WORKING PAPER

The Influence of Family Planning Logistics Systems on Contraceptive Use

Ali Mehryar Karim *

October 6, 2005

Acknowledgement: This research was supported by DELIVER, a six-year worldwide technical assistance support contract funded by the U.S. Agency for International Development (USAID) and implemented by John Snow, Inc., (contract no. HRN-C-00-00-00010-00). This document does not necessarily represent the views or opinions of USAID.

*Affiliation: Senior Quantitative Analyst, John Snow, Inc. (JSI)/DELVER, 1616 N Fort Myer Drive, 11th Floor, Arlington, VA 22209. Tel: 703-528-7474 (ext. 5135). Fax : 703-528-7480. Email: akarim@jsi.com

Abstract

This study examines the influence of family planning logistics system performance on contraceptive use. The performance of logistics systems in 17 countries was assessed in 1995 and 1999 using an index constructed from 17 items. Family planning and socioeconomic indicators for the same periods were obtained from Demographic and Health Surveys and other published sources. An areal analysis using a country-level fixed-effects regression model showed that an increase in logistics system performance scores is associated with an increase in contraceptive use, net of the secular trend and changes in other family planning program efforts, fertility desire, external population assistance, female education, female labor force participation, and per capita gross domestic product. The study supports the notion that an effective supply chain is essential for the success of family planning programs; about one-fifth of the contraceptive prevalence rate in the sampled countries is attributable to the performance of the logistics systems.

Background

The availability of contraceptives at service delivery points is an essential component of family planning services and is closely associated with increased contraceptive use (Bruce 1990; Chen and Guilkey 2003; Jain 1989; Magnani et al. 1999). Making high-quality, affordable contraceptives available at service delivery points is the purpose of logistics systems, which are used to facilitate product selection, forecasting, mobilization of necessary financing, procurement of commodities in a timely manner, and delivery of products to clients on a reliable basis (Chandani and Breton 2001; Setty-Venugopal, Jacoby, and Hart 2002). In most developing countries, family planning programs are dependent on external sources to finance commodity

procurement. In such cases, logistics functions are generally carried out by different agencies, including Ministries, donors, international financing institutions, international manufacturers, and private and public sector procuring agents. Strong commitment and coordination between the stakeholders who are responsible for performing the various functions of the logistics system are required to ensure uninterrupted delivery of contraceptives to the end users (Davis and Hart 2002; Hart 2004). Understandably, a logistics system or the supply chain is considered part and parcel of successful family planning programs (Hart 2004; Setty-Venugopal et al. 2002).

Improving the logistics systems of family planning programs that rely on external assistance is a priority of the United States Agency for International Development (USAID). Since 1986, USAID has contracted with John Snow, Inc. (JSI) to implement DELIVER, a project whose mission is to increase the availability of critical health products in developing countries by strengthening the supply chains for health and family planning programs. Originally known as the Family Planning Logistics Management (FPLM) Project, USAID changed the project's name to DELIVER in 2000 in recognition of its expansion beyond contraceptive supply chain management to a full range of health commodities, including antiretroviral drugs, HIV test kits, laboratory supplies, and other essential products. DELIVER improves contraceptive and health program supply chains by strengthening logistics management information systems, streamlining distribution, identifying financial resources for procurement and supply chain operation, and enhancing forecasting and procurement planning (Davis and Hart 2002).

For the purpose of monitoring and evaluation, JSI and the Centers for Disease Control and Prevention (CDC) developed the Composite Indicators for Contraceptive Logistics Management,

a tool to quantify the functional level of logistics systems for family planning programs in developing countries (John Snow, Inc. and the Centers for Disease Control and Prevention 1999). FPLM/DELIVER used this tool to measure the performance of contraceptive logistics systems in 1995, 1999, and 2000 in 28 countries, 17 of which were measured during two points in time. An earlier analysis of the data showed that logistics systems in the selected countries where FPLM/DELIVER provided technical assistance improved over the same period (Gelfeld 2000). The programmatic expectation is that improvement in logistics systems in the selected countries led to improvement in contraceptive availability at service delivery points, which, in turn, led to increased contraceptive use. To test the hypothesis, this study seeks cross-national evidence of the influence of logistics systems on contraceptive use.

Family Planning Logistics

A comprehensive overview of family planning logistics systems is provided by Setty-Venugopal et al. (2002). Family planning logistics systems comprise the range of supply chain management functions that organizations and people perform to ensure that customers receive the right product, in the right quantity, in the right condition, to at the right place, at the right time, for the right cost. Using a logistics management information system (LMIS) to reliably gather and analyze key information, such as the rate of product consumption, is essential to achieving these six rights of all contraceptive users. The logistics cycle (see figure 1) thus depicts the customer at the top and the LMIS in the center.

--Figure 1 about here--

All functions of the logistics system are interdependent. For example, a system whose stakeholders accurately estimate the type and quantity of products that clients need, but that lacks

an efficient inventory control system is unlikely to meet customer demand consistently and economically.

The mix of contraceptives that the system delivers should reflect clients' preferences and the capabilities of the service delivery system. The quantities of each contraceptive method procured should be based on accurate forecasts of product use. Also, each stage of the logistics systems should include monitoring and evaluation of the quality of the products and of the supply chain.

The complexity of family planning logistics systems arises from the involvement of multiple organizations at different steps of the system. Contraceptives are often provided by international manufacturers and are usually financed through multiple sources, including governments, donors, and international development organizations. The procurement process often involves international procurement agencies to meet local policies and procedures set forth by the donors. The storage and distribution of contraceptives are managed by warehouse and transportation system managers, and the provision of contraceptives to clients is performed by health workers. For the supply chain to function successfully, organizations and managers must share information and closely coordinate their activities.

Conceptual Framework

Although there is some controversy among population scientists regarding the effect of family planning programs on fertility preferences (Bongaarts 1997; Freedman 1997; Pritchett 1994; Schultz 1994), there is broad consensus that such programs influence increases in contraceptive use (Chen and Guilkey 2003; Magnani et al. 1999). Figure 2 presents the schematic framework

that shows the influence of family planning programs, including logistics systems, on contraceptive use. The framework is adapted from earlier work by Lapham and Mauldin (1985) and Bertrand et al. (1996, 2002), and incorporates findings from Pritchett (1994), Schultz (1994), and Tsui (2001). Pritchett (1994) highlights that people who practice family planning or fertility control are primarily motivated by their own fertility desire (i.e., the desire to space or limit births). Fertility desire is expected to influence the demand for and use of contraceptives. In turn, contraceptive demand is expected to create demand for family planning programs and contraceptives. Fertility desires, combined with the demand for and supply of family planning services, are affected by a number of individual, socioeconomic, cultural, and political factors.

--Figure 2 about here--

Among the different functions of a family planning program, logistics systems are responsible for ensuring contraceptive availability, especially for temporary methods (i.e., oral contraceptives, male and female condoms, injectables, implants, spermicides, and intrauterine devices), which require re-supply. Family planning programs that benefit from strong political commitment, have clinics that are well-equipped and staffed with trained providers, are supported by strong social mobilization activities, and function in an environment where there is a strong desire to control fertility, may still fail to perform if their logistics systems are not adequate to make contraceptives available. The model assumes (1) a well functioning logistics system ensures contraceptive availability at the service delivery points; and (2) a strong desire for fertility control in developing countries often remains unmet by the private sector due to clients' inability to pay the high cost of contraceptives. The thick black arrows in Figure 2 show how logistics system performance influences contraceptive availability. The dashed line

indicates that, among other factors, contraceptive use enhances socioeconomic development by helping meet a population's fertility desire.

Data and Measurements

Dependent variables

The dependent variable of interest in this study is the contraceptive prevalence for modern methods. Because logistics systems primarily affect contraceptive availability for temporary methods, and because information on logistics systems is limited to the public sector, two other outcomes are also of interest for this study: contraceptive prevalence for temporary methods and contraceptive prevalence for temporary methods distributed through the public sector[1]. Estimates of the dependent variables were obtained from Demographic and Health Surveys[2].

Independent variables

The Composite Indicators for Contraceptive Logistics Management, developed by JSI and CDC to quantify the functional level of logistics systems of family planning programs, is based on the different functions of the logistics systems. It uses 23 items to obtain information on eight aspects of family planning logistics systems, including use of a logistics management information system, forecasting, procurement, warehousing, distribution, organization and staffing, policy, and adaptability. To collect information using the tool, logistics advisors conducted in-depth interviews with family planning program policy makers and managers who are knowledgeable about their country's logistics systems. Interviews were conducted through workshops or group discussions.

The Composite Indicators for Contraceptive Logistics Management has two scores for each item: one for performance and one for sustainability. The scores for each of the items are recorded using Likert-type scales ranging between zero and four, or zero and two. The purpose of this scoring method is to give higher weight to items that were considered relatively more important. The score for each item is recorded based on consensus among the key informants. This analysis uses only the performance score and not the sustainability score because (1) the latter is less likely to influence short-term programmatic outcomes, such as the contraceptive prevalence, and (2) logistics advisors have been especially critical about the measurement error of this component due to its subjectivity (Gelfeld 2000). Six items on policy, adaptability, organization and staffing were eliminated from the tool for this study because they are not directly related to logistics functions. The scores for the 17 remaining items are summed to construct the Contraceptive Logistics System Performance Index. The Cronbach's reliability alpha[3] of the index is 0.94. Descriptions of the 17 items along with their maximum possible score are given in Table 1.

--Table 1 about here--

The Contraceptive Logistics System Performance Index may be criticized for the subjectivity of respondents, inter-rater reliability, and variance of the quality and source of data (Gelfeld 2000). Part of the subjectivity and reliability of the Contraceptive Logistics System Performance Index is improved by focusing only on the performance score of the items. Correction for measurement error of the index is further discussed later in the methodology section.

The Composite Indicators for Contraceptive Logistics Management tool was implemented to evaluate the logistics systems of family planning programs in 28 countries in 1995 and repeated

in 15 and 22 countries during 1999 and 2000, respectively. The 1999 and 2000 Contraceptive Logistics System Performance Index scores were averaged to produce a single score for each program for the reference period 1999 to 2000. Only the scores for public sector family planning programs were retained, giving a total of 17 countries[4] for which data were available for two points in time.

The Family Planning Program Effort Index was used to measure the input of national family planning programs in the selected countries. The Family Planning Program Effort Index measures four broad areas of program input: (1) policies, resources, and stage-setting activities; (2) service and service-related activities; (3) record keeping, evaluation, and management's use of evaluation findings; and (4) availability and accessibility of contraceptive supplies and services. Repeated measures of the index are available for most developing countries for 1972, 1982, 1989, 1994, and 1999 (for details see Lapham and Mauldin 1985; Mauldin and Berelson 1978; Mauldin and Ross 1991; Ross and Mauldin 1996; Ross and Stover 2001). The index is often used to account for the national family planning program efforts of developing countries (e.g., Pritchett 1994, Schultz 1994, and Tsui 2001). For the purpose of this study, Family Planning Program Effort Index scores from 1994 and 1999 are used with the assumption that the scores remained constant between the years 1994 and 1995. As proposed by Tsui (2001), a modified version of the index was used to measure family planning program inputs by netting out the component that measures availability and access to services.

Consistent with the conceptual framework of this study, several other independent variables were measured. These include: fertility desire, measured by the wanted total fertility rate; economic

status, measured by purchasing power parity adjusted per capita gross domestic product (GDP); external assistance for population and reproductive health programs; female labor force participation rate; and female secondary education rate. The total fertility rate and female education rate were obtained from DHS. The per capita GDP and female labor force participation rate were obtained from World Bank sources (2003) and external population assistance in dollars[5] was obtained from UNFPA (2003) sources.

Analytic Methods

The major threat to the validity of this analysis included the measurement error of the independent variables of interest, mainly the Contraceptive Logistics System Performance Index and the Family Planning Program Effort Index, and the non-independence of repeated country-level observations. The Family Planning Program Effort Index is criticized for measurement error because the raters of the index had prior knowledge of the outcome (i.e., contraceptive use and total fertility rate). Therefore, this knowledge is considered endogenous in the equation for predicting contraceptive use (Schultz 1993; Tsui 2001). The bias due to the measurement error manifests as omitted variables (e.g., cultural attitude towards contraception, unaccounted family planning supply environment, quality of care, public sector financing for family planning commodities) in the regression equation that jointly determine the outcome (i.e., contraceptive use) and family planning effort (Schultz 1994; Pritchett 1994). Like the Family Planning Program Effort Index, the Contraceptive Logistics System Performance Index may also be biased for similar reasons. Time invariant unmeasured factors that jointly determine the outcome and the independent variable/s are differenced out by using country-level fixed-effects model (Schultz 1994; Tsui 2001). The fixed-effects model with data from two points in time is

analogous to the difference model (Wooldridge 2003). Therefore, the model estimates the association between changes in the Contraceptive Logistics System Performance Index score and changes in contraceptive use during the same period, netting out the influence of changes in family planning effort and other socioeconomic indicators. The influence of logistics systems on contraceptive use is controlled for family planning effort, fertility desire, female education, female labor force, per capita GDP, and external assistance for population programs. An indicator variable for the survey period is included in the model to account for the secular change in contraceptive use due to all other factors that are not accounted for by the observed variables. To account for the potential bias from perceived subjectivity of the Family Planning Program Effort Index and the Contraceptive Logistics System Performance Index, the analysis controls for foreign assistance for population programs, as suggested by Tsui (2001). By definition, the country-level fixed-effects model also accounted for the non-independence of the observations (Hsiao 1986). Therefore, unbiased effect of logistics system performance on contraceptive use can be obtained using the following fixed-effects linear regression model:

$$\text{CPR} = \beta_0 + \beta_1 \text{trend} + \beta_2 \text{logistics} + \beta_3 \text{WFR} + \beta_4 \log(\text{GNP}) + \beta_5 \text{edu} + \beta_6 \text{labor} + \beta_7 \text{assist} + \beta_8 \text{FPE} + \upsilon + \varepsilon \text{.....(1)}$$

Where, $\beta_0, \beta_1, \ldots \beta_8$, *and* υ are estimated by the regression model; υ is the country-level fixed effect (i.e., country-level unobserved determinants of contraceptive use that remain constant over time); β_1 estimates the secular trend; β_2 estimates the effect of Contraceptive Logistics System Performance Index; $\beta_2, \beta_3, \ldots \beta_8$ estimates the effect of the other independent variables; and, ε indicates the unobserved or unmeasured confounders that vary over time. The major assumption of this model is that ε is not correlated with any of the independent variables. The lag period

between logistics system performance and contraceptive use is considered to be less than one year, meaning that a period of months would pass before a disruption of the contraceptive supply chain would affect stock status at service delivery points and an additional period of months before contraceptive use would be affected.

Bongaarts (1997) indicated that the country-level areal analysis to observe the family planning program effect on fertility should account for the population size of each country. Applying analytic weights to equation (1), so that the scores for the independent variables for larger countries had a greater influence on the outcome, the following model is implemented:

$$\mathrm{CPR}\sqrt{n} = \beta_0\sqrt{n} + \beta_1\mathrm{trend}\sqrt{n} + \beta_2\mathrm{logistics}\sqrt{n} + \beta_3\mathrm{WFR}\sqrt{n} + \beta_4\log(\mathrm{GNP})\sqrt{n} + \beta_5\mathrm{edu}\sqrt{n} + \beta_6\mathrm{labor}\sqrt{n} + \beta_7\mathrm{assist}\sqrt{n} + \beta_8\mathrm{FPE}\sqrt{n} + \upsilon\sqrt{n} + \varepsilon.\sqrt{n} \quad \ldots\ldots(2)$$

Where *n* is the population size.

A dose-response relationship is expected between the Contraceptive Logistics System Performance Index and contraceptive use (i.e., a comparatively high score for the index is expected to be associated with higher contraceptive use). By definition, service and service related components of the Family Planning Program Effort Index are expected to capture programmatic inputs related to logistics systems. Therefore, the Family Planning Program Effort Index and the Contraceptive Logistics System Performance Index are likely to be collinear[6] in a regression model predicting contraceptive use. To assess the matter, regression models are estimated with and without the family planning program effort index. Goodness-of-fitness of the

models was assessed. The statistical software, Stata's *areg* procedure, is used to obtain fixed-effects model estimates with analytic weights (StataCorp 2003).

Results

Table 2 shows the mean values for the dependent and the independent variables during 1995 and 1999 in the selected countries. The difference in the mean values of the indicators between 1995 and 1999 and the standard deviation of the difference are also reported. Statistically significant differences in the means between 1995 and 1999 are assessed using a paired t-test and the p-values are reported. During the analysis period, the desired fertility significantly declined from 4.0 births to 3.7 births per women ($p<.001$). The declining fertility desire in the selected countries is accompanied by a significant increase in contraceptive use, per capita GDP, female secondary education rate, and female labor force participation rate during the same period. Between 1995 and 1999 the average modern method use in the selected countries increased from 21 percent to 26 percent ($p<.001$); the per capita GDP increased from U.S. $1,950 to U.S. $2,125 ($p<.05$); the female education rate increased from 63 percent to 68 percent ($p<.001$); and the female labor force participation rate showed a meager increase of 0.4 percentage-points from 40.3 percent to 40.7 percent ($p<.1$). The increase in modern contraceptive method use included an increase in temporary method use (from 14 to 18 percent, $p<.001$), as well as an increase in the use of public sector-distributed temporary methods (from 8 to 10 percent, $p<.001$). It is interesting to note that the average external population assistance per year in the selected countries increased significantly from about U.S. $14 million in 1995 to about U.S. $23 million in 1999 ($p<.001$).

--Table 2 about here--

The five component scores of the Contraceptive Logistics System Performance Index are presented in Table 2 as a percentage of the maximum. A score of zero indicates that the logistics systems are not performing at all and a score of 100 indicates that the performance is at its best. The average score increased by about 24 points ($p<.001$), from 46 points in 1995 to 69 points in 1999, indicating substantial average improvement of the logistics systems of the selected countries. When we look at the changes in the Contraceptive Logistics System Performance Index, broken down by its five components, we observe that, on average, all components of the supply chain improved during the reference period. On average, the performance of the logistics management information system in the selected countries improved by 61 percent, from 39 points in 1995 to 63 points in 1999; forecasting system performance improved by 51 percent, from 46 points in 1995 to 69 points in 1999; procurement systems improved by 64 percent, from 49 points in 1995 to 80 points in 1999; distribution systems improved by 61 percent, from 41 points in 1995 to 67 points in 1999; but the average improvement of the warehousing system was slower (28 percent), from 58 points in 1995 to 74 points in 1999.

The three components of the Family Planning Program Effort Index are also presented in Table 2 as a percentage of the maximum score. A score of zero indicates that there is no family planning program effort, and a score of 100 indicates that the effort is at its best. The Family Planning Program Effort Index score increased by an average of 2.4 points between 1995 and 1999. However, the increase was not statistically significant ($p>.1$). When we look at the changes in the Family Planning Program Effort Index, broken down by its three components, we observe that, on average, all three components improved. The largest improvement was seen in service-related activities, which increased by 4.6 points between 1995 and 1999; followed by the monitoring and

evaluation component and then by the policy environment component, which improved by about 1.4 and 1.2 points respectively. None of these component score changes were statistically significant ($p>.1$), though. The reason for the insignificant change in the Family Planning Program Effort Index can be partially explained by the small sample size and by the measurement error of the index that is associated with the selected sample.

The expectation of this study is that increases in contraceptive use during the analysis period are associated with improved logistics system performance during the same period. A preliminary assessment of the relationship between modern method use and the Contraceptive Logistics System Performance Index during the analysis periods is shown in Table 3. For this purpose, the 17 countries are categorized into low-, medium-, and high-performing countries, based on their Contraceptive Logistics System Performance Index scores. The score for low-performing countries ranged between zero and 49; between 50 and 70 for medium-performing countries, and between 71 and 100 for high-performing countries. The analysis period appears in the left-hand column of the table and the logistics system performance categories appear in the top row. The cell average by analysis period indicates that contraceptive use is positively related to the Contraceptive Logistics System Performance Index. During 1995, the average modern method use was 31 percent among countries in the high logistics performance category, declining to between 18 and 20 percent for low- and medium-performing countries.

--Table 3 about here--

Table 4 presents crude[7] (biased) and adjusted (unbiased) coefficients of the independent variables, predicting contraceptive use for modern methods, temporary methods, and public sector temporary methods. The standard error of the coefficients and the p-values for the t-test of

the coefficients are also reported. As expected, the crude effect estimates indicate that modern method use is positively correlated with per capita GDP ($p<.001$), female education rate ($p<.001$), female labor force participation rate ($p<.05$), logistics system performance ($p<.05$), and external population assistance ($p<.001$), and inversely correlated with fertility desire ($p<.01$). Although the crude correlation between modern method use and family planning effort are positively correlated (i.e., countries with a higher score had higher modern method use), the association is not statistically significant ($p>.1$). The crude analysis of the other two outcomes—temporary method and public sector temporary method use rates—indicated similar relationships with the independent variables. However, the crude correlation between temporary method use and logistics system performance was not statistically significant ($p>.1$). Also, female education was not significantly ($p>.1$) correlated with public sector temporary method use in the crude analysis.

--Table 4 about here--

The adjusted estimates of the model predicting modern method contraceptive use, obtained using Equation 2, indicate that, between 1995 and 1999, countries with relatively high improvements in logistics system performance experienced a higher increase in modern method use during the same period, net of the secular change and changes in family planning effort, fertility desire, per capita GDP, female education, and female labor force participation. On average, for every 10-point increase in the Contraceptive Logistics System Performance Index score, the modern method use rate increased by 1 percentage-point. Although the adjusted effects of fertility desire, per capita GDP, female education, and female labor force participation were in the expected direction, the effects were not statistically significant ($p>.1$). The statistical insignificance of effect of the socio-economic variables can mainly be attributable to the small sample size.

Next, the adjusted effect of logistics system performance on temporary method use was estimated. The adjusted estimates from the temporary method model with variable specification similar to the modern method model (in Table 4) showed inconsistent effects of per capita GDP, fertility desire, and family planning effort (analysis not shown); raising question whether the model specification for temporary methods should be similar to the model for modern methods. Since there is no prior evidence that fertility desire or per capita GDP has any direct influence on temporary method use, the two independent variables were dropped to yield effect estimates for temporary methods in Table A1. Even after dropping per capita GDP and fertility desire, the effect of family planning effort on temporary method use remained inconsistent[8]. Therefore, the Family Planning Program Effort Index was dropped to produce the adjusted effect for temporary method in Table 4. As expected, the increase in logistics system performance between 1995 and 1999 among the selected countries was associated with the increase in temporary method use rate, which was net of other co-factors that were considered. Dropping the family planning program effort, per capita GDP, and fertility desire from the temporary method model (in Table 4) did not have any noteworthy impact on the magnitude or the significant level of the effect of logistics system performance.

Given that the Contraceptive Logistics System Performance Index score specifically reflected the logistics system performance of public sector family planning programs, the association between the score and public sector temporary method use was assessed next. As with the model for temporary method use, the variable specification for the model for public sector temporary method use was not straightforward. Although fertility desire, per capita GDP, female education,

and female labor force participation could indirectly influence public sector temporary method use, there is no evidence to suggest that they are the proximate determinants. Also, the adjusted estimates of the public sector temporary method model with variable specification similar to the modern method model (in Table 4) showed an inconsistent effect of the independent variables in question (analysis not shown). Therefore, they were not included in the model predicting public sector temporary method in Table A1. Even after dropping per capita GDP, fertility desire, female education, and female labor force participation, the effect of family planning effort on public sector temporary method use remained inconsistent[9]. Therefore, the Family Planning Program Effort Index was dropped to produce the adjusted effect for public sector temporary method in Table 4. As expected, countries with higher increases in logistics system performance between 1995 and 1999 were associated with higher increases in public sector temporary method use during that period. Dropping the family planning program effort, per capita GDP, female education, female labor force participation, and fertility desire from the public sector temporary method model (in Table 4) did not have any noteworthy impact on the magnitude or the significant level of the effect of logistics system performance.

Interestingly, all three models in Table 4 indicated that countries that received comparatively high external assistance for population programs have comparatively high contraceptive use. However, the effect of population assistance on contraceptive use is biased by unobserved heterogeneity (e.g., government spending on population programs) and the selection process for assistance. Conversely, the findings could imply that countries that have stronger population programs are able to draw larger amount of external population assistance funds. The observed

effect of population assistance can also be interpreted as the effect of national population programs in accelerating the transition in fertility control (see Tsui 2001 for details).

Logistics systems are an integral part of population programs. Yet, improvement in logistics systems alone cannot be expected to result in higher contraceptive use because the effect of logistics depends on the overall level of a country's population program. With the expectation that the effect of logistics system performance on contraceptive use would be greater for countries with relatively higher family planning effort, the effect modification (interaction) term between logistics system performance, family planning effort, and external population assistance were assessed for the models in Table 4. For all three models, the interaction terms between logistics system performance and external population assistance were found to be significant, and models with only the significant interaction terms are presented in Table 5. The analysis revealed that the effect of logistics system performance on contraceptive use is modified by the level of external population assistance. The positive coefficients of the significant ($p<.05$) interaction terms in the models in Table 5 indicated that the effect of the increase in logistics system performance between 1995 and 1999 on contraceptive use is higher among countries whose increase in external population assistance during the same period was relatively high.

--Table 5--

Using the adjusted coefficients in Table 4, the impact of logistics system performance on contraceptive use was simulated (see Figure 3). The fraction of use attributable to logistics systems is the percentage difference between the average contraceptive prevalence when the Contraceptive Logistics System Performance Index score is set at its observed level (the blue bars in Figure 3), and the average contraceptive prevalence when the influence of the

Contraceptive Logistics System Performance Index is removed (the green bars in Figure 3), holding the value of all the other variables constant. The analysis showed that, in 1995, about 20 percent (100 × [21.2 – 17.0] ÷ 21.2) of the average modern method use, 15 percent (100 × [13.7 – 11.6] ÷ 13.7) of the average temporary method use, and 44 percent (100 × [7.5 – 4.2] ÷ 7.5) of the average public sector temporary method use are attributable to logistics system performance. Similarly, in 1999, about 24 percent of modern method use, 18 percent of temporary method use, and 50 percent of, public sector temporary method use are attributable to the performance of the logistics systems.

The fraction of the increase in contraceptive use attributable to the improvement in logistics systems is the percentage difference between the changes in contraceptive use when the Contraceptive Logistics System Performance Index score is set at its observed level (i.e., changes in blue bars in Figure 3) and the changes in contraceptive use when the Contraceptive Logistics System Performance Index does not change over time (i.e., changes in the red bars in Figure 3), netting out the effect of the other variables. Accordingly, about 42 percent (100 × ({[26.3 – 21.2] – [24.1 – 21.2]} ÷ [26.3 – 21.2])) of the increase in average modern method contraceptive use is attributable to the improvement of logistics systems in the selected countries. Similarly, 27 percent of the increase in temporary method use and 70 percent of the increase in public sector temporary method use is attributable to the improvement in logistics systems.

--Figure 3 about here--

The observed relationship between logistics system performance and the contraceptive prevalence rate is based on the assumption that improving logistics systems improves product availability at service delivery points. The assumption was assessed based on contraceptive

availability surveys in six countries, conducted by FPLM/DELIVER between 1999 and 2001 (Chandani et al. 2000; Choudhury et al. 1999; DataPro 1999; Godinez and Papworth 2000; Kinzett et al. 2000; Rao 2000). Contraceptive availability was defined as the percentage of service delivery points with contraceptive stockouts (mainly for oral contraceptives or male condoms) on the day of the survey visit. The scatter plot between product availability and Contraceptive Logistics System Performance Index score for the selected countries during the same period shows that relatively high scores for logistics system performance are significantly associated (row = 0.9; p = .02) with lower stock-out rates for contraceptives (see Figure 4), indicating that it is reasonable to assume that higher logistics systems performance is associated with product availability at service delivery points.

--Figure 4 about here--

Limitations

The data used in this study are subject to certain limitations. For one, the countries that were analyzed do not represent a random sample, but are those for which needed data were available for both 1995 and 1999. Still, there is no compelling reason to believe that the inclusion of more or different countries would yield significantly dissimilar results. Also, a number of socio-programmatic factors that could influence CPR are not taken into account by Family Planning Program Effort Index. These include service delivery quality and the availability of public sector financing for family planning commodity procurement.

The Composite Indicator for Contraceptive Logistics Management tool attempted to measure the sustainability of logistics systems. However, the sustainability component was not used for constructing the Contraceptive Logistics System Performance Index because of the question

regarding its reliability and validity. Further research will nonetheless be required to identify indicators for measuring the all-important sustainability of family planning logistics systems. The efficiency of these logistics management systems in the developing world is increasingly threatened by the pressure of rising demand for family planning services, particularly due to rapid population growth and the increased use of condoms for HIV/AIDS prevention. Moreover, health sector reform in many countries is producing new logistics needs that cannot be met by existing system structures. Family planning supply chains are often being integrated with those for other essential health commodities, and decision-making is increasingly being decentralized to regional authorities that are closer to clients.

Conclusion

The study provides empirical evidence that the performance level of logistics systems for family planning programs contribute significantly to contraceptive use, which is net of fertility desire, family planning program effort, external population assistance, and socioeconomic factors. Improving contraceptive availability alone cannot ensure increases in contraceptive use unless the demand for contraceptives is created by other means. A well performing logistics system is necessary but not solely sufficient for achieving program outcomes. Nevertheless, investing in logistics systems can be one of the most effective interventions to improve the success of family planning programs.

Appendix

--Table A1 about here--

--Table A2 about here--

Notes

[1] Public sector temporary method use = (Contraceptive prevalence for temporary methods) × (Public sector share).

[2] For Demographic and Health Surveys that were not conducted precisely in 1995 or 1999, the contraceptive use estimates for the reference years are derived by interpolating the values between the two closest surveys available for the period. However, no values for the outcome are extrapolated.

[3] The alpha coefficient measures the internal reliability of an index or scale. Internal reliability refers to how the index measures the underlying construct, in this case which is the performance of family planning logistics systems.

[4] Nine of the 17 countries included are from the African region, four countries from the Asia and the Near East region, and four countries from the Latin America and the Caribbean region.

[5] The external population assistance for a given country included all donations from donor countries, multilateral organizations, foundations, and international NGOs for reproductive health services including family planning, prevention of sexually transmitted infections and HIV/AIDS, and basic research and policy analysis (see UNFPA 2003 for details). To minimize the measurement error due to the variation in population assistance between two subsequent years, a three-year average was taken. Therefore, the population assistance for the reference period 1995 was the average of 1993, 1994 and 1995, and the similar average was taken for 1999.

[6] Two or more independent variables are referred to be collinear with each other when they explain a common variation of the outcome in a regression model. Collinear variables usually dampen each other's effect.

[7] The crude effect estimates were obtained using country-level fixed-effects models for each of the independent variables separately.

[8] Although not statistically significant ($p>.1$), Table A1 indicates that higher scores for family planning program effort are associated with lower temporary contraceptive method use in a country. The inconsistent relationship between family planning effort and temporary method use remained even when the Family Planning Program Effort Index was reconstructed using its original four component scores instead of using the three component scores (analysis not shown). The temporary method model in Table A1 was re-estimated using the component scores of the Family Planning Program Effort Index as independent variables. It was expected that decomposing the index into its component scores would lead to more consistent model estimates; however, the spurious relationship remained (analysis not shown). It was possible that the observed inconsistency was due to the influence of effect modification (i.e., interaction) between the index and one or more of the other independent variables in the model, i.e., the impact of the Family Planning Program Effort Index depended upon the values of one or more of the other independent variables. However, the effect modification terms between the Family Planning Program Effort Index and other independent variables when added to the temporary method model in Table A1 were not significant (analysis not shown). The lack of statistical significance of the interaction terms is partly due to the lack of power of the small sample size. The spurious relationship could also be due to unaccounted time varying determinants of temporary method use which are correlated with the Family Planning Program Effort Index within the sample, i.e., measurement error or sample selection issues or both. To get consistent model parameter estimates, the inconsistent variable was dropped from the model to get the model predicting temporary method use in Table 4.

[9] Although statistically not significant ($p>.1$), the direction of the relationship between the Family Planning Program Effort Index and public sector temporary method use in Table A1 was contrary to the expectation. Like the assessment for the temporary method model in Table A1, assessment of public sector temporary method model in Table A1 was also carried out which concluded that the spurious relationship between Family Planning Program Effort Index and public sector temporary method use is due to small sample size, sample selection, or measurement error or any of their combination.

References

Bertrand, Jane T., and Gabriela Escudero. 2002. *Compendium of Indicators for Evaluating Reproductive Health Programs: Volume I.* Manual Series no. 6. Chapel Hill: MEASURE Evaluation.

Bertrand, Jane T., Robert Magnani, and Naomi Rutenberg. 1996. *Evaluating Family Planning Programs with Adaptations for Reproductive Health.* Chapel Hill: MEASURE Evaluation.

Bongaarts, John. 1997. "The Role of Family Planning Programmes in Contemporary Fertility Transitions." Edited by Gavin W. Jones, John C. Caldwell, Robert M. Douglas, and Rennie M. D'Souza. *The Continuing Demographic Transition.*

Bruce, J. 1990. "Fundamental Elements of Quality of Care: A Simple Framework." *Studies in Family Planning* 21(2): 61–91.

Godinez, Carolina M. and David Papworth. 2000. *Peru: Contraceptive Logistics System, Review of Accomplishments and Lessons Learned (1994–1999).* Arlington, Va.: Family Planning Logistics Management/John Snow, Inc., for the U.S. Agency for International Development (USAID).

Chandani, Yasmin, and Gerry Breton. 2001. "Contraceptive Security, Information Flow, and Local Adaptations." *African Health Science* 1(2): 73–82.

Chandani, Y., K. Crowley, J. Durgavich, R. Lunt, P. Nersesian, N. Pehe, and T. Rosche. 2000. *Ghana: Implications of Health Sector Reform for Family Planning Logistics.* Arlington, Va.: Family Planning Logistics Management/John Snow, Inc.

Chen, S., and David K. Guilkey. 2003. "Determinants of Contraceptive Method Choice in Rural Tanzania between 1991 and 1999." *Studies in Family Planning* 34(4): 263–276.

Choudhury, A.Y., Iqbal Ahmed, Neelofar R. Chowdhury, and Billal Hossain. 1999. *1999 Stock Level Survey.* Dhaka, Bangladesh: Program for the Introduction and Adaptation of Contraceptive Technology, Bangladesh, Directorate of Family Planning, and Family Planning Logistics Management/John Snow, Inc.

DataPro, S.A. 1999. *Línea de Base de Desabastecimiento de Anticonceptivos en Ministerio de Salud Pública y Asistencia Social, Instituto Guatemalteco de Seguridad Social y Asociación Pro-Bienestar de la Familia.* Guatemala City, Guatemala: Trabajo elaborado por DataPro, S.A. para John Snow, Inc.

Davis, H., and C. Hart. 2002. "Increasing Program Impact by Ensuring Product Availability." *Global Health Link* 114: 7 and 24.

Freedman, R. 1997. "Do Family Planning Programs Affect Fertility Preferences? A Literature Review." *Studies in Family Planning* 28(1): 1–13.

Gelfeld, Dana. 2000. *Summary of Results: The Composite indicators for Contraceptive Logistics Management Under FPLM III,* Working paper. Arlington, Va.: FPLM/John Snow, Inc., for the U.S. Agency for International Development.

Hart, Carolyn. 2004. "Commentary: No Product? No Program!" *Public Health Reports* 119 (1): 23–24.

Hsiao, Cheng. 1986. *Analysis of Panel Data.* Cambridge: Cambridge University Press.

Jain, A. K. 1989. "Fertility Reduction and the Quality of Family Planning Services." *Studies in Family Planning* 20(1): 1–16.

John Snow, Inc., and the Centers for Disease Control and Prevention (compiled). 1999. *Composite indicators for Contraceptive Logistics Management.* Arlington, Va.: FPLM/John Snow, Inc., for the U.S. Agency for International Development.

Kinzett, S., M. A. Hossain, S. Rao, and D. Thompson. 2000. *Nepal: Contraceptive and Drugs Logistics System, Review of Accomplishments and Lessons Learned (1993–2000).* Arlington, Va.: Family Planning Logistics Management/John Snow, Inc., for the U.S. Agency for International Development (USAID).

Lapham, Robert J., and W. Parker Mauldin. 1985. "Contraceptive Prevalence: The Influence of Organized Family Planning Programs." *Studies in Family Planning* 16(3): 117–37.

Magnani, Robert J., David R. Hotchkiss, Curtis S. Florence, and Leigh Anne Shafer. 1999. "The Impact of Family Planning Supply Environment on Contraceptive Intention and Use in Morocco." *Studies in Family Planning* 30(2): 120–132.

Mauldin, W. Parker, and Bernard Berelson. 1978. "Conditions of Fertility Decline in Developing Countries, 1967–75." *Studies in Family Planning* 9(5): 89–147.

Mauldin, W. Parker, and John A. Ross. 1991. "Family Planning Programs: Efforts and Results, 1982–89." *Studies in Family Planning* 22(6): 350–367.

Pritchett, Lant H. 1994. "Desired Fertility and the Impact of Population Policies." *Population and Development Review* 20(1): 1–55.

Rao, S. 2000. *Jordan: Contraceptive logistics system, Review of Accomplishments and Lessons Learned (1997–2000).* Family Planning Logistics Management/John Snow, Inc., for the U.S. Agency for International Development.

Ross, J., and John Stover. 2001. "The family planning program effort index: 1999 Cycle." *International Family Planning Perspectives* 27(3): 119–29.

Ross, John A., and W. Parker Mauldin. 1996. "Family Planning Programs: Efforts and Results, 1972–94." *Studies in Family Planning* 27(3): 137–47.

Schultz, T. Paul. 1993. “Sources of Fertility Decline in Modern Economic Growth: Is Aggregate Evidence on the Demographic Transition Credible?” Edited by M. R. Rosenzweig and O. Stark. *Handbook of Population and Family Economics.*

_____ . 1994. “Human Capital, Family Planning, and Their Effects on Population Growth.” *American Economic Review* 84(2): 255–60.

Setty-Venugopal, V., R. Jacoby, and C. Hart. 2002. “Family Planning Logistics: Strengthening the Supply Chain.” *Population Reports* 30(1): 1–23.

StataCorp. 2003. *Stata Statistical Software: Release 8.* College Station, Tx.: Stata Corporation.

Tsui, Amy O. 2001. “ Population Policies, Family Planning Programs, and Fertility: The Record.” Supplement. *Population and Development Review* 27: 184–204.

United Nations Population Fund. 2003. *Financial Resource Flows for Population Activities in 2002.* New York: United Nations Population Fund.

Wooldridge, Jeffrey M. 2003. *Introductory Econometrics: A Modern Approach, 2nd Edition.* Mason, Ohio: Thomson, South-Western.

World Bank. 2003. *World Development Indicators CD-ROM.* Washington, D.C.: World Bank.

Tables and figures

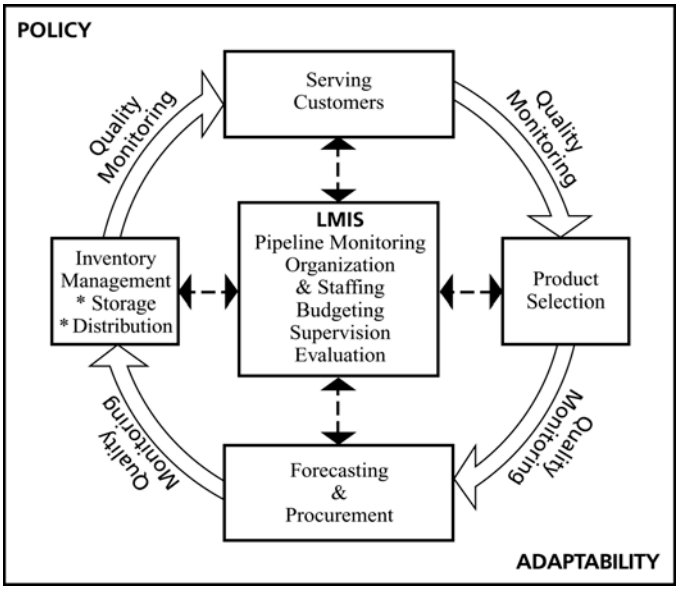

Figure 1: The logistics cycle (Source: JSI/DELIVER 2004)

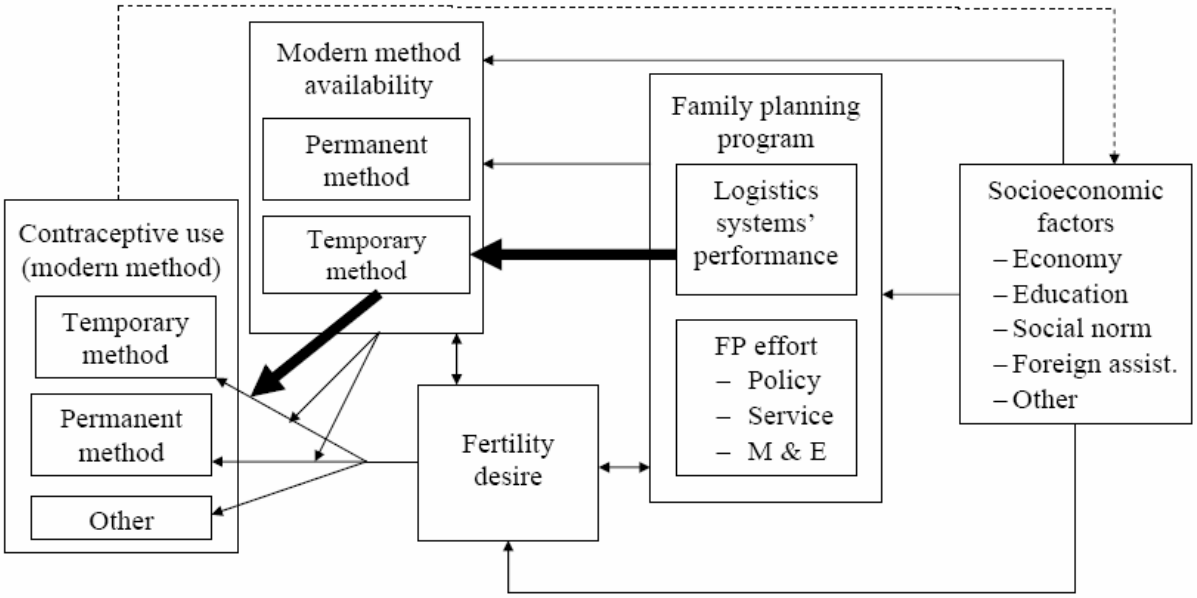

Figure 2: Framework for understanding the role of logistics system performance on contraceptive use

Table 1: Description of the items used to construct the Contraceptive Logistics System Performance Index

Items	Potential Score
Logistics Management Information System (LMIS)	
1. Program has basic elements of LMIS.	4
2. LMIS information is used in management decision making.	4
3. LMIS information is fed back to all lower levels in the distribution system.	2
4. Commodity data are validated by cross-checking with other data sources.	2
Forecasting	
5. Periodic forecasts of consumption are prepared, updated, and validated.	4
6. Forecasts are incorporated into cost analysis and budgetary planning.	4
Procurement	
7. Consumption forecasts are used to determine short-term procurement plans.	4
8. The right amount of contraceptives is obtained in an appropriate time frame.	4
Warehouse	
9. Adequacy of storage capacity and conditions.	4
10. Conducts at least one physical inventory of contraceptives per year at each warehouse.	2
11. Knows and complies with standards for maintaining product quality.	2
12. Issues stock according to first expiry/first out (FEFO) inventory control procedures.	4
Distribution	
13. Has appropriate distribution system and schedule for stocking each level.	4
14. Each level is stocked adequately.	4
15. Minimal stockouts have been experienced during the previous year.	4
16. Has a system for tracking and documenting system losses.	2
17. Has adequate transportation system for moving supplies.	4
Total	**58**

Table 2: Average contraceptive use, Contraceptive Logistics System Performance Index score, Family Planning Program Effort Index score, and socioeconomic indicators during 1995 and 1999, and the average change over time in 17 countries

	1995	1999	Change		p-value (paired t-test)
			Mean	(SD)	
Dependent variable (contraceptive use)					
Modern method	21.4	26.2	4.8	(2.5)	<.001
Temporary method	13.7	17.6	3.9	(2.1)	<.001
Public sector temporary method	7.7	9.9	2.2	(1.9)	<.001
Independent Variable					
Wanted total fertility rate	4.0	3.7	-0.3	(0.2)	<.001
Per capita GDP (adjusted for PPP, US $)	1,950	2,125	175	(316)	.036
Female secondary education rate	62.8	68.4	5.6	(3.9)	<.001
Female labor force participation rate	40.3	40.7	0.4	(0.9)	.072
Population assistance (US $, millions)	14.4	23.1	8.7	(6.7)	<.001
Family planning program effort index	50.8	53.8	3.0	(9.5)	.209
Policy environment	53.8	54.9	1.2	(11.4)	.677
Service-related activities	50.1	54.8	4.6	(13.5)	.175
Monitoring and evaluation	56.1	57.5	1.4	(22.0)	.803
Availability and accessibility [ε]	45.6	48.3	2.7	(17.6)	.536
Contraceptive Logistics System Performance Index score	45.9	69.5	23.6	(21.7)	<.001
Logistics management information system	39.0	62.9	24.0	(23.0)	.001
Forecasting system	45.9	69.4	23.5	(29.7)	.005
Procurement system	48.8	79.8	31.1	(28.6)	<.001
Warehousing system	57.7	73.7	16.0	(19.7)	.004
Distribution system	41.4	66.5	25.1	(27.9)	.002

Notes: SD: standard deviation; PPP: purchasing power parity.
[ε] The availability and accessibility component was not used to construct the Family Planning Program Effort Index for this study.

Table 3: Modern method use rates for selected countries by logistics system performance category and period, 1995 and 1999

Analysis period	**Logistics systems' performance category**						Marginal average
	Low		Medium		High		
	Country	CPR	Country	CPR	Country	CPR	CPR
1995	*Cell average*	*20.1*	*Cell average*	*17.8*	*Cell average*	*31.0*	*21.4*
	Benin	3.4	Cameroon	5.5	Bangladesh	38.4	
	Dominican Republic	57.7	Mali	4.5	Kenya	29.0	
	Ghana	11.4	Nepal	26.0	Philippines	25.6	
	Guatemala	26.9	Peru	41.3			
	Haiti	13.2	Tanzania	11.6			
	Jordan	34.6					
	Malawi	14.4					
	Senegal	6.5					
	Zambia	13.0					
1999	*Cell average*	*7.1*	*Cell average*	*23.5*	*Cell average*	*29.7*	*26.2*
	Cameroon	7.1	Benin	6.4	Bangladesh	44.0	
			Dominican Republic	64.1	Haiti	20.9	
			Ghana	14.4	Jordan	39.1	
			Guatemala	30.9	Kenya	31.8	
			Mali	6.5	Malawi	23.8	
			Zambia	18.5	Nepal	33.5	
					Peru	50.4	
					Philippines	28.2	
					Senegal	8.2	
					Tanzania	16.9	
Marginal average		*18.8*		*20.9*		*30.0*	*23.8*

CPR: contraceptive prevalence rate

Table 4: Regression models predicting contraceptive use (n=34)

Independent variable	Crude effects			Adjusted effects		
	Coef.	(SE)	p-value	Coef.	(SE)	p-value
			Modern method			
Trend (1999 vs. 1995)	4.80	(0.53)	<.001	-0.11	(1.61)	.946
Fertility desire	-10.98	(3.33)	.005	-0.41	(2.75)	.886
log (per capita GDP)	40.70	(7.45)	<.001	7.33	(13.01)	.587
Female education	0.55	(0.10)	<.001	0.10	(0.18)	.610
Female labor force	3.70	(1.72)	.047	0.57	(1.09)	.612
Population assistance	0.28	(0.04)	<.001	0.18	(0.08)	.046
Logistics systems	0.14	(0.05)	.020	0.09	(0.04)	.043
Family planning effort	0.20	(0.14)	.165	0.01	(0.08)	.926
Constant				-67.19	(97.30)	.507
Adjusted F-tests						
Model : d.f., statistics, p-value				F(8, 9)	15.61	<.001
Fixed-effects: d.f., statistics, p-value				F(16, 9)	33.76	<.001
			Temporary method			
Trend (1999 vs. 1995)	4.55	(0.43)	<.001	0.12	(0.62)	.849
Fertility desire	-9.11	(3.28)	.013			
log (per capita GDP)	38.66	(6.51)	<.001			
Female education	0.53	(0.08)	<.001	0.14	(0.04)	.008
Female labor force	2.96	(1.64)	.090	0.18	(0.34)	.616
Population assistance	0.29	(0.02)	<.001	0.22	(0.03)	<.001
Logistics systems	0.09	(0.05)	.115	0.05	(0.01)	.005
Family planning effort	0.20	(0.12)	.124			
Constant				-7.40	(14.89)	.628
Adjusted F-tests						
Model : d.f., statistics, p-value				F(5, 12)	124.16	<.001
Fixed-effects: d.f., statistics, p-value				F(16, 12)	213.58	<.001
			Public sector temporary method			
Trend (1999 vs. 1995)	1.94	(0.47)	.001	-0.15	(1.20)	.904
Fertility desire	-6.54	(1.50)	<.001			
log (per capita GDP)	11.28	(5.84)	.071			
Female education	0.13	(0.08)	.139			
Female labor force	2.14	(0.85)	.023			
Population assistance	0.11	(0.03)	.005	0.10	(0.07)	.160
Logistics systems	0.08	(0.03)	.007	0.07	(0.03)	.020
Family planning effort	0.02	(0.07)	.768			
Constant				4.88	(3.57)	.193
Adjusted F-tests						
Model : d.f., statistics, p-value				F(3, 14)	9.61	.001
Fixed-effects: d.f., statistics, p-value				F(16, 14)	29.11	<.001

Note: d.f. = degrees of freedom

Table 5: Regression models with effect modifiers added to the models in Table 4 (n=34)

Independent variable	**Coef.(SE)**	**p-value**	**Coef.(SE)**	**p-value**	**Coef.(SE)**	**p-value**
	Modern method		*Temporary method*		*Public sector temporary method*	
Trend (1999 vs. 1995)	-1.93(1.49)	.230	-0.16(0.68)	.812	-0.62(1.07)	.576
Fertility desire	-0.16(2.20)	.945				
log (per capita GDP)	19.01(11.44)	.135				
Female education	0.12(0.15)	.449	0.16(0.05)	.008		
Female labor force	1.08(0.90)	.264	0.27(0.35)	.467		
Population assistance	-0.31(0.21)	.176	0.12(0.10)	.241	-0.23(0.16)	.170
Logistics systems	0.02(0.04)	.708	0.03(0.02)	.204	0.01(0.04)	.684
Family planning effort	0.04(0.06)	.572				
Logistics × population assistance	0.008(0.003)	.039	0.002(0.001)	.329	0.005(0.002)	.042
Constant	-175.74(89.53)	.085	-12.40(15.64)	.445	5.80(3.16)	.900
Adjusted F-tests						
Model: d.f., statistics, p-value	F(9, 8) 22.33	<.001	F(6, 11) 104.03	<.001	F(4, 13) 10.59	<.001
Fixed-effects: d.f., statistics, p-value	F(16, 8) 52.43	<.001	F(16, 11) 201.40	<.001	F(16, 13) 37.38	<.001

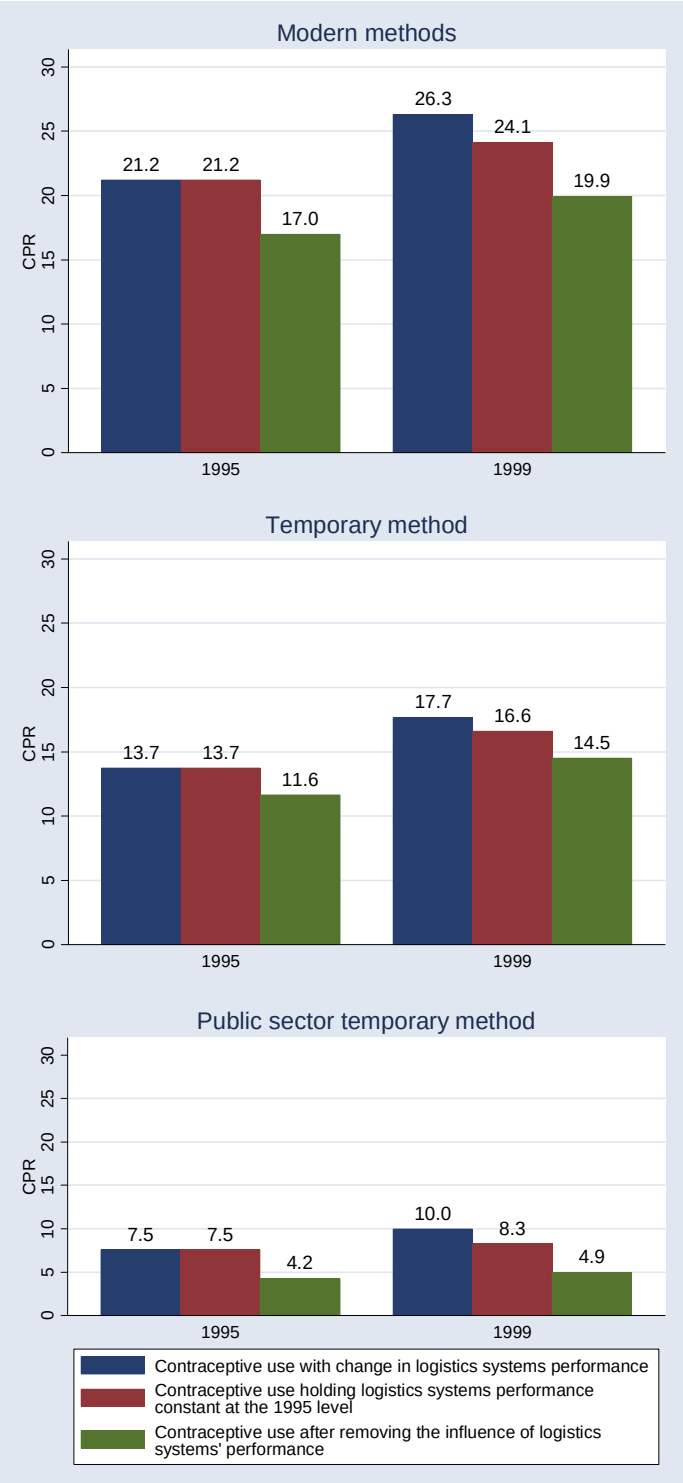

Figure 3: Predicted contraceptive use by simulating the level of logistics system performance

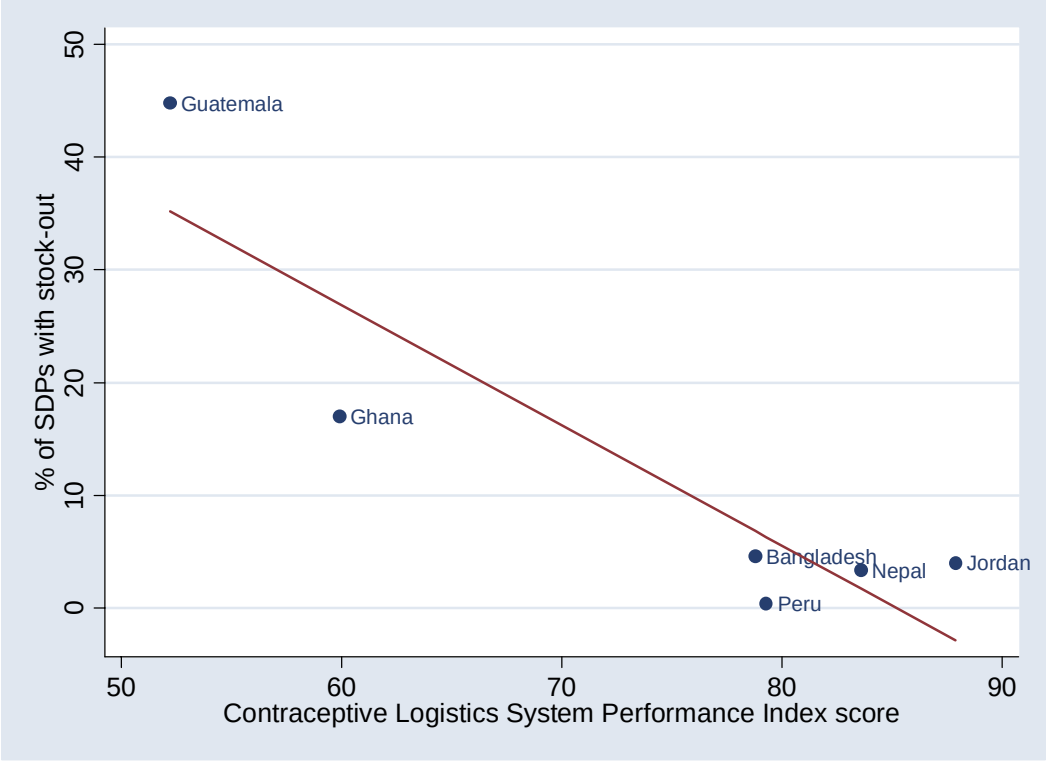

Figure 4: Scatter plot between contraceptive availability and Contraceptive Logistics System Performance Index

Table A1: Regression models for temporary method contraceptive use with Family Planning Effort Index as one of the predictors (n=34)

Independent variable	Coef.	(SE)	p-value	Coef.	(SE)	p-value
	Temporary method			*Public sector temporary method*		
Trend (1999 vs. 1995)	0.12	(0.64)	.855	-0.34	(1.15)	.771
Female education	0.14	(0.05)	.011			
Female labor force	0.02	(0.47)	.962			
Population assistance	0.22	(0.03)	<.001	0.13	(0.07)	.083
Logistics systems	0.05	(0.01)	.006	0.08	(0.03)	.012
Family planning effort	-0.02	(0.03)	.624	-0.07	(0.05)	.152
Constant	-0.71	(20.31)	.973	7.92	(3.95)	.067
Adjusted F-tests						
Model: d.f., statistics, p-value	F(6, 11)	97.08	<.001	F(4, 13)	8.46	.001
Fixed-effects: d.f., statistics, p-value	F(16, 11)	198.88	<.001	F(16, 13)	31.72	<.001

Table A2. The data used for the study

Country	Year	CPR	CPR_temp	CPR_pub	Contraceptive Logistics System Performance Index score						fpe	wtfr	GDP_PPP	secondary	labor	assist (US$)	pop
					Total	Distribution	Forecasting	LMIS	Procurement	Warehousing						(million)	(million)
Bangladesh	1995	38.4	29.3	22.6	85.3	80.6	87.5	100.0	75.0	83.3	66.3	2.2	1,230	41.8	42.1	68.6	123.1
Benin	1995	3.4	3.0	1.3	17.8	29.6	0.0	19.4	0.0	22.2	39.0	5.0	810	29.2	48.3	2.5	5.6
Cameroon	1995	5.5	4.2	1.3	51.7	33.3	37.5	50.0	50.0	91.7	49.0	4.8	1,380	65.0	37.5	4.2	13.6
Dominican Republic	1995	57.7	17.2	6.1	35.3	36.1	25.0	12.5	31.3	66.7	70.3	2.5	4,990	91.4	29.0	6.3	8.0
Ghana	1995	11.4	10.0	4.5	44.0	47.2	75.0	41.7	37.5	25.0	54.0	4.1	1,850	65.0	50.7	13.1	18.0
Guatemala	1995	26.9	11.1	3.0	25.0	27.8	0.0	4.2	12.5	66.7	63.0	4.0	3,940	71.7	26.2	9.0	10.9
Haiti	1995	13.2	9.8	2.5	27.6	11.1	25.0	0.0	37.5	75.0	42.7	3.0	1,830	64.4	43.1	9.4	7.3
Jordan	1995	34.6	29.9	8.1	24.1	11.1	12.5	33.3	25.0	41.7	37.3	3.3	3,770	84.7	21.3	2.3	5.7
Kenya	1995	29.0	23.1	14.9	78.4	72.2	87.5	79.2	87.5	75.0	55.0	3.4	990	82.1	46.1	27.9	29.1
Malawi	1995	14.4	11.4	7.9	19.0	11.1	12.5	16.7	0.0	50.0	52.0	5.6	520	58.0	49.1	9.7	11.4
Mali	1995	4.5	4.2	2.2	53.4	50.0	79.2	27.8	75.0	52.8	55.7	6.0	650	19.0	46.4	7.9	11.1
Nepal	1995	26.0	8.6	6.8	53.4	43.3	45.0	56.7	60.0	66.7	54.7	2.9	1,090	20.0	40.4	11.4	22.5
Peru	1995	41.3	31.6	22.0	50.0	44.4	37.5	37.5	62.5	70.8	56.0	2.1	4,230	93.9	29.6	14.3	24.2
Philippines	1995	25.6	13.6	9.7	77.6	77.8	87.5	75.0	87.5	66.7	63.3	2.9	3,470	97.8	37.2	29.0	69.0
Senegal	1995	6.5	6.0	3.8	34.5	38.9	50.0	16.7	62.5	16.7	58.0	5.1	1,230	27.0	42.5	7.6	8.5
Tanzania	1995	11.6	9.8	7.2	66.8	66.7	81.3	50.0	75.0	68.8	47.7	5.4	450	71.4	49.4	15.1	30.5
Zambia	1995	13.0	10.9	6.4	36.2	22.2	37.5	41.7	50.0	41.7	42.7	5.3	720	85.0	45.4	6.7	9.7
Bangladesh	1999	44.0	35.5	23.0	78.8	75.7	76.6	87.5	76.6	77.6	72.3	2.2	1,430	53.6	42.3	90.1	129.2
Benin	1999	6.4	5.6	2.5	57.8	55.6	43.8	58.3	62.5	66.7	49.3	4.6	890	36.0	48.3	6.1	6.1
Cameroon	1999	7.1	5.6	1.8	45.7	36.1	43.8	25.0	68.8	66.7	53.0	4.3	1,520	71.9	37.9	4.2	15.1
Dominican Republic	1999	64.1	19.9	8.1	52.6	38.9	37.5	37.5	56.3	95.8	46.3	2.0	6,340	97.4	30.4	7.3	8.5
Ghana	1999	14.4	12.4	5.7	59.9	61.1	37.5	72.9	56.3	62.5	67.0	3.6	2,060	70.8	50.5	18.6	20.2
Guatemala	1999	30.9	13.4	4.6	52.2	48.6	50.0	47.9	59.4	58.3	34.0	4.1	4,230	74.7	28.4	8.7	11.4
Haiti	1999	20.9	17.2	4.2	81.0	83.3	100.0	41.7	100.0	91.7	49.3	2.8	1,880	71.1	42.9	18.8	8.2
Jordan	1999	39.1	34.1	10.4	87.9	91.7	75.0	95.8	100.0	75.0	48.3	2.9	3,720	90.9	23.9	9.5	6.7
Kenya	1999	31.8	25.7	14.7	91.4	94.4	92.5	86.7	95.0	88.3	60.7	3.5	980	88.5	46.1	31.1	30.1
Malawi	1999	23.8	19.0	13.0	75.0	75.0	62.5	70.8	93.8	75.0	56.0	5.2	570	73.0	48.7	20.4	10.9
Mali	1999	6.5	5.2	2.7	58.6	45.4	83.3	48.6	75.0	61.1	66.0	6.1	740	20.0	46.2	14.8	11.2
Nepal	1999	33.5	12.8	10.2	83.6	80.6	87.5	87.5	93.8	75.0	61.3	2.5	1,190	28.0	40.5	21.4	23.9
Peru	1999	50.4	37.0	29.3	79.3	83.3	75.0	70.8	93.8	75.0	55.7	1.8	4,410	94.8	31.0	26.7	25.7
Philippines	1999	28.2	17.6	12.7	74.7	65.7	83.3	76.4	85.4	73.6	57.3	2.7	3,610	98.4	37.7	47.2	76.0
Senegal	1999	8.2	7.6	5.2	74.1	83.3	75.0	50.0	100.0	66.7	58.7	4.6	1,360	33.4	42.6	13.2	9.5
Tanzania	1999	16.9	14.8	9.9	72.6	67.4	81.3	62.5	84.4	77.1	58.3	4.8	470	72.8	49.2	35.9	33.5
Zambia	1999	18.5	16.5	10.0	56.0	44.4	75.0	50.0	56.3	66.7	53.7	4.9	720	88.0	44.9	18.2	9.2