Tulane University

Department of International Health and Development

Measuring the Cost-Effectiveness of a National Health Communication Program in Rural Bangladesh

Paul Hutchinson*
Peter Lance**
David Guilkey**
Mohammad Shahjahan***
Shahida Haque***

Working Papers in
International Health and Development

No. 6

2005

* Department of International Health and Development, Tulane University
** Carolina Population Center, University of North Carolina
*** Bangladesh Center for Communication Programs

The Working Papers in International Health and Development Series

The *Working Papers in International Health and Development* aim to provide limited but speedy circulation of recent research by Faculty members of Tulane's Department of International Health and Development. To facilitate rapid circulation of new research findings, papers in the series are released as-is, without editing. Papers released in the series are intended for subsequent publication in peer-reviewed journals.

Suggested Citation Format for IHD Working Papers:

Plautz, Andrea, Dominique Meekers, and Gabriela Escudero. 2005. Trends in HIV/AIDS Prevention, Family Planning, and Antenatal Care in Nigeria. Working Papers in International Health and Development, No.2. New Orleans: Department of International Health and Development, Tulane University.

Acknowledgements

The study was funded by the United States Agency for International Development (USAID) through the Health Communication Partnership and under the terms of Cooperative Agreement No. GPH-A-00-02-00008-00. The authors are grateful to Jane Bertrand and David Bishai for comments and suggestions. An abbreviated version of this paper was presented at the Cost-Effectiveness Analysis (CEA) for Behavior Change Communication Programs Expert Meeting, organized by the Health Communication Partnership, and held in Baltimore, MD, on March 17, 2005.

Abstract

This paper examines the cost-effectiveness of the Smiling Sun multi-channel media campaign, which was undertaken in Bangladesh during the period 2001-2003 and involved a nationally broadcast television serial drama supported by radio, television, newspaper and billboard advertisements and local promotion activities. The goal was to encourage the use of a package of family health services at NGO Service Delivery Program (NSDP) providers. This analysis relates the costs of the Smiling Sun campaign at the national and local level to measures of change in the use of health services, namely antenatal care, iron supplementation during pregnancy and childhood immunizations. Effectiveness is measured using an (approximately) pre- and post-campaign research design with data from cross-sectional surveys conducted in 2001 and 2003 in NSDP catchment areas in rural Bangladesh. Bi-probit specifications are used to control for non-random exposure to the program's media messages, advertisements and signs.

Measuring the Cost-Effectiveness of a National Health Communication Program in Rural Bangladesh

Background

Communication programs have become integral components of many prevention and health promotion activities (Piotrow et al 1997, U.S. DHHS 2000). Most, if not all, family planning programs include a communication component, a significant change from the situation of the late 1960s and early 1970s (MEASURE *Evaluation* and Population Communication Services Project 2002). In the United States, communication activities have influenced the social climate, altering norms of behavior, particularly with regard to smoking, cancer screening, seatbelt usage, and diet (U.S. DHHS 2000). Mass media campaigns have also shaped perceptions, knowledge, and awareness of HIV/AIDS and methods for prevention and treatment, in the process helping to slow, and in some cases reverse, the momentum of the epidemic (UNAIDS 2004).

Measuring the effectiveness of communication programs has been problematic, since attribution of responsibility for changes in knowledge, attitudes, beliefs, values and behaviors can be hampered by a variety of factors. Often, evaluations of communication programs have relied upon post-only research designs, eliminating the possibility of measuring changes across time. Even with pre-/post-evaluation designs, however, researchers frequently must contend with the absence of control groups of unexposed individuals, since precluding exposure is either impractical or undesirable. Even when it is possible, it generally risky to assume that unexposed individuals represent a statistically valid control for exposed individuals (Bertrand and Kincaid 1996, Piotrow et al 1997. MEASURE *Evaluation* and Population Communication Services Project 2002).

When communication activities are national in scope, precluding the possibility of experimental research designs involving randomization of individuals into those exposed and not exposed to a campaign, more complex statistical methods are generally required to determine effectiveness. Multivariate regression techniques using statistical controls for measured differences in the characteristics of those exposed and not exposed are often employed as a first step in measuring communication effectiveness. However, evaluations of effectiveness that rely on self-reported measures of exposure can be severely biased if unmeasured differences - motivations, attitudes, access, health competency, etc. – are correlated with both exposure and the outcome of interest (Belmont Report 2003; Bertrand, Kincaid and Babalola 2004). Different statistical methods are available to control for non-random exposure to communication programs, though their applicability depends upon the type of data collected to evaluate the program – post-only cross sectional surveys, pre- and post-cross sectional surveys, or longitudinal (panel) surveys (Moffitt 1991, Piotrow et al 1997, Guilkey, Hutchinson and Lance 2005).

While it is often reported that specific communication programs contributed significantly to changes in beliefs, attitudes and behaviors, their cost-effectiveness is rarely addressed (i.e. whether these programs led to changes with fewer financial resources per unit of change than other interventions). Studies considering the cost-effectiveness of national

multi-media communication activities have largely focused on a few areas: family planning, HIV/AIDS and tobacco control (Hutchinson and Wheeler 2005). Most have concluded that communication programs are in fact cost-effective relative to the obvious alternatives: few other mechanisms exist to reach national populations with as few resources as TV or radio spots. Even so, such findings may reflect inherent biases of the researchers, often communication specialists themselves, or of the peer-review process, in which non-statistically significant results, or in this case non-cost-effective results, are less likely to appear in the published literature.

The comparative dearth of cost-effectiveness studies also reflects the aforementioned difficulties determining effectiveness. For instance, costing methodologies for health (particularly family planning and primary health) interventions have received considerably more attention (Creese and Parker 1994, Janowitz and Bratt 1994, World Bank 1993). The studies of the cost-effectiveness of communication programs that have been carried out are often vague in terms of their descriptions of which costs are included or excluded, the methods used to annualize costs and distribute shared costs, or even the sources of the cost data themselves (Hutchinson and Wheeler 2005).

In this paper, we examine the cost-effectiveness of the Smiling Sun communication program in Bangladesh, a multi-channel campaign launched in 2001 to promote NGO clinic services in urban and rural areas. The campaign involved two components, the 'Branding' and 'Health Category' campaigns, which were, respectively, developed and implemented to establish the Smiling Sun symbol and disseminate important health-related messages. The Smiling Sun logo was intended to convey the message, "Come for health care with your whole family" and to brand health services at the *Paribarik Shastha Clinics* (Family Health Clinics) operated by the NGO Service Delivery Program.[1] The Smiling Sun logo was to be associated with high quality health services and information that could be trusted and was delivered with a smile in a friendly, caring atmosphere. Signboards with the Smiling Sun logo were to be posted at all static (fixed site) clinics, satellite (mobile) clinics, and depotholder (sellers of family planning supplies and ORS) locations (BCCP 2002, 2003).

The campaign program was implemented at the national, community and local levels. Specific activities included a 26-episode television drama serial 'Eyi Megh Eyi Roudro' ("Now cloud, now sunshine"), television advertisements, radio spots, posters, billboards, press ads in daily newspapers and local publicity efforts. 'Eyi Megh Eyi Roudro' was aired on BTV from August 2001 through March 2002. The serial, written by well-known playwright Humayun Ahmed and containing recognized television actors, focused on the daily lives of urban and rural Bangladeshis and blended into the drama health themes related to maternal and child health, family planning, and communicable disease control. Each episode was followed by discussion and a quiz show with prizes that involved over

[1] Until 2002, the Smiling Sun logo was used to promote health services of the National Integrated Population and Health Program, which was divided into a rural component – the Rural Service Delivery Partnership (RSDP) and an urban component – the Urban Family Health Partnership (UFHP). The separate components were led by Pathfinder International and John Snow International respectively. In 2002, the program was combined under the leadership of Pathfinder International.

800,000 participants (BCCP 2002, 2003). The program was supported by the Ministry of Health and Family Welfare and the Johns Hopkins University Center for Communication Programs and funded by USAID.

The serial drama covered a variety of health topics related to issues commonly confronting the public. In various episodes, parents were taught to recognize the signs and symptoms of Acute Respiratory Infections (ARI) and diarrhea and to take their children to the clinic for treatment when such danger signs appeared. They were also advised to follow the recommended schedule of childhood immunizations. Maternal health topics focused on the use of antenatal care, postnatal care and tetanus toxoid vaccinations. Mothers were told to seek antenatal care on learning of a pregnancy, to visit a clinic at least once every three months, to ensure that they received a full set of TT injections and to visit the clinic within two weeks after delivery. Family planning topics focused on delaying marriage and pregnancy, the benefits of female education and family planning options over the long-term. Issues of communicable disease control touched on HIV/AIDS and sexually transmitted infections (STIs) (BCCP 2002).

Commercials were televised nationally through Bangladesh Television (BTV), as well as private channels such as ETV, ATN and Channel-*I*, and aired through Radio Metro Wave. Television and radio spots on the various health topics were aired on national and private channels in order to insure a far-reaching effect.

The serial drama and the Smiling Sun campaign were supported at the community and clinic level by advocacy, interpersonal communication, group meetings, loudspeaker announcements and colorful rallies. The logo was displayed on all NGO project clinics, satellite clinics, depot holder homes and directional signs. Billboards were also placed along major highways and thoroughfares.

The Smiling Sun campaign has been the subject of previous evaluation efforts (BCCP and ACNielsen Bangladesh 2003). In April and May 2002, immediately following the airing of the serial drama, a nationally representative population-based survey of 2,010 women aged 15-49 years and 2,010 men married to women 15-49 years was conducted to measure awareness and branding of the Smiling Sun logo, audience receptivity to the serial drama and the extent of knowledge, attitudes, and behavioral changes in the wake of the serial drama and campaign. The survey found that approximately 16 percent of rural residents and 37 percent of urban residents had watched the drama. Spontaneous recognition of the Smiling Sun logo, however, was low – only 16 percent of viewers and non-viewers recognized the logo. Among rural residents, the most common mediums for encountering the Smiling Sun logo were the drama serial 'Eyi Megh Eyi Roudro' (40 percent), billboards (33 percent), newspapers (9 percent), ETV (4 percent) and television advertisements (1 percent). The evaluation found positive associations between viewership of the serial drama, awareness of the Smiling Sun logo and measures of health knowledge and health practices, including the practice of family planning. Even so, the evaluation could not ascertain causality. The research design involved a post-only evaluation – rather than a pre- and post-evaluation design – and no statistical controls

were undertaken to address non-random reporting of exposure to the serial drama or the Smiling Sun logo.

This analysis builds on these previous efforts. It measures effectiveness, in the process explicitly statistically controlling for the possible endogeneity of reporting of exposure. To evaluate the cost-effectiveness of the Smiling Sun campaign, we link measures of exposure to the program (self-reports of having seen the Smiling Sun in the television drama and advertisements, on billboards, posters, brochures and clinic signs or elsewhere) to measures of campaign costs (development, production, airing of messages, print media, and local promotion activities). To control for possible non-random exposure to the campaign, we treat exposure to the Smiling Sun logo as an endogenous variable determined by a set of socio-demographic factors and by ownership of different media – radios and television – and by local NGO expenditures on promotion activities and signs.

Data

Our data come from two sources: (1) cost data for the development, production, implementation and promotion of the Smiling Sun campaign for the period 2000 to 2003 and (2) population-based household surveys of reproductive age women conducted in 2001 and 2003 in rural areas of Bangladesh.

(1) Cost Data on Program Inputs

Cost data were collected by the Bangladesh Center for Communications Programs for program inputs at the national, NGO and local levels. At the national level, costs included those for project development and management (Table 1). Key development costs included: (1) development, production, placement and maintenance of billboards; (2) development, production and media placement of radio spots; (3) development and production of TV spots and the drama serial; (4) airing of TV spots; (5) production and (6) distribution of IEC print materials; and (7) press and other media activities. Over the life of the project, development costs were the predominant costs- approximately 99 percent of the total. Staff salaries constituted only a minor part of total costs. Costs of technical assistance from expatriate staff are not included in these figures.

At the national level, the total cost of the Smiling Sun campaign over the period 2001/02 to 2003/04 was Taka 49 million (US$832,000). Campaign costs were heavily front-loaded towards development and production of TV spots, billboards and IEC materials: fully two-thirds of the national costs occurred in 2001/02. Airing of the TV serial and advertisements largely occurred during this period; 84 percent of the costs of airing the TV spots occurred in 2001/02. Billboard costs were also substantial, approximately Taka 15 million in 2001/02 and 9 million in 2003/04. Campaign costs in 2002/03 were considerably smaller than in other years, only 6.4 percent of the total. Staff salaries were a small portion of total costs in all years.

Table 1 here

Developing and producing billboards were the largest overall activities (Table 2), representing approximately 54 percent of all development costs. The costs of airing the TV serial and advertisements were approximately one-third of development costs – 41 percent in 2001/02 but only 13.5 percent in 2003/04. In later years, when the costs of airing the TV serial drama and spots diminished, the share attributable to billboards increased (74 percent in 2003/04). The costs of the radio spots were less than 1 percent of campaign costs in all years.

Table 2 here

In addition to national level activities, the Smiling Sun campaign was supported by local activities undertaken in 8 regions by the 41 NGOs that comprise the NSDP. Because systems to report the local cost components of the BCCP Smiling Sun campaign to the central level did not exist, cost data collection was done retrospectively and involved visits to specific NGOs and static clinics by staff members of the Bangladesh Center for Communications Programs. Cost information was compiled at the clinic level from receipts, financial records and management information systems. The collection of financial information at the clinic level took approximately one half to one-day of staff time per clinic, including travel**.** Cost data collection occurred during the period November 2004 to February 2005.

Because of the difficulty of compiling cost data from sources at clinics and NGOs, local cost data collection was restricted to NGOs and clinics in Dhaka division, where the largest concentration of project activities occurred. Overall, cost data were collected at 105 static clinics (roughly evenly divided between urban and rural areas). These were run by 23 different NGOs. For this analysis, data are used only from the rural cost sample, largely because linking the cost information with the specific enumeration areas in the household survey could be performed more easily in the rural setting.

The specific items for which cost information was collected include the following:

- Static clinic indication signs and spot signboards
- Satellite clinic indication signs and spot signboards
- Depotholder indication signs and spot signboards
- NGO HQ indication signs and spot signboards
- Plastic and Steel frame signboards
- Semi-signboards
- Repairing costs of all signboards
- Costs for behavior change communication (BCC) meetings
- Other BCC activities (including rallies)

The means and standard deviations of these costs for the Static Clinics serving the survey enumeration areas are presented in Table 3.

Table 3 here

(2) 2001 and 2003NSDP Evaluation Surveys

The 2001 RSDP Evaluation Survey and the 2003 Rural NGO Service Delivery Partnership (NSDP) Survey were intended to measure awareness and use of RSDP/NSDP health services among women age 10 to 49 years. The surveys were conducted in areas that were reportedly covered by the NSDP project and in proximate, often contiguous, areas that were intended to be similar in demographic and socioeconomic characteristics but not defined as project catchment areas (and hence could provide a comparison sample for the purpose of assessing the project's impact).

In each survey, a two-stage cluster sampling procedure was used. The 2001 RSDP Evaluation Survey used the sample frame from the 1998 Baseline Survey of the RSDP project, which collected information on 47,000 women in project and non-project areas. The sample frame consisted of project catchment areas, or project clusters, in which the population of each cluster was defined as the number of eligible married couples of reproductive age. In 1998 (but not 2001 or 2003), survey designers wished to obtain estimates of indicators for each of the project's 23 NGOs. As a result, the sample size in that year was substantially larger than in subsequent years.

The 1998 sample was stratified by NGO, and within each stratum, clusters were chosen with probability proportional to the number of eligible couples. Households were selected systematically in each cluster. For every selected cluster, 150 to 350 households were listed, proceeding from the northwest corner of the area. Following that, 35 to 38 households were systematically selected, with the expectation that at least 30 eligible women (ever married aged 10 to 49 years) would be found for interview.

The 2001 and 2003 Surveys used the same sample frame as in 1998 but with the addition of clusters into which the project had expanded since the baseline and the removal of clusters in which the project had ceased operation. Just prior to the 2001 Survey, one of the principal NGOs, BRAC, withdrew from the project. Catchment areas covered by BRAC were still included in the sample since the purpose of the Survey was to measure the impact of the program at that point in time. BRAC clusters were excluded from the sample for the 2003 Survey. Additional clusters were added in the 2003 Survey to account for further expansion of the project.

The 2001 and 2003 Surveys were intended to be representative nationally and in terms of the six divisions in which the project operated. The sample domains for the 2001 and 2003 Surveys were therefore: project and non-project areas and Dhaka, Chittagong, Sylhet, Khulna, Barisal and Rajshahi divisions. Because the project operated in only a few clusters in Barisal, this domain was combined with Khulna division. The distribution of division populations was used to allocate the number of clusters by NGO for each.

Fieldwork was carried out by the Dhaka-based Associates for Community and Population Research (ACPR). It occurred between July and September in 2001 and June and September in 2003. The similar timing limits the role that seasonal factors could play in driving differences in indicators over time.

In 2001, interviews were conducted with 9,625 women in project areas and 1,322 women in non-project areas. In 2003, 7,507 project women and 4,372 non-project women were interviewed. Since the purpose of this analysis is to evaluate the effectiveness of the Smiling Sun campaign on the use of NSDP services, we restrict our analysis only to the sample of women in project areas.[2]

In order to evaluate the effectiveness of the Smiling Sun campaign in encouraging the utilization of health services, we examine changes in the use of four health services[3] during the period 2001-2003:

- antenatal care during pregnancy
- iron supplementation during pregnancy
- DPT3 vaccinations among children 12-35 months of age
- measles vaccinations among children 12-35 months of age

For the latter four outcomes, we use data on children born in the five years preceding the survey. This sample includes 6,618 and 4,812 children respectively in 2001 and 2003 for the full rural sample. The sub-sample for which local cost information is available includes 827 children in 2001 and 723 children in 2003. To examine use of childhood vaccinations, we further restrict our sample in several estimations to children 12 to 35 months of age, of which there are 337 in 2001 and 278 in 2003 for the sub-sample and . The means and standard deviations of the health services utilization variables and selected background characteristics are presented in Tables 4 and 5.

Table 4 here

Table 5 here

To gauge awareness of project services, women were asked whether or not they had ever seen the Smiling Sun logo. If they had seen the Smiling Sun logo, they were then asked where they had seen the logo: on television in an advertisement, on television in a drama, on a poster, on a pamphlet/brochure, on a billboard sign, or on a sign at a clinic. Respondents were allowed to report multiple sources for where they had seen the Smiling Sun Logo.

Methodology

Because the local cost data cover only a subset of the project areas, our cost-effectiveness analysis is divided into two components: (1) an analysis of the cost-effectiveness of the national program and (2) an analysis of the cost-effectiveness of local promotion

[2] We acknowledge that part of the effectiveness of the Smiling Sun campaign could be to alter health knowledge or influence health care utilization of non-NSDP health services. For example, since the Smiling Sun campaign was national in coverage, a woman in a non-project area could watch the serial drama, learn of the importance of using antenatal care or childhood vaccinations, and then go to a local government or other NGO health care provider. These additional effects are not included in our measures of effectiveness, and therefore our analysis would tend to understate the full effectiveness of the program.

[3] Subsequent work will also examine use of family planning services.

activities and billboards. The latter analysis restricts attention to Dhaka division (because it is there that we have cost information for local promotion activities and billboards), which represented approximately 35 percent of the project population in 2001 and 2003. In either case, we employ the same basic methodology for evaluating the impact of the Smiling Sun campaign on specific health behaviors.

Since the Smiling Sun campaign focused on both urban and rural areas but our analysis focuses solely on rural areas, we use the distribution of the project population – in both urban and rural areas – to apportion national costs of the Smiling Sun BCC campaign. According to project documents (MEASURE *Evaluation* 2001a and 200b), the project covered approximately 22 million people, about one-third (32.1%) of whom were in rural areas. We therefore attribute this same proportion of the national costs to the rural program – US$267,568.

In addition to apportioning costs across urban and rural areas, we must also apportion national costs across different activities. Since the project was intended to promote the use of a wide range of health services – reproductive health, family planning, child health services, etc. – the costs of the national program are therefore shared across these different activities. We use the distribution of visits by activity to RSDP/NSDP static clinics as a rough approximation of the appropriate share of the national costs to each of these activities. This information comes from a survey of NSDP facilities conducted in 2001 as part of the RSDP Evaluation Survey (MEASURE *Evaluation* 2001c). Overall, costs are apportioned approximately

Econometric Model

Using the notation introduced in the structural equations section of Guilkey, Hutchinson and Lance (in this volume), we can write:

$$M^{*}_{ic} = \gamma\ Z_{ic} + \delta\ X_{ic} + \mu_c^M + \varepsilon_{ic}^M$$

$$Y^{*}_{ic} = \alpha\ M_{ic} + \beta\ X_{ic} + \mu_c^Y + \varepsilon_{ic}^Y$$

where M^{*}_{ic} and Y^{*}_{ic} are a latent variables for respondent i (i=1,2,…,N) from community c (c=1,2,…,C). The observed variables, M_{ic} and Y_{ic}, are binary indicator variables for whether or not the respondent recalls seeing the Smiling Sun logo and whether or not the respondent engages in one of the health outcomes (antenatal care, for example). The Z's represent a set of variables that affect message recall but do not have direct effects on the health outcome (ownership of a television or radio, for example) while the X's represent other explanatory variables such as the respondent's age and level of education.

The μ's and ε's represent unobservable community and individual level variables that affect the two outcomes and we assume that there is overlap in the unobservables that affect the two outcomes at least for the ε's. For example, respondents with a high level of motivation which is not observable in our data may be more likely to recall the Smiling Sun logo and also obtain antenatal care for their children. We model this overlap by

assuming that the ε's in the two equations follow a bivariate normal distribution with zero means, variances equal to one and correlation ρ. Setting the variances to one is the standard normalization that must be imposed in probit type models where we only observe binary outcomes. If ρ≠0, common unobservables affect the two equations which implies that estimation of the second equation by single equation methods will result in biased estimates of the impact of message recall on the health related behavior. Our solution to this problem is to use simultaneous equations methods as discussed in Guilkey, Hutchinson and Lance. Since we have to binary outcome, we use the bivariate probit maximum likelihood method and then use Ecker, Huber, White standard errors to correct for community level correlation implied by the presence of the μ's (see Angeles, Guilkey, and Mroz, 2005 for details).

The bivariate probit method provides an estimate of ρ which we present in the tables of results. This estimate of ρ allows for a direct test of the null hypothesis that ρ=0. A rejection of this hypothesis implies that message recall is endogenous to the health outcomes.

Results

Exposure

In the full rural sample, approximately 40 percent of women in 2001 and 54.3 percent in 2003 reported having ever seen the Smiling Sun logo (Figure 1). These figures were similar in the Dhaka sub-sample – 43.3 percent in 2001 and 57.8 percent in 2003 (Figure 2). The most common site where the Smiling Sun logo was seen was on a sign at a clinic (28.1 and 40.0 percent in the full sample in 2001 and 2003 respectively). The next most common sources in 2001 were on television in an advertisement (8.8 percent in 2001 and 9.9 in 2003) or on a poster (7.4 percent in 2001 and 11.9 in 2003). Exposure to the television drama was low – only 1.8 percent in 2001 and 2.5 percent in 2003. This is a considerably lower percentage than the rate observed elsewhere for rural residents – 16.0 percent (BCCP 2003a). The proportion of respondents who reported seeing the Smiling Sun logo anywhere except at a clinic was approximately 16.3 percent in 2001 and 28.0 percent in 2003. These patterns were roughly similar in the Dhaka sub-sample.

Self-reported exposure to the Smiling Sun campaign – by any mechanism – was positively related to the use of all health services at better than the one percent level of statistical significance in all years and in all samples (Table 7). In 2001 in the full sample, for example, 51 percent of women exposed to the Smiling Sun logo reported using antenatal care, as compared to only 30 percent of women not reportedly exposed to the logo. Just over 63 percent of children 12 to 35 months whose mothers reported exposure to the Smiling Sun campaign received their DPT3 vaccination, as compared to only 49 percent of children whose mothers did not report exposure. As compared to the full sample, the magnitude of the differences in health services utilization were larger for the Dhaka sub-sample in 2001, but slightly smaller for most indicators in 2003.

Figure 1. Source of Awareness of Smiling Sun logo, All Rural Areas – 2001 and 2003

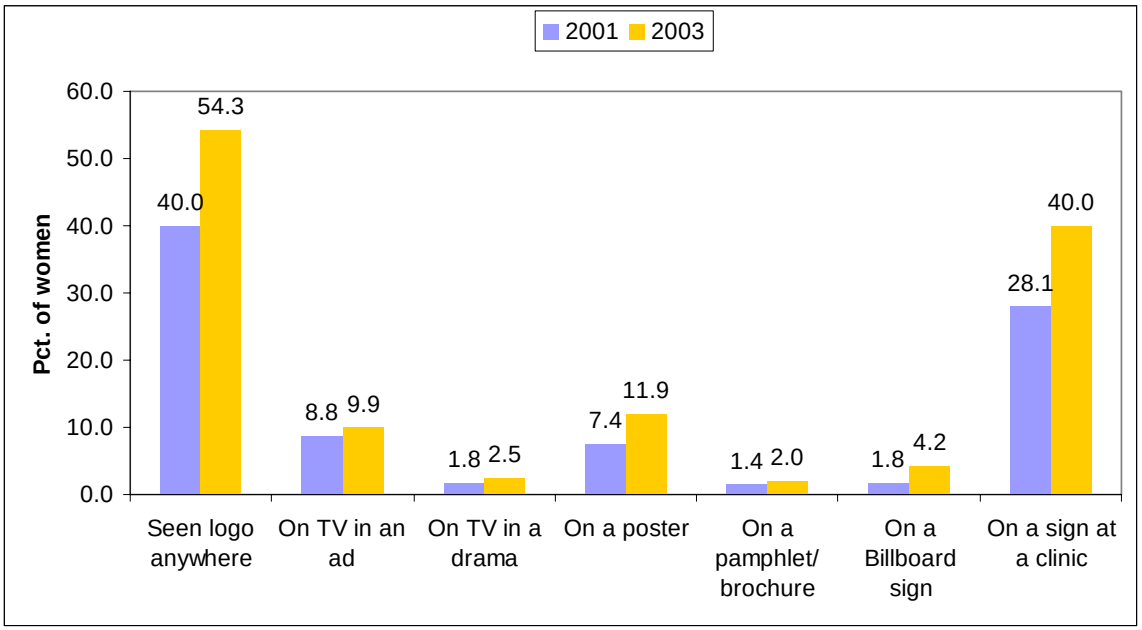

Figure 2. Source of Awareness of Smiling Sun logo, Dhaka Sample – 2001 and 2003

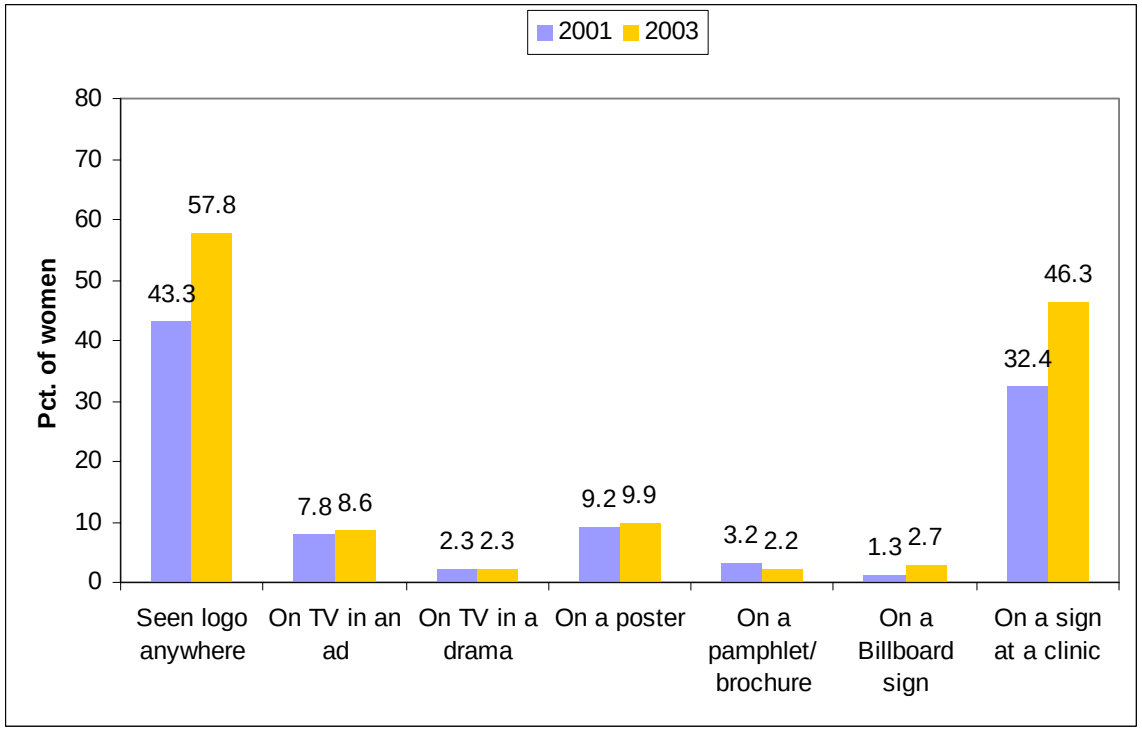

Table 7 here

Table 8 provides the simple probit results (i.e. estimation of each equation separately) for the recall and demand equations for the Dhaka sub-sample. We begin with the recall equation. The most obvious feature of our estimates is that few of the covariates are

significant at conventional levels. Indeed, recall appears to be significantly associated only with mothers being older and owning a television and being better educated. It is notable that it comes close to being significantly (at conventional levels) associated with expenditures on billboards.

In terms of the demand equations, we generally see that there are more significant predictors of demand than in the case of recall. Older (with the exception of the oldest) mothers are less likely to demand ANC for their children. Better educated women are also basically more likely to demand ANC (the positive parameter for having secondary or better education comes very close to significance at the 10% level) for their children. Wealthier families are also more likely to demand ANC. Crucially, the coefficient on recall of the Smiling Sun logo is positive and highly significant.

The same basic sign pattern emerges for demand for iron supplementation. However, there are generally fewer significant regressors. The strongest predictors are wealth and recall of the Smiling Sun symbol (the parameter of which once again has the theoretically anticipated sign). The children of older women are less likely to demand DPT3 vaccination, though the patterns of parametes estimates suggests, as in the earlier cases, a rather complex maternal age gradient. Children from wealthier families are more likely to get the third DPT vaccination. Recall of the Smiling Sun symbol is again a positive and significant predictor of demand. Finally, maternal age plays a much different, and less obvious, role in shaping demand for measles. Following the established pattern, children from wealthier families are, however, more likely to receive measles vaccination. Finally, recall of the Smiling Sun symbol is significant, with a positive parameter estimate.

These results thus generally conform to the anticipated patterns. Crucially, expenditures on billboards have a positive, and close to significant effect on recall of the Smiling Sun symbol.[4] Recall in turn had a uniformly significant and positive effect on demand. However, as discussed above, it is not clear whether these probit estimates are acceptable as a basis for the cost-effectiveness that follows. The reason for their potential inadequacy is the possibility of unobserved factors that might influence *both* recall of the Smiling Sun symbol and the demand outcomes, thus rendering our estimates of the impact of the former on the latter biased and inconsistent.

The results for the bivariate probit are provided in table 9. We do not discuss these in as much detail as the single equation results. Instead, we focus on several essential series of results. First, we note that expenditures on billboards sometimes had a significant effect on recall of the Smiling Sun symbol. This is important because, aside from being a parameter of critical structural interest, the effect of expenditures is a potentially important instrument. However, ownership of television or radio and whether the household ever moved are also introduced as potential instruments. The instruments are

[4] This is, of course, a slightly inaccurate statement. We report underlying parameter estimates, and not true marginal effects. However, the authors have found that *average* marginal effect of a covariate generally reflects the sign and significance of the underlying regression parameter associated with that covariate, unless several regression parameters are associated with the same covariate as in the case of interaction effects. It then becomes harder to speculate about the sign and significance of interaction effects.

generally close to significance at conventional levels. Second, recall of the Smiling Sun logo is still positively associated with the four demand outcomes. However, it is no longer significant in the cases of demand for ANC and iron supplementation. Finally, ρ is not significant at conventional levels for most of the estimations.[5] Thus, moving to joint estimation has had some implications. Of course, pairwise estimations involving the assumption of normality are still rather restrictive (as opposed to an estimator that does not involve any parametric assumption regarding the correlation across equations and allows for richer patters of correlation by jointly estimating the full set of equations).

Tables 8 and 9 here

Tables 10a and 10b provide estimates for the full rural sample, looking at two measures of exposure to Smiling Sun campaign activities: (1) the serial drama and TV spots and (2) billboards, posters and brochures. For each, separate bivariate probit estimations were conducted for each of the four health service utilization indicators: antenatal care, iron supplementation, DPT3 vaccination and measles vaccination. The full results will not be discussed here but are presented in Table 10a (Exposure to Serial Drama and TV spots) and Table 10b (Exposure to Billboards, Posters and Brochures).[6] Rather, it is sufficient to note that exposure to the serial drama is endogenous (rho statistically different from 0 at the 10 percent level) in two of the four cases, while exposure to billboards, posters and brochures was endogenous in three of the four cases. Further, exposure to the serial drama was statistically significant in the outcome equations in all but one case and exposure to billboards, posters and brochures in two cases. The predicted probabilities of use of health services for exposed and unexposed individuals are presented in Table 11 and are used for the calculations of the magnitude of the effects of exposure.

Cost-effectiveness

The simple probits and bivariate probits provide us with estimates of the magnitudes of the effects on health service utilization from exposure to the Smiling Sun campaign. Using these estimates, we can derive estimates of the cost-effectiveness of specific components of the Smiling Sun campaign by simulating how exposure to the Smiling Sun campaign would change if expenditures on those components changed. These changes in exposure can then be linked to changes in behavior. For example, we could calculate the increased probability that a woman would report seeing the Smiling Sun if local clinic managers incurred additional expenditures on billboards and clinic signs or on local promotion activities. We could then, using the estimated coefficients from the econometric models, simulate the increased likelihood of using antenatal care or receiving iron supplementation during pregnancy or on a being child vaccinated.

Such estimates, however, would provide us only with the cost per marginal probability of using health services. In order to construct a measure of cost-effectiveness in

[5] It is again worth noting, however, that this does not necessarily allow us to conclude with confidence that recall is exogenous.

[6] We present just one representative set of results for the recall equation in each case.

conventional terms, we must also make some link to project population data. That is, we must also estimate the number of people who might actually be affected by such a change.

In order to make this link, we use information from the survey sample,[7] specifically from the age and sex distribution of the population and the percentage of women who reported having live births in the last five years, to approximate the number of people that might be affected from marginal changes in Smiling Sun campaign expenditures. This information is linked with data on estimates of the project's target, or catchment, population. Applying the proportions from our random population sample to the estimates of the project population allows us to calculate our cost-effectiveness denominators, that is, the number of new users of NSDP services attributable to the Smiling Sun campaign.

According to project documents, the NSDP covered approximately 7,079,890 people in rural areas in 2001. In our surveys, approximately 13.1 percent of the sample were children age 0 to 5 years and 5.2 percent were children age 12 to 35 months, meaning that the project covered approximately 927,466 children under the age of five and 370,059 children age 12 to 35 months. Similarly, approximately 31.1 percent, or 2,201,846 people, were women age 10 to 49 years. Of these, 48.7 percent, or 1,072,299 women, were pregnant in the five years prior to the survey. In the Dhaka sub-sample, we make similar calculations, though our estimated population is considerably smaller – only 50,310 in our 43 clusters. This amounts to 2,630 children age 12 to 35 months and 7,620 pregnant women.

Using the results from our bivariate probit estimations, we simulate the effects of an increase in expenditures on billboards and signs of $173 per cluster[8], which represents approximately a one standard deviation increase in such costs. This leads to an increase in reported exposure to the Smiling Sun campaign of approximately 3.6 percentage points for mothers of children 12 to 35 months and of 4.4 to 4.6 percentage points for pregnant women. This means that in our sample population of 50,310 people, there will be approximately 95 newly exposed mothers of children age 12 to 35 months and 338-350 newly exposed pregnant women as a result of the increased spending on signs and billboards. This would lead in turn to 31 new DPT3 vaccinations, 33 new measles vaccinations, 105 new users of antenatal care and 74 new users of iron supplementation. This yields measures of the cost per newly exposed person of approximately $16 for mothers of children 12 to 35 months and $2.52-$2.63 per newly exposed pregnant women. When linked to our estimates of effectiveness, this would amount to a cost of $48.18 per new DPT3 vaccination, $44.81 per new measles vaccination, $8.45 per new user of antenatal care, and $11.99 per new user of iron supplementation.

In a similar manner, we use the estimated coefficients from the bivariate probit models for the full rural sample to calculate the cost-effectiveness of billboards and print media

[7] Cluster-level population estimates were not available at the time of this analysis but should be available for revised versions.

[8] The costs of billboards and signs are the only costs examined for the sub-sample in the current analysis.

relative to the serial drama and other TV and radio spots for each of our health outcomes (Table 11). As mentioned, total costs for billboards and print media and radio and TV spots were apportioned to child vaccinations (DPT3 and measles) and reproductive health (antenatal care and iron supplementation) based on service statistics from a concurrently conducted facility survey. These service statistics indicated that roughly 20.7 percent of users of NSDP services were for child health and 11.9 percent were for maternal health. We therefore calculated billboard and print media costs attributable to child health to be $27,824, while those for maternal health were approximately $19,399. Similarly, costs for radio and TV spots.

We faced a dilemma in deciding what to do with costs incurred in the fiscal year 2003-04, since, depending upon timing, many of these costs might have occurred after the period of our household survey, and therefore would theoretically be impossible to link to exposure and health behaviors. In order to provide a more conservative estimate of costs, we decided to include the full value of the costs.

Using the bivariate probit coefficients, we calculated that exposure to the Smiling Sun campaign through billboards, signs and print media would lead to increases in DPT3 vaccination from 54.1 percent to 70.2 percent, in measles vaccinations from 66.5 percent to 87.2 percent, in antenatal care use from 39.5 percent to 61.1 percent and in iron supplementation from 35.7 percent to 57.0 percent. The simulated impacts for exposure to the Smiling Sun through the serial drama and other TV and radio spots were of a similar magnitudes: from 55.0 to 71.3 for DPT3 vaccinations, from 68.9 to 83.5 percent for measles vaccinations, from 39.4 to 73.2 percent for antenatal care and from 36.6 to 57.8 percent for iron supplementation.

Applying the above proportions to the population numbers (and weighting by the actual percentages of the sample who reported exposure) provides us with estimates of the total population affected by exposure to the Smiling Sun campaign. These numbers range from 4,933 people whose predicted use of DPT3 vaccinations is attributable to exposure to the Smiling Sun radio and TV spots to 33,178 pregnant women whose use of antenatal care is also attributable to the radio and TV spots. Self-reported exposure to Smiling Sun billboards, signs and print media is associated with the use of DPT3 and measles vaccinations for 8,200 and 10,600 children respectively and in the use of antenatal care and iron supplementation for 31,800 and 31,400 pregnant women respectively.

Dividing the costs of the Smiling Sun campaign attributable to maternal health and child health (and further sub-dividing into those costs for billboards and print media and those for TV and radio spots) by the relevant populations affected provides us with the costs per behavior change. We find that the behavior change cost-effectiveness estimates from billboards and print media are roughly comparable to those for radio and TV spots. For example, the cost per new DPT3 user attributable to Smiling Sun billboards and print media is approximately $3.39, while that for Smiling Sun radio and TV spots is approximately $4.09. Billboards and print media appear slightly more cost-effective than radio and TV spots for childhood vaccinations. The opposite is true for antenatal care and

iron supplementation; the cost per new user of antenatal care is approximately $0.61 for billboards and print media and $0.39 for radio and TV spots.

Conclusion

The principal contribution of this analysis, while preliminary, is in its ability to demonstrate that rigorous evaluation methods can be linked to estimates of program costs to develop estimates of the costs per exposed individual and the costs per behavior change from a national multi-year behavior change communication campaign. We have further demonstrated that it is possible to evaluate the cost-effectiveness of specific components of a BCC campaign – a TV serial drama with TV advertisements versus billboards versus print media - though there are certainly more complex synergies requiring additional modeling that have not been attempted here; our analysis has focused solely on billboards and print media versus television and radio. A more nuanced analysis might assist in determining appropriate combinations of BCC activities, though clearly all components of the Smiling Sun campaign were necessary in some amounts.

We have not made any conclusions about whether the Smiling Sun BCC campaign was cost-effective, since such assessments must be made relative to the alternatives or relative to the counter-factual – what would have happened in the absence of the program? Whether or not the behavior change communication campaign is cost-effective relative to other interventions aimed at increasing the demand for health services is left to future work.

There are several limitations with the current analysis. Most notably is the manner with which we treat costs, though this is largely due to the absence of information on specific items that are commonly included in cost-effectiveness analysis. Program costs are almost certainly under-estimated. Notably absent are such items as the costs of technical assistance of expatriate staff, while in-country personnel and other recurrent costs also appear substantially under-represented. No estimates of the costs of project management and overhead have been included. At the local level, we have not included information on staff time devoted to BCC activities other than to local promotion activities. We have made no adjustments for valuing (capital) items such as billboards whose productive lives extend across multiple periods and might therefore influence their cost-effectiveness ratios relative to more heavily recurrent activities such as the serial drama. At this point, we have also not performed any sensitivity analysis, so our estimates of the cost-effectiveness of the Smiling Sun campaign do not include confidence intervals. All of these adjustments are left to forthcoming work.

No effort has been made here to extend the cost-effectiveness analysis to cost-utility analysis, examining outcomes such as Disability-Adjusted Life Years (DALYs) or Quality-Adjusted Life Years. Such an extension would require considerably more information on the quality of the available health services than we have at hand. Such an extension would, however, allow us to make comparisons of the cost-effectiveness of behavior change communication activities to other common health interventions –

community outreach activities, school-based health education programs, or clinic-based quality and service availability improvements.

Bibliography

Angeles, G., D.K.Guilkey and T.A.Mroz. (2005). "The Impact of Community-Level Variables on Individual-Level Outcomes: Theoretical Results and Applications" *Sociological Methods and Research* 34: 76-121.

Bangladesh Center for Communication Programs. 2003. "Evaluation of Smiling Sun Campaign," ACNielsen Bangladesh, Dhaka.

------. 2003. *Annual Report 2001-2*, Dhaka.

------. 2002. *Annual Report 2002-3*, Dhaka.

Bertrand, J. and L. Kincaid. (1996) "Evaluating Information-Education-Communication (IEC) Programs for Family Planning and Reproductive Health: Final Report of the IEC Working Group," The Evaluation Project Working Paper WG-IEC-03, Carolina Population Center, University of North Carolina at Chapel Hill; Center for International Health and Development, School of Public Health and Tropical Medicine, Tulane University; and The Futures Group, Washington, D.C.

Creese, A. and D. Parker. 1994. "Cost analysis in primary health care: a training manual for programme managers," WHO, Geneva.

Guilkey, D.K., P.L. Hutchinson and P.M. Lance. 2005. "Cost-effectiveness for health communication programs," Carolina Population Center, University of North Carolina, Tulane School of Public Health and Tropical Medicine, New Orleans.

Hausman, J. 1978. "Specification Tests in Econometrics" *Econometrica* 46: 1251-71.

Heckman, J., B. Singer. 1984. "A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data" *Econometrica* 52(2): 271-320.

Hutchinson, P.L. and J. Wheeler. 2005. "The cost-effectiveness of health communication programs: What do we know and where do we go from here?" Draft. Tulane University, New Orleans.

Janowitz, B. and J. Bratt. 1994. "Methods for costing family planning services," UNFPA and Family Health International.

MEASURE *Evaluation* and Population Communication Services. 2002. "Evaluating the Impact of Communication Programs: Summary of an Expert Meeting Organized by the MEASURE Evaluation Project and the Population Communication Services Project," October 4-5, 2001, Belmont Conference Center, Elkridge, MD.

MEASURE *Evaluation* and Associates for Community and Population Research. "2001 Rural Service Delivery Partnership Evaluation Survey – Household Survey Report," 2003, Technical Report TR-03-15a.

MEASURE *Evaluation* and Mitra and Associates. "2001 Urban Family Health Partnership Evaluation Survey – Household Survey Report," 2003, Technical Report TR-03-15b.

MEASURE *Evaluation* and Associates for Community and Population Research. "2001

Rural Service Delivery Partnership Evaluation Survey - Facility Survey Report," 2003, Technical Report TR-03-15c.

Moffitt, R. 1991. "Program evaluation with nonexperimental data," *Evaluation Review*, 15(3): 291-314.

Mroz, T. 1999. "Discrete factor approximations in simultaneous equation models: Estimating the impact of a dummy endogenous variable on a continuous outcome," Journal of Econometrics 93(1): 233-274.

Piotrow, P.T., D.L. Kincaid, J.G. Rimon II, and W. Rinehart. 1997. *Health Communication: Lessons from Family Planning and Reproductive Health*, Westport, CT: Praeger.

Shepard, Donald S., and Mark S. Thompson. 1991. "Cost effectiveness in health: first principles," in M. Over, Ed., *Economics for Health Sector Analysis: Concepts and Cases*, World Bank, pp. 133-144.

UNAIDS and the Henry J. Kaiser Foundation. 2004. "The Media and HIV/AIDS: Making a difference," Geneva.

U.S. Department of Health and Human Services. 2000. Healthy People 2010: Understanding and Improving Health. 2nd edition, Washington, D.C. U.S. Government Printing Office.

World Bank. 1993. "A Framework and Indicative Cost Analysis for Better Health in Africa," Technical Working Paper 8. World Bank, Africa Technical Department, Human Resources and Poverty Division, Washington, D.C.

Table 1. National Level Operating Costs for the Smiling Sun Campaign, 2001-2004

Activity	2001-02 Cost in Taka	2001-02 Cost in USD	2002-03 Cost in Taka	2002-03 Cost in USD	2003-04 Cost in Taka	2003-04 Cost in USD	Total - All Years Cost in Taka	Total - All Years Cost in USD
A. Project Development cost								
1. Billboard	15,371,864	260,540	1,475,277	25,005	9,535,620	161,621	26,382,761	447,165
row pct.	*58.3%*	*58.3%*	*5.6%*	*5.6%*	*36.1%*	*36.1%*	*100.0%*	*100.0%*
2. Radio spots	305,315	5,175	8,185	139	12,547	213	326,047	5,526
row pct.	*93.6%%*	*93.6%*	*2.5%*	*2.5%*	*3.8%*	*3.8%*	*100.0%*	*100.0%*
3. TV spots & drama serial	1,632,860	27,676	604,753	10,250	604,753	10,250	2,842,366	48,176
row pct.	*57.4%*	*57.4%*	*21.3%*	*21.3%*	*21.3%*	*21.3%*	*100.0%*	*100.0%*
4. TV spots – Airing	13,681,999	231,898	839,775	14,233	1,735,677	29,418	16,257,450	275,550
row pct.	*84.2%*	*84.2%*	*5.2%*	*5.2%*	*10.7%*	*10.7%*	*100.0%*	*100.0%*
5. IEC print materials production	1,186,990	20,118	2,119	36	715,474	12,127	1,904,583	32,281
row pct.	*62.3%*	*62.3%*	*0.1%*	*0.1%*	*37.6%*	*37.6%*	*100.0%*	*100.0%*
6. IEC print materials distribution	113,027	1,916		-		-	113,027	1,916
row pct.	*100.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*100.0%*	*100.0%*
7. Press & other media campaign	413,226	7,004	25,000	424	287,875	4,879	726,101	12,307
row pct.	*56.9%*	*56.9%*	*3.4%*	*3.4%*	*39.6%*	*39.6%*	*100.0%*	*100.0%*
Sub-total	32,705,281	554,327	2,955,108	50,087	12,891,945	218,508	48,552,335	822,921
row pct. – sub-total	*67.4%*	*67.4%*	*6.1%*	*6.1%*	*26.6%*	*26.6%*	*100.0%*	*100.0%*
B. Project Management Cost								
1. Staff salary	169,031	2,865	178,758	3,030	193,596	3,281	541,385	9,176
Sub-total	169,031	2,865	178,758	3,030	193,596	3,281	541,385	9,176
row pct. - sub-total	*31.2%*	*31.2%*	*33.0%*	*33.0%*	*35.8%*	*35.8%*	*100.0%*	*100.0%*
GRAND TOTAL	32,874,312	557,192	3,133,866	53,116	13,085,541	221,789	49,093,720	832,097
row pct. – total	*67.0%*	*67.0%*	*6.4%*	*6.4%*	*26.7%*	*26.7%*	*100.0%*	*100.0%*

Table 2a. Distribution of National-level Operating Costs, 2001/02 -2003/04

Activity	2001-02	2002-03	2003-04	Total
A. Project Development Cost				
1. Billboard	47.0%	49.9%	74.0%	54.3%
2. Radio spots	0.9%	0.3%	0.1%	0.7%
3. TV spots & drama serial	5.0%	20.5%	4.7%	5.9%
4. TV spots - Airing	41.8%	28.4%	13.5%	33.5%
5. IEC print materials production	3.6%	0.1%	5.5%	3.9%
6. IEC print materials distribution	0.3%	0.0%	0.0%	0.2%
7. Press & other media campaign	1.3%	0.8%	2.2%	1.5%
Sub-total	100.0%	100.0%	100.0%	100.0%
Sub-total Project Development	99.5%	94.3%	98.5%	98.9%
B. Project Management Cost				
B1. Staff salary	100.0%	100.0%	100.0%	100.0%
Sub-total Project Management	0.5%	5.7%	1.5%	1.1%
Total Management & Development	100.0%	100.0%	100.0%	100.0%

Table 2b Distribution of National-level Operating Costs, 2001/02 -2003/04

Activity	2001-02	2002-03	2003-04	Total
A. Project Development Cost				
1. Billboard	58.3%	5.6%	36.1%	100.0%
2. Radio spots	93.6%	2.5%	3.8%	100.0%
3. TV spots & drama serial	57.4%	21.3%	21.3%	100.0%
4. TV spots - Airing	84.2%	5.2%	10.7%	100.0%
5. IEC print materials production	62.3%	0.1%	37.6%	100.0%
6. IEC print materials distribution	100.0%	0.0%	0.0%	100.0%
7. Press & other media campaign	56.9%	3.4%	39.6%	100.0%
Sub-total	67.4%	6.1%	26.6%	100.0%
B. Project Management Cost				
1. Staff salary	31.2%	33.0%	35.8%	100.0%
Total	**67.0%**	**6.4%**	**26.7%**	**100.0%**

Table 3. Means and SDs of Costs of Local BCC Activities and Signs, Taka (N=43)

Item	2000-01	2001-02	2002-03	2003-04
Static Clinic Spot Signboards	3.44	149.07	152.79	744.63
	5.19	*345.16*	*324.33*	*2485.93*
Static Clinic Indication Signboards	1477.95	806.40	268.02	965.12
	2213.54	*1265.18*	*671.38*	*1706.92*
Satellite Clinic Spot Signboards	5860.17	1665.67	2897.81	6618.19
	6240.99	*5003.04*	*4973.93*	*7761.86*
Satellite Clinic Indication Signboards	396.05	315.70	786.05	2666.23
	1684.69	*2039.17*	*3020.77*	*6127.31*
Depotholder Spot Signboards	7361.45	1359.19	2139.18	8677.42
	5577.01	*4498.12*	*4096.43*	*8019.99*
Depotholder Indication Signboards	116.28	1534.88	146.98	2447.21
	762.49	*3939.11*	*963.79*	*5637.59*
NGO HQ Spot Signboards	0.00	0.00	0.00	29.07
	0.00	*0.00*	*0.00*	*190.62*
NGO HQ Indication Signboards	0.00	0.00	0.00	0.00
	0.00	*0.00*	*0.00*	*0.00*
Plastic Signboards	0.00	55.81	0.00	0.00
	0.00	*366.00*	*0.00*	*0.00*
Steel Frame Signboards	0.00	690.70	18.60	636.67
	0.00	*1401.33*	*122.00*	*3483.00*
Semi-signboards	0.00	0.00	0.00	0.00
	0.00	*0.00*	*0.00*	*0.00*
Repair Costs	2381.56	565.00	1032.54	2467.77
	5078.68	*1538.66*	*3035.95*	*3233.47*
BCC Meeting Costs	19815.88	21663.40	21479.47	23595.47
	10956.19	*12686.47*	*12419.24*	*13280.14*
Other BCC Activities	446.65	427.02	597.63	562.14
	550.34	*616.59*	*767.80*	*783.69*
Total	38369.71	29214.23	29519.06	49409.91
	17746.72	*18563.52*	*15093.69*	*24795.10*

Table 4. Means, SEs, Observations for Health Outcomes, 2001 and 2003

Outcome		2001	2003
ANC	Mean	0.329	0.450
	SE	0.016	0.019
	N	827	723
	P>|t|		**0.00**
Iron	Mean	0.279	0.411
	SE	0.016	0.018
	N	827	723
	P>|t|		**0.00**
DPT3	Mean	0.475	0.573
	SE	0.028	0.031
	N	316	255
	P>|t|		**0.02**
Measles	Mean	0.627	0.694
	SE	0.027	0.029
	N	316	255
	P>|t|		**0.09**

Table 5. Means and Standard Deviations of Selected Background Characteristics

	2001		2003	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
N	827		723	
Mother's age				
15-19	0.148	0.355	0.162	0.369
20-24	0.289	0.454	0.308	0.462
25-29	0.227	0.419	0.248	0.432
age30_34	0.189	0.391	0.163	0.370
age35_39	0.092	0.289	0.071	0.256
age40_44	0.045	0.207	0.035	0.183
age45_49	0.008	0.092	0.012	0.111
Mother's education				
None	0.648	0.478	0.675	0.468
Primary	0.238	0.426	0.252	0.434
Secondary	0.010	0.098	0.149	0.357
University	0.010	0.098	0.011	0.105
Wealth Quintile				
Poorest	0.235	0.424	0.167	0.374
2nd Poorest	0.308	0.462	0.286	0.452
Middle	0.196	0.397	0.214	0.411
2nd Wealthiest	0.160	0.366	0.176	0.381
Wealthiest	0.102	0.302	0.156	0.363
Exposure to Smiling Sun				
Anywhere	0.403	0.491	0.683	0.466
…in a TV ad	0.060	0.238	0.084	0.278
…in a TV serial drama	0.023	0.150	0.021	0.143
…on a poster	0.085	0.279	0.124	0.330
…in a pamphlet/brochure	0.022	0.146	0.026	0.160
…on a billboard	0.011	0.104	0.033	0.179
…on a sign at a clinic	0.308	0.462	0.542	0.499
Own TV	0.086	0.280	0.108	0.310
Own radio	0.203	0.403	0.219	0.414
Never moved in lifetime	0.266	0.442	0.275	0.447

Table 6. Costs of the Smiling Sun campaign apportioned by activity, all years, rural areas

Activity	Taka	US$	Pct.
Family Planning	6,532,716	$110,724	41.4%
Maternal Health	1,879,858	$ 31,862	11.9%
Child Health	3,271,550	$ 55,450	20.7%
Other Health	4,102,388	$ 69,532	26.0%
Total	15,786,512	$ 267,568	100.0%

Table 7. Means, SDs, and number of observations for Health Services Utilization Outcomes by Exposed/Unexposed to the Smiling Sun Campaign

	2001			2003		
	Unexposed	Exposed	Diff.	Unexposed	Exposed	Diff.
ANC	0.237	0.465	0.229	0.301	0.518	0.217
	0.426	0.500		0.460	0.500	
	494	333		229	494	
Iron	0.180	0.426	0.246	0.297	0.464	0.167
	0.385	0.495		0.458	0.499	
	494	333		229	494	
DPT3	0.376	0.615	0.239	0.430	0.645	0.215
	0.486	0.488		0.498	0.480	
	186	130		86	169	
Measles	0.522	0.777	0.255	0.570	0.757	0.187
	0.501	0.418		0.498	0.430	
	186	130		86	169	

Table 8. Simple Probit Estimates of Exposure to Smiling Sun, Use of Antenatal Care, Iron Supplementation, DPT3 Vaccination and Measles Vaccination

	Know Smiling Sun logo			ANC			Iron			DPT3			Measles		
Variable	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|
Mother's Age (omitted="15-19")															
20-24	-0.0255	0.1332	0.848	-0.1583	0.1107	0.153	0.1147	0.1337	0.391	-0.1687	0.1640	0.304	0.0654	0.1479	0.658
25-29	-0.1692	0.1354	0.212	-0.2626	0.1472	0.074	-0.0226	0.1349	0.867	-0.2890	0.1739	0.096	0.0519	0.1719	0.763
30-34	-0.2313	0.1567	0.140	-0.3706	0.1725	0.032	-0.0754	0.1661	0.650	-0.5371	0.1962	0.006	0.1002	0.1839	0.586
35-39	-0.4406	0.1619	0.006	-0.3129	0.1840	0.089	-0.1323	0.1609	0.411	-0.1410	0.2499	0.573	0.1696	0.2084	0.416
40-44	-0.7356	0.2430	0.002	-0.5782	0.2531	0.022	0.0179	0.2694	0.947	-0.7022	0.3065	0.022	-0.0521	0.2997	0.862
45-49	-0.0851	0.3574	0.812	-0.0648	0.5120	0.899	0.0859	0.4147	0.836	-0.3628	0.6139	0.555	-0.4674	0.6621	0.480
Mother's Education (omitted="none")															
Primary	0.0997	0.0928	0.283	0.0387	0.1095	0.724	0.1011	0.0966	0.295	0.0803	0.1221	0.511	0.1524	0.1243	0.220
Secondary or above	0.3972	0.1562	0.011	0.2383	0.1495	0.111	0.3538	0.1762	0.045	-0.0743	0.2058	0.718	0.3970	0.2990	0.184
WealthQuintile (omitted="poorest")															
2nd poorest	0.1695	0.1238	0.171	0.0993	0.1418	0.484	0.4314	0.1224	0.000	0.2670	0.1460	0.067	0.1570	0.1177	0.182
Middle	0.2188	0.1810	0.227	0.3356	0.1497	0.025	0.6450	0.1455	0.000	0.4083	0.1689	0.016	0.4742	0.1517	0.002
2nd wealthiest	0.2371	0.1572	0.131	0.4732	0.1781	0.008	0.7892	0.1555	0.000	0.5691	0.1688	0.001	0.5181	0.1453	0.000
Wealthiest	0.3542	0.2685	0.187	0.9512	0.2031	0.000	1.0807	0.1477	0.000	1.1036	0.2820	0	0.9474	0.2415	0.000
Own television	0.5850	0.1808	0.001												
Own radio	0.0063	0.1049	0.952												
Never moved	-0.0054	0.0617	0.931												
Expenditures on billboards	0.0007	0.0005	0.120												
Seen Smiling Sun logo				0.4726	0.1068	0.000	0.4794	0.1170	0.000	0.4750	0.1438	0.001	0.5282	0.1512	0.000
Year (=2003)	0.7671	0.1311	0.000	0.1012	0.0932	0.278	0.1353	0.0889	0.128	0.0238	0.1378	0.863	-0.1280	0.1294	0.323
Intercept	-0.5153	0.2037	0.011	-0.7208	0.1686	0.000	-1.3712	0.1951	0.000	-0.3670	0.1955	0.06	-0.2434	0.1424	0.087
Obs	1550			1550			1550			571			571		
Wald chi2(17)	166.12			92.33			146.72			56.36			78.49		
Prob>chi2	0.00			0.00			0.00			0.00			0.00		
Log pseudolikelihood	-952.72			-928.88			-883.43			-357.37			-332.76		
Test of exclusion restrictions															
chi2(3)	10.51														
Prob>chi2	0.0147														

Table 9. Bivariate Probit Results, Exposure to Smiling Sun logo and Health Services Utilization

	ANC			Iron			DPT3			Measles		
		Robust			Robust			Robust			Robust	
Variable	Coef.	Std. Err.	p	Coef.	Std. Err.	p	Coef.	Std. Err.	p	Coef.	Std. Err.	p
Outcomes												
Mother's Age (omitted="15-19")												
20-24	-0.1535	0.1091	0.159	0.1156	0.1325	0.383	-0.1791	0.1671	0.284	0.0458	0.1510	0.761
25-29	-0.2392	0.1605	0.136	-0.0129	0.1416	0.927	-0.2829	0.1785	0.113	0.0513	0.1711	0.764
30-34	-0.3369	0.1735	0.052	-0.0614	0.1798	0.733	-0.5196	0.1976	0.009	0.1070	0.1869	0.567
35-39	-0.2509	0.2475	0.311	-0.1029	0.1821	0.572	-0.0801	0.2530	0.752	0.2391	0.2092	0.253
40-44	-0.4810	0.3381	0.155	0.0627	0.3225	0.846	-0.5643	0.3188	0.077	0.1098	0.2954	0.710
45-49	-0.0459	0.5443	0.933	0.0935	0.4086	0.819	-0.4048	0.6333	0.523	-0.5174	0.6776	0.445
Mother's Education (omitted="none")												
Primary	0.0233	0.1331	0.861	0.0934	0.0875	0.286	0.0727	0.1206	0.546	0.1392	0.1305	0.286
Secondary or above	0.1986	0.2127	0.350	0.3342	0.2177	0.125	-0.1031	0.2060	0.617	0.3525	0.3048	0.248
WealthQuintile (omitted="poorest")												
2nd poorest	0.0723	0.1490	0.627	0.4170	0.1117	0.000	0.2253	0.1415	0.111	0.1064	0.1260	0.398
Middle	0.2969	0.1883	0.115	0.6255	0.1453	0.000	0.3446	0.1774	0.052	0.3882	0.1771	0.028
2nd wealthiest	0.4268	0.2330	0.067	0.7661	0.1677	0.000	0.4975	0.1684	0.003	0.4227	0.1847	0.022
Wealthiest	0.8424	0.4298	0.050	1.0291	0.2471	0.000	0.9817	0.3200	0.002	0.7905	0.2922	0.007
Saw Smiling Sun Logo	0.8206	1.0658	0.441	0.6541	0.6624	0.323	0.8620	0.3560	0.015	1.0285	0.4183	0.014
Year (=2003)	0.0140	0.2481	0.955	0.0922	0.1778	0.604	-0.0565	0.1483	0.703	-0.2293	0.1502	0.127
Intercept	-0.8392	0.3727	0.024	-1.4298	0.3155	0.000	-0.4879	0.2430	0.045	-0.4033	0.1738	0.020
Saw the Smiling Sun logo												
Mother's Age (omitted="15-19")												
20-24	-0.0247	0.1330	0.852	-0.0275	0.1325	0.836	0.0856	0.1912	0.654	0.0738	0.1927	0.702
25-29	-0.1695	0.1358	0.212	-0.1703	0.1348	0.207	-0.0448	0.1953	0.818	-0.0404	0.1961	0.837
30-34	-0.2274	0.1584	0.151	-0.2331	0.1556	0.134	-0.0548	0.2229	0.806	-0.0529	0.2220	0.812
35-39	-0.4333	0.1662	0.009	-0.4436	0.1626	0.006	-0.3565	0.2456	0.147	-0.3636	0.2536	0.152
40-44	-0.7297	0.2383	0.002	-0.7340	0.2406	0.002	-0.9484	0.3959	0.017	-0.9420	0.3915	0.016
45-49	-0.1023	0.3784	0.787	-0.0797	0.3633	0.826	0.4197	0.5870	0.475	0.4195	0.5938	0.480
Mother's Education (omitted="none")												
Primary	0.1044	0.0956	0.275	0.1011	0.0938	0.281	0.0286	0.1103	0.796	0.0383	0.1105	0.729

Variable	ANC Coef.	ANC Robust Std. Err.	ANC p	Iron Coef.	Iron Robust Std. Err.	Iron p	DPT3 Coef.	DPT3 Robust Std. Err.	DPT3 p	Measles Coef.	Measles Robust Std. Err.	Measles p
Secondary or above	0.4173	0.1573	0.008	0.4016	0.1584	0.011	0.2749	0.2492	0.270	0.2710	0.2468	0.272
WealthQuintile (omitted="poorest")												
2nd poorest	0.1679	0.1229	0.172	0.1680	0.1228	0.171	0.2205	0.1626	0.175	0.2130	0.1688	0.207
Middle	0.2169	0.1799	0.228	0.2168	0.1793	0.227	0.3099	0.1970	0.116	0.2960	0.2019	0.143
2nd wealthiest	0.2343	0.1569	0.135	0.2352	0.1547	0.128	0.3074	0.1842	0.095	0.3069	0.1833	0.094
Wealthiest	0.3747	0.2967	0.207	0.3545	0.2692	0.188	0.3747	0.3055	0.220	0.3659	0.2993	0.222
Own television	0.5498	0.2425	0.023	0.5863	0.1842	0.001	0.2658	0.2705	0.326	0.2873	0.2667	0.281
Own radio	0.0085	0.1058	0.936	0.0095	0.1040	0.927	0.2106	0.1572	0.180	0.1977	0.1533	0.197
Never moved	-0.0072	0.0603	0.904	-0.0138	0.0745	0.853	-0.1141	0.0939	0.224	-0.1224	0.0967	0.205
Expenditures on billboards	0.0008	0.0005	0.090	0.0007	0.0005	0.125	0.0006	0.0006	0.293	0.0006	0.0005	0.291
Year (=2003)	0.7735	0.1272	0.000	0.7693	0.1303	0.000	0.6563	0.1546	0.000	0.6483	0.1549	0.000
Intercept	-0.5252	0.1996	0.008	-0.5130	0.2011	0.011	-0.5783	0.2067	0.005	-0.5622	0.2095	0.007
/atrho21	-0.2220	0.7093	0.754	-0.1092	0.3975	0.783	-0.2493	0.2304	0.279	-0.3307	0.3043	0.277
rho21	-0.2184	0.6755	0.746	-0.1088	0.3928	0.782	-0.2443	0.2167	0.260	-0.3191	0.2733	0.243
Obs	1550			1550			571			571		
Wald chi2(31)	845.25			1016.5			987.92					
Prob.chi2	0			0			0					
Log pseudolikelihood	-1881.64			-1836.32			-713.67					
Random Draws	40			40			20			20		
LR test of rho21=0												
chi2(1)	0.430856			0.14802			0.56037			1.06886		
Prob > chi2	0.5116			0.7004			0.4541			0.3012		
Test of exclusion restrictions												
chi2(3)	5.21			10.17			5.62			5.57		
Prob>chi2	0.1574			0.0172			0.1315			0.1348		

Table 10a. Bivariate Probit Results, Exposure to Serial Drama and TV and Radio Spots and Health Services Utilization, Full Sample (Continued)

Variable	DPT3			Measles		
	Coef	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
Mother's age (omitted="15-24")						
25-34	-0.0458	0.0448	0.306	-0.0015	0.0449	0.973
35-49	-0.0915	0.0678	0.177	-0.0675	0.0696	0.332
Mother's Education (omitted="none")						
Primary	0.0880	0.0489	0.072	0.1785	0.0515	0.001
Secondary or above	0.1354	0.0812	0.095	0.3087	0.0880	0.000
WealthQuintile (omitted="poorest")						
2nd poorest	0.1080	0.0621	0.082	0.1847	0.0662	0.005
Middle	0.1675	0.0670	0.012	0.3362	0.0742	0.000
2nd wealthiest	0.2747	0.0725	0.000	0.3757	0.0804	0.000
Wealthiest	0.3431	0.1180	0.004	0.5821	0.1172	0.000
Region (omitted="Dhaka")						
Chittagong/Sylhet	0.0434	0.0788	0.582	-0.0571	0.0825	0.489
Khulna/Barisal	0.1611	0.0998	0.107	0.2053	0.1141	0.072
Rajshahi	0.5126	0.0830	0.000	0.3957	0.0934	0.000
Ownership of TV	0.0494	0.1049	0.637	0.0986	0.1260	0.434
Ownership of radio	0.0454	0.0616	0.460	-0.0179	0.0612	0.770
Husband's occupation (Omitted="agriculture")						
Landowner/farmer	0.0253	0.0643	0.693	-0.0409	0.0707	0.563
Unskilled laborer 1	0.0535	0.0812	0.510	0.1465	0.0985	0.137
Unskilled laborer 2	0.0311	0.0690	0.652	0.0012	0.0694	0.986
Semi-skilled laborer	0.1398	0.0787	0.076	0.0716	0.0811	0.377
Professional/business	0.1280	0.0669	0.056	0.0393	0.0673	0.559
Other occupation	0.0675	0.1044	0.518	0.0236	0.1109	0.832
Seen Smiling Sun on billboard, brochure	0.4492	0.2400	0.061	0.5007	0.3104	0.107
Frequency of TV watching						
Frequency of radio listening						
Moved in last 5 years						
Never moved						
Year(=2003)	0.0132	0.0572	0.817	0.0366	0.0526	0.486
Intercept	-0.2429	0.0869	0.005	0.0597	0.0854	0.485
/atrho21	-0.1610	0.130	-1.24	-0.0449	0.1549	-0.29
rho21	-0.1597	0.127	-1.26	-0.0449	0.1546	-0.29
Obs	4259			4259		
Wald chi2(39)	833.17			873.15		
Prob>chi2	0			0		
Draws	15			15		
Log pseudo-likelihood	-3842.14			-3490.17		
LR test of rho21=0						
Chi2(1)	1.6701			0.11726		
Prob > chi2	0.1962			0.732		

Table 10b. Bivariate Probit Results, Exposure to Billboards, Posters, Pamphlets, Brochures and Health Services Utilization, Full Sample

Variable	Seen billboard, brochure, poster			Antenatal Care			Iron Supplementation		
	Coef.	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
Mother's age (omitted="15-24")									
25-34	-0.0034	0.0433	0.937	-0.1838	0.0362	0.000	-0.1041	0.0348	0.003
35-49	-0.1264	0.0585	0.031	-0.3270	0.0484	0.000	-0.2864	0.0467	0.000
Mother's Education (omitted="none")									
Primary	0.0600	0.0461	0.193	0.2251	0.0373	0.000	0.2712	0.0348	0.000
Secondary or above	0.2054	0.0623	0.001	0.6072	0.0663	0.000	0.5227	0.0631	0.000
WealthQuintile (omitted="poorest")									
2nd poorest	-0.0684	0.0610	0.263	0.1520	0.0475	0.001	0.1229	0.0461	0.008
Middle	-0.0811	0.0613	0.186	0.2654	0.0531	0.000	0.2130	0.0526	0.000
2nd wealthiest	0.0462	0.0685	0.499	0.4413	0.0605	0.000	0.3430	0.0631	0.000
Wealthiest	0.0265	0.0897	0.768	0.5984	0.0803	0.000	0.5280	0.0779	0.000
Region (omitted="Dhaka")									
Chittagong/Sylhet	-0.0550	0.0689	0.425	0.1342	0.0749	0.073	0.2340	0.0673	0.001
Khulna/Barisal	0.3171	0.0923	0.001	0.2465	0.0916	0.007	0.0690	0.0763	0.366
Rajshahi	0.0584	0.0708	0.409	0.3083	0.0776	0.000	0.3123	0.0721	0.000
Ownership of TV	-0.0818	0.0805	0.310	0.2021	0.0612	0.001	0.0564	0.0650	0.386
Ownership of radio	-0.0258	0.0539	0.632	0.1007	0.0387	0.009	0.1003	0.0389	0.010
Husband's occupation (Omitted="agriculture")									
Landowner/farmer			0.005	-0.0592	0.0537	0.270	-0.0407	0.0558	0.466
Unskilled laborer 1			0.018	0.2696	0.0730	0.000	0.1696	0.0704	0.016
Unskilled laborer 2			0.340	0.1058	0.0540	0.050	0.1172	0.0516	0.023
Semi-skilled laborer			0.236	0.2002	0.0642	0.002	0.1664	0.0596	0.005
Professional/business			0.000	0.1814	0.0517	0.000	0.1191	0.0506	0.019
Other occupation			0.000	0.0797	0.0915	0.384	-0.0099	0.0876	0.910
Seen Smiling Sun on billboard, brochure				0.5962	0.2029	0.003	0.5799	0.2013	0.004
Frequency of TV watching	0.0718	0.0255							
Frequency of radio listening	0.0558	0.0236							
Moved in last 5 years	0.0449	0.0471							
Never moved	0.0543	0.0458							
Year(=2003)	0.3776	0.0527		0.0347	0.0452	0.443	0.0622	0.0440	0.158
Intercept	-1.3893	0.0776		-0.8171	0.0741	0.000	-0.9033	0.0664	0.000

/atrho21	-0.1775	0.1099	0.106	-0.1775	0.1099	0.106	-0.1660	0.1118	0.137
rho21	-0.1756	0.1065	0.099	-0.1756	0.1065	0.099	-0.1645	0.1088	0.130
Obs				11426			11430		
Wald chi2(39)				816.57			913.08		
Prob>chi2				0			0		
Draws				15			15		
Log pseudo-likelihood				-11480.9			-11478.3		
LR test of rho21=0									
Chi2(1)				3.83863			3.21643		
Prob > chi2				0.0501			0.0729		

Table 10b. Bivariate Probit Results, Exposure to Billboards, Posters, Pamphlets, Brochures and Health Services Utilization, Full Sample (Continued)

Variable	DPT3			Measles		
	Coef	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
Mother's age (omitted="15-24")						
25-34	-0.0546	0.0446	0.221	-0.0127	0.0450	0.778
35-49	-0.1023	0.0651	0.116	-0.0707	0.0663	0.286
Mother's Education (omitted="none")						
Primary	0.0728	0.0492	0.139	0.1527	0.0535	0.004
Secondary or above	0.1305	0.0833	0.117	0.2871	0.0883	0.001
WealthQuintile (omitted="poorest")						
2nd poorest	0.1158	0.0623	0.063	0.1965	0.0646	0.002
Middle	0.1781	0.0671	0.008	0.3444	0.0742	0.000
2nd wealthiest	0.2853	0.0721	0.000	0.3817	0.0796	0.000
Wealthiest	0.3895	0.1123	0.001	0.6204	0.1107	0.000
Region (omitted="Dhaka")						
Chittagong/Sylhet	0.0529	0.0794	0.505	-0.0428	0.0824	0.604
Khulna/Barisal	0.1190	0.1035	0.251	0.1381	0.1177	0.241
Rajshahi	0.5152	0.0837	0.000	0.3915	0.0957	0.000
Ownership of TV	0.1627	0.0908	0.073	0.2173	0.1049	0.038
Ownership of radio	0.0437	0.0616	0.478	-0.0234	0.0606	0.699
Husband's occupation (Omitted="agriculture")						
Landowner/farmer	0.0217	0.0643	0.736	-0.0434	0.0704	0.537
Unskilled laborer 1	0.0581	0.0814	0.475	0.1571	0.0981	0.109
Unskilled laborer 2	0.0348	0.0690	0.614	0.0129	0.0695	0.852
Semi-skilled laborer	0.1449	0.0785	0.065	0.0857	0.0813	0.292
Professional/business	0.1381	0.0670	0.039	0.0671	0.0679	0.323
Other occupation	0.0760	0.1048	0.468	0.0520	0.1102	0.637
Seen Smiling Sun on billboard, brochure	0.4441	0.2670	0.096	0.7433	0.2125	0.000
Frequency of TV watching						
Frequency of radio listening						
Moved in last 5 years						
Never moved						
Year(=2003)	-0.0113	0.0595	0.849	-0.0072	0.0549	0.895
Intercept	-0.2721	0.0895	0.002	-0.0039	0.0868	0.964
/atrho21	-0.1713	0.1512	0.257	-0.2260	0.1237	0.068

Variable	DPT3			Measles		
	Coef	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
rho21	-0.1597	0.1469	0.248	-0.2222	0.1176	0.059
Obs	4259			4259		
Wald chi2(39)	247.79			309.44		
Prob>chi2	0			0		
Draws	15			15		
Log pseudo-likelihood	-4513.2449			-4156.32		
LR test of rho21=0						
Chi2(1)	1.3378			3.24884		
Prob > chi2	0.2474			0.0715		

Table 11. Cost-effectiveness of national level expenditures on Smiling Sun activities

Indicator	Population Estimate	Billboards, Signs and Print Media Predicted Probability of use for … Total Cost 2001-04	Unexposed	Exposed	Pop. affected	CE	Radio and TV spots Predicted Probability of use for … Total Cost 2001-04	Unexposed	Exposed	Pop. affected	CE
Population	7,079,890										
Total											
0-5 years	927,466										
12-35 months	370,059										
DPT3	370,059	$27,824	0.5409	0.7024	8,217	$3.39	$22,517	0.5502	0.7129	5,502	$4.09
Measles	370,059	$27,824	0.6647	0.8722	10,557	$2.64	$22,517	0.6887	0.8345	4,933	$4.56
Women 10-49	2,201,846										
Pct. pregnant	1,072,299										
Antenatal	1,072,299	$19,399	0.3953	0.6110	31,802	$0.61	$12,938	0.3935	0.7320	33,178	$0.39
Iron suppl.	1,072,299	$19,399	0.3566	0.5698	31,431	$0.62	$12,938	0.3659	0.5777	20,761	$0.62