Measuring Family Planning Sustainability at the Outcome and Program Levels

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MEASURE Evaluation

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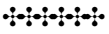

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Measuring Family Planning Sustainability at the Outcome and Program Levels

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Summary

The paper examines the validity of two indices of sustainability: family planning program sustainability (PSI) and outcome sustainability (OSI), developed by Tsui and Knight (1997) by applying their original method to recent data. The indices succeed in identifying the directional path of program and outcome sustainability. Close correlations are found between PSI and OSI predicted values and actual program and outcome values. The indices provide a repeatable method for measuring sustainability, although they are sensitive to data measurement errors. The indices provide a policy tool for funding decisions but should be used with other data sources to judge sustainability.

Introduction

As a natural outgrowth of years of development assistance, the United States Agency for International Development (USAID) has increased its emphasis on sustainable development concerns (USAID, 1999). Although external assistance continues to play a critical role in the development of impoverished nations, some countries are approaching a level of socioeconomic and demographic well being that can be sustained with more targeted, little or no foreign input. This paper describes the development of two indices to measure sustainability: the first to measure the sustainability of a national family planning program and the second to measure the sustainability of a nation's fertility transition. The indices, developed originally by Tsui and Knight (1997), used data from the Family Planning Effort Scores (FPES) for 1982-1994 (Mauldin and Ross, 1991; Ross and Mauldin, 1996). This paper examines the validity of the indices as measures of sustainability by applying the methodology used by Tsui and Knight (1997) to 1999 FPES data (Ross and Stover, 1999). The paper also discusses the potential usefulness of these measures of program and outcome sustainability as policy tools for informing external and internal funding decisions.

Background

The shift towards sustainable development

In the context of family planning programs, recent years have seen a shift in focus towards the funding of programs that are sustainable and generate long-term sustainable outcomes. Sustainable family planning programs are those that require increasingly smaller international or national subsidy and can operate a service providing wide access to quality family planning services. Sustainable outcomes refer to the continuation of contraceptive uptake and reduction of unwanted fertility among the population. Ashford and Haws (1992) report that there are three conditions necessary in order for family planning programs to become self-sufficient: an improvement in efficiency, income generation and the provision of quality services. In their

review, service quality and sustainability are mutually dependent, with the provision of quality services attracting clients and the presence of clients generating income to allow improvements in quality. Income generation has been criticized as having the potential to limit access to family planning services among the very poor (Harvey 1991), although studies have demonstrated the willingness to pay for quality services even among the poorest (Lande and Geller 1991; Lewis 1987).

The achievement of a self-reliant program that perpetuates and improves health outcomes requires sustainability in both systems and demand (Office for Sustainable Development 1999). System sustainability requires that a program have financial sustainability, the institutional capacity to provide a quality service and an environment that enables service provision (e.g. effective management, cooperation between agencies). In the context of the sustainability of contraceptive provision, demand sustainability has two components: willingness to pay and attitude towards contraceptive use. Attempts to attain sustainability in family planning programs must therefore address both demand and supply. In addition, the social context in which the program operates influences the degree of sustainability that can be achieved. For example, a country with low levels of income and a predominantly rural population will have fewer resources to sustain a national family planning program than a more urbanized middle-income country. These contextual influences must be taken into account when measuring the sustainability of family planning programs and outcomes.

Earlier restructuring of USAID led to greater emphasis placed on sustainable development, wherein the programs supported by the Agency should demonstrate the potential for continued impact, even after graduation from assistance. Programs with only short-term impacts were deemed inappropriate, and program sustainability was promoted by building host country capacity to plan and manage programs (USAID 1999). The Office of Population in the Center for

Population, Health and Nutrition (PHNC) of the Bureau for Global Programs, Field Support and Research at USAID has placed particular emphasis on sustainability. In its strategic planning process at the time, the Office of Population created four results under the PHNC Strategic Objective for family planning (USAID 1999). USAID's strategic objective for family planning is "Increased use by women and men of voluntary practices that contribute to reduced fertility" (USAID 1999). As a part of this objective, one formalized result (Result 1.3) addresses capacity building and sustainability, specifically "enhanced capacity for public, private, non-governmental and community-based organizations to design, implement, and evaluate sustainable family planning programs." The statement indicates two levels of program sustainability: the national program and the constituent organizations implementing the program.

At the Agency level, all goals and strategic objectives are pursued under a framework directed at sustainable development (USAID 1997). Both the PHNC Strategic Objective for family planning and Result 1.3 for sustainability contribute to the Agency's strategic objective of reducing unintended and mistimed pregnancies, which is turn contributes towards the overall USAID goal, "World population stabilized and human health protected". Achieving this objective and goal in sustainable terms requires that progress continue over time. Programs must focus on building and improving the management capacity of provider organizations, including the development of strategic plans and management information systems. Increasing cost recovery and financial sustainability are key elements of PHNC's assistance to host country organizations (USAID 1999).

While the PHNC Strategic Objective for family planning appears to be directed at reduced fertility and implies a shift in focus away from unintended and mistimed pregnancies directly, in fact the two are closely linked. The indicators at the Agency level reflect this link. In addition to the number of unintended births, the Agency indicators for population include the Total Fertility

Rate (TFR). Moreover, the focus on the increased use of family planning at the PHNC level may further give an impression that the quality of programs sustained is not of concern to USAID. However, service quality has long been an expressed concern of the Agency, as one of PHNC's other formal results (Result 1.4) emphasizes the quality of, as well as access to, family planning services. Both quality and access are thus seen as integral to couples' achievement of their fertility intentions. Related to quality and access is the issue of whether to maintain the current level of service or to expand and improve it. Simply maintaining low levels of service of limited quality in a country will not help sustain its fertility transition. Sustainability must therefore include continued movement towards the goal of providing easy access to high quality services.

The sustainability of family planning programs can thus be conceptualized at three levels. First, the *outcome* level, where sustainability refers to conditions in a country that support its continued decline in fertility. Second, the *program* level, where sustainability refers to conditions of a national program to deliver quality services over time. Finally, the *organizational* level, where sustainability refers to organizational characteristics supporting its ability to achieve its mission and deliver quality services over time. These definitions imply a close link between organizations, programs and outcomes. Sustainable organizations contribute to sustainable programs that in turn contribute to sustainable outcomes. At each level there are also other factors that enhance the prospects of an organization, program or outcome to maintain its directional course. The assessment of a country's success in achieving sustainability of their family planning program requires indices that measure sustainability at both the program and outcome levels, whilst including the range of factors (program and contextual) that influence the ability to achieve sustainability.

The use of indices to measure developmental sustainability

The measurement of progress in socioeconomic development necessitates the availability of clearly defined indicators or composite indices that accurately reflect the situation under observation. Whilst indicators can be used to measure individual aspects of development, the use of a composite index, that incorporates a number of base indicators, provides a more multidimensional view. The use of more than one indicator to form an index also improves the measurement reliability of the construct. National composite indices used for monitoring development provide a useful policy tool, allowing aspects of socioeconomic development to be measured simultaneously and compared across aggregate units, such as regions, countries, or provinces, as well as time. In order for indices to accurately capture the aspect that they aim to measure, it is important that the construction of the index be guided by relevant theory. Theoretical grounding enhances an index's credibility and long-term utility.

In 1997 Tsui and Knight developed two indices to measure the sustainability of a nation's family planning program (Program Sustainability Index) and the sustainability of a nation's transition to replacement fertility (Outcome Sustainability Index). The indices incorporate various factors that influence the ability of a country to 1) approach and maintain their fertility transition (e.g., through levels of education and urbanization) and 2) sustain access to contraception (e.g., through effective management of public and private sector supply). The indices thus conceptualize program effort and outcome in terms of both program inputs and the wider socioeconomic context. Some of the factors draw on data used to gauge the performance of national family planning programs, specifically the Family Planning Effort Scores for 1982, 1989 and 1994. The incorporation of these data into indices, that also reflect the socioeconomic context in which the programs exist, provides a potential tool for monitoring national family planning programs and informing decisions on national and international financing of these largely public programs. This paper examines the validity of the indices created by Tsui and Knight (1997) by applying the

methods used to create the indices to the data from the 1999 round of Family Planning Effort Scores. The aim of this exercise is thus to establish whether the original indices created by Tsui and Knight (1997) are appropriate for more recent rounds of data, and if so, provide a means of measuring family planning program and fertility transition sustainability that can be replicated for future data rounds.

Conceptual Framework

The two indices described in this paper, the Program Sustainability Index (PSI) and Outcome Sustainability Index (OSI), were created based on a review of the factors influencing access to contraception at the program level and the determinants of fertility (Tsui and Knight 1997). The choice of indicators to include in the PSI was based upon the conceptual framework for family planning supply factors presented in Buckner *et al* 1995 (Figure 1). The framework presumes that national family planning program effort seeks to sustain access to contraceptive services. Thus the program sustainability index is constructed to measure how much access is provided over time and which factors contribute to this. Not unrelated to Ashford and Haws' conceptualization (1992), Tsui and Knight outline three program components thought to have direct primary effects on contraceptive service access: finances, management and cooperation. The finances of the national program provide the basic local resources needed for the program to deliver services. Management ensures a program has proper supervision and execution of tasks and activities, trained staff, adequate record keeping, performance evaluations and utilization of findings to maximize contraceptive access. Cooperation involves coordination with other sectors to ensure resources are used efficiently while providing adequate services to clients in need. Figure 1 suggests that two external factors also have indirect effects on contraceptive service provision – donor inputs and population demand for contraception. Both act and interact with the three direct components in affecting how well the national program is able to provide access to contraceptive services.

Beyond the program level is the outcome level. Figure 2 shows a framework for understanding the institutional and demographic factors that affect the sustainability of USAID's goal of population stabilization (USAID 1999). This demographic condition is the consequence of trends in fertility, mortality and migration. The population structure of a country will eventually become stable if fertility declines to replacement level (TFR 2.1) and mortality remains low: migration usually contributes negligibly to stabilization conditions within a country. Because fertility is the main engine in population growth, focussing on it to construct the OSI directly can lead to population stabilization. Well-established models of fertility determinants (Becker 1991; Bulatao and Lee 1983; Easterlin 1975) inform the framework used to construct the OSI. The framework includes a path of influence for infant and child mortality on population stabilization. The structure of this framework suggests that programs organize the supply of services to assure contraceptive service access and that development generates the demand for lower fertility and contraception. In turn these influence the levels of fertility and infant and child mortality, which influence prospects for population stabilization.

The framework does not suggest that either supply or demand is more important. Donors tend to view supply as more relevant because the majority of their efforts are directed to improving supply (e.g. strengthening program infrastructures). Some donor efforts focus on demand. For example, USAID supports extensive work on contraceptive demand creation in many developing countries through IEC (Information Education Communication) programs. Relatively speaking, however, the influences of donor assistance and program resources on fertility are not likely to be as strong as those of development factors.

As in the PSI framework, the influence of donors on fertility in the OSI framework is indirect. Donors and their cooperating agencies provide financial, material and technical support to developing country organizations to implement many of the activities that constitute the family

planning program in a country. The overall program includes these and additional activities supported by the host-country government, as well as those performed by local private organizations. All of these activities in turn influence fertility by raising contraceptive practice levels. The components of the PSI and OSI were selected based on the frameworks described and are shown in Tables 1 and 2.

Data

Data from the Family Planning Effort Scores (Mauldin and Ross 1991; Ross and Mauldin 1996; Ross and Stover 2001) form the primary basis for the PSI. The FPES is comprised of 30 national-level characteristics of program effort, collected via self-completed questionnaires with key informants in developing countries (Ross and Stover 2001). Data were first collected in 1972 (Lapham and Mauldin, 1972) and then collected systematically with more detail in 1984, 1989, 1994 and 1999, as described in the cited studies. The PSI uses a subset of data from the FPES, including items on access to contraception, management of family planning programs, and the funding of programs. Data on the TFR for each country are taken from the International Database Bureau managed by the United States Bureau of the Census (Bureau of Census 1996; 2001). Data on USAID funding for 1991 and later are from the Population Projects Database (PPD) of expenditures for different projects (JSI 1996 and USAID 2001). Country levels of funding for years prior to 1991 were obtained from USAID's annual report to Congress. Due to high fluctuations in annual funding, amounts between 1972-1981, 1982-1988, 1989-94 were summed and then divided by the number of years to provide an annual average. This amount was then divided by the country's population in the cross section year to obtain the per capita annual amount. The data used to form the OSI come primarily from the World Bank Tables, which provide data on levels of female and male education, percentage in agriculture, percentage living in urban areas, gross domestic product (GDP) and the infant mortality rate for each country. The

selection of countries to analyze was based on the availability of complete data. The PSI is calculated for 54 countries, and the OSI for 50 countries.

Method

Each of the two indices was calculated using cross-sectional time series analysis, i.e., an analysis of a series of cross sections of national data at different points in time. The cross-sectional time points used to calculate the original indices were 1982, 1989 and 1994, dates dictated by the availability of comparable FPES data. A fixed effects cross-sectional time series model can be written as:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)\beta + (\varepsilon_{it} - \bar{\varepsilon}_i)$$

where y_{it} equals the outcome (contraceptive access or TFR) for country i at time t, $\bar{y}_i$ equals the average outcome for each country across all time points $(\sum_t y_{it}/T)$, x_{it} equals the value of the independent variable for country i at time t, $\bar{x}_i$ equals the average value of the independent variable for each country across all time points $(\sum_t x_{it}/T)$, β equals a vector of unknown parameters, ε_{it} equals the residual effect for country i at time t, and $\bar{\varepsilon}_i$ is the average residual for country i across time points t $(\sum_t \varepsilon_{it}/T)$.

Separate models are fitted to generate the PSI and OSI. The first model generates the PSI and takes the contraceptive access score (taken from the FPES data) as the dependent variable. Contraceptive access measures the access couples have to five types of methods: female sterilization, male sterilization, pills, condoms and IUD. The five items are summed to create an index of access that ranges from 0 to 20. To standardize the total score, it is recalculated as a percentage of the maximum, such that the score ranges from 0 to 100. Contraceptive access is modeled as a function of the TFR (lagged by two years to measure demand for services), program

management, local and international funding and private sector and other ministry involvement in family planning. Management is measured with a six-item index based on items from the FPES: training, task execution, record keeping, evaluation, and management use of evaluation findings (Bulatao 1996). The level of the family planning budget derived from local resources, and USAID funding per capita represent the financial aspect of contraceptive access. The involvement of the private sector and other ministries in family planning measure the cooperation factor highlighted in the framework (Figure 1).

Once the regression model for contraceptive access is estimated, the coefficients for the six factors serve as the weights to each country's values for those factors and are used to calculate the PSI. The PSI thus represents the country's predicted contraceptive access weighted for the six factors thought to influence access. The predicted values are generated for each of the three time points (1982, 1989, and 1994). In this exercise to validate the PSI, the weights from the original model are applied to data from the 1999 FPES (for contraceptive access, management, funding of family planning, private sector involvement and cooperation) and 1999 values of the remaining components of the PSI. The estimated 1999 PSI is then compared with the 1999 contraceptive access score from the FPES.

The second model, to generate the OSI, takes the Total Fertility Rate as the dependent variable and models it as a function of seven factors known to influence the transition to replacement fertility (e.g., Schultz, 1993). Five factors (female education, male education, percent working in agriculture, percent urban and per capita GDP) measure aspects of socioeconomic development. To measure health improvements, the OSI includes the Infant Mortality Rate (IMR) which directly measures the risk of infant mortality and serves as a proxy for subsequent child mortality. The inclusion of the PSI measures access to contraceptive services and causally links the sustainability of the family planning program to that of the fertility trend. The coefficients of the

seven variables act as the weights for each country's value of that variable and are used to estimate the TFR for each country for each of the three time points.

The predicted TFR is then divided by 2.1 (the level of fertility enhancing population stabilization prospects) used to calculate the OSI and multiplied by 100. This produces an OSI value that equals 100 when the country has reached replacement fertility, with the explicit effects of family planning program sustainability and other influences included. In order to validate the OSI for 1999, the coefficient for the PSI is applied as a weight to the 1999 value of the PSI (generated by the previous model), and the coefficients of the remaining components are applied to 1999 data. As with the PSI, the predicted OSI and actual TFR (divided by 2.1 and multiplied by 100) are then compared to validate the OSI index. (TFR estimates for 2000 from the U.S. Census Bureau are used due to unavailability of a 1999 series.)

Results

Tables 3 and 4 show the results of the cross-sectional time series analysis models used to generate the PSI and OSI. The modeling of contraceptive access (Table 3) produces statistically significant coefficients for most of the key variables. Higher TFRs, lagged by 2 years, are associated with low contraceptive access, and conversely lower TFRs are associated with higher access. The other variables all increase contraceptive access. Of these, the percent of program budget from local sources, USAID funding and private sector involvement all produce statistically significant coefficients. The regression model for Total Fertility Rate (Table 4) produced expected results for all variables. Contraceptive access (PSI), female education, percent urban and GDP per capita all reduce fertility. The results for contraceptive access and female education are statistically significant. The percent of the labor force in agriculture and the Infant Mortality Rate (IMR) increase fertility, although only the result for IMR is statistically significant. Male education has a

positive effect on fertility, which likely reflects the underlying positive correlation between male education and household income.

Table 5 shows the PSI values for 54 developing countries for 1982-1999 and the actual contraceptive access score for 1999 (taken from the FPES). A high value of the PSI implies that the various components of the program (management, USAID funding, private sector and other ministry involvement) generate a high level of contraceptive access. The PSI may be higher than the actual contraceptive access score as it is estimated from a regression model. The higher the value of the PSI the more sustainable the program is expected to be in providing contraceptive access. A number of Asian countries appear at the top of the list, while many Latin America countries appear nearer the middle and sub-Saharan African countries are concentrated primarily at the bottom. Three of the South Asian countries (Sri Lanka, Bangladesh and India) are above the middle of the list, whilst Pakistan remains low on the list.

Table 6 shows the OSI for 1982-1999 and the actual percentage of replacement fertility achieved by 2000 for 50 countries (four countries in Table 5 lacked data to permit OSI estimation). The OSI represents the predicted percentage of replacement fertility achieved. Latin American countries fare well in terms of predicted sustainable fertility outcomes, whilst fertility transitions in sub-Saharan African countries are not very advanced. With the exception of Sri Lanka, South Asian countries are towards the middle of the list. A comparison of the PSI and OSI ranking shows some shifting between the rankings of the countries. Latin American countries do not dominate the top of the PSI list as they do the OSI list. Sub-Saharan African countries presently have both poorly sustainable family planning programs and fertility transitions.

The PSI values for 1999 are consistently above those for 1994, suggesting a predicted increase in the sustainability of family planning programs. Figures 3, 4, 5 and 6 support this trend, showing the relationship between the PSI and actual contraceptive access scores for 1982-1999. Strong positive relationships exist between predicted sustainability and actual access in all four years, as seen in the R-square values, although the strength of the relationship is weaker in 1999. A few outliers drive the relatively weaker relationship in 1999: Haiti, Colombia, Iran and Brazil. The actual access values are both at maximum (100.0) for Brazil and Iran, compared to estimated PSI values of 64.72 and 56.69 respectively. For Colombia actual access was assessed to be 92.33, compared to an estimated 56.52; and for Haiti, the reverse occurs, with the actual access scored at 49.33, compared to an estimated PSI of 82.94. Colombia no longer receives USAID funding and Iran has not in recent decades, while Brazil receives limited funding for two northeastern low-income regions. Conversely, Haiti has been targeted for increased funding and in 1999 received the second largest amount of USAID funding in Latin America, behind Peru. The disparity between the measured contraceptive access in these countries and their estimated PSI levels is driven by the size of USAID funding. Indeed if these four outliers are eliminated, the R-square for the fit between the PSI and actual access scores increases from 0.419 to 0.579.

Most of the factors influencing program sustainability have increased in value between 1994 and 1999. Table 7 shows the mean values for each of the components of the PSI for the two time points. The mean management index rose from 62.81 to 67.34 and annual USAID per capita funding increased from $0.19 to $0.27. Two factors (percentage of FP budget local and other ministry involvement) did not change significantly, and the FPES rating of private sector involvement in FP) declined slightly from 2.63 to 2.42 (on a 0 to 4 scale). Because the calculation of the PSI places the greatest weight on USAID funding (see coefficients in Table 3), the predicted increase in program sustainability is driven primarily by observed increases in USAID funding and secondarily by increases in the management of family planning programs.

Table 8 categorizes the countries by their 1994 PSI score in high, middle and low effort levels and displays the mean PSI for and actual contraceptive access scores for both 1994 and 1999. Over all 54 countries, the averages for the predicted 1999 PSI and actual contraceptive access

differ by only 3.7 points. The mean 1999 PSI in countries with greater predicted sustainability in 1994 (scores greater than 64) is negligibly different from actual contraceptive access in 1999, i.e., 76.76 compared to 77.69. These two means only differ slightly also for the 21 countries with 1994 PSI scores between 50 and 64 (65.50 compared to 67.27). Thus for 34 of the 54 countries, the means for the predicted PSI and actual access scores in 1999 are very close. The index method does, however, overestimate 1999 contraceptive access in countries with weaker programs (scores less than 50), i.e., mean of 51.08 compared to 38.62. In terms of actual trend, the improvement in contraceptive access is clear in Table 8, with access scores increasing from 56.25 to 59.17 between 1994 and 1999.

In contrast, the predicted OSI values for 1999 differ more substantially from and are lower than their equivalent measure, percent of replacement fertility, i.e., 53.07 versus 65.7 or a difference of 12.6 percentage points, as seen in Table 9. The OSI method tends to underestimate the pace of the fertility transition between 1994 and 1999 in these 50 countries. The underestimation is greatest in the 12 countries where family planning program sustainability was predicted in 1994 to be high, that is, 1994 PSI values were 65 and over; the difference in mean predicted and actual OSI is 21.9 points. For the 21 countries with 1994 PSI scores between 50 and 64--where family planning program sustainability in 1994 was considered moderate--the difference in OSI averages is much smaller, 7.9 points or 53.8 versus 61.7. The underestimation virtually disappears for the 17 countries with weaker programs in 1994, where the predicted percent of replacement fertility reached for 1999 is only 2.5 points higher than the actual level achieved. This spread suggests the OSI performs better in assessing the sustainability (or lack thereof) of the fertility transition of countries with moderate or weaker family planning systems. Actual transition to replacement fertility is seen in the comparison of the 1994 and 1999 averages of 57.59 to 65.70, which are based on actual TFRs.

The underestimation of 1999 OSI values for countries with very high 1994 PSI levels is the result of some underestimation of contraceptive access in those countries. For example, taking an extreme case, in Thailand the predicted 1999 PSI was 82.21, while actual access was rated 97.55. Consequently, the predicted 1999 OSI was 58.18, although Thailand reached below replacement fertility by 1999 or an OSI equivalent of 110.5. The weight attached to the PSI factor in the OSI regression model is thus sensitive to underestimation of sustainable family planning programs which carries forward into underestimating the pace of fertility transition. On the other hand, where the PSI more visibly overestimates program sustainability in 1999, as in many sub-Saharan African countries, the effect on the predicted sustainability of the fertility transition is balanced by marginal improvements in the development-related factors, leading to fertility estimates close to actual levels.

Application of the PSI and OSI

One use of the PSI and OSI is to inform donor funding decisions by highlighting those countries that can either be graduated from assistance or require continued, if not increased, support. This could be done by selecting a threshold level, which, for the purposes of discussion, might be a PSI value of 65. Applied to these data, of the 13 countries with PSI scores over 64 in 1994, 9 (69%) experienced actual increases in their contraceptive access situations by 1999. Thus, had internal or external funding decisions to reduce support been guided by the 1994 PSI within this group of 13 countries, four would have turned out to be "false positives" as judged by 1999 data. In the next group of 21 countries with 1994 PSI scores between 50 and 64, 13 (62%) proceeded to contraceptive access levels higher than 64 by 1999. Thus, among these 34 countries judged in 1994 to have moderately or highly sustainable family planning programs, 22 or about two thirds progressed to access scores 65 or higher by 1999 and, on average, very close to that predicted for their 1999 PSI levels.

For the 20 countries with PSI less than 50 in 1994, that would not have been judged as candidates for withdrawal of internal or external subsidization, 13 (65%) experienced decreased or constant

contraceptive access between 1994 and 1999. Of the 7 countries that experienced increases in contraceptive access between 1994 and 1999, only two improved their contraceptive access to over 65%. Contraceptive access increased to 100% in Iran and 65% in Pakistan, but neither received USAID population assistance in this period. The remaining 5 countries all experienced moderate increases in contraceptive access and remain under the threshold of 65% contraceptive access. No countries requiring further population assistance would have seen funding inappropriately withdrawn.

Similarly, of the 8 countries with a 1994 OSI value of greater than 64, all 8 experienced actual increases in the percentage of replacement fertility achieved between 1994 and 1999. Among the 13 countries with 1994 OSI values between 51 and 64, 12 experienced increases in the percentage of replacement fertility achieved. For the 29 countries with 1999 OSI values less than 50, 12 experienced declines in the percentage of replacement fertility achieved, whilst 17 experienced increases. Of the latter group, only 6 experienced increases above the 65% threshold level. Hence, 23 (79%) of the countries predicted to have the weakest sustainable fertility transitions did end up with actual levels of replacement level fertility below 65%.

Discussion

The PSI and OSI provide the means to monitor the sustainability of family planning programs and fertility transition outcomes. Within a country, these indices highlight progress over time toward achieving sustained access to contraceptive services and sustained progress toward replacement level fertility. These indices offer a means to rank the relative status of countries in terms of sustainability of their course of contraceptive systems development and demographic outcome. The indices have an advantage over single indicators of sustainability in that they incorporate aspects of the program (management, funding, and cooperation) and the socioeconomic context (levels of education and urbanization) that influence sustainability. The

indices attribute greater weight to factors the regression analysis showed to be most influential in predicting contraceptive access and fertility and the pace of their change over a twelve-year period of time. Hence the PSI and OSI measures incorporate the differing influences of factors in the programmatic environment and human development that result in behavioral change.

In general, there are strong associations between the PSI and OSI and actual contraceptive access and the fertility transition, indicating that the indices provide robust measures of actual program and outcome performance. When the performance of the indices is examined by earlier predicted levels of program sustainability, on average the PSI overestimates contraceptive access of countries with weaker programs five years later and closely estimates access in countries with stronger programs. The indices do well, however, in identifying the directional path that program sustainability and fertility transitions are taking, with most countries having scores in 1999 that follow the direction predicted in previous years. In particular, the indices do well in identifying those countries with low values in 1994 that experienced actual low values in 1999.

The ability of the indices to highlight the directional path of both program and outcome sustainability has the potential to inform funding decisions for family planning programs. However, this is not to suggest that the indices provide a stand-alone measure of sustainability. Sustainability is a complex process that requires examination of qualitative and other quantitative data. Information is required on a country's age structure to gauge the likely future demand for family planning services. Even if the program appears sustainable at current levels of service provision it may not be sustainable at increased levels of demand. Qualitative insights into leadership, management and operational capacity of family planning organizations are helpful supplementary data. Additional data on private sector services will also be instrumental in providing a comprehensive view of the level of sustainability suggested by the indices.

In using the indices to inform funding decisions users should take caution in setting threshold values of sustainability. Firstly, there is no standard level at which a program can be deemed sustainable. For example, if a PSI threshold of 65 had been used in 1994 to identify sustainable programs, this would have resulted in the removal of assistance from 4 countries that in fact experienced some decline in contraceptive access by 1999, although none of these countries had contraceptive access below 53%. Conversely, all countries that required further assistance (those with continued high fertility and low contraceptive access) would have received funding. The indices succeed in highlighting those countries with weaker family planning programs, and even among those countries with moderate and strong programs, the indices are relatively successful in identifying the direction of growth in sustainability.

Second, the indices attempt to capture the main aspects of a complex process but do not include all factors that may be unique to individual settings. Also, the values of the PSI and OSI fluctuate, and thus a country's rise over a threshold level of sustainability may in fact be a minor fluctuation. The index values should be used to represent relative levels of sustainability rather than an absolute percentage of a program or outcome that is sustainable. Although the values of both indices can range from 0-100, a value of 100 is not always required to be sustainable. A value of 65 appears to be a relatively sustainable level given that the values of a number of countries known to have sustainable programs are around this level. Many more of the OSI values approach 100 than the PSI values. Despite this, a value of 100 is not needed for a country to have a sustainable reduction in fertility. The degree to which a program is sustainable must therefore be gauged based on other countries that have reached a degree of maturity considered sustainable and take into account a range of other influential factors unique to that country.

Conclusion

The PSI and OSI provide an opportunity to conceptualize program and outcome sustainability in terms of the many program and socioeconomic factors that can influence a country's ability to achieve sustainability. The indices prove to be a good reflection of reality, and provide a robust measure of sustainability based on a nexus of factors known to influence the outcome. The use of regression modeling to generate the indices ensured that the most influential factors are given the greatest weight in the indices. The application of the original method used to create the indices to the 1999 FPES data found that the measures are repeatable, although the PSI is sensitive to potential measurement errors in the FPES data. The strong relationships observed between predicted PSI and OSI in 1994 and actual outcomes in 1999 point to the ability of the indices to act as a policy tool for guiding program funding decisions. However, these indices should be used as part of a range of data used to judge sustainability and users should be aware of the errors that can occur if threshold levels of sustainability are used. The continuation of these indices relies heavily on the continued collection of FPES data. In the past, these data have been collected approximately every five years and there is currently no systematic program sponsoring the regular collection of these data. The continued and more regular collection of FPES will allow the sustainability indices to be calculated continuously, informing users of national program capacity and the permanence of desired demographic outcomes in the longer term and aiding in decisions to modify assistance levels.

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Table 1. Variables used in the construction of the Program Sustainability Index

Variable	**Description**
Contraceptive access score [1]	Sum of FPES data for five types of contraceptives (male/female sterilization, IUD, pill, condom). Scored from 1-100.
TFR (lagged 2 years)	TFR two years prior
Management Index	Sum of FPES data for 1) training 2) task execution 3) supervision 4) record keeping 5) evaluation and 6) management use of evaluation findings. Scored from 0-100.
Percentage family planning budget local	Degree to which annual family planning budget is derived from in-country resources (scored 0-4)
USAID funding for family planning	Per capita USAID funding for family planning (in dollars)
Private sector involvement in family planning	Involvement of private sector in family planning (scored 0-4)
Other ministries in family planning	Involvement of ministries in family planning other than the ministry primarily responsible for family planning (scored from 0-4)

[1] This score is modeled as a function of the other variables in the table. The predicted result is labeled as the Program Sustainability Index.

Table 2. Variables used in the construction of the Outcome Sustainability Index

Variable	**Description**
Total Fertility Rate[1]	Average number of births to a woman through her childbearing years at current levels
Program Sustainability Index	Program Sustainability Index (0-100)
Female education	Mean years of education for women
Male education	Mean years of education for men
Percentage in agriculture	Percentage of the labor force working in agriculture
Percentage urban	Percentage of the population living in urban areas
GDP per capita (log)	Log of the Gross Domestic Product at market prices (in per capita dollars)
Infant Mortality Rate	Number of infant deaths per 1000 live births in a given year

[1] The TFR is modeled as a function of the other variables in the table. The predicted TFR is then compared to replacement fertility and standardized to 100 to obtain the Outcome Sustainability Index.

Figure 1. Framework for Program Sustainability Index

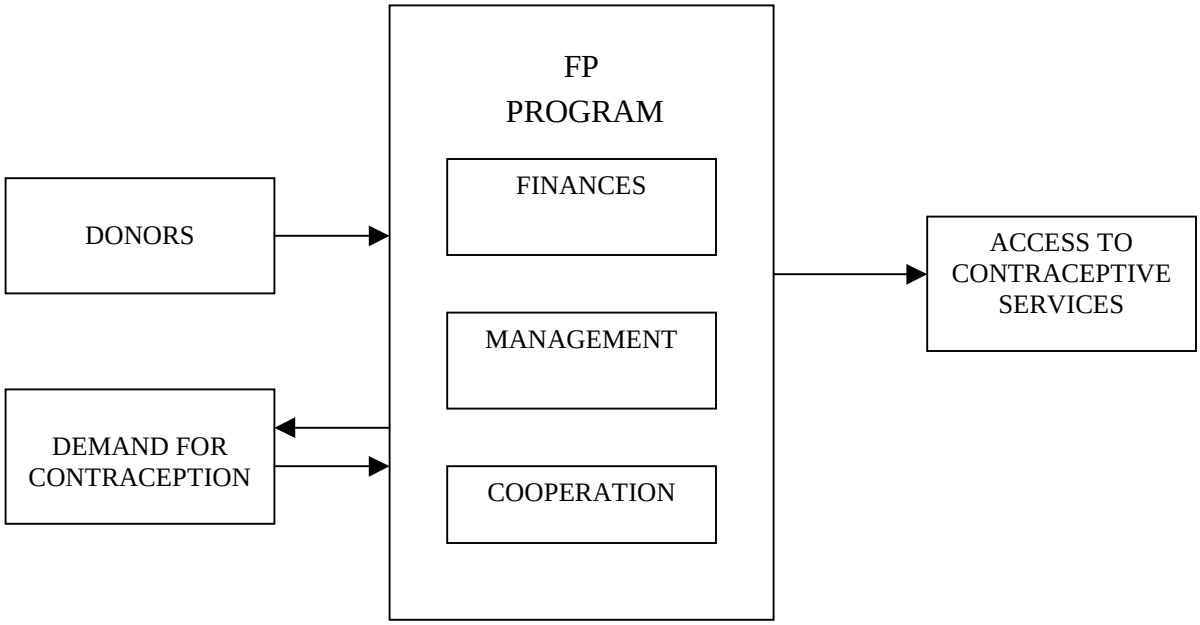

Figure 2. Framework for Outcome Sustainability Index

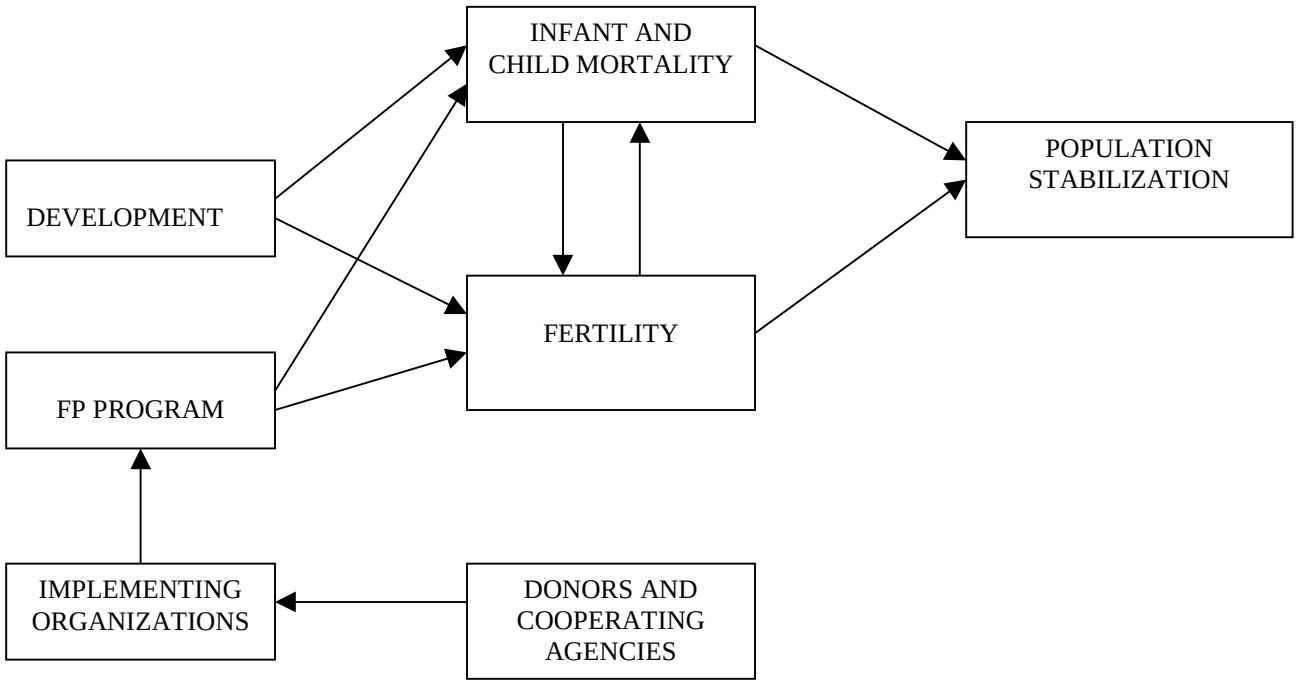

Table 3. Cross-sectional Time Series Regression Analysis of Contraceptive Access for Program Sustainability Index

Variable	**Beta Coefficient**	**P-value**
TFR (lagged 2 years)*	-5.087	0.064
Management Index	0.117	0.248
% FP Budget Local*	2.120	0.084
USAID Funding for FP*	20.506	0.071
Private Sector in FP*	3.603	0.044
Other Ministries in FP	2.456	0.142
Year = 1989	2.798	0.404
Year = 1994	0.343	0.937
Constant	47.776	0.002

* Significant at 10% level (one-tailed)

Table 4. Cross-sectional Time Series Regression Analysis of Total Fertility Rate for Outcome Sustainability Index

Variable	**Beta Coefficient**	**P-value**
Program Sustainability Index*	-0.019	0.001
Female Education*	-0.253	0.014
Male Education	0.119	0.245
% in Agriculture	0.010	0.303
% Urban	-0.007	0.407
GDP per capita (log)	-0.001	0.991
Infant Mortality Rate*	0.008	0.089
Year = 1989	0.061	0.673
Year = 1994	-0.201	0.356
Constant	5.287	0.000

* Significant at 10% level (one-tailed)

Figure 3. Program Sustainability Index and Contraceptive Access 1982

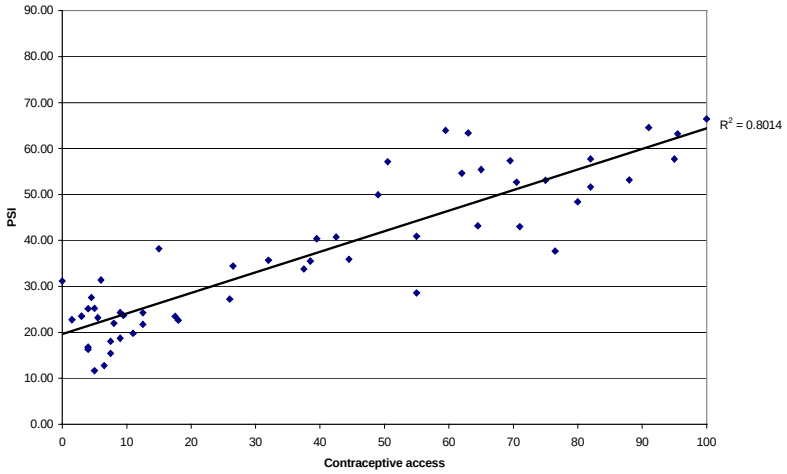

Figure 4. Program Sustainability Index and Contraceptive Access 1989

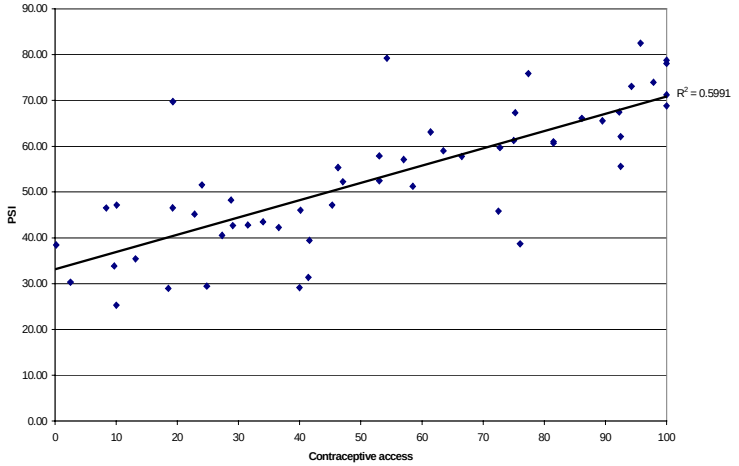

Figure 5. Program Sustainability Index and Contraceptive Access 1994

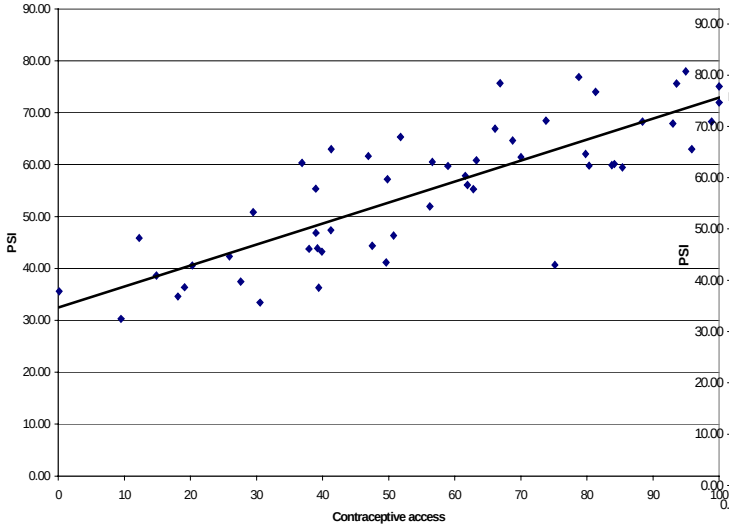

Figure 6. Program Sustainability Index and Contraceptive Access 1999

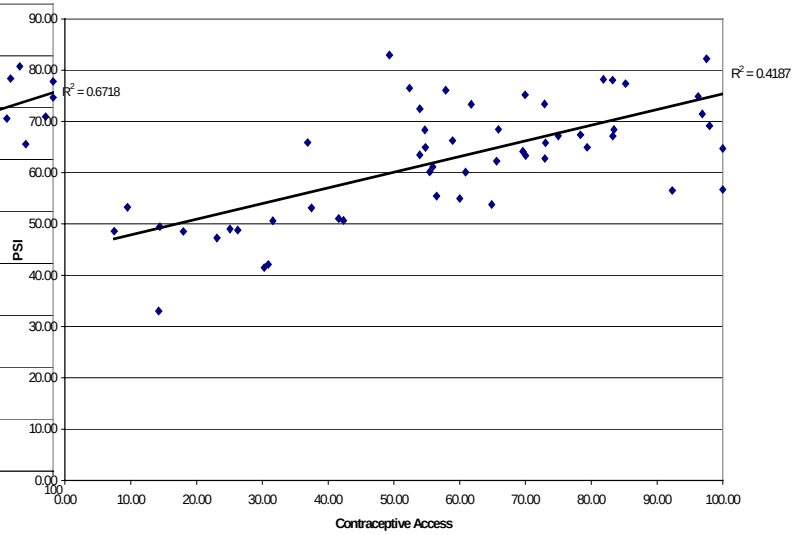

Table 5. Program Sustainability Index 1982-1999 and Contraceptive Access 1999 (Ranked by 1994 PSI)

Country	PSI 1982	PSI 1989	PSI 1994	Contraceptive Access 1999	PSI 1999
Thailand	53.16	73.94	77.96	97.55	82.21
Jamaica	57.35	79.21	76.90	57.88	76.09
Indonesia	63.41	75.88	75.68	81.87	78.20
China	57.72	71.26	75.61	85.24	77.35
Korea, Re	66.46	78.09	75.07	96.25	74.87
Mauritius	63.94	82.52	74.02	83.25	78.05
Tunisia	43.00	59.69	71.95	52.38	76.48
Turkey	38.21	57.09	68.49	72.90	73.41
Mexico	51.66	68.83	68.30	96.89	71.45
El Salvador	48.42	67.46	68.29	53.95	72.45
Trinidad & Tobago	55.43	78.79	67.91	69.95	75.12
Chile	57.16	67.34	66.94	98.00	69.14
Bolivia	31.20	48.22	65.34	63.92	92.97
Guatemala	28.61	45.80	64.62	60.90	60.11
Panama	63.19	61.23	62.98	69.60	64.15
Sri Lanka	57.74	73.09	62.97	79.38	64.97
India	54.64	62.13	62.05	78.38	67.37
Philippines	53.10	63.12	61.65	74.99	67.17
Kenya	23.47	52.28	61.45	70.04	63.34
Morocco	33.80	57.89	60.81	65.90	68.44
Ghana	31.40	51.55	60.55	61.77	73.35
Egypt	35.53	57.78	60.34	53.92	63.48
Costa Rica	43.20	60.96	60.14	65.63	62.24
Malaysia	52.69	66.10	59.91	73.05	65.83
Bangladesh	37.69	60.69	59.80	83.47	68.42
Brazil	49.94	51.25	59.75	100.00	64.72
Ecuador	40.95	55.60	59.48	58.94	66.25
Zimbabwe	27.24	47.16	57.85	54.80	64.91
Lesotho	27.60	55.33	57.20	72.95	62.77
Peru	34.44	59.00	56.10	83.29	67.14
Senegal	24.28	46.51	55.38	54.70	68.33
Colombia	64.56	65.57	55.26	92.33	56.52
Cameroon	21.98	38.45	51.92	9.50	53.27
Haiti	40.40	46.02	50.85	49.33	82.94
Nepal	35.70	52.47	47.38	55.94	61.14
Guyana	40.74	69.75	46.85	56.50	55.45
Pakistan	35.89	42.79	46.34	64.87	53.78
Mali	18.06	40.54	45.86	36.90	65.89
Algeria	25.18	45.17	44.39	60.00	54.97
Uganda	16.32	29.44	43.92	37.48	53.11
Nigeria	23.71	42.65	43.79	42.34	50.66
Syria	15.44	31.35	43.25	55.46	60.15
Malawi	11.68	25.26	42.31	26.27	48.80
Tanzania	24.31	39.42	41.15	23.12	47.27
Iran	19.82	38.69	40.71	100.00	56.69
C. African Rep	23.53	46.55	40.57	7.50	48.61
Madagascar	21.77	47.15	38.63	18.00	48.54
Myanmar	22.65	28.97	37.47	25.10	48.99
Sudan	22.78	33.83	36.38	14.40	49.47
Zambia	25.25	43.48	36.28	41.62	51.04
Congo	23.20	42.25	35.59	14.25	33.01
Ethiopia	16.78	35.43	34.62	30.90	42.09
Benin	18.74	29.13	33.42	31.60	50.63
Mauritania	12.82	30.29	30.28	30.28	41.49
Mean	**36.18**	**53.34**	**55.23**	**59.17**	**62.87**
R-squared	**0.80**	**0.60**	**0.57**		**0.42**

Table 6. Outcome Sustainability Index (Percentage of Replacement Fertility Achieved) Ranked by 1994 OSI

Country	OSI 1982	OSI 1989	OSI 1994	Actual % Replacement Fertility 2000	OSI 1999
Jamaica	66.27	81.81	99.01	100.00	72.08
Trinidad & Tobago	64.88	83.65	95.70	116.67	90.01
Chile	67.06	75.13	87.10	9545	83.44
Panama	62.20	64.51	73.54	91.30	74.75
Costa Rica	57.42	65.54	72.79	77.78	66.63
Mauritius	55.23	65.12	72.53	105.00	69.00
Mexico	51.18	60.09	70.30	77.78	71.54
Colombia	56.64	60.91	66.66	77.78	67.28
Malaysia	49.44	57.34	64.41	63.64	67.11
Brazil	49.11	52.72	61.62	100.00	62.67
Sri Lanka	51.83	58.16	61.59	105.00	59.11
Philippines	47.68	53.34	61.08	60.00	68.17
Ecuador	46.48	52.57	60.05	65.63	67.55
El Salvador	45.35	52.44	59.49	61.76	62.60
Thailand	45.15	51.60	59.07	110.53	58.18
Peru	43.95	52.54	58.54	70.00	65.80
Turkey	39.25	45.73	54.81	95.45	56.82
China	43.60	47.60	54.11	116.67	51.95
Tunisia	41.85	46.07	53.81	105.00	62.71
Guyana	45.07	52.87	52.37	100.00	57.91
Indonesia	41.56	45.85	51.62	80.77	55.40
Bolivia	37.57	41.63	49.32	56.76	62.51
Guatemala	38.43	41.89	49.31	44.68	49.64
Lesotho	38.55	44.18	48.82	50.00	50.61
Zimbabwe	36.70	42.16	48.51	63.64	47.32
Algeria	37.36	43.13	48.41	75.00	55.01
Egypt	36.07	41.96	47.67	65.63	52.11
Kenya	34.21	39.22	45.03	56.76	43.80
Morocco	36.39	40.87	44.87	67.74	48.00
Ghana	36.00	39.54	44.49	52.50	44.60
Cameroon	34.44	37.72	43.81	42.86	43.07
Haiti	36.05	39.12	42.86	46.67	47.03
India	35.84	38.18	41.80	67.74	44.63
Myanmar	35.79	37.45	41.63	87.50	40.92
Senegal	33.66	36.82	41.51	40.38	44.21
Nigeria	34.05	37.01	41.50	36.84	43.27
Madagascar	33.06	38.03	40.61	36.21	42.50
Congo	34.05	37.45	40.03	41.18	40.38
Nepal	32.89	36.78	39.56	44.68	37.94
Zambia	35.60	38.43	39.08	37.50	35.64
Tanzania	32.06	34.63	38.24	38.18	38.59
Bangladesh	31.03	34.71	38.06	72.41	44.49
Pakistan	33.15	34.76	37.67	45.65	41.24
C. African Republic	32.71	35.44	36.75	42.00	38.34
Benin	32.42	33.87	36.44	33.33	40.02
Mauritania	31.09	33.28	35.55	33.33	39.18
Uganda	30.95	32.11	35.43	30.00	38.60
Malawi	29.36	31.42	34.75	39.62	36.52
Ethiopia	29.69	32.56	34.63	29.58	35.20
Mali	28.76	31.94	34.59	30.43	37.86
Mean	**41.18**	**46.23**	**51.82**	**65.70**	**53.07**

Table 7. Mean Values of Components of Program Sustainability Index 1994 and 1999

	1994	**1999**
Contraceptive Access	56.25	59.12
TFR (lagged 2 years)	4.40	3.89
Management Index	62.81	67.34
% FP Budget Local	1.21	1.20
Private Sector in FP	2.63	2.42
Other Ministries in FP	2.69	2.69
USAID Funding for FP	0.19	0.27
Program Sustainability Index	**55.23**	**62.87**

Table 8. Mean values of PSI in 1999 and Actual Contraceptive Access 1999

PSI 1994	No. Countries	Mean PSI 1999	Mean Contraceptive Access 1994	Mean Contraceptive Access 1999	Difference between 1999 PSI and Actual Access
> 65	13	76.75	83.65	77.69	-0.94
50 – 64	21	65.50	62.50	67.27	-1.77
< 50	20	51.08	31.89	38.62	+12.46
Total	**54**	**62.87**	**56.25**	**59.17**	**+3.7**

Table 9. Mean values of OSI in 1999 and Actual Percentage of Replacement Fertility Achieved in 1999

PSI 1994	No. Countries	Mean OSI 1999	Mean % Replacement Fertility 1994	Mean % Replacement Fertility 2000	Difference between 1999 OSI and Actual Fertility
> 65	12	65.6	82.62	87.5	-21.9
50 – 64	21	53.8	57.84	61.7	-7.9
< 50	17	42.8	39.49	40.3	+2.5
Total	**50**	**53.07**	**57.59**	**65.7**	**-6.7**