Social networks, ideation, and contraceptive behavior in Bangladesh: a longitudinal analysis

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Abstract

Longitudinal survey data from a panel of married women in Bangladesh is used to estimate the impact of a social network approach to family planning field worker communication and to test a theoretical model of behavior change that explains why women adopt modern contraceptives.

Government field workers were trained to organize group discussions with women in the homes of opinion leaders located at central points in each village's social network. A set of intervening variables, referred to collectively as 'ideation', are derived from diffusion of innovation and social network theory to explain how the social network approach affects contraceptive behavior. The rate of increase in modern contraceptive use was found to be five times greater among women in the social network approach than among women who were visited by field workers at home. The impact of the social network approach on modern contraceptive use was almost double that of conventional field worker visits after controlling for the effects of prior contraceptive use and intention, prior home visits, and selected socio-demographic characteristics. Both approaches had the same degree of impact on ideation. The results confirm the influence of ideation on fertility change and suggest that family planning programs would benefit from training field workers to use a social network approach. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Social networks; Communication; Family planning; Ideation; Evaluation

Introduction

This paper has two complementary purposes: to estimate the impact of a social network approach to family planning communication and to test a theoretical model of behavior change that explains why women in Bangladesh adopt modern contraceptives. In the social network approach, government family planning field workers are trained to organize a series of group discussions with women in the homes of opinion leaders located at central points in the village social network. These group discussions rotate geographically from point to point over the course of a month, and then the cycle is repeated. The conventional home visits that it replaces are only conducted for women who cannot attend the meetings. The approach was tested in the three 'thana'-level government health centers where it was first implemented on a full scale[1].

An unusual feature of this evaluation research is that it is theory-driven as well as method-driven

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[1] A 'thana' in Bangladesh is a geographical and administrative unit similar in size to a US county and having a population of about 300,000 people

(Chen, 1990; Chen and Rossi, 1983, 1987; Weiss, 1972; Weiss, 1997). First, a set of intervening variables, collectively referred to as an 'ideational factor', are derived from diffusion of innovations and social network theory. 'Ideation', defined 'as new ways of thinking that diffuse in a society by means of social interaction', was introduced by demographers as an alternative explanation of fertility transition (Cleland and Wilson, 1987; Freedman, 1987). The impact of the social network approach on these intervening, ideational variables is determined. Finally, the impact of the social network approach and ideation on modern contraceptive behavior is estimated by means of a multivariate regression analysis with data from a longitudinal survey (panel) of married women ages 14–49. The paper ends with a discussion and a set of recommendations for improvement of the approach based on both theoretical and empirical considerations. Although the data are limited to family planning behavior, the findings of this study with respect to the role of social networks and ideation in behavioral change have implications for other areas of health and social development.

Background

In 1975, four years after its War of Independence and a famine of historical proportions, the total fertility rate of Bangladesh was estimated to be 6.3 children, and contraceptive prevalence, 7.7% (Mitra et al., 1994). The population was about 75 million at that time (Nortman, 1972), which meant that with an annual natural rate of increase of 2.5–3.0% the population was expected to double to 150 million in just 23–25 years — by the end of the 1990s. 25 years ago, there was very little prospect for economic development and no easy way for the government to reach people outside the capital of Dhaka (Arthur and McNicoll, 1978).

Fortunately, a substantial effort was made by the government and international donors to reduce fertility and population growth. The 1997 estimate of Bangladesh's population is 122.2 million (Population Reference Bureau, 1997), not the 150 million predicted 25 years ago. Much of the unexpected shortfall of some 28 million people can now be attributed to the country's extensive, national family planning program, which is considered to be one of the most successful programs in the world today, especially in light of that nation's low level of economic development and economic growth. In 1975, some 3639 family planning extension agents known as Family Welfare Assistants (FWAs) were introduced. Their number grew to about 12,000 between 1977 and 1987, and then increased to 21,155 in 1990 and 23,500 by 1994 (Cleland et al., 1994).

FWAs were trained and supervised to make approximately 20 household visits each day within their assigned catchment areas so that they could reach all married women every two months. Surveys have shown, however, that the percent of women visited by a family planning field worker in the last six months has never exceeded 40%, and it was only 35% in 1996 (Bangladesh Demographic and Health Survey (BDHS) 1996–97, 1997). But even with this level of performance contraceptive prevalence has reached 49% (41.5% modern methods), and the total fertility rate has dropped to 3.3 children (BDHS 1996–97, 1997). In a recent review of the program, Cleland et al. (1994) found "unassailable evidence that routine household visits by family planning workers have an impact on reproductive behavior that is not merely transient … the growth in contraceptive use and the decline in fertility coincide with the scale and nature of the effort made by the government family planning program" (p. 134). Unfortunately, the current rate of population growth combined with existing population momentum means that the population will continue to grow well into the next century. Furthermore, as contraceptive prevalence increases, especially by means of temporary methods such as the oral pill, the burden on FWAs to distribute contraceptives and deal with discontinuation will increase as well. One solution is to increase the number of FWAs and/or the number of fixed clinic sites. An alternative is to increase the efficiency and effectiveness of FWA performance. The social network approach was developed to meet this challenge.

A social network approach to communication

The initial social network project was conducted in the Trishal 'thana' of Mymensingh district from 1989 to 1992 in 12 villages (Kincaid et al., 1993; Mitra et al., 1992)[2]. Evaluated by means of a randomized experimental design, the research results showed that the 12 villages using the social network approach had an increase in modern contraceptive use that was more than double the increase in the 12 control villages which used conventional FWA home visits (Piotrow et al., 1997). Based on the results of the Trishal project, the Ministry of Health and Family Welfare of Bangladesh authorized the replication of the approach

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[2] The social network approach was developed by the Bangladesh Center for Communication Programs (BCCP) in cooperation with the Ministry of Health and Family Welfare of the Government of Bangladesh with technical assistance from Johns Hopkins University's Center for Communication Programs and funding from the US Agency for International Development

in seven new 'thanas' in early 1994, and then another 11 'thanas' during 1995. The replication consisted of training the supervisors and all of the approximately 50–75 FWAs of a 'thana' to apply an integrated set of communication activities. Rather than relying solely upon private visits in individual homes, FWAs were trained to make use of rotating discussion groups of women, 'jiggashas', which are centered in the homes of volunteer 'link' persons[3]. These volunteers link the FWA and women in their own social network, host small group discussions at their homes, and help coordinate the FWA's work in their village. Link persons are strategically located in the social network so that by rotating the meetings from link person to link person most of the women in the FWA's catchment area are able to participate at a point close to their own homes. Some home visits may still be made after the meetings, but only for women who cannot attend the meetings or who still require the privacy of their own homes.

Key features of the social network approach include.

1. Training of field workers (FWAs) to improve their interpersonal communication, counseling, and group leadership skills and to locate and mobilize opinion leaders ('link persons') in each communication network.
2. Identification of village communication networks to locate volunteer link persons who are:
   2.1. centrally located within the social network;
   2.2. satisfied users of family planning and willing to promote it publicly;
   2.3. influential within the social network.

3. Establishment of rotating peer group discussions ('jiggashas') by each FWA which:
   3.1. meet at the homes of local link persons at least once a month;
   3.2. discuss health and family planning issues;
   3.3. encourage peer group support and influence;
   3.4. include counseling facilitated by audiovisual educational materials, especially entertaining audio cassette programs;
   3.5. provide family planning supplies at the meetings in place of time-consuming home visits by FWAs.

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[3] 'Jiggasha', a Bangla word which means 'to inquire', was selected by the Bangladeshi staff to represent the community network approach because it implies the active participation of village women in obtaining health and family planning information, counseling, and supplies.

Theory

According to classical demographic theory formulated during the 1950s and 1960s, a society's fertility declines as a consequence of the rising cost and declining economic value of children that accompanies economic and social changes such as industrialization, urbanization, and education (Easterlin, 1978; Notestein, 1953). Empirical research over the last two decades, however, has challenged the expected relationship between socioeconomic variables and fertility (Hirschman, 1994; Kirk, 1996; Coale and Watkins, 1986, Knodel and van de Walle, 1979). Recent sociological and demographic literature has identified 'ideational factors' (Cleland, 1985; Cleland et al., 1994; Cleland and Wilson, 1987; Freedman, 1987; Tsui, 1985) and 'social interaction' (Bongaarts and Watkins, 1996) as important determinants of fertility decline. After reviewing the evidence from developing countries, Bongaarts and Watkins (1996) concluded that "development alone is insufficient to account for observed variations in the timing and the onset of [fertility] transitions … and that social interaction should be taken into account" (p. 669). They theorize that once contraceptive behavior has been adopted by a group within a community or by a community within a society, then social interaction "can become a powerful force that accelerates the pace of transition for the rest of the community" (Bongaarts and Watkins, 1996 p. 669).

The conclusions from historical and contemporary demographic research are indirect and are based primarily on an inference that spatial patterns of fertility decline (i.e., by county) imply that diffusion of contraceptive practices must be occurring by means of interpersonal communication among individuals (Bocquet-Appel and Jakobi, 1998; Rosero-Bixby and Casterline, 1993). Because the ideational hypothesis has not been directly confirmed and because ideation is considered difficult to measure (Lesthaeghe and Vanderhoeft, 1998), this new theoretical approach to fertility decline is still considered to be incomplete (Mason, 1997). What is missing is a clear explication of the psychological and social interaction components of ideation, their measurement at the individual level of analysis, and an empirical test of their influence on contraceptive behavior.

Research on the determinants of contraceptive adoption in Bangladesh (Ahmed, 1987; Akhter and Ahmed 1992; Amin et al., 1987; Phillips et al., 1988), on the impact of the Matlab project (Caldwell and Caldwell, 1992; Koenig et al., 1987), on community (Allaudin, 1985) and 'bari' (household) factors (Rahman, 1986), on field worker and client interaction (Koenig et al., 1992; Osteria et al., 1979; Philipps, et al., 1993), on the role of religion (Bernhart and Uddin, 1988), on contra-

ceptive intentions (Bhatia, 1982), and on husband–wife discussion of contraception (Koenig et al., 1984; Pathak, 1997) support the general proposition that ideation and social interaction are important influences of contraceptive behavior and fertility. None of these studies, however, were conducted explicitly to measure and test the role of ideation in fertility change.

Diffusion of innovation theory (Rogers, 1995) and social network theory (Montgomery and Casterline, 1996; Rogers and Kincaid, 1981) may be combined to explain the psychological and social components of ideation and to derive appropriate measures for empirical research. Diffusion theory states that the adoption of new behavior/technology is a 5-stage, innovation-decision process from knowledge to persuasion, decision, implementation, and then confirmation. Knowledge is obtained through various channels of communication, and persuasion is considered to be primarily determined by interpersonal communication. Persuasion is determined primarily by the attributes of the innovation, and its compatibility with one's values, beliefs, and needs — all of which are included in most theories of attitude change (Fishbein and Ajzen, 1975). The theory implies that if there is sufficient knowledge and a positive enough attitude then the individual will decide to adopt the innovation. If the expected advantages are realized after implementation, then the decision is confirmed and use of the innovation will continue. A measure of ideation derived from diffusion theory would include a combination of knowledge, beliefs about the positive and negative attributes (values) of the innovation, and discussion of the innovation with one's family, peers, and change agents (if they exist), and their social approval.

Social network theory has been used to extend the classical diffusion of innovation theory in response to criticism that it is predominantly an individual, psychological approach to behavior change (Rogers and Kincaid, 1981). Individuals who are isolates or on the periphery of local social networks (e.g., within villages, communities, organizations) are less likely to hear about an innovation, will hear about it much later, and will not have as much opportunity for social comparison (Festinger, 1954; Suls, 1977) nor exposure to social influence from others (Kincaid, 1987, 1994; Latane, 1981; Moscovici, 1986; Nowak et al., 1990). Individuals who are more highly interconnected and centrally located within local social networks are more likely to hear about innovations earlier and to have more opportunity for social comparison and influence.

Similar propositions apply to cliques within a local network. A clique is a relatively bounded set of individuals who interact more with one another than with those outside the clique. Isolated cliques would be expected to adopt innovations later than cliques inter-connected to other cliques by means of liaisons (members of multiple cliques) and bridges (members' ties to members of other cliques). Social network structure is expected to 'accelerate' the diffusion of an innovation to the extent that clique boundaries protect those inside (where the innovation is normative) from opposing, outside social influence (where the innovation is still not the norm), and to the extent that innovative cliques recruit new members from the outside and/or influence other cliques to adopt the innovation and provide support to them to maintain the change.

When family planning field workers implement a social network approach, they are explicitly appying social network theory. By holding meetings of village women in the homes of family planning opinion leaders (satisfied current adopters) who are centrally located but geographically dispersed to cover the entire village network, they are making use of the existing informal social network while at the same time changing the content of communication by providing a forum for the face-to-face discussion of family planning with other women. The 'jiggasha' meetings in which this discussion occurs provide an opportunity for the social comparison, support, and influence that is less likely when the field workers use only home visits with individual women.

Implementation of the social network approach also changes the structure of the local network by recruiting isolated women and increasing links among the cliques in which the 'jiggasha' meetings are held. By changing the structure and process of social interaction in local village networks, field workers are increasing the likelihood that the process of diffusion — knowledge, persuasion, implementation, decision, and confirmation — will take place sooner and among a higher proportion of individual village women. In the classic 'S' curve of diffusion (cumulative distribution of adoption), there is an inflection point in which the rate of change increases (accelerates) presumably due to the influence of social interaction once a sufficient number of adopters is reached and they talk to others about the innovation.

From the perspective of diffusion and social network theory, ideation is a multidimensional construct, comprised of psychological and social components. The elements of ideation are expected to have a cumulative or joint effect on behavior, functioning in a synergistic manner like health risk factors in epidemiology (Kahn and Sempos, 1989; Schlesselman, 1982). From a cultural diffusion perspective, 'ideation is defined operationally as the cumulative conjunction of variables used to measure progress on the stages of the innovation-decision process prior to behavior change'. In the current research, these variables include knowledge of contraceptive methods, attitudes towards practicing family planning, discussion of family planning with

one's spouse and friends, and approval of family planning practice by one's husband.

The small group communication that occurs in 'jiggasha' meetings as well as subsequent communication within village social networks is expected to have a positive impact on these five measures of ideation which in turn are expected to lead to an increase in the adoption of contraception and continuation of its use over time. It is assumed that the FWAs' conventional pattern of work also affects contraceptive adoption by the same process of change, but with less effect because of the constraints on social interaction and influence. The rate of behavior change among women participating in the social network approach is expected to be greater than the rate of change among women with conventional home visits by FWAs or women with no FWA contact at all. The theory-based, longitudinal nature of the research design lends itself to the following five hypotheses.

- Hypothesis 1: the rate of change in modern contraceptive use of women who participate in the social network approach will be greater than the rate of change of women who are visited in their homes by FWAs, which in turn will be greater than the rate of change of women who have no FWA contact at all.
- Hypothesis 2: the social network approach will have a positive impact on modern contraceptive use that is greater than the impact of conventional FWA home visits.
- Hypothesis 3: the social network approach will have a positive impact on new adoption and on the continuation of modern contraceptive use that is greater than the impact of FWA home visits.
- Hypothesis 4: ideation will have a significant impact on modern contraceptive use, and the probability (proportion) of modern contraceptive use will increase monotonically with the level of ideation.
- Hypothesis 5: the social network approach will have a significant indirect impact on modern contraceptive use through its effect on ideation.

Methodology

A one-group, before–after quasi-experimental design

was used to conduct this evaluation research. A longitudinal (panel) sample survey of women was conducted in three of the seven thanas where the social network approach was being replicated. The baseline sample survey was conducted from 22 January 1994 to 21 February 1994, in Zakiganj thana of Sylhet District in the Chittagong Division, Daulatkhan thana of Bhola District in the Barisal Division, and Barura thana of Comilla District in the Chittagong Division by the survey research company of Mitra and Associates (Islam and Mitra, 1997). The follow-up survey of the same respondents was conducted from 20 May 1996 to 14 June 1996, approximately two and a half years after the baseline survey.

Sampling design

Out of the seven thanas in which the new approach was first implemented, three were chosen for purposes of evaluation because they represented a range of existing contraceptive prevalence and culturally conservative (Zakiganj) as well as progressive areas (Daulatkhan). The data were collected by means of a multi-stage, snowball sample in the three thanas (Goodman, 1961). Within each thana, 10 FWA catchment areas were randomly selected by means of a systematic sampling procedure after a random start in the list of FWA catchments ordered by level of performance — the contraceptive acceptance rate as determined from the FWA's couple registration record. This procedure ensured that the full, representative range of initial FWA performance levels would be used to test the new approach. Across the three thanas, this procedure yielded a total of 30 randomly selected primary sampling units for the survey[4]. Each of the selected FWA catchment areas was divided into the 5–6 sub-catchment areas where FWAs were to be trained to conduct the rotating 'jiggasha' meetings. One of these 'jiggasha' sub-catchment areas was randomly selected for the survey of women by means of a 3-stage, snowball sampling procedure initiated with two potential link persons. This procedure yielded a total snowball sample of 1479 women, an average of 49 women per FWA catchment area (village).

The same snowball sampling procedure was used for the follow-up survey two and half years later. Women from the baseline survey in 1994 who were not named in the follow-up snowball procedure in 1996 were located and re-interviewed[5]. The final sample included 1862 women overall and 1313 married women ages 14–49. Of these married women, 860 were interviewed at both points in time and comprise the intact panel to be used for present statistical analysis. Of the 453 lost from the panel (34.5%), 361 were lost due to attrition (27.5%), another 51 were excluded because they were not married at both points in time (3.9%), and another

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[4] An FWA catchment area corresponds to approximately 1–1.5 natural villages, and therefore will sometimes be referred to as a village.

[5] This sampling procedure was used to permit a separate analysis of the change in the social network structure due to the influence of the group meetings.

41 (3.1%) were excluded because the data from both points in time could not be adequately verified (matched) on variables such as age and number of children. This attrition left an intact panel of 860 married women age 14–49, 65.5% of the original baseline survey.

This snowball sampling technique was used because it matched the social network aspect of the intervention. Women were selected who would be most likely to be included in any implementation of the social network approach that the FWAs are trained to use. The results indicate only what would be expected from repeated snowball samples selected in the same way (Sudman, 1976). The snowball sample suffers from the non-coverage of women who are unlikely to be in the social networks of potential volunteer link persons. Thus, technically speaking, the results only generalize to women who are likely to be within the social networks of centrally located women identified by FWAs trained in the social network approach. This sub-population of women was considered to be the relevant group to test the effectiveness of the new approach.

Measurement

Participation in the social network approach was measured by means of a simple yes or no question regarding participation in the jiggasha meetings, as was home visitation by a FWA. Knowledge of contraceptive methods was measured by means of unaided recall of six modern contraceptive methods. Family planning attitude was measured by four statements about the expected consequences of practicing family planning: (1) if you practice family planning to have fewer children, you can avoid poverty; (2) families that practice family planning and have fewer children are better able to provide food for their family; (3) having fewer children makes it easier to raise them properly; and (4) practicing family planning improves the relationship between a wife and her husband. Each item was measured by means of a 17-point ratio rating scale

from 0–16 'anna', corresponding to degree of belief[6]. Zero indicates no belief whatsoever and 16 indicates complete certainty. The midpoint, 8, corresponds to moderate belief, and any number from 12 on up corresponds to a very strong belief. Internal reliability of the four items was 0.80 as measured by Cronbach's alpha coefficient.

The two family planning communication questions and the husband approval question were dichotomized as yes or no. These five variables all loaded on the first principal component of a factor analysis. However, because 'discussion of family planning with other women' was auto-correlated with participation in jiggasha meetings, it was not included in the ideational factor used for impact analysis. To combine continuous and dichotomous items, the remaining four variables were standardized and then averaged to construct the overall ideation measure for each respondent. Internal reliability of the resulting ideation scale was 0.72 at the baseline and 0.66 at the follow-up, and the correlation across time was 0.45.

Among the socio-demographic control variables, education was dichotomized as no formal schooling vs primary school and above. In the intact panel only 37.4% of the women had any schooling at all. Socio-economic status (SES) was measured by means of four variables: husband's education level; husband's occupation; land ownership; and the number of eight household items owned by the family (almirah, cot, table, watch, bicycle, latrine, cows, and tubewell). The internal reliability (alpha) of this measure was 0.76, and it was standardized with a mean of 50 and standard deviation of 10.

Analysis of impact

In longitudinal research designs change is measured directly and causal analysis is facilitated because the time-order of variables is made explicit (Finkel, 1995). The three major threats to internal validity are: (1) selectivity bias due to the attrition of cases (Heckman and Hotz, 1989), (2) selectivity bias due to voluntary participation (Heckman and Hotz, 1989; Moffitt, 1991), and (3) 'endogeneity and reciprocal causality' which may lead to the misspecification program effects (Bollen et al., 1995).

In the following statistical analysis, potential selectivity bias is reduced by controlling statistically many of the variables related to attrition and voluntary participation, such as age, parity, education, and so forth (Heckman and Hotz, 1989). The longitudinal analysis also permits comparison of the changes (growth rates) over two points in time of non-participants and participants in the intervention (Moffitt, 1991). The possi-

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[6] The anna scale was originally developed in the Pachod rural health program in India at the request of non-literate village women who said they preferred a numerical scale rather than an ambiguous verbal scale for monitoring the weight of their babies (Kapadia-Kundu, 1994). The anna was used as the denomination of coins in the old currency system of Bangladesh, with 16 annas making 1 taka, the smallest paper currency. The anna is used indigenously for degree of belief, 'I do not believe you, not even one anna', or to indicate proportions of inheritance, '12 anna of my father's land went to my elder brother, two to my sister, and only two anna to me'.

bility that prior contraceptive use leads to participation in the intervention as well as subsequent contraceptive use is handled in the longitudinal design by the use of 'static-score' or 'conditional change' regression analysis in which the current value of contraceptive use (in 1996) is predicted by its lagged value (in 1994) and a set of independent control variables (Finkel, 1995). The lagged value of contraceptive use is also statistically controlled when estimating the effect of the social network approach and ideation on contraceptive use in 1996. And finally, statistical tests of endogeneity are performed on the observed relationships among variables measured at the same point in time (e.g., exposure, ideation, and contraceptive behavior measured in 1996) to determine if unobserved influences are affecting the observed relationship or if the direction of causality is reciprocal (Bollen et al., 1995).

Results

Sample validation

The similarity of the snowball sample compared to the rural sample of married women ages 14–49 from the national demographic and health survey (BDHS) survey also conducted in 1994 by Mitra and Associates is shown in Table 1. Compared to the national rural sample, women in the snowball sample were somewhat older, had approximately the same level of education and radio exposure, a lower level of land ownership, a higher use of injectables, and a lower level of traditional contraceptive use. The level of attrition from the baseline to the follow-up survey was relatively high (34.5%), but age group was the only statistically significant difference. Mean age, however, was not signifi-

Table 1
Distribution of characteristics of rural married women age 14–49 in 1994 by sample[a]

Variable	Sample validation		1994–96 panel validation	
	1994 DHS (weighted) $N = 7967$ (%)	1994 snowball baseline $N = 1313$ (%)	Intact panel $N = 860$ (%)	Lost from panel $N = 453$ (%)
Age				
< 20	15.7	8.2	6.5	11.3
20–29	2.9	39.8	40.1	39.3
30–39	26.9	37.9	39.8	34.2
40–49	14.6	14.2	13.6	15.2
Total	00.1	100.1	100.0	100.0
Mean age	–	29.79	29.97	29.43
Education				
None	59.3	62.1	62.6	61.2
Primary	28.4	30.3	29.4	32.0
Secondary or higher	12.3	7.6	8.0	6.8
Total	100.0	100.0	100.0	100.0
Current contraceptive				
None	56.7	59.3	57.4	62.7
Pills	16.9	18.1	18.3	17.7
Condoms	2.3	2.0	2.0	2.0
Injectables	4.5	8.9	10.4	6.2
IUD	2.0	1.1	1.2	1.1
Tubal ligation	8.3	5.3	5.2	5.5
Vasectomy	1.1	0.8	1.2	0.0
Rhythm	4.8	2.8	3.1	2.2
Withdrawal	2.3	0.4	0.4	0.4
Other	1.1	1.4	0.9	2.2
Total	100.0	100.1	100.1	100.0
Field worker (FWA) visit last six months	37.3	65.4	64.2	67.8
Radio FP exposure	40.5	37.1	37.7	36.0
Land ownership	59.4	49.4	50.5	47.2

[a] The source of the DHS 1994 is from Macro International; the 1994–96 snowball surveys are from Mitra and Associates. Statistical tests were conducted only to assess the potential bias in the intact panel due to attrition. The only statistically significant difference found was for the age distribution ($P < 0.01$), but no significant difference was found for the mean age.

cantly different (29.97 and 29.43 years). More importantly, for the purpose of measuring impact, there were no statistically significant differences in current contraceptive methods used between women in the panel and those who were lost, nor in the level of FWA home visits in 1994. These variables are included in the multivariate analysis as statistical controls (see Table 1), but it appears that attrition would not create a significant selectivity bias in the estimation of program impact.

Level of participation

A descriptive analysis of the level of participation, activities, and members' opinions is reported elsewhere (Islam and Mitra, 1997). One of the important findings from the women's own self-evaluation was that a majority of the women who participated rated the jiggasha meetings as good or very good, and over two thirds said that they would like them to continue in their village, about half without FWA home visits and the other half with home visits in combination with jiggasha meetings.

In the three thanas as a whole, 12.4% of the women in the intact panel said that they participated in jiggasha meetings, 61.6% continued to be visited only in their homes by an FWA, and 25.9% reported no type of FWA contact. There was a substantial variation, however, in participation rates across thanas and villages. In Zakiganj thana only 4% of the women interviewed participated in jiggasha meetings, whereas 12% participated in Daulatkhan, and 17% in Barura. At the village level, participation ranged from 0 to 42%. Eight villages reported no participation in the social network approach at all, which indicates that as many as 27% of the FWAs trained to use the new approach did not try it.

These figures are deceptive because seven of the eight villages that did not participate were found in one thana, Zakiganj. The thana is the primary unit where the social network approach is taught and implemented. In Zakiganj, the most conservative thana, seven of 10 FWAs did not organize any jiggasha meetings. Assuming that these 10 FWAs were representative of all FWAs in that thana (given their random selection), then the implementation rate in Zakiganj was only 30%. Not surprisingly, Zakiganj also had the lowest overall FWA home visitation, 40% compared to 75% in Daulatkhan and 62% in Barura, and it was the only thana to have a village that reported no FWA home visits at all. These results suggest that the social network approach is more likely to be implemented in 'thana's where FWAs are already performing well, and where they are well received by local communities.

Table 2 presents the initial characteristics of women in 1994 by the type of FWA communication that they reported in 1996. There were no statistically significant differences among the three groups in terms of land

Table 2
Characteristics of married women ages 14–49 in 1994 by type of FWA communication in 1996[a]

Variable[b]	None $N = 223$ (%)	Home visit by FWA $N = 530$ (%)	Network approach[c] $N = 107$ (%)
Modern contraceptive use***	19.3	42.1	< 57.9
FWA home visit in last six months (1994)***	35.9	65.7	73.8
Heard family planning on the radio***	31.4	39.4	42.1
Primary school or higher***	31.4	37.9	47.7
Thana***			
Zakiganj	48.4	14.3	> 7.5
Daulatkhan	19.7	46.4	> 37.4
Barura	31.8	39.3	< 55.1
Religion**			
Islam	83.0	90.4	94.4
Hindi	17.0	9.6	5.6
Land ownership	53.8	48.7	52.3
Mean age	30.7	29.7	29.7
Mean SES	49.6	49.6	50.8
Mean number of children	3.2	3.5	3.5

[a] Surveys were conducted by Mitra and Associates. Panel sample size is 860 married women interviewed in January 1994 and again in June 1996.

[b] Statistical significant for each variable $*p < 0.05$, $**p < 0.01$, $***p < 0.001$. Greatest differences are due to the group with no FWA contact in the last six months.

[c] Statistically significant differences between the social network approach and FWA home visits are indicated by the equality signs ($<, >$) between the columns.

Table 3
Change in modern contraceptive use and ideation among married women ages 14–49 by type of FWA communication reported in 1996[a]

Dependent variables[b]	1994 baseline survey Type of FWA communication in 1996			1996 follow up survey Type of FWA communication in 1996			1994–1996 Change over time		
	None	FWA home visit	Social network approach	None	FWA home visit	Social network approach	None	FWA home visit	Social network approach
Modern contraceptive use	19.3%	42.1%	< 57.9%	9.9%	43.0%	< 62.6%	−9.40	+0.90	+4.70
Elements of ideation									
Mean modern method knowledge (Range=0–6)	3.0	3.8	4.1	2.5	3.7	< 4.5	10.5	10.1	+0.4
Mean FP attitude (Range=0–16)	12.8	14.3	14.9	13.4	14.6	14.9	+0.6	+0.3	0.0
FP discussion with husband (Yes/No)	55.6%	82.3%	86.0%	56.5%	89.8%	< 96.3%	+0.9	+7.5	+10.3
Husband approves of FP (Yes/No)	57.9%	79.1%	86.9%	58.7%	86.0%	90.7%	+0.8	+6.9	+3.8
FP discussion with other women (Yes/No)	19.7%	37.6%	43.9%	46.2%	73.4%	< 93.5%	+26.5	+35.8	+49.6
Overall ideation (mean)[c]	46.02	51.11	52.81	44.70	51.50	< 53.60	−1.32	+0.39	+0.79
Number of cases	223	530	107	223	530	107	223	530	107

[a] 1994–96 surveys were conduced by Mitra and Associates. FP = family planning.
[b] $N = 860$ intact panel. All differences within each survey are statistically significant beyond the 0.001 level of probability. Statistically signficant differences between the social network approach and FWA home visits are indicated by the inequality sign (<).
[c] Overall ideation is measured by the mean of the standardized scores of the first four elements of ideation. Overall ideation ranges from 21.8 to 57.7; internal reliability, $a = 0.66$.

Table 4
Percent of married women ages 14–49 using modern contraceptive methods by type of ideation in 1996[a]

	Percent using modern method of contraception when the variable is:			
Type of ideation[b]	Percent Yes/High	No/Low	Yes/High	Crude odds ratio[c]
High knowledge modern contraceptives (4–6)	50.6	24.5	49.0	2.96
High FP attitude (15–16)	61.1	28.4	42.3	1.85
Discussed FP with husband	82.0	8.4	43.1	8.28
Husband approves of family planning practice	79.6	12.0	43.1	5.59
Discussed FP with other women	68.8	16.4	46.1	4.36

FP = Family planning.
[a] 1994 and 1996 surveys were conducted by Mitra and Associates. FP = Family planning.
[b] The two continuous variables are dichotomized at the median for purposes of comparison with the other three variables.
[c] $N = 860$ intact panel; all differences are statistically signficant beyond the 0.001 level of probability. All variables are measured in 1996.

ownership, mean age, mean number of children, and mean socio-economic status. Women who participated in the social network approach or who were visited at home both had a significantly higher percentage of primary school education or higher (47.7% and 37.9%, respectively) compared to women with no contact at all (31.4%). Both social network participants and women who continued with FWA home visits were much more likely to have had FWA home visits during the six months prior to the start of the project in 1994 (73.8% and 65.7%, respectively) than women with no FWA contact (35.9%). Social network participants and women who had FWA home visits also had higher levels of exposure to family planning messages on the radio before the project began. Only 7.5% of women in Zakiganj thana participated in the social network approach, compared to 37.4% of the women in Daulatkhan and 55.1% in Barura. Only 14.3% of women in Zakiganj reported having FWA home visits, compared to 46.4% in Daulatkhan and 39.3% in Barura.

All of the significant differences in 1994 which are shown in Table 2 are due to the group of women who had no FWA contact of any kind, except for use of modern contraceptives and thana residence. Differences in prior modern contraceptive use poses the most serious selectivity bias to the estimation program impact. The panel design, however, makes it possible to control for prior contraceptive use, thana residence, and socio-economic characteristics when estimating the impact of the social network approach in the multivariate analysis that follows.

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[7] In Table 3, significant differences between the social network approach and FWA home visits are indicated by the inequality sign (<).

FWA communication and change in ideation and modern contraceptive use

Analysis of changes in modern contraceptive use and ideation by type of FWA communication is shown in Table 3. In 1994, all of the differences among the three groups in the elements of ideation were statistically significant. Except for modern contraceptive use, all of these differences were due to the group with no FWA contact. There were no initial differences in any of the five elements of ideation between women who continued with FWA home visits and those who participated in the social network approach. By 1996, however, overall ideation was significantly greater among social network participants than women visited at home, which may be attributed to the significant positive differences in knowledge of modern methods and family planning discussion with one's husband[7].

Although the prevalence of modern method use was initially greater among social network participants (57.9%) than those visited at home (42.1%), the rate of change among social network participants during the two-year period was greater. Prevalence among participants in the social network approach increased by 4.7 percentage points compared to 0.9 percentage points among women who continued to be visited at home, and declined 9.4 percentage points among women with no FWA contact at all. Given the initial similarity of the two groups, the rate of change observed among women who continued with home visits is what we would have expected to occur among social network participants if there had been no intervention — the counter factual condition (Moffitt, 1991). Assuming that a higher initial level would not lead to a higher rate of change, we can infer that difference in the respective 'rates of change' was due to

Table 5
Conditional change regression models for ideation and modern contraceptive method use in 1996[a]

Independent variables[b]	Level	Ideation — Linear regression Std. beta coefficient	Modern method use[c] — Logistic regression Model 1 Odds ratio	Model 2 Odds ratio	95% confidence interval
1994 Survey:					
Prior contraceptive intention and use					
Non-use (ref.)	22.2%	–	1.00	1.00	
Intend use or trad. method use	39.7%	0.07	3.17	3.13***	1.7–5.88
Modern method use	38.1%	0.08	7.73***	7.68***	4.11–14.36
Prior ideation					
Mod. method knowledge (mean)	3.62	0.08**			
FP attitude (mean)	14.0	0.03			
Discuss FP with husband	75.8%	−0.03			
Husband approves FP use	74.5%	0.13**			
FWA home visit during last six months	59.0%	0.04	1.10	1.08	0.73–1.60
Socio-economic characteristics					
Education (primary or above)	37.4%	0.10**	0.67	0.67	0.44–1.02
SES (39–67: mean)	49.8	−0.02	1.00	1.00	0.97–1.03
Age (14–49 years: mean)	30.0	0.25	1.31**	1.31**	1.08–1.60
Age^2 (mean)	953.73	−0.28	0.99**	0.99**	0.88–0.99
Number of children (0–14: mean)	3.39	−0.04	1.07	1.06	0.95–1.20
Thana					
Zakiganj (Ref.)	22.3%	–			
Daulatkhan	38.4%	0.34***			
Barura	39.3%	0.31***			
Radio exposure to family planning	37.7%	0.10***			
1996 survey:					
Overall ideation (mean)	50.0		1.11***		
Mod. method knowledge (mean)	3.51			1.19**	1.07–1.33
FP attitude (mean)	14.4			1.09*	1.00–1.18
Discuss FP with husband	82.0%			1.85	0.89–3.83
Husband approves FP use	79.5%			2.05*	1.12–3.76
Type of FWA communication					
None (ref.)	26.0%	–	1.00	1.00	
FWA home visit only	62.0%	0.25***	2.93***	2.92***	1.71–4.99
Social network approach	12.0%	0.23***	5.18	5.12***	2.61–10.0
Number of cases	860	860	860	860	
Variance explained (R^2)		0.38	0.25	0.25	
Goodness-of-fit (10 group)[d]					
(Hosmer-Lemeshow χ^2 8df)		–	11.86	5.99	
Probability $> \chi^2$			0.16	0.65	
Correctly classified			73.5%	73.6%	

[a] January 1994 and June 1996 panel survey of married women ages 14–49 was conducted by Mitra and Associates. FP = family planning.

[b] Statistical significance: $^*P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

[c] Prior ideation, thana residence, and FP radio exposure were not statistically significant and were dropped from the model for modern method use and used to specify the equation for ideation.

[d] Non-significant goodness-of-fit χ^2 indicates that there is no statistically significant difference between the model and the data.

the greater effectiveness of the social network approach compared to conventional FWA home visits. These results support the first hypothesis. The increase in modern contraceptive use among women who participated in social network approach was five times greater than the increase among women with only FWA home visits (4.7 over 0.9), and the change among women with no FWA contact was negative (−9.4).

Why the rate of change in modern contraceptive use is greater for the social network approach than conventional home visits may be inferred by examining the corresponding rate of change in ideation by type of communication (Table 3). The overall mean level of ideation increased by 0.79 points among social network members, increased 0.39 points among women with home visits, and declined 1.32 points among women with no contact. Among the separate elements of ideation, the rate of change in modern method knowledge and family planning discussion with one's husband was greater among social network participants, while the rate of change in husband approval was greater among women visited by FWAs at home. Very little change was found for family planning attitude, possibly because of a ceiling effect in its measurement. The social network approach had a greater impact on overall ideation than FWA home visits, due mainly to its effect on method knowledge and discussion of family planning with one's husband.

Table 4 presents the percentage of women using modern methods by the level of each ideational element (coded low/high at the median for continuous measures and no/yes for dichotomous measures). Each separate indicator of ideation had a strong, statistically significant relationship with current modern contraceptive use. Discussion of family planning with one's husband had the strongest relationship. Among the 82% of women who said that they talked to their husband in 1996, 43.1% reported using a modern contraceptive compared to only 8.4% for women who did not talk to their husband. The crude odds ratio indicated that women who talked to their husbands were over eight times more likely to use a modern contraceptive.

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[8] When the residual term from the least squares regression model for the continuous form of ideation ($R^2 = 0.38$) was included with the elements of ideation in the equation shown for modern contraceptive use it was not statistically significant. A non-significant result was also observed when the residual from the regression model for type of FWA communication ($R^2 = 0.17$) was included. When the residual term for type of FWA communication was added to the equation for ideation it was also not statitically significant. All three tests failed to reject the null hypothesis that these three variables are exogenous variables.

Approval of one's husband was the second strongest ideation variable ($OR = 5.59$), followed by discussion with other women ($OR = 4.36$), unaided knowledge of modern methods ($OR = 2.96$), and family planning attitude ($OR = 1.85$).

Impact of the social network approach

The results of the conditional (static-score) multiple regression analysis of ideation and modern contraceptive use are shown in Table 5. Thana residence had the strongest association with level of ideation, which is an indication of the more conservative culture of Zakiganj thana compared to Daulatkhan and Barura thanas. After thana residence, the type of FWA communication had the greatest impact on ideation. FWA home visits had about the same effect on ideation as the social network approach ($b = 0.25$ and 0.23, respectively). Prior intention and traditional method use, and even prior modern method use, had no statistically significant effect on current ideation. Among the four elements of prior ideation, prior modern method knowledge and prior husband approval were statistically significant ($b = 0.08$ and 0.13, respectively). The only socio-economic control variable that was significantly related to ideation was level of education ($b = 0.10$). Radio exposure to family planning messages in 1994 was also significantly related to current level of ideation ($b = 0.10$). The model as a whole explained 38% of the variance in ideation (adjusted $R = 0.62$). If ideation is significantly related to modern method use, then we may conclude that type of FWA communication has a significant and substantial indirect impact on modern method use through its effect on ideation.

The first logistic regression model for modern method use includes the overall measure of ideation, and the second model uses the first four elements of ideation. Discussion of family planning with other women was omitted because of its autocorrelation with participation in jiggasha meetings. The specific coefficients in each model are approximately the same. Each model explains 25% of the variance in modern method use (pseudo R^2), correctly classifies 74% of the cases, and is not statistically different from the data ($P > 0.16$ and $P > 0.65$, respectively). No statistical evidence of endogeneity was found for ideation or type of FWA communication when their residual terms were each added to the regression equations for modern method use (Bollen et al., 1995)[8].

The odds of using a modern contraceptive among women who were visited at home by an FWA were 2.9 times greater than women with no FWA contact, and the odds of using a modern method were over five times greater among women participating in the social network approach than women with no FWA contact.

The odds ratio for the social network approach was significantly greater than the odds ratio for FWA home visit ($\chi^2 = 5.25$; $P \geq 0.02$). The regression analysis confirmed the second hypothesis that the social network approach has a positive impact on modern contraceptive use that is greater than the impact of conventional FWA home visits.

The observed difference between the two types of FWA communication are adjusted for the effects of other influences on modern contraceptive use, including the potential selectivity bias of prior intention and use, prior FWA home visits, and selected socio-demographic variables. As would be expected, women who intended to use modern contraceptives or who already used a traditional method in 1994 were over 3 times more likely to use a modern method in 1996, and women who already used a modern method in 1994 were over 7 times more likely to use a modern method in 1996 than non-users. Home visiting by FWAs in 1994 was not significantly related to modern method use in 1996 after adjusting for the other variables in the model. The only significant socio-demographic control variable was age. The significant, negative sign of age squared indicates a curvilinear relationship, with a greater likelihood of modern method use among women in the middle age group and lower likelihood for women in the younger and older age groups. None of the prior ideation elements, radio exposure to family planning messages in 1994, nor thana residence were statistically significant when added to the regression model for modern contraceptive use, so they were dropped from the regression models for modern contraception and used to specify the model for ideation.

Overall ideation used in Model 1 was found to be significantly related to modern method use ($OR = 1.11$), thus confirming the fourth hypothesis. In Model 2, three of the specific elements of ideation were statistically significant. Women whose husbands
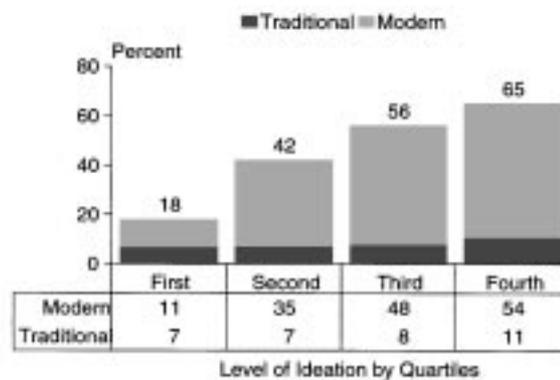
Fig. 1. Percentage of women using traditional and modern contraceptives in 1996 by level of ideation.

approved of their practicing family planning were twice as likely to use modern contraceptives than women whose husbands disapproved. For every modern method spontaneously recalled, the likelihood of modern contraceptive use increased by 0.19, and for every unit increase in the 17-point scale for family planning attitude, modern contraceptive use increased by 0.09. The impact of discussion of family planning with one's husband was not large enough to be statistically significant, but was positive. Given the observed effect of the social network approach on ideation, the results support the fifth hypothesis: the social network approach has a significant indirect impact on modern contraceptive use through it effect on ideation.

The cumulative effect of overall ideation is shown in the bar graph in Fig. 1. The overall ideation score was divided into quartiles, and the level of modern contraceptive use for each group was calculated. Modern

Table 6
Turnover in modern contraceptive use among married women ages 14–49 from 1994 to 1996 by type of FWA communication[a]

Change in contraceptive status from January 1994 to June 1996	Type of FWA communication reported in 1996[b]			
	None (%)	FWA home visit (%)	Social network approach (%)	Total (%)
Continued as non-user	77.6	40.4	23.4	47.9
Discontinued contraceptive use	12.6	16.6	14.0	15.2
Began contraceptive use	3.1	17.6	18.7	14.0
Continued contraceptive use	6.7	25.5	43.9	22.0
Total	100.0	100.0	100.0	100.0
Number of cases	223	530	107	860

[a] 1994/1996 surveys were conducted by Mitra and Associates. FWA = Family Welfare Assistant.
[b] χ^2 (6 df) = 135.5; $p < 0.001$.

contraceptive use among women in the lowest quartile of ideation was only 11%. The rate jumped to 35% among women in the second quartile, 48% in the third quartile and 54% in the highest quartile. In contrast, the effect of ideation on traditional contraceptive use was negligible. These results also support the fourth hypothesis: the probability (proportion) of modern contraceptive use increases monotonically with the level of ideation.

Continuation of contraceptive use

The turnover in modern contraceptive use from 1994 to 1996 by type of FWA communication is shown in Table 6. The results illuminate one of the main benefits of the social network approach. The largest difference in the table is for continuation of contraceptive use. The continuation rate for women who participated in social network approach was 43.9% compared to 25.5% for women with FWA home visits and only 6.7% for women with no contact. The percentage of women who began using modern contraceptives during this period is only slightly higher for social network participants than for women with FWA home visits (17.6% and 18.7%, respectively), and both are substantially higher than the rate for women with no contact (3.1%). These results partially support the third hypothesis: the social network approach has a positive impact on the continuation of modern contraceptive use that is greater than the impact of conventional FWA home visits. There was no support for the hypothesis that the new approach would have greater impact on new adoption of modern contraceptives than conventional home visits by FWAs.

The continuation rate was much higher among participants in the social network approach than the other two groups. This difference helps explain why the rate of modern contraceptive use among women with no contact declined, the rate among women with home visits increased by only 0.9%, and the rate among women who participated in the social network approach increased by 4.7%. Apparently, the opportunity to discuss family planning with other women, to receive social support, and perhaps to switch methods rather than discontinue, made it much more likely to continue using modern contraceptive methods.

Discussion

The two main purposes of this paper were to measure the impact of the social network approach to family planning communication and to test a theoretical model of behavior change that explains why women in Bangladesh adopt modern contraceptives. The analysis focused on the differences among women who participated in the social network approach, women who continued to have conventional FWA home visits, and women who had neither type of communication. A majority of women who participated in the new approach said that they would like it to continue either with or without home visits. The impact analysis revealed that the rate of increase in modern contraceptive use between 1994 and 1996 was five times greater among participants in the social network approach than among women who had FWA home visits. Modern contraceptive use declined substantially among women who had neither type of FWA communication.

The regression analysis showed that the social network approach had almost twice the impact of FWA home visits after controlling for the effects of prior use and intention, prior FWA home visits, and selected socio-demographic characteristics. The analysis of turnover in modern contraceptive use also confirmed that the social network approach had about twice the impact of conventional home visits, suggesting that one of the main advantages of the new approach is that it provides social support and encourages women either to continue with the method they are using or to switch to another modern method rather than discontinuing.

Why the social network approach was more effective than conventional home visits was explained by the analysis of its indirect effect on modern contraceptive use through its effect on ideation and its components. The regression analysis showed that both home visits and participation in the network approach had about the same degree of impact on ideation, after controlling for the effects of prior use, prior ideation, radio exposure, thana residence, and socio-demographic characteristics. The panel design helped reduce the threat of selectivity bias due to prior contraceptive behavior and ideation, and there was no statistically significant evidence of endogeneity for either ideation or type of communication in the regression model for modern contraceptive use.

The results also provide empirical support for diffusion theory and social network theory of behavior change from which the ideational factor was derived and which guided the strategic design of the social network approach. The social network approach was designed to increase discussion of family planning among women, to encourage discussion with spouses, to increase spouse approval for family planning practice, and to improve attitudes and increase levels of contraceptive knowledge. The regression analysis confirmed that these subobjectives were achieved by both the conventional FWA home visits and the social network approach, but that the social network approach had greater impact on modern contraceptive use, primarily due to its impact on the rate of continuation.

If the four components of ideation included in this study capture what demographers consider to be some of the important aspects of ideation, then the study has important implications for theories of fertility decline. Over the last 25 years, fertility in Bangladesh has declined from 6.3 to 3.3 children (BDHS, 1997). The survey results from the three thanas selected for this study are consistent with previous studies: that much of the decline in fertility in Bangladesh should be attributed to home visits by field workers and to ideational change (Cleland et al., 1994).

The social network approach has been shown to be effective when it its used by field workers. Two of the most important unanswered questions are why all of the FWAs who were trained did not implement the approach and why the level of participation was not higher where it was implemented. Although the training itself was shown to be effective when it was applied by FWAs, the relatively low level of participation suggests that a training intervention by itself is not sufficient to change the work patterns of FWAs in every thana. There are two potential sources of the lower than expected level of implementation and participation: conditions in the thana health center and the local community. Training alone may not have generated a sufficient level of consensus and commitment among FWAs, nor support on the part of health center directors and FWA supervisors. In conservative thanas such as Zakiganj the social network approach may have been resisted for the same reasons that home visits were low: local community norms opposing women's participation in group meetings and the opposition of spouses and (male) community leaders.

To overcome either of these constraints would require more than the training of FWAs in the new approach. Some type of organizational development for the entire thana health center and community mobilization would also be required. In the replications of the social network approach conducted in other thanas after the three thanas studied here, improvements in the training curriculum and modifications to the approach itself were made to overcome some of these difficulties. The social network approach now includes orientation sessions for village link persons which includes the FWAs' male supervisors. Training now emphasizes the roles and responsibilities of link persons, family planning and maternal–child health services, and how to operate local community-based distribution and sales of contraceptives.

Once the social network approach has been established within local communities the potential exists to expand its function to address some of the other felt needs of the participants. Other health field workers and even agricultural extension agents can be invited to attend jiggasha meetings to discuss oral rehydration therapy for diarrhea, control of upper respiratory infection, immunization, vitamin A supplements, household gardens, rotating credit associations, and the organization of income-generation projects. Throughout the rural areas of Bangladesh, the FWA represents the only employed female role model. Her presence has undoubtedly affected the way young people in particular perceive the roles of women (Mita and Simmons, 1995; Simmons et al., 1992). Anecdotal evidence suggests that village women who serve as jiggasha link persons gain an increased sense of self-efficacy and prestige by volunteering. In addition to achieving specific developmental goals such as family planning and reproductive health, the social network approach has the potential for empowering women to take greater responsibility for their own destiny.

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