# THE EFFECTS OF A FAMILY PLANNING BEHAVIOR CHANGE COMMUNICATION PROGRAM ON CONTRACEPTIVE IDEATION AND USE IN BURKINA FASO: AN APPLICATION OF THE PROPENSITY SCORE MATCHING METHOD.

Stella Babalola, Johns Hopkins University, Bloomberg School of Public Health, Center for Communication Programs, 111 Market Place, Baltimore, MD 21202

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***Abstract***

Burkina Faso is characterized by high fertility and low contraceptive usage. Against this background, the Johns Hopkins University Center for Communications Programs with funding from the USAID worked with the Burkina Ministry of Health to design and implement a behavior change communication campaign between 1998 and 2001. The campaign includes a quality promotion campaign and methods promotion jingles. Using propensity score matching technique this paper analyzes data from a 2001 survey to assess the effects of the campaign. The results show that more than three-quarters of the respondents reported exposure to at least one campaign material. Moreover, the campaign has significant graduated effects on contraceptive ideation and use. High campaign exposure is associated with an increase of 21.8 percentage points over no exposure while zero exposure is associated with 7.3 percentage point increase. The campaign is also associated with increased knowledge about contraceptives and more favorable attitudes towards family planning.

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## BACKGROUND

Burkina Faso, a landlocked West African country of about 12.6 million people, is one of the most densely populated nations in the sub-Saharan Africa. As in most countries in the region, the indicators concerning reproductive health in Burkina Faso paint a rather gruesome picture. The country is among the worst affected by the human immuno-deficiency virus (HIV) infection in West Africa: in 2001, the adult infection rate was 6.5%. In general, Burkinabe women start their reproductive life early and continue childbearing until relatively late in life. The results of the 1998/99 Demographic and Health Survey (BFDHS-II) show that almost one in two women have already started childbearing by the age of 18 years. Among adolescents aged 15 – 19 years, about one quarter already had at least a child or were pregnant with their first child at the time of the survey. The total fertility rate was 4.1 children per woman in urban areas and 7.3 children per woman in rural areas. Moreover, contraceptive prevalence is very low among women of reproductive age in Burkina Faso. In 1999, nationwide, only 5.8 percent were currently using a method while in urban areas, the contraceptive prevalence was only 20.1%.

Against this background of poor reproductive health outcomes, the Burkinabe government is currently working with a number of national and international organizations to design and implement appropriate reproductive health interventions. One of such interventions is the Gold Circle initiative. The Gold Circle (GO) initiative is a quality improvement and promotion that the regional project Santé Familiale et Prévention du SIDA (SFPS) implemented between 1998 and 2002. The United States Agency for International Development (USAID) provided funding for the SFPS project and the Gold Circle initiative. The GO initiative sought to reward and to promote family

planning quality improvements in the four SFPS target countries: Burkina Faso, Cameroon, Côte d'Ivoire and Togo. A key objective of the initiative was to increase contraceptive use while fostering quality services.

This paper uses data from a 2001 survey to assess the effects of the GO initiative in Burkina Faso. An ideation model provides the background for the analyses and the primary analytic method was the propensity score matching (PSM) technique.

**The Gold Circle Initiative**

A detailed description of the GO initiative has been described elsewhere (Babalola et al., 2001). Suffice it however to say here that both the design and the implementation of the initiative have their premise on empirical data. Findings from a pre-intervention formative research served as a basis for the design of the GO initiative. The formative research sought to assess community definition of, and experience about family planning service quality. The formative research also explored providers' perceptions about the needs and expectations of clients, provider understanding of the importance of quality in service delivery. The study revealed that the community generally perceive quality in terms of good client-provider interactions, competent provider, affordable services, reasonable waiting time, met needs, and method availability.

Based on the results of the formative research, the GO initiative targets both the demand and the supply sides.

On the supply side, the initiative involves a certification process and the use of a quality of care diagnostic tool to determine the current level of quality of services provided in the clinics that routinely receive technical and other forms of assistance from the SFPS project. Using the diagnostic tool, program staff identified a number of sites that meet commonly agreed upon quality indicators and ascribed to them the status of GO site. The GO sites are further strengthened through staff training and the provision of relevant equipment and supplies to enable them provide better quality services. In Burkina Faso, forty clinics were selected and designated GO sites between 1998 and 2001.

On the demand side, the GO strategy involves the use of mass media and community activities to promote GO sites. The demand generation activities specifically seek to:

- empower clients and community to expect and demand certain quality standards from the clinic and providers;
- identify sites where services are available; and,
- increase the utilization of modern family planning methods and provide increased visibility to service delivery sites.

The initial launching of the GO initiative took place in 1998. Thereafter, the initiative was re-launched every year. Typically, the GO promotional activities included:

- Mass media materials including television and radio jingles;
- Printed materials including a logo featuring a smiling provider inside a gold circle, a Gold Circle advocacy tool, posters, a comic strip, and other promotional items (calendars, T-shirts, etc.);

- Community mobilization activities organized by Gold Circle committees (Quality Teams) made up of community members and clinic personnel.

The various promotional materials portray providers in GO sites as caring, knowledgeable, and ready to listen to their clients. Although campaign messages specifically promoted GO sites, they also encouraged people to visit the family planning clinics nearest to them.

In addition to the activities that directly promoted the GO initiative, the GO strategy also involved the development and distribution of four short radio and television programs about specific family planning methods. These infomercials were three to four minutes long and were developed to enhance access to information on methods, debunk myths and rumors about the methods and provide information on management of side effects. The four animated, method-specific infomercials covered condom, injectables, the pill and the range of methods available in GO and other family planning clinics. They were translated in local languages and were available and broadcast on TV and radio for the GO media campaign in Togo, Burkina Faso and Cameroon starting in the year 2000. The use of local languages such as Moore, Dioula, Pidgin, Ewe, and Kabiye helped to increase the reach of the GO campaign. Many national NGOs and SFPS partners received the video and audiocassettes to distribute to specific GO sites and Quality Teams for use in community outreach activities.

## DATA

The data that we analyze in this paper derive from a 2001 household survey. The survey targeted the 54 enumeration areas (EAs) that were covered during the 1998/99 BFDHS-II in two urban areas – Ouagadougou and Bobo-Dioulasso. The intention was to identify and revisit the households that were surveyed during the DHS. When a particular DHS household could not be located, it was replaced with another randomly selected household from the same EA. During the 1998/99 BFDHS-II, 1003 households (730 from Ouagadougou and 273 from Bobo-Dioulasso) were surveyed in the two study cities. During the 2001 survey, a total of 715 households were surveyed in Ouagadougou and 272 in Bobo-Dioulasso. Of these households, 74% in Ouagadougou and 55.5% in Bobo-Dioulasso had been surveyed during the DHS. In the selected households, all the women aged between 15 and 49 years old were targeted for interview. Overall, 1421 women (1042 in Ouagadougou and 379 in Bobo-Dioulasso) were interviewed through questionnaire. The Burkinabe Institut National des Statistiques et de la Démographie (INSD) coordinated the implementation of the survey on behalf of SFPS. The Johns Hopkins Bloomberg School of Public Health Center for Communication Programs (JHU/CCP) was responsible for the overall design of the survey and provided technical assistance at every stage of the design and implementation.

## METHODS

In this paper, we use a non-parametric propensity score matching (PSM) technique to evaluate the effects of the GO initiative on family planning ideational variables and contraceptive use. Introduced about two decades ago by Rosenbaum and Rubin (1983) the use of PSM is becoming increasing popular in impact evaluation (Cook

and Goldman, 1988; Gu and Rosenbaum, 1993; Connors et al., 1996; Heckman et al., 1998; Lechner, 1999; Dorsett, 2001; Purdon, 2002).

A key problem in assessing the effects of a program is that of missing data. While it is possible at a point in time to observe the choices people make and the outcome that result from such, it is not possible to observe what the resulting outcome would have been had they made an alternative choice. This is the counterfactual dilemma. For example, concerning program participation, the respondents in a survey can fall into either of two categories: participants or non-participants. While we know what the behavior of program participants is with respect to a particular outcome, it is not possible to know how they would have behaved had they not participated in the program. It is not possible to infer this missing information directly from the behavior of those that did not participate in the program since participants are very likely to be different in key socio-demographic and other characteristics from non-participants. In other words, there may be a selection problem in the data. Ignoring the potential selectivity bias may result in incorrect estimation of the impact of the program. Econometrics literature documents various procedures for addressing this type of problem. PSM is one of such methods.

As a program evaluation technique, PSM is based on the idea of comparing the outcomes of program participants with the outcomes of "equivalent" non-participants. Since the two groups are comparable on all observed characteristics with the exception of program participation, the differences in the outcomes are attributed to the program. Based on this logic, PSM allows evaluators to calculate the mean effect of treatment (program participation, campaign exposure, etc.) on the treated.

If $Y^1$ denotes the potential outcome conditional on participation and $Y^0$ denotes the potential outcome conditional on non-participation, the impact of program is given by:

$$\Delta = Y^1 - Y^0 \quad \text{.....1}$$

The mean effect of treatment on the treated is given by:

$$\Theta = E(\Delta \mid D=1, \mathbf{X})$$

$$= E(Y^1 - Y^0 \mid D = 1, \mathbf{X})$$

$$= E(Y^1 \mid D = 1, \mathbf{X}) - E(Y^0 \mid D = 1, \mathbf{X}) \quad \text{.....2}$$

where D = 1 denotes program participation (treatment) and **X** is a set of conditioning variables on which the subjects will be matched. Equation 2 would have been easy to estimate except for the quantity $E(Y^0 \mid D = 1, X)$. This is the mean of the counterfactual and denotes what the outcome would have been among participants had they not participated in the program. PSM provides a way of estimating this quantity.

To estimate the counterfactual, we have to assume that, conditional on observable characteristics, potential non-treatment outcome is independent of treatment participation. This is the Conditional Independence Assumption (CIA) or the ignorable treatment assignment assumption. This assumption requires a rich data set since we are in essence assuming that all the variables that influence treatment and outcome are observed. In other words, we assume that unobservables can be ignored since they do not affect both the outcome and the treatment. Given this assumption, after adjusting for observable differences, the mean of the no-treatment potential outcome for program participants is identical to that of non-participants. In other words, we can infer the participants'

counterfactual from non-participants' outcomes. This is however possible to the extent that there is an overlap between participants and non-participants characteristics (the common support condition).

A unique advantage of PSM is that instead of matching subjects on a vector of characteristics, we only need to match on a single item, the propensity score that measures the probability of participating in the program. Given that the Conditional Independence Assumption and the common support assumption hold, then we estimate the mean effect of the treatment through the mean difference in the outcomes of the matched pairs:

$$E[Y^0 \mid D = 1, P(X)] = E[Y^0 \mid D = 0, P(X)] \quad \text{.....3}$$

Equation 3 is applicable to single treatment programs where the treatment variable is a categorical variable that has only two mutually exclusive categories. However, the equation is easily generalizable to multiple treatment programs (Imbens, 2000; Lechner, 1999, 2001).

Let us consider a multiple treatment program that has K+1 potential mutually exclusive treatment outcomes, viz.: $Y^0$, $Y^1$, $Y^2$…. $Y^k$. For any individual, only one treatment outcome can be observed. In contrast, each individual now has K-1 counterfactuals that need to be estimated. The mean effect of treatment outcome k versus treatment outcome l is given as:

$$\theta^{k,l} = E(Y^k - Y^l \mid D = k) = E(Y^k \mid D = k) - E(Y^l \mid D = l)$$

where $D \in \{0, 1, \ldots K\}$ denotes the type of treatment.

Assuming that the Conditional Independence Assumption and the common support condition hold, to estimate the mean treatment effect of k versus l, we only need information from the sub-sample of participants in treatment outcomes k or l, and the propensity score conditional on being in treatment k or l. However, to obtain all the required propensity scores, we will need to model and estimate K(K-1)/2 conditional probabilities, one for each pair of possible treatment outcomes.

The campaign that we evaluate in this paper is similar to a multiple treatment program. It is possible for a person to be exposed to more than one of the campaign materials and activities. Preliminary analyses of the data (not shown) show that there is a dose-response relationship between campaign exposure and key behavioral and attitudinal variables. Specifically, while being exposed to either the GO promotional materials or the method infomercials makes some difference, what appears to be most effective is exposure to both types of materials. Therefore, we define our treatment variable as an ordinal variable with three categories, viz.: zero exposure, exposure to either type of materials (low exposure) and exposure to both types of materials (high exposure).

In the case of multiple-treatment programs, PSM literature suggests deriving participation propensity from a multinomial probit model or a series of simple probit models (reduced form approach). The latter solution considers participation at each of the possible levels compared to every other level (Bonjour et al., 2001). If there are K participation levels, then K(K-1)/2 models will be estimated. Lechner (2001) assesses the relative performance of the multinomial probit approach and the approach based on the series of simple probit modes. He concludes that while both approaches are comparable

in terms of performance, the approach based on a series of simple probit models is more robust since specification problems in one of the models will not compromise the others. Therefore, in this paper, we derived participation propensity through a series of simple probit models. Since our treatment variable has three categories (zero, low and high exposure) we estimated three models: (3X2)/2. The three models respectively compare zero exposure with low exposure, zero exposure with high exposure, and low exposure with high exposure.

Selecting which variables to include in the propensity score models is critical and many authors (e.g. Heckman et al., 1997) have stressed that omitting important variables can result in serious bias in the estimated propensities. Indeed, when any variable affecting both program participation and the outcome is excluded from the propensity models, the Conditional Independence Assumption is violated and the counterfactual cannot be inferred. The predictors that we include in the models estimating the propensity scores are those variables that have been known to affect both campaign exposure and contraceptive use. The predictors include place of residence, children-ever-born, current age, marital status, median exposure, education and religion.

The propensity scores were estimated using the PSCORE command in STATA. PSCORE not only estimates the propensity scores. it also matches the treated and the non-treated cases directly and verifies that the characteristics are balanced across the treatment and matched groups. The cases were matched using the stratification option. With this option, STATA classifies the cases into categories on the basis of their propensity score. Within each category, treated cases are matched with non-treated cases.

The common support condition was enforced and individuals for which no matches were found because their propensity scores were either too low or too high were discarded.

### Theoretical Model

We use an ideation framework to guide the analyses done in this paper. The ideation analytic framework incorporates constructs from leading behavior change theories. As an explanation of behavior change, ideation has its genesis in demographic literature where the concept first appears in the 1980s as an alternative to the classical demographic transition theory (Lesthaeghe, 1983; Cleland, 1985; Cleland and Wilson, 1987). The model attributes behavior change to change in the "ways of thinking" or value orientations (Kincaid, 2000a; Babalola et al., 2002; Bongaarts and Witkins, 1996). The change is facilitated intergenerationally through the child-rearing process and intragenerationally through the mass media and social interactions. The ideation framework is a predictive model that incorporates psychosocial predictors borrowed from leading behavior change theories.

The theoretical basis underlying the ideation model is that the factors reflecting a person's ways of thinking are the proximate determinants of behavior. Furthermore, the model assumes that the proximate ideational determinants mediate the behavioral impact of socio-demographic and contextual variables, including communication. (Kincaid, 2000a, 2000b; Babalola et al., 2002).

In analyzing the effects of the Gold Circle campaign, we first examine the effects of campaign exposure on pertinent ideational variables. Subsequently, we will look at the impact of the campaign on contraceptive use while controlling for the ideational

variables. The ideational variables that we examine are knowledge about contraceptive methods, personal approval of family planning, discussion of family planning with others, and personal advocacy in favor of family planning.

## RESULTS

In this section, we first examine campaign exposure and discuss the variables that predict exposure. Subsequently, we use propensity score matching to estimate the effects of the campaign on selected ideational variables and on contraceptive use.

### Campaign Exposure

Exposure to the campaign was very high. Almost four-fifths (78.7%) of the respondents reported having seen or heard at least one of the campaign materials and could recall the messages of the material. Overall, 8.8% could recall the GO promotional campaign messages alone, 17.0% recalled the infomercials alone while more than half (52.9%) recalled messages from both components of the campaign. Subsequently, in the analysis of the effects of the campaign, we will ascribe high exposure to the respondents that were exposed to both components of the campaign while we ascribe low exposure to those that were exposed to only one component.

The major sources of exposure to the campaign were the television (50.1%), radio (22.4%), print media (4.4%) and health facility (3.4%).

### The Propensity Scores

The campaign is a sort of multiple-treatment intervention in the sense that the audience could be exposed to more than one of the various components of the campaign. On the premise of possible dose-response effects of the campaign on family planning ideation and use, we estimated three sets of propensity scores to enable us compare a specific level of exposure with each of the two other levels: zero exposure versus low exposure, zero exposure versus high exposure, and low exposure versus high exposure. To estimate each set of propensity scores, we predicted campaign exposure from eight variables that are susceptible to influence campaign exposure as well as family planning

**Table 1: Results of the probit regression of specifc levels of campaign exposure on selected socio-demographic variables, Burkina Faso, 2001**

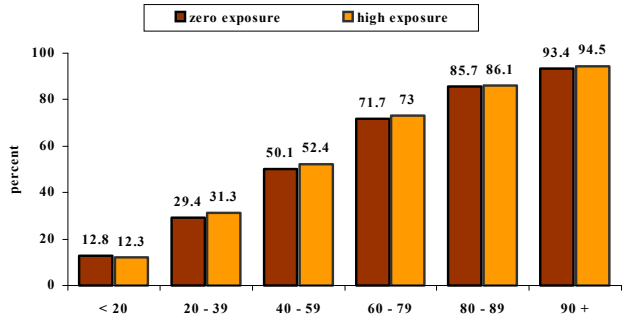
| Predictors | Low vs. Zero Exposure | High vs. Low Exposure | High vs. Zero Exposure |
|---|---|---|---|
| Place of Residence | | | |
| Ouagadougou (RC) | 0.0 | 0.0 | 0.0 |
| Bobo-Dioulasso | 0.199‡ | 0.219* | 0.281** |
| Current age | | | |
| 15 – 24 (RC) | 0.0 | 0.0 | 0.0 |
| 25 – 34 | 0.196 | 0.204‡ | 0.480*** |
| 35 – 44 | 0.164 | 0.001 | 0.422** |
| 45 + | -0.018 | -0.124 | -0.085 |
| Marital States | | | |
| Never married (RC) | 0.0 | 0.0 | 0.0 |
| Ever married | -0.068 | 0.064 | -0.113 |
| Listens to the radio regularly at least once a week | 0.871*** | -0.059 | 0.687*** |
| Watches television regularly at least once a week | 0.146 | 0.870*** | 0.914*** |
| Read magazine/newspaper at least once a month | -0.012 | 0.032 | 0.058 |
| Religion | | | |
| Moslem and others (RC) | 0.0 | 0.0 | 0.0 |
| Christian | 0.247* | 0.122 | 0.296** |
| Education | | | |
| None (RC) | 0.0 | 0.0 | 0.0 |
| Primary or more | 0.531*** | 0.533*** | 0.970*** |
| **Pseudo-$R^2$ (percent explained)** | 12.3 | 11.5 | 31.6 |
| **Hosmer-Lemeshow $X^2$ (10 groups)/p** | 4.0 / 0.859 | 11.8 / 0.161 | 7.4 / 0.497 |
| **Number of observations** | 670 | 1118 | 1054 |
| **Range of predicted propensity score (common support)** | 0.1508 – 0.8870 | 0.2212 – 0.8995 | 0.0531 – 0.9879 |

Source: SFPS/JHU/CCP/ Burkina Faso GO Evaluation Survey, 2001
*** p≤0.001; ** p≤0.01; * p≤0.05; ‡p≤0.1

ideation and use. The predictors include education, current place of residence, current age, marital status, religion, television viewing habits, radio listening habits, and newspaper/magazine reading habits using probit regression. The results of the probit models are presented on Table 1.

The estimated models fit the data relatively well as indicated by the Hosmer-Lemeshow goodness of fit statistics. The results show that the key predictors of campaign exposure are radio listening habits, television viewing habits, formal education and place of residence during childhood. In addition, the results show some differences in the predictors of the various levels of campaign exposure. For example, whereas regular radio viewing and Christian religious affiliation predict the probability of being exposed to the campaign in any way, the variables are not associated with increased level of exposure. In contrast, television viewing and place of residence predict high exposure but not low exposure.

**Figure 1:** Mean propensity score by level of campaign recall and propensity score strata - Respondents with zero or high exposure only, Burkina Faso, 2001




*Source: JHU/CCP/SFPS GO Evaluation Survey, Burkina Faso, 2001* n=546

We used the results from the probit models to estimate, for each respondent, the propensity score, that is, the probability of reporting a specific level of campaign exposure. Based on the propensity scores, we stratified all the observations included in the regression into strata (blocks). The stratification was done in such a way that, within

each block, the mean propensity scores for the treated (exposed) and the controls (unexposed) were not statistically different (see, for example, Figure 1 that compares the respondents with high exposure and their peers with zero exposure). Not only does the stratification process ensure that the mean propensity scores are not statistically different for the treated and the controls in each block, it also ensures that on each of the eight variables used to compute the propensity scores, the treated and the controls were statistically identical. In other words, the balancing property is satisfied and the resulting estimated are not biased. Through this process, we ended up with six blocks for the high versus zero exposure pair, six blocks for the low exposure versus high exposure pair, and five blocks for the low versus zero exposure pair. We used the common support option and discarded the controls for which no matching treated could be found because their propensity score fell outside of the common support. This resulted only in minimal loss of observations: 7 in the case of high exposure versus zero exposure, 1 in the case of high exposure versus low exposure and 2 in the case of low exposure versus zero exposure.

**Campaign exposure and ideation**

We hypothesize that the campaign affects ideational variables and use propensity score matching technique to assess the effects of campaign exposure on each of the ideational variables.

To assess the effects of campaign exposure on ideational variables, we compare the outcome between the respondents that were exposed (treated) and those that were not exposed (controls). The key measure of impact is the average treatment effects, which is a weighted average of the difference in the outcome variable between treated and controls

across propensity score blocks. We discuss the findings relative to each of the ideational variables in the following paragraphs.

Campaign and knowledge about family planning methods

On average, the number of modern contraceptive methods reportedly known by the respondents is 5.5. The data show that knowledge about contraceptive methods increases by campaign exposure: 4.1 among the respondents with no campaign exposure, 5.1 among those with low exposure, and 6.2 among the respondents with high exposure. The observed increase in knowledge from one level of campaign exposure to the next is consistently significant suggesting a dose-response relationship (Table 2). The PSM-adjusted effects confirm the dose-response relationship but also indicate that some of the differences in contraceptive knowledge are due to pre-existing differences among the campaign exposure categories. For example, while the data indicate that even a low level of campaign exposure has led to a significant increase in contraceptive knowledge, about 20% of the raw effects is due to pre-existing differences between the respondents with zero exposure and those with low exposure.

Personal Approval of Family Planning

The data indicate a high level of approval of family planning among the study population: 87.2% of the respondents reported personal approval of family planning. The raw differences in approval by campaign exposure are such that the higher the level of exposure the more widespread the approval. When we adjust for pre-existing differences through propensity scores, the raw effects of low exposure relative to zero exposure are

considerably reduced. Indeed, the data show that adjusting for pre-existing characteristics through PSM reduces the magnitude of the effects of low exposure on family planning approval by about 25%. The data also show that about a third (33.5%) of the raw effects of high exposure relative to zero exposure is attributable to factors external to the

**Table 2: Raw and adjusted effects of campaign exposure on selected ideational variables – Burkina Faso, 2001**

| Effects | Low vs. Zero | High vs. Low | High vs. Zero |
|---|---|---|---|
| Number of modern methods known | | | |
| Raw effects[1] | 1.0*** | 1.1*** | 2.0*** |
| PSM-adjusted effects (ATT)[2] | 0.8*** | 0.9*** | 1.9*** |
| Approval of family planning (percentage points) | | | |
| Raw effects[1] | 11.1*** | 8.6*** | 19.7*** |
| PSM-adjusted effects (ATT)[2] | 8.4** | 8.2** | 13.1*** |
| Personal advocacy in favor of family planning (percentage points) | | | |
| Raw effects[1] | 16.6*** | 29.4*** | 46.1*** |
| PSM-adjusted effects (ATT)[2] | 12.1*** | 24.4*** | 35.0*** |
| Discussion about family planning (percentage points) | | | |
| Raw effects[1] | 16.3*** | 22.8*** | 39.2*** |
| PSM-adjusted effects (ATT)[2] | 13.7*** | 18.2*** | 31.1*** |

Notes:
[1]The observed difference in the relevant ideational variable between the respondents in the higher exposure category compared to those in the lower exposure category
[2]Indicate how being in the higher exposure category affects ideational variable compared to being in the lower exposure category.
*** p≤0.001; ** p≤0.01; *p≤0.05

campaign. In contrast, propensity score adjustments results in little change in the effects of high exposure relative to low exposure, indicating that the difference in family planning approval between the two groups has little to do with pre-existing characteristics.

Personal advocacy in favor of family planning

For each pair-wise comparison of campaign exposure level, the adjusted effects are smaller than the raw effects. For example, the data indicate that about one-quarter

(24.7%) of the raw effects of low exposure relative to zero exposure are due to pre-existing characteristics. Nonetheless, the adjusted effects are consistently significant indicating that the campaign has helped to increase the number of people that encourage others to practice family planning.

Discussion about family planning

As with the other three ideational variables, the effects of the campaign remain strong after adjusting for pre-existing characteristics through propensity score. Although the data indicate that part of the raw effects of the campaign is attributable to pre-existing differences in socio-demographic characteristics among the various campaign exposure groups, the campaign clearly has a significant graduated impact on discussion about family planning.

### Campaign exposure and contraceptive use

The data show that, overall, about one quarter (25.6%) of the respondents were currently using a modern contraceptive method. Contraceptive prevalence increased monotonically with campaign exposure: 9.3% of the respondents with zero exposure,

**Table 3: Estimated effects of campaign exposure on current use of modern contraceptive methods – Burkina Faso, 2001**

| Effects | Low vs, Zero | High vs. Low | High vs. Zero |
|---|---|---|---|
| Raw effects[1] | 10.4*** | 15.7*** | 26.0*** |
| PSM-adjusted effects (ATT)[2] | 7.3* | 13.2*** | 21.8*** |

Notes:
[1]The observed difference in contraceptive prevalence between the respondents in the higher exposure category compared to those in the lower exposure category
[2]Indicate how being in the higher exposure category affects contraceptive use compared to being in the lower exposure category after adjustment through propensity score.
*** p≤0.001; ** p≤0.01; *p≤0.05

19.6% of those with low exposure and 35.2% of those with high exposure reported

current use of modern methods. The observed dose-response relationship may reflect the effects of the campaign on contraceptive use but it could also result from the influence of

**Table 3: Results (odds ratio) of the logistic regression of current use of modern method on campaign exposure, propensity score and selected ideational variables, Burkina Faso, 2001**

| **Socio-demographic Predictors** | **Odds Ratio** | | |
|---|---|---|---|
| | Low vs. Zero | High vs. Low | High vs. Zero |
| Personal approval of family planning | 2.02‡ | 1.69‡ | 1.31 |
| Personal advocacy in favor of family planning | 1.55‡ | 2.01*** | 2.17*** |
| Number of modern methods known | 1.11 | 1.15** | 1.25*** |
| Discussed family planning with someone during the past year | 2.13** | 1.65** | 1.82*** |
| Propensity score | 1.11 | 1.01 | 1.03 |
| Campaign Exposure | 1.58‡ | 1.42* | 1.98** |
| **Pseudo-$R^2$ (percent explained)** | 9.8% | 8.6% | 15.5% |
| **Goodness of Fit $X^2$/p** | 256.3 / 0.104 | 268.6 / 0.508 | 261.8 / 0.824 |
| **Number of observations** | 670 | 1112 | 1054 |

Source: SFPS/JHU/CCP/ Burkina Faso GO Evaluation Survey, 2001
*** p≤0.001; ** p≤0.01; * p≤0.05; ‡p≤0.1

contraceptive use on campaign exposure (reverse causation) or an external factor that influences both contraceptive use and campaign exposure. We therefore use propensity score to control for confounding pre-existing characteristics. The propensity scores were derived from the models described above. The raw and adjusted effects are displayed on Table 3.

The adjusted effects confirmed that the campaign had a graduated, dose-response effect on contraceptive use: the higher the level of exposure, the greater the gain in contraceptive use. We observe that even a low level of campaign exposure resulted in a significant increase in contraceptive use. The data further showed contraceptive use among the respondents with low campaign exposure would have increased by 13.2 percentage points had they experienced high exposure. Similarly, high exposure increased contraceptive use by more than 21.8 percentage points compared to zero exposure.

A unique advantage of propensity score matching is that it adjusts for pre-existing socio-demographic characteristics that predict campaign exposure and that are susceptible to influence contraceptive use. It ensures that the two groups being examined are comparable with respect to the pre-existing socio-demographic characteristics thereby helping to reduce the bias due to selectivity. Nonetheless, socio-demographic variables are not the only factors influencing contraceptive use. Our theoretical framework posits that communication influences contraceptive use directly but also indirectly through its intermediate effects on ideation. There is considerable empirical evidence to show that ideational variables are strong proximate determinants of contraceptive use (Kincaid, 2000a, 2000b; Babalola et al., 2001). Failure to take ideational variables into consideration in the estimation of the effects of the campaign may result in incorrect attribution of effects. We therefore included the propensity score quintile as a covariate in a logistic regression that assesses the impact of campaign exposure on contraceptive use while controlling for ideational variables. The socio-demographic variables used to predict the propensity score were excluded from the estimated model. The inclusion of the propensity score in the estimated logistic models helps to account for selectivity on the measured socio-demographic covariates. Moreover, the final model is much simpler than if we had included the eleven socio-demographic variables. Again, three separate models were estimated to account for the multiple-treatment nature of the campaign and the results are presented on Table 4.

The analyses show that personal approval of family planning does not have independent effects on contraceptive use. In contrast, personal advocacy in favor of family planning, knowledge about contraceptive use and discussion of family planning

show the expected relationship with contraceptive use. The analyses further reveal that in the presence of ideational variables and the propensity for campaign exposure, low campaign exposure is not associated with significant increase in contraceptive use compared with zero exposure. In contrast, a high level of exposure makes a significant difference compared with zero exposure or low exposure. In other words, it appears that what makes a significant difference for contraceptive use is considerable exposure to the campaign. This finding is in consonance with what previous studies on the impact of communication intervention have found.

**Discussion**

This paper examined the effects of a behavior change communication program on contraceptive use in Burkina Faso. The data showed that the dual-component campaign reached more than three-quarters of the target audience with messages promoting family planning and modern contraceptive methods. This testifies to the importance of communication programs that allow the audience to receive consistent messages from a variety of sources.

The findings show that there is a dose-response relationship between the campaign and selected ideational variables that are susceptible to influence contraceptive. Adjusting for pre-existing socio-demographic characteristics through propensity score matching reduces the magnitude of the raw effects of the campaign on each of the ideational variables that we considered. However, the residual effects remain significant in all cases.

The propensity score analyses further show that the campaign has a graduated significant impact on contraceptive use. Even a low level of exposure to the campaign resulted in some increase in contraceptive use while high level of exposure has a considerable impact. The findings suggest that it is possible to change behavior through appropriately designed communication interventions.

A serious issue in ascribing causal effects using observational data (that is, data not derived from randomized experiments) is the counterfactual problem. PSM technique addresses this problem by creating groups of treated and untreated individuals that are statistically equivalent on a set of background characteristics. The method presents considerable advantage over standard statistical methods that control for background variables, such as linear and logistic regression, for two distinct reasons. First, it reduces a set of background variables to a single "composite" score that appropriately summarizes the variables. This reduction in dimensionality makes it easy to see the extent to which treated and untreated groups overlap on background variables. Given such overlap, PSM allow straightforward estimation of treatment effects. Second, unlike regression models, in estimating treatment effects, PSM does not rely on any particular functional form for the relationship between the outcome and the predictor within each treatment group.

However, our study has its limitations. First, estimates from PSM rely on the conditional independence or ignorable treatment assignment assumption. In other words, we assume that there are no important variables predicting campaign exposure that we left out of the model used to predict the propensity scores. It is possible that some important predictors of campaign exposure were unmeasured in our study and therefore excluded from the model. For example, use of health facilities and life goals (aspirations)

were unmeasured variables that could have influenced campaign exposure. If such variables also predict our outcome variables (contraceptive use and ideation), our estimates might be biased. However, if the omitted variables are correlated with the predictors included in the model, their omission is not likely to represent a serious problem (Perkins, et al., 2000).

The extent to which unobserved variables are a threat to the validity of the results from propensity score matching can be assessed using sensitivity analysis (Rosenbaum and Rubin, 1983a; Connors etal. 1996; Lin, et al., 1998; Christakis and Iwashyna, 2003). There are many ways of assessing sensitivity to unmeasured variables (Connors etal. 1996). The approach we adopt in this paper involves estimating the effects of the campaign when specific predictors are excluded from the model used to estimate the propensity score. The strongest predictors of campaign exposure that are also associated with contraceptive use are regular radio listening, regular television viewing, education and current age. When we excluded regular television viewing, the estimated effects of high exposure compared to zero exposure on contraceptive use changed insignificantly by 6.8%. Excluding regular radio listening changed the estimated effects by 3.2% while excluding education changed the effects by 5.0%. We obtained similarly insignificant results when we focused on the effects of high exposure compared to low exposure. In other words, our sensitivity analyses suggest that to bias the measured effect of the campaign, an unmeasured variable would need to have a more powerful effect on campaign exposure than any of the variables that we measured.

Another limitation of our study is that in order to take the influence of ideation into consideration in our assessment of the effects of the campaign on contraceptive use,

we estimated a logistic regression model that controls for propensity score and the ideational variables. Due to the relatively small number of covariates, this model allows us to perform diagnostic checks on the fit of the model more reliably than if we had included the array of socio-demographic variables that were used to predict the propensity score. Moreover, since the sample on which the model is estimated includes only matched treated and untreated groups, we are confident that there is adequate overlap in the pre-existing characteristics of the two groups and that we can draw causal inferences from the model. Nonetheless, there is a problem with using propensity score in this manner. Introducing propensity score in a regression model brings us back to the problem of dimensionality that the propensity score matching method seeks to avoid. Moreover, Rubin (1973, 1979) has warned that regression adjustment using propensity score can lead to increased bias in the estimates if the treated and the untreated groups are of unequal variance.

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