.147)	-0.474 (-0.880)	1.530*** (4.824)	1.251*** (3.893)	0.170** (1.996)	-0.344 (-1.303)
7+ years (4+ years for Morocco)	0.244 (0.620)	0.476 (0.930)	0.644*** (4.167)	-0.414 (-1.563)	1.012** (2.386)	-0.573 (-0.918)	2.529*** (7.631)	1.723*** (5.152)	0.321*** (3.072)	-0.756** (-2.497)
Husband's education										
1–6 years (1–3 years for Morocco)	0.137 (0.640)	-0.777** (2.550)	0.030 (0.148)	-0.182 (-0.579)	0.312 (0.863)	-0.202 (-0.295)	–	–	0.139 (1.497)	0.474* (1.819)
7+ years (4+ years for Morocco)	0.069 (0.450)	-0.035 (-0.140)	0.674*** (3.774)	0.355 (1.240)	0.767** (2.116)	-0.291 (-0.505)	–	–	0.206** (2.036)	0.093 (0.336)
Household size	–	–	0.017 (0.767)	0.013 (0.355)	0.026 (0.373)	0.129 (1.186)	–	–	-0.086*** (-6.249)	-0.075* (-1.924)
Number of adult females in household	0.040* (1.800)	0.016 (0.400)	-0.225*** (-2.803)	-0.033 (-0.254)	-0.312 (-1.286)	-0.586 (-1.635)	-0.004 (-0.048)	0.088 (1.004)	0.041 (0.539)	0.035 (0.154)
Household assets index	0.088 (1.550)	-0.004 (0.040)	0.237*** (4.119)	0.072 (0.781)	-0.223* (-1.829)	-0.273 (-1.330)	0.340*** (6.246)	0.215*** (4.020)	0.138*** (6.356)	-0.013 (-0.259)
Intensity of MCH service use	0.680** (2.370)	-0.494 (-1.360)	0.080 (0.657)	-0.071 (-0.335)	1.323*** (4.657)	1.426*** (3.605)	-0.310** (-1.972)	-0.102 (-0.625)	0.207*** (5.667)	0.194* (1.831)
Urban residence	-0.114 (-0.370)	-0.081 (-0.190)	0.809*** (4.701)	0.972*** (3.535)	0.646 (1.502)	-0.651 (-0.995)	-0.020 (-0.072)	-0.165 (-0.620)	-0.002 (-0.025)	-0.202 (-1.035)
Sewage system in community	0.049 (0.220)	0.376 (1.300)	–	–	–	–	–	–	–	–

Table 5. continued

Explanatory Variable	Morocco		Tanzania		Guatemala		Bolivia		Indonesia	
	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method	Modern vs. no Method	Modern vs. Trad. Method
Distance to nearest family planning facility	0.014 (1.590)	0.024 (1.310)	-0.012 (-1.046)	-0.014 (-0.820)	0.079 (0.685)	0.122 (0.587)	-0.009 (-1.156)	-0.011 (-1.444)	-0.008 (-0.957)	0.004 (0.205)
Private facility or pharmacy offering FP within 15 km	–	–	–	–	–	–	0.716*** (2.852)	0.660*** (2.665)	–	–
No. of facilities offering MCH and FP a	0.174 (0.600)	0.086 (0.180)	-0.049 (-0.606)	-0.104 (-0.878)	–	–	–	–	0.113** (2.503)	0.408*** (3.533)
Facility with APROFAM within 2 km	–	–	–	–	0.843* (1.649)	1.195* (1.813)	–	–	–	–
Facility with APROFAM within 5 km	–	–	–	–	-0.444 (-0.843)	-0.079 (-0.095)	–	–	–	–
Availability of pills at pharmacy	0.090 (0.750)	1.021*** (5.580)	–	–	–	–	–	–	–	–
Contraceptive availability index	–	–	-0.005 (-0.364)	0.014 (0.719)	0.039 (1.269)	-0.043 (-1.008)	0.012 (0.964)	0.002 (0.195)	-0.019* (-1.910)	-0.078*** (-3.173)
No. of family planning staff	–	–	0.013 (1.210)	-0.016 (-1.021)	–	–	–	–	–	–
CBD present in community	0.077** (2.210)	-0.034 (-0.620)	–	–	–	–	–	–	–	–
Infrastructure and equipment index b	0.182*** (5.550)	0.165*** (2.740)	0.001 (0.175)	-0.008 (-1.028)	-0.001 (-0.013)	-0.394*** (-2.922)	0.007 (0.454)	0.015 (1.067)	–	–
Constant	-2.851	1.579	-3.297***	2.381	-5.181***	32.301***	-8.655***	-5.441***	-6.139***	3.369**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *T*-statistics shown in parentheses.

a Dummy variable for Morocco.

b Family planning infrastructure/equipment index in Morocco and Tanzania.

While the private sector is already an important source of family planning services in Bolivia, our results suggest that the availability of private-sector supplies and services is an important determinant of modern contraceptive use, and that additional increases in the availability of private family planning services would be expected to further increase contraceptive utilization rates in Bolivia. This result is consistent with previous research in Bolivia that finds that the majority of adolescent girls prefer pharmacies over health care facilities as a source for contraceptives — an indication that the quality of private services may be frequently superior to that found in the public sector (Zielinski-Gutiérrez *et al.*, 2001).

Interestingly, the sole indicator of service integration used in this analysis, the number of facilities within 30 km that offered a full range of MCH and family planning services, was found to be statistically significant in only one of the five countries analyzed —

Indonesia. One possible explanation for the failure of this variable to emerge as significant is that although the physical availability of MCH and family planning services are physically integrated, there may be little operational integration of services. We revisit this issue in the Discussion section of this paper.

Of the variables that measure the “readiness” of facilities to provide family planning services, the findings are best characterized as mixed. For example, the contraceptive availability index was found to have a positive and statistically significant effect only in Indonesia. The infrastructure and equipment index was significant only in Guatemala, and the number of staff available to provide family planning services was not found to be a significant determinant. We also estimated many other model specifications that tested alternative combinations of these variables, as well as other variables not considered here, including whether the availability of oral contraceptives and

Table 6. Policy simulation results: Predicted levels of MCH service use and contraceptive use associated with hypothetical changes in selected policy variables

Change in policy variables	Morocco			Guatemala			Indonesia		
	MCH service-use index	Proportion using trad. method	Proportion using modern method	MCH service-use index	Proportion using trad. method	Proportion using modern method	MCH service-use index	Proportion using trad. method	Proportion using modern method
Baseline values	4.02	6.9	53.1	6.24	3.1	18.1	6.53	3.0	59.4
Respondent's education									
All=0 years	3.78	6.0	50.1	6.10	2.5	16.2	5.73	1.8	53.4
All=1–6 years (1–3 years for Morocco)	4.53	2.9	71.0	6.31	3.1	17.8	6.47	2.7	59.0
All=7+ years (4+ years for Morocco)	5.06	9.0	65.9	6.57	7.4	28.0	6.93	3.9	62.8
Husband's education									
All=0 years	3.89	6.0	52.0	5.91	2.2	14.2	6.25	3.5	55.3
All=1–6 years (1–3 years for Morocco)	4.05	12.0	51.3	6.27	3.4	17.8	6.42	2.3	59.1
All=7+ years (4+ years for Morocco)	4.27	8.0	56.0	6.51	4.6	23.0	6.72	3.3	60.9
Mean distance to the nearest health facility									
0 km	4.14	8.0	54.2						
5 km	4.04	7.0	53.0	–	–	–	–	–	–
10 km	3.94	6.0	51.8						
Distance to nearest health facility									
Distance by half	–	–	–	–	–	–	6.56	3.0	59.5
Double distance							6.46	3.0	59.1
Facility with APROFAM within 2 km									
No	–	–	–	NA	3.4	17.8	–	–	–
Yes				NA	3.1	22.9			
No. MCH services available in community									
0	3.68	6.0	49.0						
20	4.01	7.0	53.1	–	–	–	–	–	–
40	4.34	8.1	55.8						
No. of facilities offering MCH and FP									
minus σ	–	–	–	–	–	–	6.53	4.1	56.5
plus σ							6.53	2.0	62.3
No. trained staff at nearest facilities									
1	3.94	7.0	51.9						
150	4.02	7.2	53.0	–	–	–	–	–	–
300	4.10	7.0	53.0						
Infrastructure and equipment index									
minus σ (7 for Guatemala)	–	–	–	5.47	0.4	14.1	6.37	3.0	58.9
plus σ (16 for Guatemala)				6.52	6.1	19.8	6.67	3.0	60.0
MCH service-use index									
minus σ	NA	2.0	31.7	NA	5.8	5.9	NA	4.2	42.5
plus σ	NA	19.0	65.3	NA	2.7	44.2	NA	1.7	74.3

injections (used as separate indicators) at public facilities were an important determinant of demand. None of these indicators of availability were found to be significantly associated with contraceptive use. In Morocco, however, one indicator measuring the readiness of the private sector to provide family planning services was significant — the availability of pills at pharmacies was positively associated with a higher likelihood of modern versus traditional method use.

Turning to other potential determinants of contraceptive demand, a sizeable number of variables emerged as statistically significant in the contraceptive-use equation. Among the individual- and household-level factors considered, the respondent's years of schooling, the husband's years of schooling, and household wealth emerged as significant determinants of contraceptive use in most of the country-specific analyses — findings that are observed frequently in developed and developing countries. Morocco was the only country in which household wealth was not found to be a significant determinant of contraceptive use.

Of the demographic variables included in the model, age was found to be a significant predictor of the choice of modern contraceptive use versus no use in Tanzania, Bolivia, and Indonesia, but not in Morocco and Guatemala. Regarding household structure, women in households with greater numbers of other adult females were less likely to use a modern method versus no method in Tanzania, but more likely to use a modern versus no method in Morocco. The finding in Tanzania is unexpected, as women living with more adult females would be expected to have greater exposure to messages regarding the benefits of family planning and, as a result, more likely to use modern contraceptive services. One possible explanation is that some of the other women living the household may be older relatives who exert a traditional influence on women in the sample. The number of adult females in the household was not found to be significant in Guatemala, Bolivia, and Indonesia.

The only community-level factor included in each of the country-specific analyses was urban-rural status. While this variable frequently is reported to be among the most important determinants of contraceptive use in developing countries, Tanzania is the only country in which this factor emerged as statistically significant after controlling for other factors.

Regarding the unobserved heterogeneity parameters, a key finding of the study is that, for each country's estimation, the influence of unobserved individual/household- and community-level characteristics had a statistically significant effect. In addition, the coefficient on the MCH usage variable in the contraceptive-choice equation was found to be substantially different in the estimation that controlled for endogeneity than in the estimation that did not. Appendix B includes a more detailed technical discussion of the findings on the influence of unobserved heterogeneity on the results.

POLICY SIMULATIONS

As the magnitude of the effects on contraceptive use cannot be ascertained readily by examining the results of logit-type equations, simulation exercises were carried out with respect to selected policy-relevant variables. The simulations entailed first taking the observed values of the independent variables along with the estimated regression coefficients shown in Tables 4 and 5, and then predicting a level of MCH service use and a probability of using either a traditional or modern contraceptive method for each respondent. Then, the value of policy-malleable variables were modified to values or levels that might conceivably be achieved through policy or program interventions and predicted levels of MCH service use and contraceptive use were recalculated holding all other factors constant at their observed levels. Since the primary aim of this exercise is to predict the influence of improvements in both MCH service use and its determinants on the use of family planning services, we chose to carry out these simulations for Morocco, Guatemala, and Indonesia, the countries where MCH service use was found to have a statistically significant effect on the probability of using a modern contraceptive method. Table 6 shows the levels of MCH use and contraceptive use associated with hypothetical changes in selected policy variables. These results are then used to compute predicted changes from the baseline levels in MCH use and contraceptive use associated with these same hypothetical policy changes, presented in Table 7. The discussion in the rest of this section relies on the results in Table 7.

The first set of simulations indicates the expected effects of changes in levels of the respondent's and husband's level of educational attainment. As may be

Table 7. Policy simulation results — Predicted percentage changes from baseline levels in MCH-service use and contraceptive use associated with hypothetical changes in selected policy variables

Change in policy variables	Morocco			Guatemala			Indonesia		
	MCH service-use index	% change using trad. method	% change using modern method	MCH service-use index	% change using trad. method	% change using modern method	MCH service-use index	% change using trad. method	% change using modern method
Baseline values	4.02	6.90	53.10	6.24	3.05	18.14	6.53	3.03	59.35
Respondent's education									
All=0 years	-5.97%	-13.04%	-5.65%	-2.29%	-17.05%	-10.64%	-12.28%	-40.26%	-10.04%
All=1–6 years (1–3 years for Morocco)	12.69%	-57.97%	33.71%	1.15%	0.00%	-2.04%	-0.92%	-10.56%	-0.54%
All=7+ years (4+ years for Morocco)	25.87%	30.43%	24.11%	5.22%	143.61%	54.13%	6.13%	29.04%	5.85%
Husband's education									
All=0 years	-3.23%	-13.04%	-2.07%	-5.32%	-29.18%	-21.72%	-4.35%	14.85%	-6.81%
All=1–6 years (1–3 years for Morocco)	0.75%	73.91%	-3.39%	0.43%	9.84%	-1.65%	-1.65%	-23.43%	-0.39%
All=7+ years (4+ years for Morocco)	6.22%	15.94%	5.46%	4.25%	51.15%	26.63%	2.84%	8.91%	2.56%
Mean distance to the nearest health facility									
0 km	2.99%	15.94%	2.07%						
5 km	0.50%	1.45%	-0.19%	–	–	–	–	–	–
10 km	-1.99%	-13.04%	-2.45%						
Distance to nearest health facility									
Distance by half	–	–	–	–	–	–	0.46%	-2.64%	0.27%
Double distance							-1.07%	-0.66%	-0.35%
Facility with APROFAM within 2 km									
No	–	–	–	NA	9.84%	-2.04%	–	–	–
Yes				NA	0.00%	26.24%			
No. MCH services available in community									
0	-8.46%	-13.04%	-7.72%						
20	-0.25%	1.45%	0.00%	–	–	–	–	–	–
40	7.96%	17.39%	5.08%						
No. of facilities offering MCH and FP									
minus σ	–	–	–	–	–	–	-0.03%	35.64%	-4.89%
plus σ							-0.03%	-35.31%	4.89%
No. trained staff at nearest facilities									
1	-1.99%	1.45%	-2.26%						
150	0.00%	4.35%	-0.19%	–	–	–	–	–	–
300	1.99%	1.45%	-0.19%						
Infrastructure and equipment index									
minus σ (7 for Guatemala)	–	–	–	-12.28%	-87.87%	-22.55%	-2.45%	-1.65%	-0.76%
plus σ (16 for Guatemala)				4.49%	100.00%	9.04%	2.14%	-1.65%	1.04%
MCH service-use index									
minus σ	NA	-71.01%	-40.30%	NA	90.16%	-67.64%	NA	36.96%	-28.41%
plus σ	NA	175.36%	22.98%	NA	-12.13%	143.88%	NA	-44.55%	25.14%

observed, the effects are substantial in each of the three countries. With respect to the respondent's educational attainment, for example, if all women among the Guatemalan sample were to have seven or more years of education rather than their actual levels of education, then MCH service use and the probability of using a contraceptive method would increase by 5.2 percent and 54.1 percent, respectively. The simulated effects of improvements in the respondent's educational attainment are also quite large in Morocco and Indonesia. Table 7 shows that improvements in the husband's educational attainment would lead to large increases in the use of both types of health care services.

The next set of simulations indicates the expected effects of selected changes in the supply environment for MCH services. Simulated changes in the first type of characteristics considered — the physical availability of MCH services — suggest that lowering the distance to the closest facility of any type in Morocco, Guatemala, and Indonesia would have only modest effects on the use of MCH services. An interesting exception is found by observing the results in Morocco, where increasing the number of MCH services available by one standard deviation above the mean number of services available to women would be predicted to have led to an 8.0 percent increase in MCH use, and as a result, a 5.1 percent increase in the probability of subsequently adopting a modern family planning method. As this determinant was not found to be statistically significant in Guatemala or Indonesia, comparable simulations were not carried out for those countries.

With respect to the variables that measure the readiness of health care facilities, the findings are mixed. For example, in Morocco, raising the number of trained staff available in communities is predicted not to have a substantial effect on the use of MCH services. On the other hand, in Guatemala, improving the infrastructure and the availability of equipment in health care facilities to one standard deviation above the mean is predicted to increase the use of MCH services by 4.5 percent, and the probability of subsequently using a family planning method by 9.0 percent. In addition, in Indonesia, increasing the number of facilities that offer MCH and family planning services — the only measure of service integration included in the analysis — by a standard deviation would be expected to increase the probability of using a modern method by 4.9 percent.

Using the model results from Guatemala, we also predicted the effect of improving access to APROFAM clinics — the type of private family planning clinic described previously — on the probability of using a modern family planning method. It should be noted that this simulation involved the use of only the family planning equation and not the MCH service-use equation. The results are interesting: we predict that if all women in the Guatemala sample had access to an APROFAM clinic within two km of their communities, the probability of subsequently using a modern method would have increased by 26 percent. While improving the availability of APROFAM clinics to this extent may not be feasible in the short-term, the simulation does suggest that APROFAM clinics are effective in raising contraceptive-use rates.

The final simulation results displayed in Table 7 indicate the expected effect of hypothetical increases in the intensity of MCH service use. Specifically, the effects of changing the level of the MCH service use index to one standard deviation below and one standard deviation above the mean are shown in the table. This simulation involved only the use of the contraceptive use equation. The results support the premise that increases in the use of MCH service use would be expected to have a substantial effect on subsequent contraceptive use in each of the three countries. For example, increasing each woman's use of MCH services by a standard deviation would be expected to increase the probability of using a modern method by 23 percent in Morocco, 144 percent in Guatemala, and 25 percent in Indonesia. These simulations should be interpreted with caution, as the variable simulated — MCH service utilization — is not a policy instrument that is within the control of government policy makers responsible for MCH and family planning programs. The simulations are illuminating, however, in that they suggest that policies that are effective in increasing the use of MCH services would be expected not only to improve MCH service use, but also the use of family planning services.

5 Discussion

DISCUSSION

Since 1994's International Conference on Population and Development in Cairo, there has been renewed emphasis among reproductive health policy decision-makers on efforts to deliver services through integrated programs. Among the potential advantages of integrated delivery of reproductive health services — by public or private health care networks — are greater efficiency and effectiveness of health care provision and an increased ability to meet the needs of clients (Hardee and Yount, 1995). Efforts to further integrate reproductive health services are not universally accepted, particularly among members of the family planning movement. While opponents express concern that integration can dilute the quality of family planning programs, proponents argue that the effective bundling of family planning with other services can result in greater use of contraceptive methods by increasing the level of awareness among MCH clients of the benefits of family planning, and by reducing the time and monetary costs necessary to utilize contraceptive services.

The purpose of the analysis is to investigate the potential of strategies aimed at improving the use of MCH services as a tool for improving subsequent family planning utilization. Specifically, we assess the impact of the intensity of MCH service use, and its individual-, household-, and community-level determinants, on subsequent contraceptive use in five countries — Morocco, Tanzania, Guatemala, Bolivia, and Indonesia. Two of the countries — Morocco and Indonesia — are characterized by relatively high levels of contraceptive prevalence, while the rates observed in the remaining three countries — Tanzania, Bolivia, and Guatemala — are considerably lower.

In three of the five countries — Morocco, Guatemala, and Indonesia — the results of the analysis suggest that the intensity of MCH service use is indeed positively associated with subsequent contraceptive use among women, even after controlling for observed and unobserved individual-, household-, and community-level factors. This result lends support to the proposition that — at least in the context of these three countries in which our data were collected — the intensity of MCH service per se use has a “causal” impact on subsequent contraceptive use, even after controlling for factors that “predispose” sample women to use both types of services. (The possibility of a third explanation — that contact with contracep-

tive service providers leads to subsequent utilization of MCH services — is discounted by the finding that women in our samples rarely initiated contraception prior to their first birth. Although we cannot eliminate the possibility that contraceptive use subsequent to the first birth may have influenced later utilization of MCH services, both the low level of contraceptive use and high level of reproductive health care use make the proposition implausible for most women in our sample.) This finding is important, as it suggests that investing in programs that are effective in improving the use of MCH services can be a viable policy strategy — not only to improve MCH service use, but also to raise the use of family planning services. Potential strategies that could be used to raise MCH service utilization rates include, but are not limited to, efforts to strengthen the integration of MCH and family planning services, to improve MCH service access and quality, to strengthen the role of the private sector, and to influence health care seeking behavior through health education and communication programs.

In Tanzania and Bolivia, however, our findings do not support the hypothesis that MCH service use per se leads to an increase in the probability of subsequently using a modern contraceptive method. In these countries, we find that the positive relationship between the use of MCH services and family planning services is best explained by the presence of observed and unobserved factors that predispose women to use both types of services. One important limitation of the Tanzania analysis should be noted: unlike the data from the other four countries, our data on contraceptive use in Tanzania consisted only of information on whether sample women were using a contraceptive method at the time of the survey, and not whether women had used a modern method at any time since the last birth. It's conceivable that — as was the case in Morocco — our findings for Tanzania would have been different if we had this type of information available.

Information on proximity to any family planning facility was available in all five countries but was not associated with contraceptive use in any of them. In both countries where this information was available (Guatemala and Bolivia), however, proximity to private sector facilities was strongly associated with contraceptive use — even after controlling for physical proximity to any family planning services and observed and unobserved factors at multiple levels.

These effects were observed in urban and rural areas. In Guatemala, being within two km of APROFAM, a full-service private sector family planning NGO, was positively associated with contraceptive use. In Bolivia, being within 15 km of a private facility offering family planning significantly increased the likelihood of contraceptive use. We also conducted simulations that predicted that universal access to APROFAM clinics would increase modern contraceptive prevalence by 26 percent in Guatemala. In Morocco, the availability of pills at pharmacies, an indicator measuring the “readiness” of the private sector to provide family planning services, was positively associated with a higher likelihood of modern versus traditional method use in rural areas.

The findings regarding the influence of the MCH service supply environment on health seeking behavior are best characterized as “mixed.” Two types of measures were used to measure the MCH services supply environment — physical availability of MCH services and structural attributes of the “readiness” to provide MCH services. In terms of the physical availability, we find that access to MCH services is a significant determinant of MCH use in four of the five countries (Tanzania is the exception). Of the indicators used to measure MCH service supply “readiness,” there was not one type of indicator that was found to be an important determinant of service use across the countries included in the analysis. The availability of infrastructure and equipment, however, was found to be an important determinant on service use in Guatemala and Indonesia.

Of methodological interest is our finding that unobserved factors not included in our data play an important role in determining the use of MCH and family planning services. While it’s impossible to identify the specific unobserved factors responsible for our findings, there are a number of possibilities. For example, our data doesn’t capture important variations in certain individual- and household-level factors, such as the intensity of traditional beliefs or the influence of other household members on women in our sample. Nor does our data contain information about potentially important community- or program-level attributes that might explain the use of MCH service and contraceptive use. For example, community norms, the presence of charismatic health care workers, or even the extent to which services are operationally integrated may be possible factors that “predispose” women to use both types of

services. Clearly, the statistically significant role of unobserved heterogeneity suggests that research on the determinants of health care utilization and contraceptive behavior that does not account for such factors may result in incorrect parameter estimates and misleading policy conclusions.

There are a number of important limitations to this study. First, because of the lack of appropriate data on service integration, the study did not rigorously test whether service integration influences the contraceptive behavior via MCH service use. Although we controlled for the physical integration of MCH and family planning services (i.e. whether services are offered in the same facilities), the study does not include information on the extent to which services are integrated in other important ways. For example, the inclusion of sensitive measures of referral practices, training, supervision, and communication efforts also may be useful in assessing the degree of service integration and its impact on the demand for MCH and family planning services. Second, our data does not allow us to identify the influence of community-based programs and strategies that may be effective in improving the use of MCH services. For example, we had no information on health education and communication campaigns. Third, we only had limited information on the availability and quality of privately-provided MCH and family planning services.

One possible direction for future research efforts on this issue is to devote greater attention to the measurement of service integration, non-facility-based program implementation, and the availability and quality of private and public providers. Although facility-based survey instruments, like the service-availability surveys used in this study, represent an important step forward in efforts to systematically measure the health care supply environment, our findings suggest that key dimensions of community environments, including the extent to which health care services are integrated and the availability of services offered by the private sector, remain unmeasured. Specific survey questions that would have great utility include whether referral systems are used appropriately, whether management systems are conducive to service integration, what user fees are charged, whether women utilize MCH and family planning services at the same facility, and whether program supervisors and staff are trained to encourage service integration among clients. A further suggestion to improve our understanding of this issue is

to build state-of-the-art monitoring and evaluation techniques into future programmatic efforts to strengthen service integration. For example, the collection of longitudinal data from women of reproductive age through a quasi-experimental pre-test/post-test research design would offer an opportunity to better understand the influence of MCH service use on the decision to use modern family planning methods, as well as the role that service integration strategies play in this relationship.

References

REFERENCES

- Bitran, R.** 1995. "Efficiency and Quality in the Public and Private Sectors in Senegal." *Health Policy and Planning* 10, 271–283.
- Blumenfeld, SN.** 1983. "Cost Analysis of the DANFA (Ghana) Project Family Planning Component." In I Siregeldin, D Salkever D, and RW Osborn, eds., *Evaluating Family Planning Programs: International Experience with Cost-Effectiveness and Cost-Benefit Analysis*. New York: St. Martin's Press, 228–244.
- Bureau of Statistics [Tanzania] and Macro International Inc.** 1997. *Tanzania Demographic and Health Survey 1996*. Calverton, Maryland: Bureau of Statistics and Macro International.
- Bruce, J.** 1989. "Fundamental Elements of the Quality of Care: A Simple Framework." *Studies in Family Planning* 21, 61–91.
- Entwisle, B, RR Rindfuss, DK Guilkey, A Chamrathirong, SR Curren, and Y Sawangdee.** 1995. "Community and Contraceptive Choice in Rural Thailand: A Case Study of Nang Rong." *Demography* 33, 1–11.
- Faruqee, R.** 1982. *Integrating Family Planning with Health Services: Does it Help?* World Bank Staff Working Papers No. 515. Washington DC: World Bank.
- Hardee, K and K Yount.** 1995. *From Rhetoric to Reality: Delivering Reproductive Health Promises through Integrated Services*. North Carolina: Family Health International.
- Heckman, J and B Singer.** 1984 "A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data." *Econometrica* 52, 271–320.
- Hotchkiss, DR, RJ Magnani, JJ Rous, M Azelmat, TA Mroz, and J Heikel.** 1999. "The Effects of Maternal-Child Health Service Utilization on Subsequent Contraceptive Use in Morocco." *Journal of Biosocial Science*, 31:2.
- Maddala, G.S.** 1992. *Introduction to Econometrics*. New York: MacMillan.
- Mensch, B, A Jain, M Arends-Kuenning, and A Jain.** 1996. "The Impact of Quality of Family Planning Services on Contraceptive Use in Peru." *Studies in Family Planning*, 27, 59–75.
- Mroz, T and D Weir.** 1990. "Structural Change in Life Cycle Fertility During the Fertility Transition: France Before and After the Revolution of 1789." *Population Studies*, 44, 61–87.
- Mroz, TA.** 1999. "Discrete Factor Approximations in Simultaneous Equation Models: Estimating the Impact of a Dummy Endogenous Variable on a Continuous Outcomes." *Journal of Econometrics*, 92:2, 233–274.
- Rahman, M, WH Mosley, AR Khan, AI Chowdhury, and J Chakraborty, J.** 1980. "Contraceptive Distribution in Bangladesh: Some Lessons Learned." *Studies in Family Planning*, 11, 191–201.
- Reinke, W.** 1985. "The Lampang (Thailand) Health Development Project: Proposed Methodology for Integrated Cost/Task Analysis." In I Siregeldin, D Salkever D, and RW Osborn, eds., *Evaluating Family Planning Programs: International Experience with Cost-Effectiveness and Cost-Benefit Analysis*. New York: St. Martin's Press, 351–390.
- Seiber, EE and JT Bertrand.** 2002. "Access as a Factor in Differential Contraceptive Use Between Mayans and Ladinos in Guatemala." *Health Policy and Planning*, 17, 167–177.
- Simmons, R. and JF Phillips.** 1987. "The Integration of Family Planning With Health and Development." In R.L. Lapham & G.B. Simmons eds., *Organizing for Effective Family Planning Programs*. Washington, DC: National Academy Press, 683–706
- Taylor, CE, RSS Sarma, RL Parker, WA Reinke, and R Faruqee.** 1983. *Child and Maternal Health Services in Rural India, The Narangwal Experiment: Integrated Family Planning and Health Care, Vol 2*. Baltimore: The Johns Hopkins University Press.
- Tsui, AO and LH Ochoa.** 1992. "Service Proximity as a Determinant of Contraceptive Behavior: Evidence from Cross-National Studies of Survey Data." In JF Phillips and JA Ross, eds., *Family Planning Programs and Fertility*. Oxford: Clarendon Press.
- Trussell, TJ, F Stewart, M Potts, and C Ellertson.** 1993. "Should Oral Contraceptives be Available without Medical Prescription?" *American Journal of Public Health*, 83, 1094–99.
- Zielinski Gutiérrez, E, R Magnani, L Rada de Belmonte, and V Lipovsek.** 2001. *Who Can We Trust with Our Problems? Barriers to Adolescents' Use of Reproductive Health Services in Three Bolivian Cities* (Mimeo).

Appendix A

APPENDIX A

LIKELIHOOD FUNCTION FOR THE FULL-INFORMATION, MAXIMUM-LIKELIHOOD ESTIMATOR

This appendix describes the construction of the likelihood function used in the full-information, maximum-likelihood (FIML) estimation procedure employed in the analysis. If the random error term in contraception-use equation (1) in section 3 follows a negative extreme value distribution, the probabilities of using no contraception, a traditional method, and a modern method (respectively) take the following form:

$$\text{Prob (no method)} = \frac{1}{1 + \sum_{k=1}^2 e^{\alpha_k M_{ij} + \beta_k X_{ij} + \gamma_k Z_j + \rho_{1k} \omega_{ij} + \rho_{2k} v_j}}$$

$$\text{Prob (trad method)} = \frac{e^{\alpha_1 M_{ij} + \beta_1 X_{ij} + \gamma_1 Z_j + \rho_{11} \omega_{ij} + \rho_{21} v_j}}{1 + \sum_{k=1}^2 e^{\alpha_k M_{ij} + \beta_k X_{ij} + \gamma_k Z_j + \rho_{1k} \omega_{ij} + \rho_{2k} v_j}}$$

$$\text{Prob (modern method)} = \frac{e^{\alpha_2 M_{ij} + \beta_2 X_{ij} + \gamma_2 Z_j + \rho_{12} \omega_{ij} + \rho_{22} v_j}}{1 + \sum_{k=1}^2 e^{\alpha_k M_{ij} + \beta_k X_{ij} + \gamma_k Z_j + \rho_{1k} \omega_{ij} + \rho_{2k} v_j}}$$

The probability of observing any given level of MCH service use, $M_{ij} = M'_{ij}$, is

$$\text{Prob}(M_{ij} = M') = (2\pi\sigma^2)^{-1/2} e^{-[M' - \delta X_{ij} - \zeta Z_j - \rho_3 \omega_i - \rho_4 v_j]^2 / 2\sigma^2}$$

The joint probability of any observed set of MCH service use and contraceptive outcomes, conditional upon ω and v , is the product of the probabilities of using contraception and the probability of using a given intensity of MCH care. Each woman's contribution to the likelihood function conditional on the individual and community unobservable factors is

$$L_i = \prod_{k=1}^3 \text{Prob}(M_{ij} | \omega_i, v_j) (\text{Prob}(\text{alternative}) | \omega_i, v_j)^{d_{ijk}}$$

where d_{ijk} = 1 if individual i of community j chose alternative k
= 0 otherwise

To obtain the unconditional likelihood function, a discrete factor method is used. In this method the distributions of individual-specific and the community-specific unobservables are approximated with step functions. Each step function consists of a finite number of mass points and associated probabilities.

These mass points and their probabilities are simultaneously estimated with the other coefficients in the model following procedures outlined in Mroz (1999). The distributions of the unobservable covariates for woman i , ω_i , and for community j , v_j , are given by

$$\text{Prob}(\omega_i = \omega_{il}) = P\omega_{il} \text{ for } l = 1, 2, \dots, L$$

$$\text{Prob}(v_j = v_{jr}) = Pv_{jr} \text{ for } r = 1, 2, \dots, R$$

Accordingly, the likelihood function of woman i at community j unconditional on the individual and community unobservables is

$$L_{ij} = \sum_{r=1}^R Pv_{jr} \sum_{l=1}^L P\omega_{il} \prod_{k=1}^3 \text{Prob}(M_{ij} | \omega_i, v_j) (\text{Prob}(\text{alternative}) | \omega_i, v_j)^{d_{ijk}}$$

The likelihood function takes the form:

$$L_{ij} = \prod_{j=1}^J \sum_{r=1}^R Pv_{jr} \prod_{i=1}^N \sum_{l=1}^L P\omega_{il} \prod_{k=1}^3 \text{Prob}(M_i | \omega_i, v_j)$$

$$(\text{Prob}(\text{alternative}) | \omega_i, v_j)^{d_{ijk}}$$

In the analysis, the likelihood function is maximized with respect to the parameters of equations (1) and (2) in section 3. To carry out the analysis for the present study, a special Fortran program was written using the GQOPT non-linear optimization package.

Appendix B

APPENDIX B

DISCUSSION OF UNOBSERVED HETEROGENEITY PARAMETERS

This appendix describes the unobserved heterogeneity parameters that are displayed in Tables C12 through C14 in Appendix C. The FIML statistical method used for this study controls for unobserved factors that are correlated between MCH usage and contraceptive usage by estimating a discrete distribution that approximates the true underlying distribution of the unobserved factors. In doing so, the estimation generates the parameters that define the approximated distribution. For Morocco and Tanzania, the individual- and community-level distributions are made up of a series of mass points, the ω and v in equations (1) and (2) in section 3. Their accompanying probability weights and can be thought of as making up a probability distribution of the unobserved individual- and community-level variables that affect both outcomes studied. Each equation contains an estimated correlation coefficient, the ρ , that correlates the dependent variable to the distribution. For these two estimations, the estimated correlation coefficients were not allowed to vary over the estimated distribution.

For the other three countries, a more complicated error structure was utilized. It is more complicated because we allow the correlation coefficient to vary by mass point. The more complicated error structure was used because it is more flexible. Therefore, it is sometimes easier to estimate as it imposes fewer restrictions on the model. Using a less or more complicated error structure should only affect the ease of estimation and should not substantively affect the results of interest. The Morocco and Tanzania analyses were easily estimated with the simpler error structure; once we switched to the more complicated structure for Guatemala, however, we decided to use it for Bolivia and Indonesia as well. With the more complicated error structure, a multivariate error distribution that combines the approximated distribution and the correlation coefficients was estimated. For this reason, multiple factors that correlate the distribution to each equation and their accompanying probability weights are estimated for each equation. However, the more complicated error structure means that the mass points and correlation coefficients cannot be estimated separately and only one

parameter, which can be thought of as their product, is estimated to accompany each probability weight.

For each country's estimation, the parameters that make up the estimated distribution that approximates the distribution of the underlying unobserved variables that correlate the error terms for the MCH and contraceptive choice equations are statistically significant. In addition, the coefficient on the MCH usage variable in the contraceptive choice equation was substantially different in the estimation that controlled for endogeneity than in the estimation that did not (Table C11 in Appendix C). For example, in Tanzania, the single-equation multinomial logit parameter estimate of the effect of MCH use on using a modern method versus no method is 0.249, which is statistically significant and substantially higher than the FIML parameter estimate of 0.080. In Morocco, however, we found that ignoring unobserved heterogeneity at the individual- and community-level would result in underestimating the impact of the intensity of MCH service use on contraceptive use. Whether correcting for endogeneity increases or decreases the size of the parameter depends on the nature of the correlation between the unobserved characteristics that would cause endogeneity bias and the dependent variables in equations (1) and (2) in section 3.

Appendix C

APPENDIX C

COUNTRY-SPECIFIC VARIABLE DEFINITIONS & SUMMARY STATISTICS

Table C1. Country-specific variable definition — Morocco

Variable Name	Type	Description/Calculation
Individual-level		
Age		
20–24 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
25–29 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
30–39 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
40–49 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
Currently in polygamous marriage	Dummy	Equal to 1 if woman reports being in a polygamous marriage, otherwise 0
Respondent's education		
1–3 years	Dummy	Equal to 1 if woman reports having 1 to 3 years of formal schooling, otherwise 0
4+ years	Dummy	Equal to 1 if woman reports having 4 or more years of formal schooling, otherwise 0
Intensity of MCH service use	Continuous	Index computed by assigning for each birth that was reported to occur within five years of the survey points using the schedule shown below. For women who report more than one birth, an average was computed . Has antenatal care treatment card? (No=0; Yes=1) Has one or more antenatal visits? (No visits=0; One or more visits=2) Received tetanus injection? (No=0; Yes=1) Delivery at a health facility? (No=0; Yes=1) Trained practitioner during delivery? (No=0; Yes=1) Had vaccination card? (No=0; Yes=1) Had one or more vaccinations? (No vaccinations=0; One or more vaccinations=2)
Family planning use	Categorical	Family planning ever use since last birth. Three categories: no method use, traditional method use, modern method use
Household-level		
Husband's education		
1–3 years	Dummy	Equal to 1 if woman's husband reports having 1 to 3 years of formal schooling, otherwise 0
4+ years	Dummy	Equal to 1 if woman's husband reports having 4 or more years of formal schooling, otherwise 0
Number of adult females in household	Continuous	Number of women aged 15–49 who slept in the house the previous night
Household assets index	Continuous	Sum of 5 dummy variables: non-dirt floor, electricity, flush toilet, radio, motorcycle

Table C1. continued (Morocco)

Variable Name	Type	Description/Calculation
Community-level		
Urban residence	Dummy	Equal to 1 if woman reports household is in an urban area, otherwise 0
Sewage system in community	Dummy	Equal to 1 if there is a sewage system in the community, otherwise 0
No. of MCH services available	Continuous	Sum the number of MCH services offered by the nearest health facilities of each type
Infrastructure and equipment water and index (MCH)	Continuous	Sum the following 5 dummy variables services across all facilities per cluster: running electricity, refrigerator, weighing scale for children, hemoglobinometer
Distance to nearest health facility	Continuous	Include: hospital, public clinic, private clinic, private doctor, pharmacy
Distance to nearest family planning facility	Continuous	Include: hospital, public clinic, private clinic, private doctor, pharmacy
No. of trained MCH staff	Continuous	Number of doctors, nurses, and trained midwives found at the nearest facility of each type
Availability of pills at pharmacy	Dummy	Equal to 1 if the facility offers the method without stock-outs over the previous 6 month, otherwise 0
Family planning infrastructure/equipment index	Continuous	Sum the following 2 dummy variables services across all facilities per cluster: running water and electricity, table for gynecological exam
No. of facilities offering MCH and FP	Dummy	Equal to 1 if the facility offers MCH and FP, otherwise 0
CBD present in community	Dummy	Equal to 1 if the community has a CBD, otherwise 0

Table C2. Country-specific variable definition — Tanzania

Variable Name	Type	Description/Calculation
Individual-level		
Age		
20–24 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
25–29 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
30–39 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
40–49 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
Currently in polygamous marriage	Dummy	Equal to 1 if woman reports being in a polygamous marriage, otherwise 0
Respondent's education		
1–6 years	Dummy	Equal to 1 if woman reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman reports having 7 or more years of formal schooling, otherwise 0
Intensity of MCH service use	Continuous	Index computed by assigning for each birth that was reported to occur within five years of the survey points using the schedule shown below. For women who report more than one birth, an average was computed. Prenatal care provided by a trained provider? (No=0; Yes=1) Timing of 1st antenatal check (No visits=0; 3rd trim.=1; 2nd trim.=2; 1st trim.=3) Received tetanus injection? (No=0; Yes=1) Delivery at a health facility? (No=0; Yes=1) Trained practitioner during delivery? (No=0; Yes=1) Had vaccination card? (No=0; Yes=1) Vaccination average (Sum of 9 different vaccinations received. Each one score for 1/4.5; min=0, max=2)
Family planning use	Categorical	Family planning currently use since last birth. Three categories: no method use, traditional method use, modern method use
Household-level		
Husband's education		
1–6 years	Dummy	Equal to 1 if woman's husband reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman's husband reports having 7 or more years of formal schooling, otherwise 0
Household size	Continuous	Number of individuals who woman reports reside in the household
Number of adult females in household	Continuous	Number of women aged 15–49 who slept in the house the previous night
Household assets index	Continuous	Sum of 7 dummy variables: non-dirt floor, electricity, flush toilet, radio, motorcycle, car, piped drinking water

Table C2. continued (Tanzania)

Variable Name	Type	Description/Calculation
Community-level		
Urban residence	Dummy	Equal to 1 if woman reports household is in an urban area, otherwise 0
No. of MCH services available	Continuous	Sum the number of MCH services offered by the nearest health facilities of each type
1 or 2 facilities offering MCH services	Dummy	Equal to 1 if there are 1 or 2 facilities offering MCH services in the community, otherwise 0
3 or 4 facilities offering MCH services	Dummy	Equal to 1 if there are 3 or 4 facilities offering MCH services in the community, otherwise 0
No. of facilities offering MCH and FP	Categorical	Range from 0 to 4 facilities within 30 km
Immunization index	Continuous	Sum of the following 6 vaccines across facilities per cluster with the following scores: BCG (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Polio (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) DPT (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Measles (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Hepatitis (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Tetanus (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2)
Infrastructure and equipment index (MCH)	Continuous	Sum of 35 dummy variables across all facilities per cluster: sterilizer, angle poise lamps, thermometer, blood pressure gauge, adult scale, flashlight, stethoscope, speculum, gal-lipot, uterine elevator, uterine sound, tubal hook, tenaculum, instrumental container, scissors, disposable syringes, disposable needles, reusable syringes, reusable needles, anesthetics, antiseptics, swab container, sterilizing solution, metal sterilization tray with cover, non-disposable gloves, disposable gloves, wash hand basin, examination couch, privacy screen, refrigerator, cloth/blanket, growth cards, gauze, cotton wool, VDRL kit
Distance to nearest health facility	Continuous	Include: hospital, health center, dispensary, Marie Stopes, UMATI
Distance to nearest family planning facility	Continuous	Include: hospital, health center, dispensary, Marie Stopes, UMATI
Contraceptive availability index	Continuous	Sum of the following 5 contraceptive methods across facilities per cluster with the following scores: Pills (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) IUD (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Condom (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Injection (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2) Foam, tablet (No=0; Yes, but stock out in the last 6 month=1, Yes, but no stock out=2)
No. of trained MCH staff	Continuous	Number of doctors, nurses, and trained midwives in the community
No. of family planning staff	Continuous	Number of public health nurses, midwives, and MCH aides providing FP per cluster
Family planning infrastructure/equipment index	Continuous	Sum of 26 dummy variables across all facilities per cluster: sterilizer, angle poise lamps, thermometer, blood pressure gauge, stethoscope, speculum, uterine elevator, tenaculum, scissors, disposable syringes, anesthetics, swab container, sterilizing solution, metal sterilization tray with cover, disposable gloves, face mask, wash hand basin, examination couch, tables, chair, benches, telephone or radio transmitter, vehicle, gauze, hemoglobi-nometer for diagnosis of anemia, VDRL kit
No. of days/week MCH services available	Continuous	Sum the number of days per week MCH services offered by the nearest health facilities of each type

Table C3. Country-specific variable definition — Guatemala

Variable Name	Type	Description/Calculation
Individual-level		
Age		
20–24 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
25–29 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
30–39 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
40–49 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
Respondent's education		
1–6 years	Dummy	Equal to 1 if woman reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman reports having 7 or more years of formal schooling, otherwise 0
Intensity of MCH service use	Continuous	Index computed by assigning a score of 1 for each birth that was reported to occur within five years of the survey. Points were given using the following schedule. For women who report more than one birth, an average was computed Prenatal care provided by a trained provider? (No=0; Yes=1) Timing of 1st antenatal check (No visits=0; 3rd trim.=1; 2nd trim.=2; 1st trim.=3) Received tetanus injection? (No=0; Yes=1) Delivery at a health facility? (No=0; Yes=1) Trained practitioner during delivery? (No=0; Yes=1) Had vaccination card? (No=0; Yes=1) Vaccination average (Sum of 8 different vaccinations received. Each one score for 1/4; min=0, max=2)
Family planning use	Categorical	Family planning ever used since last birth. Three categories: no method use, traditional method use, modern method use
Household-level		
Husband's education		
1–6 years	Dummy	Equal to 1 if woman's husband reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman's husband reports having 7 or more years of formal schooling, otherwise 0
Household size	Continuous	Number of individuals who woman reports reside in the household
Number of adult females in household	Continuous	Number of women aged 15–49 who slept in the house the previous night
Household assets index	Continuous	Sum of 5 dummy variables: non-dirt floor, electricity, flush toilet, radio, piped drinking water
Community-level		
Urban residence	Dummy	Equal to 1 if woman reports household is in an urban area, otherwise 0
No. of MCH services available	Continuous	Sum the total number of MCH services offered by the nearest health facilities of each type
1 or 2 facilities offering MCH services	Dummy	Equal to 1 if there are 1 or 2 facilities offering MCH services in the community, otherwise 0
3 or 4 facilities offering MCH services	Dummy	Equal to 1 if there are 3 or 4 facilities offering MCH services in the community, otherwise 0
No. of facilities offering MCH and FP	Continuous	Sum of the number of facilities within 30 km that offer MCH and FP services
Infrastructure and equipment index (MCH)	Continuous	Sum the following 4 dummy variables services across all facilities per cluster: safe water, electricity, refrigerator, weighing scale for babies
Private facility within 2 km	Continuous	Distance to the private facilities within 2 km

Table C3. continued (Guatemala)

Variable Name	Type	Description/Calculation
Private facility within 5 km	Continuous	Distance to the private facilities within 5 km
Distance to nearest health facility	Continuous	Include: hospital, clinic, health center, health post
Distance to nearest family planning facility	Continuous	Include: hospital, clinic, health center, health post
Contraceptive availability index	Continuous	Sum of the following 6 contraceptive methods across facilities per cluster with the following scores: Pills (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) IUD (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Condom (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Injection (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Norplant (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Diaphragm, foam, tablet (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2)
Facility with APROFAM within 2 km	Dummy	Equal to 1 if there is a facility with APROFAM within 2 km, otherwise 0
Facility with APROFAM within 5 km	Dummy	Equal to 1 if there is a facility with APROFAM within 5 km, otherwise 0

Table C4. Country-specific variable definition — Bolivia

Variable Name	Type	Description/Calculation
Individual-level		
Age		
20–24 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
25–29 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
30–39 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
40–49 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
Currently married or living together	Dummy	Equal to 1 if woman reports being currently married or living together, otherwise 0
Respondent's education		
1–6 years	Dummy	Equal to 1 if woman reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman reports having 7 or more years of formal schooling, otherwise 0
Intensity of MCH service use	Continuous	Index computed by assigning a score of 1 for each birth that was reported to occur within five years of the survey. Points were given using the following schedule. For women who report more than one birth, an average was computed. Prenatal care provided by a trained provider? (No=0; Yes=1) Timing of 1st antenatal check (No visits=0; 3rd trim.=1; 2nd trim.=2; 1st trim.=3) Received tetanus injection? (No=0; Yes=1) Delivery at a health facility? (No=0; Yes=1) Trained practitioner during delivery? (No=0; Yes=1) Had vaccination card? (No=0; Yes=1) Vaccination average (Sum of 8 different vaccinations received. Each one score for 1/4; min=0, max=2)
Family planning use	Categorical	Family planning ever use since last birth. Three categories: no method use, traditional method use, modern method use

Table C4. continued (Bolivia)

Variable Name	Type	Description/Calculation
Household-level		
Husband's education		
1–6 years	Dummy	Equal to 1 if woman's husband reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman's husband reports having 7 or more years of formal schooling, otherwise 0
Household size	Continuous	Number of individuals who woman reports reside in the household
Number of adult females in household	Continuous	Number of women aged 15–49 who sleep in the house the previous night
Household assets index	Continuous	Sum of 5 dummy variables: non-dirt floor, electricity, flush toilet, radio, piped drinking water
Community-level		
Urban residence	Dummy	Equal to 1 if woman reports household is in an urban area, otherwise 0
No. of MCH services available	Continuous	Sum of the total number of MCH services offered by the nearest health facilities of each type
1 or 2 facilities offering MCH services	Dummy	Equal to 1 if there are 1 or 2 facilities offering MCH services in the community, otherwise 0
3 or 4 facilities offering MCH services	Dummy	Equal to 1 if there are 3 or 4 facilities offering MCH services in the community, otherwise 0
No. of facilities offering MCH and FP	Categorical	Range from 0 to 4 facilities within 30 km
Immunization index	Continuous	Sum of the following 6 vaccines across facilities per cluster with the following scores: BCG (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Polio (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) DPT (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Measles (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Tetanus (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2)
Infrastructure and equipment index	Continuous	Sum of 15 dummy variables across all facilities per cluster. Include: safe water, electricity, refrigerator, generator, telephone or radio, operating room, maternity room, blood bank, table for gynecological exam, light for gynecological examination, weighing scale for baby, blood pressure cuff, hemoglobinometer, microscope, AIDS test
Distance to nearest health facility	Continuous	Include: hospital, clinic, health center, pharmacy, private doctor
Distance to nearest family planning facility	Continuous	Include: hospital, clinic, health center, pharmacy, private doctor
Contraceptive availability index	Continuous	Sum of the following 6 contraceptive methods across facilities per cluster with the following scores: Pills (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) IUD (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Condom (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Injection (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Norplant (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2) Diaphragm, foam, tablet (No=0; Yes, but stock out in the last 6 month=1; Yes, but no stock out=2)
No. of trained staff	Continuous	Number of doctors, nurses, and trained midwives in the community
Private facility within 15 km	Dummy	Equal to 1 if there is a private health facility within 15 km, otherwise 0
Private facility or pharm. offering FP within 15 km	Dummy	Equal to 1 if there is a private health facility or pharmacy offering FP services within 15 km, otherwise 0

Table C5. Country-specific variable definition — Indonesia

Variable Name	Type	Description/Calculation
Individual-level		
Age		
20–24 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
25–29 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
30–39 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
40–49 years	Dummy	Equal to 1 if woman reports to be in this age range, otherwise 0
Currently married or living together	Dummy	Equal to 1 if woman reports being currently married or living with someone; otherwise 0
Respondent's education		
1–6 years	Dummy	Equal to 1 if woman reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman reports having 7 or more years of formal schooling, otherwise 0
Intensity of MCH service use	Continuous	Index computed by assigning a score of 1 for each birth that was reported to occur within five years of the survey. Points were given using the following schedule. For women who report more than one birth, an average was computed. Prenatal care provided by a trained provider? (No=0; Yes=1) Timing of 1st antenatal check (No visits=0; 3rd trim.=1; 2nd trim.=2; 1st trim.=3) Received tetanus injection? (No=0; Yes=1) Delivery at a health facility? (No=0; Yes=1) Trained practitioner during delivery? (No=0; Yes=1) Had vaccination card? (No=0; Yes=1) Vaccination average (Sum of 9 different vaccinations received. Each one score for 1/4.5; min=0, max=2)
Family planning use	Categorical	Family planning ever used since last birth. Three categories: no method use, traditional method use, modern method use
Household-level		
Husband's education		
1–6 years	Dummy	Equal to 1 if woman's husband reports having 1 to 6 years of formal schooling, otherwise 0
7+ years	Dummy	Equal to 1 if woman's husband reports having 7 or more years of formal schooling, otherwise 0
Household size	Continuous	Number of individuals who woman reports reside in the household
Number of adult females in household	Continuous	Number of women aged 15–49 who sleep in the house the previous night
Household assets index	Continuous	Sum of 7 dummy variables: non-dirt floor, electricity, flush toilet, radio, motorcycle, car, piped drinking water
Community-level		
Urban residence	Dummy	Equal to 1 if woman reports household is in an urban area, otherwise 0
No. of MCH services available	Continuous	Sum the total number of MCH services offered by the nearest health facilities of each type
1 or 2 facilities offering MCH services	Dummy	Equal to 1 if there are 1 or 2 facilities offering MCH services in the community, otherwise 0
3 or 4 facilities offering MCH services	Dummy	Equal to 1 if there are 3 or 4 facilities offering MCH services in the community, otherwise 0
No. of facilities offering MCH and FP	Categorical	Range from 0 to 4 health facilities within 30 km

Table C5. continued (Indonesia)

Variable Name	Type	Description/Calculation
Immunization index	Continuous	Sum of the following 6 vaccines across facilities per cluster with the following scores: BCG (No=0; Yes=1) Polio (No=0; Yes=1) DPT (No=0; Yes=1) Measles (No=0; Yes=1) Tetanus (No=0; Yes=1)
Infrastructure and equipment index (MCH)	Continuous	Sum of 15 dummy variables services across all facilities per cluster. Include: safe water, electricity, refrigerator, generator, telephone or radio, operating room, maternity room, blood bank, table for gynecological exam, light for gynecological examination, weighing scale for baby, blood pressure cuff, hemoglobinometer, microscope, AIDS test
Distance to nearest health facility	Continuous	Include: hospital, health center, pharmacy, private doctor, private midwife
Distance to nearest family planning facility	Continuous	Include: hospital, health center, pharmacy, private doctor, private midwife
Contraceptive availability index	Continuous	Sum of the following 6 contraceptive methods across facilities per cluster with the following scores: Pills (No=0; Yes=1) IUD (No=0; Yes=1) Condom (No=0; Yes=1) Injection (No=0; Yes=1) Norplant (No=0; Yes=1) Diaphragm, foam, tablet (No=0; Yes=1)
No. of trained MCH staff	Continuous	Number of doctors, nurses, and trained midwives in the community

Table C6. Summary statistics on characteristics of the MCH service and family planning service supply environment, by urban/rural status — Morocco

Independent variables	Place of Residence	
	Urban	Rural
Mean distance to the nearest facility in km	< 1.0	8.0
Mean distance to the nearest facility that offers FP in km	< 1.0	8.0
Mean of no. of public health nurses, midwives, and MCH aides providing FP	538.1	81.9
Mean MCH equipment index	8.7	4.7
Mean FP equipment index	5.4	2.9

Table C7. Summary statistics on characteristics of the MCH service and family planning service supply environment, by urban/rural status — Tanzania

Independent variables	Place of Residence	
	Urban	Rural
Mean distance to the nearest facility in km	1.0	4.3
Mean distance to the nearest facility that offers FP in km	1.4	5.2
Mean immunization index	25.3	23.2
Percentage of communities with access to		
1 or 2 facilities offering MCH services	78.5	51.6
3 or 4 facilities offering MCH services	17.5	42.9
Percentage of communities with access to		
1 or 2 facilities offering both MCH and FP services	78.0	42.1
3 or 4 facilities offering both MCH and FP services	17.1	40.1
Mean FP service index (condoms, pills, IUDs, injections)	24.6	17.2
Mean no. of public health nurses, midwives, and MCH aides providing FP	17.2	8.5
Mean MCH equipment index	80.8	61.1
Mean FP equipment index	44.7	23.5

Table C8. Summary statistics on characteristics of the MCH service and family planning service supply environment, by urban/rural status — Guatemala

Independent variables	Place of Residence	
	Urban	Rural
Mean distance to the nearest facility in km	0.7	2.6
Mean distance to the nearest facility that offers FP in km	0.7	2.6
Mean immunization index	23.9	21.2
Mean FP service index (condoms, pills, IUDs, injections)	14.4	14.1
Mean no. of public health nurses, midwives, and MCH aides providing FP	NA	NA
Mean MCH equipment index	14.4	13.4
Mean FP equipment index	NA	NA

Table C9. Summary statistics on characteristics of the MCH service and family planning service supply environment, by urban/rural status — Bolivia

Independent variables	Place of Residence	
	Urban	Rural
Mean distance to the nearest facility in km	< 1.0	9.9
Mean distance to the nearest facility that offers FP in km	< 1.0	12.7
Mean immunization Index	14.4	10.3
Percentage of communities with access to		
1 or 2 facilities offering MCH services	32.9	72.6
3 or 4 facilities offering MCH services	66.3	19.6
Percentage of communities with access to		
1 or 2 facilities offering both MCH and FP services	43.5	54.7
3 or 4 facilities offering both MCH and FP services	44.8	15.0
Mean FP service index (condoms, pills, IUDs, injections)	15.1	5.7
Mean no. of public health nurses, midwives, and MCH aides providing FP	96.6	13.5
Mean MCH equipment index	30.6	14.6
Mean FP equipment index	25.8	11.3

Table C10. Summary statistics on characteristics of the MCH service and family planning service supply environment, by urban/rural status — Indonesia

Independent variables	Place of Residence	
	Urban	Rural
Mean distance to the nearest facility in km	< 1.0	5.4
Mean distance to the nearest facility that offers FP in km	< 1.0	4.6
Mean immunization index	6.9	5.6
Percentage of communities with access to		
1 or 2 facilities offering MCH services	5.5	36.4
3 or 4 facilities offering MCH services	94.1	60.7
Percentage of communities with access to		
1 or 2 facilities offering both MCH and FP services	8.5	40.9
3 or 4 facilities offering both MCH and FP services	91.1	55.9
Mean FP service index (condoms, pills, IUDs, injections)	14.5	11.2
Mean of no. of public health nurses, midwives, and MCH aides providing FP	142.9	57.6
Mean MCH equipment index	40.5	27.0
Mean FP equipment index	NA	NA

Table C11. Parameter estimates of the affect of MCH service use on contraceptive use, by type of statistical model

Country	Type of model	Naïve model ^a	FIML model ^b
Morocco	Modern vs. no method	0.174*** (5.720)	0.680** (2.370)
	Modern vs. trad. Method	-0.116** (-2.110)	-0.494 (-1.360)
Tanzania	Modern vs. no method	0.249*** (8.151)	0.080 (0.657)
	Modern vs. trad. Method	0.202*** (4.207)	-0.071 (-0.335)
Guatemala	Modern vs. no method	1.365*** (3.113)	1.323*** (4.657)
	Modern vs. trad. Method	1.127 (0.877)	1.426*** (3.605)
Bolivia	Modern vs. no method	0.020 (1.241)	-0.310** (-1.972)
	Modern vs. trad. Method	0.005 (0.281)	-0.102 (-0.625)
Indonesia	Modern vs. no method	-0.056*** (-8.825)	0.207*** (5.667)
	Modern vs. trad. Method	-0.032** (-2.146)	0.194* (1.831)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics shown in parentheses.

a The naïve model refers to a multinomial logit model in which the observed value of MCH service use is an independent variable.

b The FIML model refers to the full-information, maximum-likelihood model described in the text.

Table C12. Mass points of estimates distribution for Morocco and Tanzania

Mass Point	Morocco		Tanzania	
	Probability Weight	Mass Points Make Up the Estimated Distribution	Probability Weight	Mass Points Make Up the Estimated Distribution
Community Distribution				
1	.02	0 ^a	.27	0 ^a
2	.08	.276	.25	.209
3	.17	.538	.36	.440
4	.36	.662	.12	1.0
5	.37	1.0	–	–
Individual Distribution				
1	.05	0 ^a	.59	0 ^a
2	.23	.257	.31	.234
3	.51	.468	.08	.496
4	.17	.747	.02	.708
5	.05	1.0	.004	1.0

Table C13. Parameter estimates of the error-term correlation distributions for Morocco and Tanzania

Correlation Coefficient	Morocco			Tanzania		
	MCH Usage	Trad. Method vs. no Method	Modern vs. no Method	MCH Usage	Trad. Method vs. no Method	Modern vs. no Method
Between Community Distribution and Equation	-5.403*** (-36.240)	0.814 (1.11)	1.314** (2.870)	-1.781*** (-13.913)	-0.014 (-.027)	-2.217 (0.524)
Between Individual Distribution and Equation	1.551*** (8.160)	-6.570*** (-2.60)	-4.096* (-2.170)	-7.590*** (-20.834)	1.549 (0.858)	-0.396 (-0.332)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics shown in parentheses.

a First factor in each distribution is normalized to zero.

Table C14. Parameter estimates of related factors for Guatemala, Bolivia, and Indonesia

Factor	Guatemala				Bolivia				Indonesia			
	Probability Weight	FACTORS THAT MAKE UP THE DISTRIBUTION			Probability Weight	FACTORS THAT MAKE UP THE DISTRIBUTION			Probability Weight	FACTORS THAT MAKE UP THE DISTRIBUTION		
		MCH Usage	Trad. Method vs. no Method	Modern vs. no Method		MCH Usage	Trad. Method vs. no Method	Modern vs. no Method		MCH Usage	Trad. Method vs. no Method	Modern vs. no Method
Community Distribution												
1	.14	0 ^a	0 ^a	0 ^a	0.38	0 ^a	0 ^a	0 ^a	.11	0 ^a	0 ^a	0 ^a
2	.20	-1.490*** (-8.168)	-2.98** (-2.039)	-2.159*** (-2.739)	0.25	0.119* (1.794)	0.586* (1.647)	2.038*** (9.397)	.46	1.941*** (13.136)	0.380 (0.591)	1.260*** (3.230)
3	.11	0.286 (1.432)	-0.49 (-0.678)	-3.333*** (-4.600)	0.37	0.015 (0.223)	1.295*** (9.399)	0.843* (1.713)	.15	0.659** (2.341)	-1.686 (-0.586)	1.347*** (6.355)
4	.56	-0.817*** (-6.351)	-0.570 (-0.890)	-0.575 (-1.591)	–	–	–	–	.03	2.080*** (5.470)	3.234*** (4.371)	0.901** (2.024)
5	–	–	–	–	–	–	–	–	.24	1.634*** (13.463)	0.256 (0.337)	-0.186 (-0.455)
Individual Distribution												
1	.05	0 ^a	0 ^a	0 ^a	0.17	0 ^a	0 ^a	0 ^a	.05	0 ^a	0 ^a	0 ^a
2	.46	6.674*** (40.521)	27.45*** (19.164)	-8.479*** (-3.896)	0.38	-2.354*** (-59.794)	-0.172 (-0.525)	1.180** (2.500)	.004	8.216*** (16.992)	0.040 (0.026)	-2.025*** (-4.116)
3	.30	4.943*** (28.043)	25.717*** (24.680)	-6.246*** (-4.052)	0.19	6.47*** (125.620)	1.909** (2.258)	4.118*** (3.713)	.05	-3.342*** (-27.013)	-0.259 (-0.365)	0.270 (1.207)
4	.19	2.638*** (17.765)	26.930*** (28.738)	-2.987*** (-2.800)	0.14	4.442*** (60.608)	0.795 (1.429)	2.227*** (2.890)	.35	-13.310*** (-74.813)	0.442 (0.292)	2.504*** (4.748)
5	–	–	–	–	0.12	2.166*** (36.845)	0.507 (1.609)	1.664*** (3.322)	.54	-9.030*** (-53.227)	0.583 (0.606)	2.059*** (5.890)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics shown in parentheses.

a First factor in each distribution is normalized to zero.



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