

Do Men Discuss Birth Control? A Social Network Analysis in Bangladesh

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Abstract

Family planning programs have made significant contributions to lowering fertility levels in several developing nations. These advances often focus on women as the main agents of population control, ignoring the important role of men. However, in many countries/cultures decisions about fertility are highly embedded in social relationships at all levels, which make it imperative to investigate men's position in the social structure. This study explores the relationship structures between men in Bangladesh using social network analysis to explore new possibilities for cost-effective healthcare strategies that have more far-reaching effects than the status quo. The results of this research show that men are embedded in unfragmented and diffuse communication structures, formed across age and educational divide, beyond the bounds of kinship relations and village boundaries. Not only do men not shy away from discussion of contraceptives, but also approve and support their use. Men's networks, thus, provide a potentially rich, but untapped, channel of communication for effectively and efficiently disseminating population control initiatives.

KEYWORDS: birth control, social network analysis, diffusion, Bangladesh

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Introduction

Population control is commonly recognised as one of the keys to national growth and the welfare of women and children (Cleland et al., 2006) and for over half a century, developing countries have sought the benefits through implementing health programmes and family planning services for women (Hardee et al., 2017; Greene and Biddlecom, 2000; Hasan et al., 2015). Bypassing the obvious fact that fertility decisions are influenced by both partners, women were largely assumed to have a stronger motivation to control fertility and embrace birth control due to the higher opportunity cost of childbirth. Given frequent interaction with the health system in managing children's health needs, superior range of contraceptive technology available for women and fewer employment demands, women further proved to be an easy target for family planning services (Becker, 1996; Cockcroft et al., 2011). This focus on women is even more readily justified by painting a simplistic view of man's world of either support or resistance towards family planning with limited space for alternative perspectives (Greene and Biddlecom, 2000; Becker, 1996; Hasan et al., 2015).

However, researchers have begun to look to the couple as the core for family planning decisions (Becker, 1996; Jejeebhoy et al., 2015; Lundgren et al., 2012; El-Khoury et al., 2016), and men's sexual and reproductive health rights are being acknowledged more (United Nations, 1994; Hawkes and Collumbien, 2007). The embeddedness of population control in broader social structures is also gaining momentum, as recent studies on diffusion have shown that fertility choices often are made within a social network (Behrman et al., 2002; Kincaid, 2000; Montgomery and Casterline, 1993; Rutenberg and Watkins, 1997; Perkins et al., 2015). Even so, few studies have focused on the role of men enmeshed within social and institutional structures. This is especially wanting in the fertility studies in the South Asian context, which is characterised by pervasive patriarchal structures, in which men often play a dominant role in both the private and public domain (Hasan et al. 2015).

This study is the first to focus on male society in Bangladesh in the context of fertility regulation from a relational perspective.¹ Bangladesh is a classic example of a strong patrilineal setting, in which men are the main decision makers and women are expected to produce the family's desired number of children, which is often set without regard for the women's preferences (Balk 1997). The historically skewed focus on women has been further reinforced in the design of Bangladesh's national family planning programme. For nearly half a century, women have been targeted in their homes with motivational messages, contraceptive supplies, and counselling, while formally engaging men through community leaders to gain acceptance for the cause or addressing the needs of resistant men on an ad hoc basis (Cleland et al., 1994; Hardee et al., 2017). The cost intensive program has been largely credited for lower fertility rates in Bangladesh, from 6.3 births per woman in 1975 to 2.3 in 2011 (NIPORT et al., 2016; Cleland et al. 2006; Cleland et al. 1994). However, Bangladesh is still far from achieving its target total fertility rate of 1.7 children per woman by 2021 (NIPORT and ICF International, 2016). Further, many women continue to report an unmet need for contraceptives and high discontinuation rates are an issue (NIPORT et al. 2016). Given the significant cost of reaching women in homes, Bangladeshi family planning programmes are struggling to meet the demand for care and are facing low uptake of male contraceptive methods (DGFP 2014; NIPORT et al. 2016). All the while men and socio-structural factors continue to exert important influences on Bangladeshi's women's fertility choices (Kamal, 2000; Kincaid, 2000; Gayen and Raeside, 2010; Greene et al., 2006).

¹ For a brief exposition into men's social network in Bangladesh see Bhatia and Salignac (2018).

Trapped in theoretical perspectives of microeconomic models focussing on individual demand for children, family planning programmes in Bangladesh are unable to break the impasse by formulating a more inclusive and balanced approach. Demand based theories argue that fertility changes are a result of changing economic circumstances and dropping mortality rates; such that costs of fertility regulation must be counterbalanced with the benefits of having fewer children. Within these narratives, based on individualistic decision-making, there has been limited space to form socially contested and negotiated attitudes towards birth control. The diffusion perspective takes a more nuanced view, where men and women are both immersed in, and consequently influenced by, social processes (Behrman et al., 2002). Through this lens, social processes are seen as the primary driver of fertility change by invoking the spread of ideas through a social network. However, while there is a great deal of supporting evidence about women's networks and their relationship with contraception, little is known about the structure and content of men's social ties (Behrman et al., 2002; Kincaid, 2000; Montgomery and Casterline, 1993; Rutenberg and Watkins, 1997; Perkins et al., 2015). Fundamental questions of whether Bangladeshi men discuss birth control have not been posed. Hence, the aim of this study is to provide the first-ever view of men's social interactions in the context of fertility control in Bangladesh using social network analysis. The results of this analysis reveal new avenues for action in population policy where dwindling funding demands greater programme efficiency (Cleland et al., 2006) and concrete actions to further engage men in family planning programmes continues to evade policymakers (Hasan et al. 2015; Hardee et al., 2017).

Networks, Diffusion and Family Planning

Firmly grounded in the tenants of classical sociology, the diffusion perspective focuses on the structure of relationships. According to diffusion theory, family planning is an innovation that may spread through a variety of channels, such as interpersonal or central sources like the media (Alvergne et al., 2011; Valente et al., 1997). Within this context, social learning and social influence are two important, but separate, elements of diffusion theory.

In social learning, individuals acquire and evaluate new information from networks, and the type of network governs the level of social learning derived (Alvergne et al., 2011; Behrman et al., 2002). Tie strength in social network analysis is used to invoke a general sense of closeness in relations – strong ties refer to connections, such as close friends, whereas weak connections refer to connections of acquaintances (Granovetter, 1973; Granovetter, 1983). Diffuse and heterogeneous networks typically draw on richer sources of information, which enhances social learning, because they are characterised by weak connections between a diverse set of individuals (Granovetter, 1973; Granovetter, 1983; Alvergne et al., 2011; Behrman et al., 2002).

In social influence, more commonly known as peer group pressure, conformist behaviour arises when norms of behaviour are altered or reinforced by an individual's social networks. Dense social networks, where typically similar individuals in close relations share connections with many of the same people, are especially prone to conformist behaviour, because peer group pressure is often exerted by multiple sources (Behrman et al., 2002). Weak ties, on the other hand, result in low-density or diffuse/sparse networks, because

respective contacts are less likely to be “socially involved with one another than our close friends” (Granovetter 1983: 201).²

Moreover, from a broader theoretical lens, sexuality and procreation are deeply impacted by notions of gender identity, which are formed through hierarchical relationship structures (Agadjanian, 2002). Gender is enacted in relationship structures; informing many social practices including sexuality, division of labour and fertility choices (Connell, 2012; Jamieson et al., 2010). Notions of masculinity and femininity have a deep bearing on the relationship between partners, as well as in interactions with the broader social structure (Jamieson et al., 2010). Therefore, a richer view of diffusion can be derived by incorporating male and female perspectives within the context of gender relations.

Macro-level studies have inspired the diffusion hypothesis for many decades. Diffusion effects have been supported in the Asian fertility transition in a variety of socio-economic conditions, with lower fertility rates diffusing across geographic borders (Freedman, 1987). Using data on 361 Taiwanese townships over 20 years, Montgomery and Casterline (1993) produced some of the strongest evidence for a within-township diffusion of birth control practices.

Large-scale diffusion of birth control practices mainly occurs through interactions between family, friends and neighbours (Munshi and Myaux, 2002; Perkins et al., 2015; Behrman et al., 2002). Kincaid (2000) found women in Bangladesh are five times more likely to use contraception if they engage in group family planning discussions. Recent evidence from Bangladesh shows that perceptions of support from women in peer networks are one of the primary determinants of contraceptive use (Gayen and Raeside 2011). Robust support for large-scale diffusion effects through social networks have also been confirmed using longitudinal data from Kenya that show, after successfully controlling for most confounding influences, the odds “of a woman currently using contraceptives increases by a factor of more than 2 ... if she has at least one contraceptive user among her network partners” (Behrman et al. 2002, p. 728). Group interactions are important not only in fertility; they impact a range of health behaviours (Wemrell et al., 2016; Perkins et al., 2015).

Much research on the diffusion of fertility practices recognises the importance of social relationships, but fails to employ a socially integrated view of men’s role (Greene and Biddlecom, 2000). Yet, studies show that men often require support when using modern methods of birth control, and, in the absence of adequate support, men rely solely on friends for help and information (Chimbiri, 2007; Shattuck et al., 2011; Drennan, 1998; Karra et al., 1997; Brown et al. 2017). For example, men in Malawi consistently seek advice on how to use a condom both within and outside marital bonds (Chimbiri, 2007) while issues of family size and marriage are discussed more in Pakistani men’s networks (Brown et al. 2017). In Kenyan men’s networks, interactions regarding family planning is noted to be even more frequent than among women’s networks. (Behrman et al., 2002: 732). These qualitative observations have also been supported by regression analyses, which show the comparatively stronger effect of social networks on men than women (Behrman et al., 2002). Early results from experiments in group meetings in Pakistan reveal that men are optimistic about

² Granovetter (1983: 201-202) further clarifies the notion of density and weak ties by asserting that “the set of people made up of any individual and his or her acquaintances comprises a low-density network (one in which many of the possible relational lines are absent) whereas the set consisting of the same individual and his or her close friends will be densely knit (many of the possible lines are present).”

disseminating contraceptive information through social networks, and their attitudes toward birth control improve after participating in peer discussion groups (Ashfaq and Sadiq, 2015).

In a wide-ranging context in Africa, where community-based family planning programmes have been more inclusive of both sexes, health workers have been able to penetrate men's networks more deeply to disseminate contraceptives knowledge (Stoebenau and Valente, 2003); to successfully influence men's preferences toward birth control (McCarthy, 2015); and to stimulate greater uptake of contraception (Shattuck et al., 2011). In fact, South Asian research stresses that community health workers are essential to men undertaking child bearing responsibilities (Ali et al., 2004). Furthermore, these efforts complement, rather than eliminate, the importance of peer interactions (Stoebenau and Valente, 2003).

Men also play a key role in their partner's choices about birth control (Karra et al., 1997; Lasee and Becker, 1997; Shattuck et al., 2011; El-Khoury et al., 2016). Many studies have found that a husband's approval of family planning is a primary determinant in a woman's decision to use contraceptives (Kamal, 2000; Kincaid, 2000; Gayen and Raeside, 2010). Kincaid (2000), for example, found that women in Bangladesh are twice as likely to practise family planning if their husbands approve. Similarly, spousal disapproval can be a major impediment to contraceptive use, though these attitudes are not always insurmountable (Drennan, 1998; Greene and Biddlecom, 2000; McCarthy, 2015; Shattuck et al., 2011; El-Khoury et al., 2016; Ali et al., 2004). In reality, most men and women do not have a fixed position on family planning issues. Hence, a more nuanced approach to exploring ideas about fertility in a socially interactive world with multi-layered relationship structures is required.

Bargaining within a marriage is common, and couples often navigate key decisions by negotiating with each other (Greene and Biddlecom, 2000), and contraceptive use is no exception (Ali et al., 2004; Shattuck et al., 2011; Drennan, 1998). Furthermore, fertility transition challenges gender roles in itself (McDonald, 2000; Wang and Pillai, 2001), creating space for new identities to emerge. Falling fertility rates have been shown to strengthen gender equality, which further drive changes in preferences that lead to renegotiations about family size (McDonald, 2000). It is, therefore, not surprising that communication and the power dynamics within a marriage have been found to be instrumental in dispelling misconceptions and changing attitudes about family planning in several contexts (El-Khoury et al., 2016; Lasee and Becker, 1997; Shattuck et al., 2011; McCarthy, 2015).

Power dynamics are also important to interactions between men. In Bangladesh, masculine notions of virility often rule out vasectomy as a form of contraception (Shahjahan and Kabir, 2006). Notions of weak men are found to coincide with poverty and the inability to provide for one's family in Pakistan; thereby, relying on fertility control. Strong, educated men are not only expected to be good providers, but also demonstrate modern values, such as maintaining a small family. Thus, adoption of birth control practices coincides with both negative and positive perception of manhood creating confounding beliefs (Brown et al., 2017). Interactions with spouse, peers and health workers prove to be important influences on men and women, but diffusion studies call for a more integrated decision-making framework that brings social networks to the forefront of those choices. Accepting health services is as much a social process as it is an individual one and cannot be reduced to simple demand-side decisions. However, little has been done, beyond qualitative observations, to make men's communication structures explicit (for an important exception see, Alvergne et al., 2011 and Behrman et al. 2002).

Bangladesh provides an interesting context to study men's social networks. Its patriarchal structure affords men significant power, yet they remain peripheral to the national family planning programme (Cleland et al., 1994; Hardee et al., 2017). Some suggest that involving men in family planning may only serve to increase their control over women's sexual health and reproductive rights (Cornwall, 1998, as cited in Sternberg and Hubley, 2004). However, the success of the Bangladeshi programme in the patriarchal context implicitly suggests a shift in community sentiments from resistance to support (Munshi and Myaux, 2002). Recent evidence further indicates that men have substantial potential to play a supportive role in family planning programmes in Bangladesh (Barker and Das, 2004; Kamal, 2000; Kincaid, 2000; Gayen and Raeside, 2010; Dorman and Bishai, 2012). These accounts are yet to be integrated with relational dynamics being explored in the diffusion theory. By analysing and quantifying men's social networks, the aim of this study is to map the contemporary social space in which Bangladeshi men form and contest their opinions.

Methodology

This research focuses on mapping the structure of men's interactions in the context of fertility and family planning using insights from social network analysis. Social network analysis explores the relationships between members of a social network by representing relationships as network structures. These, often hierarchical, structures determine the content of social relationships (Mizruchi, 1994).

Data Collection and Context

The data for this study was collected from select Bangladeshi villages in a rural community in the Matlab region totalling nearly 150 villages. The ethics approval for the research was granted by Macquarie University.

The Matlab population consists primarily of agricultural community with Islam being the predominant religion followed by Hinduism. The questionnaire was designed to determine men's family planning network. Interspousal communication at a dyadic level, although extremely important, has been covered in previous studies and was not included in the scope of this study.³

The villages of Matlab have long been the subject of demographic research (Bhatia et al., 1980), and this history of experimentation has divided the community into two regions. Half the region has participated in an intensive health and family planning programme run by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The other half has only received government services. The women in both programmes have access to contraceptives and counselling via the 'home delivery model'. However, the ICDDR,B programme includes more visits by community health workers, and its health care centres are more accessible (Bhatia et al., 1980). Except for a sterilisation scheme introduced in 1976 by the government that targeted men, but that was abandoned in 1983, neither programme systemically incorporates men through field visits or through specialised clinics (Rob, Khuda and Chowdhury 1996 as cited in Hossain 2003).

³ It is important to remember men's networks are connected to women's network through spouses. This remains an important area of research.

The long presence of ICDDR,B in select regions of Matlab may create opportunities for distinct networking patterns to emerge by influencing the attitude to contraceptive practices. Fertility trends in the Matlab area are similar to the rest of Bangladesh. However, villages participating in the ICDDR,B programme have seen a much faster drop in fertility rates than areas with access to only the government programme. Both areas are currently plateauing at 2.6 births per woman (ICDDR,B 2016).

To capture the systemic difference in program delivery, the snowball survey method employed began with initial seeds in four different villages – two of which were in ICDDR,B area and the remaining in the government area. In the initial round, a random sample of 1% was drawn from a pool of all married women aged 15-49 in each village. Women were chosen as the initial seeds due to the availability of data. If a woman's spouse did not live in the village, another married woman of relevant age was selected, again at random. Each spouse was then contacted for an interview and was asked to *name up to five people with whom they discuss family planning issues excluding their spouse* along with questions about their socio-economic characteristics. In round two, each of the five nominated people was interviewed and asked for the same information. New contacts identified in round three were also contacted, but their nominees were only noted, not contacted. In total, the final sample comprised 430 respondents. Several men nominated people in neighbouring villages. 90% of these contacts were followed and successfully interviewed. However, those residing outside of the Matlab region could not be interviewed due to budgetary constraints. Spatial data was compiled with the assistance of ICDDR,B.

Data Analysis

Network structures for both men and women were constructed according to the concepts of social networks analysis using Ucinet software (Borgatti et al., 2002). These network or relationship structures are mapped using graphs, such that points are used to represent actors, and lines are used to represent social connections/ties/relationships between the respondents.

This study started with respondents in four separate villages, but the contacts quickly expanded outside the village boundaries due to snowball sampling techniques – resulting in four distinct social network structures with minimal overlap. The geographic location of each of the network structures is, thus, spread over a cluster of villages (referred to as Clusters A-D, respectively).

The resulting network structures were graphed and analysed using four criteria: subgroups, density, centrality and homophily. Subgroups and density were used as the main structural measures for capturing network cohesion. Centrality was used to measure the power distributions in each cluster. Additionally, an analysis of homophily was conducted to complement the insights derived from network theory. Concepts of homophily were used to examine socio-economic similarities between network partners. Given the interviews targeted discussions about family planning and the direction of those discussions does not convey any particular meaning in this context, each measure was based on symmetrised data, that is, A and B were assumed to be in a reciprocal relationship. Age and education homophily was measured through standard Pearson's correlations. The significance test was based on 10,000 randomised trials (Hanneman and Riddle, 2005). No direct measure of economic status was available, but some inferences can be derived from household locations. Many rural Bangladeshi live in multi-level compounds, referred to as *bari*, that house several branches of an extended family. The socio-economic classification of kinship groups is controlled

Table 1. Percentage of females in each male social network

Government programme	% of females	ICDDR,B programme	% of females
Cluster A	2.40%	Cluster C	22.06%
Cluster B	20.80%	Cluster D	5.20%

through marriage norms discouraging connections between different classes. Thus, the location of the *bari*, or *baris* in this case, provides some indication of social status and socioeconomic similarity as families related along kinship lines congregate around each other and usually share similar social status (Aziz 1979; Ishrat 2015). This captures the most basic source of homophily patterns of interaction – kinship structure and geographic location. Living in the same *bari* also makes communication easier in regions where technology is not ubiquitous. Analyses of *bari* locations further highlights the confounding influences of institutional parameters on the patterns of ties observed. No other socio-economic data was available for analysis. To aid readership across wide-ranging disciplines, each measure is described in greater detail below along with the results.

Results

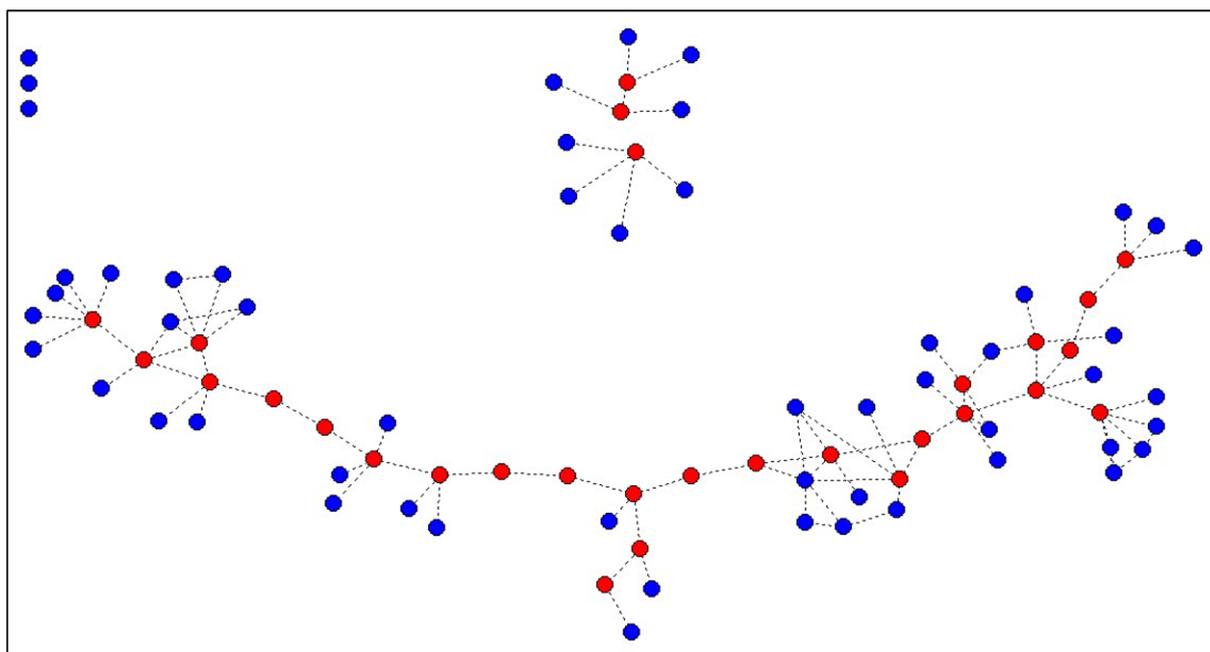
The survey results showed support for contraceptive initiatives. On average, men desired a small family of 2.2 children. There was minimal difference between the average number of sons and daughters preferred in the ICDDR,B area, but a marginally higher proportion of sons were desired in the government area (1.34 sons vs 1.09 sons in ICDDR,B area). Few men reported using male contraceptive methods (less than 5% in each cluster).⁴

The sampling strategy led to four distinct network structures. Each network cluster was predominantly composed of men, but some clusters had more notable cross-gender communication. Close to 20 percent of respondents in Clusters B and C were female (Table 1) with approximately 10% of men across the sample nominating at least one female in their network. However, when contacted, most of those females nominated other women as members of their social network, creating the illusion of more cross-gender interaction than actually existed. Nevertheless, the data from both programmes shows that, even in a conservative rural setting, there is potential to incorporate cross gender communication channels beyond the spouse into family planning programmes. Overwhelmingly, respondents perceived their network relations to support contraceptive use, where nearly 95% of their nominated contacts were reported to approve of the use of birth control methods. Thus, this challenges the perception of resistant men in family planning.

Across each of the four clusters, the network structures were largely the same with some differences. On average, men had 2 to 3 connections. All clusters repeatedly illustrate that almost all the men are embedded in chain-like structures mostly connected to one main structure (Figures 1-4). While the initial seeds were selected randomly, when all the relationships between men in each cluster were subsequently mapped, they formed a coherent whole rather than multiple substructures. Even the ICDDR,B community health workers were included in the social network for Clusters C and D as indicated by P20 (Cluster C) and P30 (Cluster D) in Figure 3-4. Furthermore, Cluster B evidenced the inclusion of ICDDR,B from

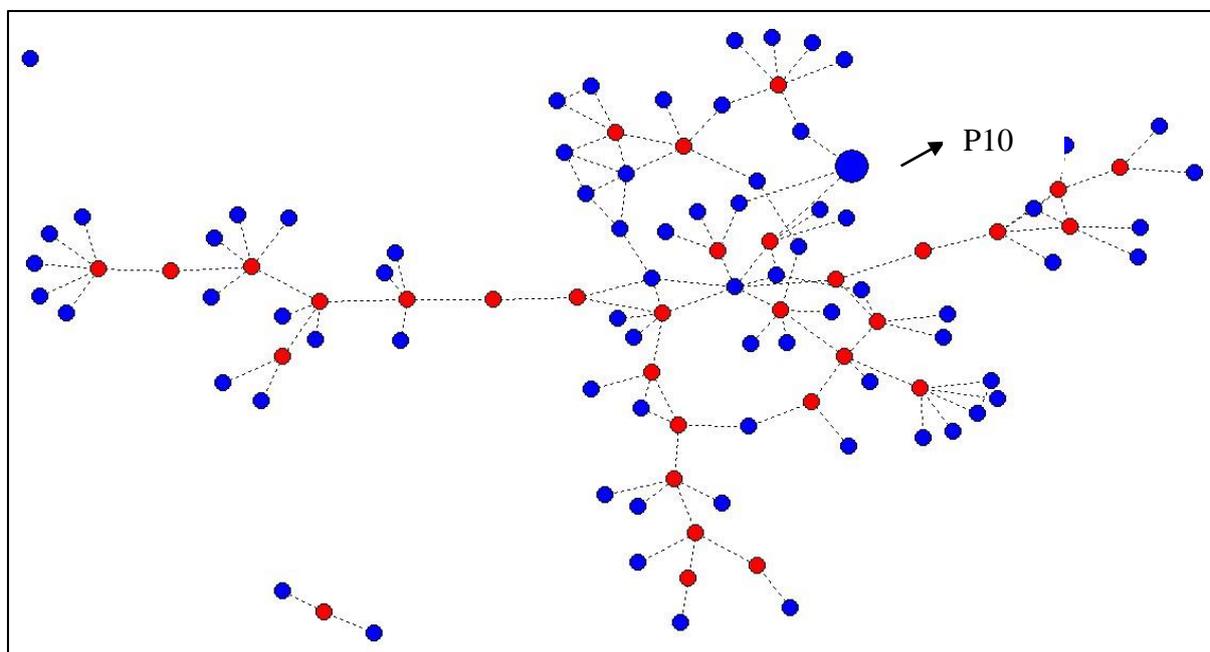
⁴ This average is in line with reality in other parts of Bangladesh (NIPORT 2016). The study did not include questions on wife’s contraceptive use as discrepancy in couple’s reports has been well documented in prior studies (Becker 1996)

Figure 1: Social network in Cluster A*



*red nodes represent cutpoints

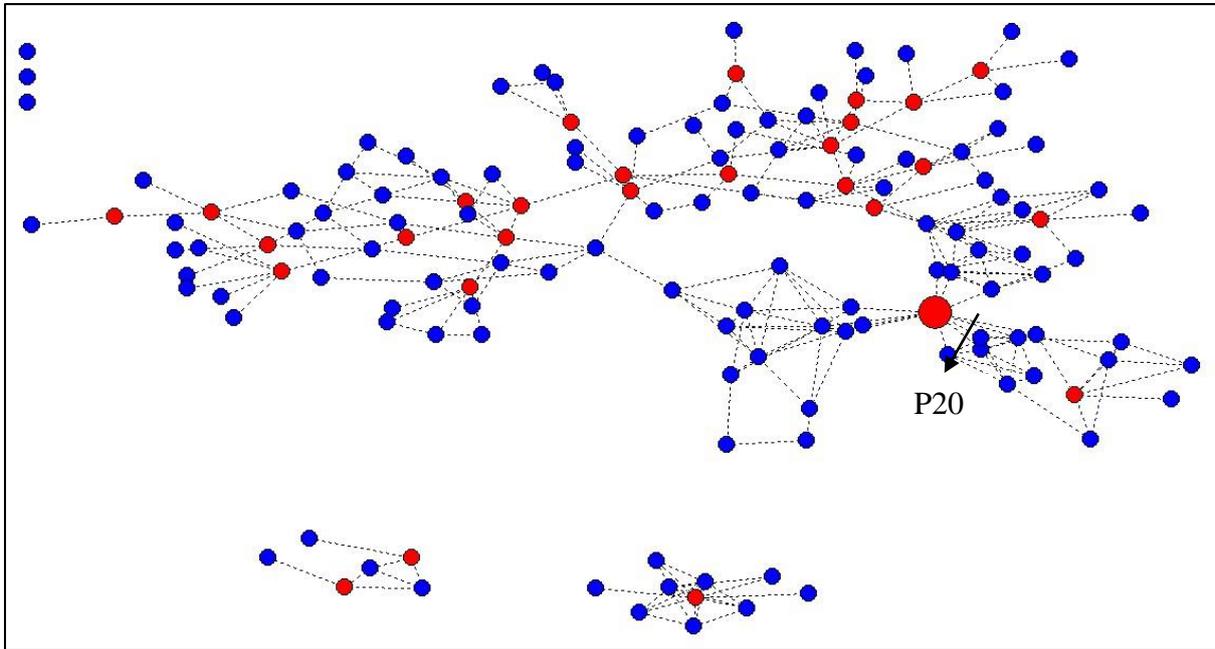
Figure 2: Social network in Cluster B



*red nodes represent cutpoints

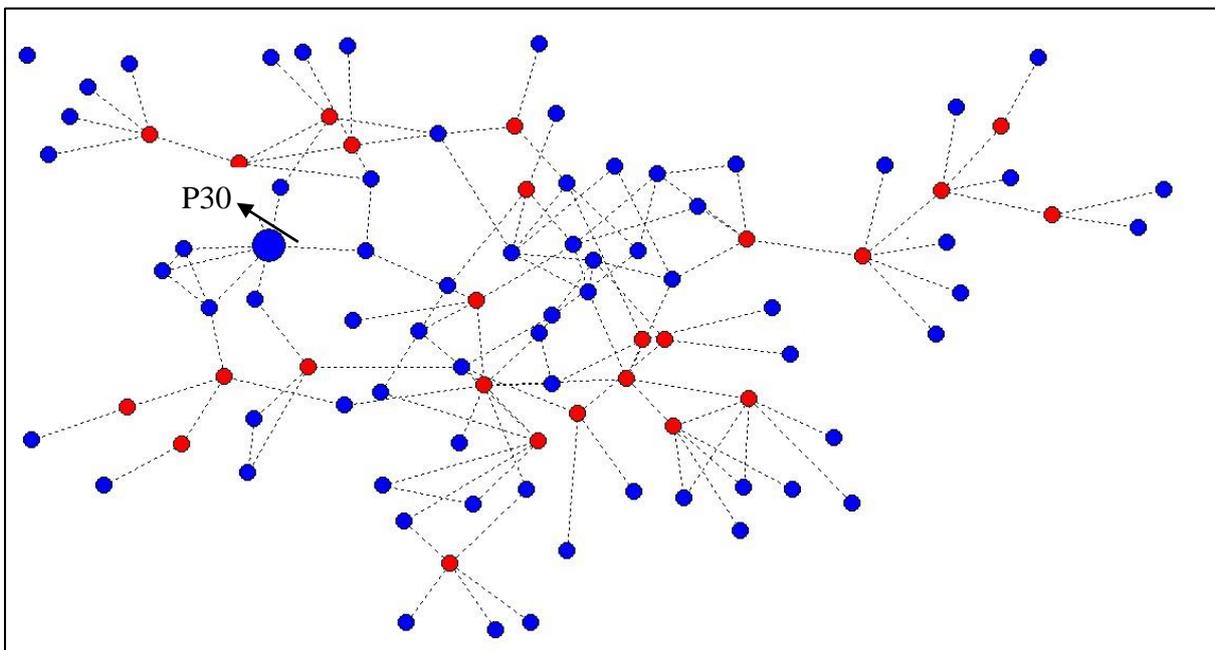
the presence of a community health worker, marked as P10 in Figure 2, resident in the area, but not responsible for providing support services. Originally, community health workers were thought to have minimal contact with men, but this acknowledgement as part of their

Figure 3: Social network in Cluster C*



*red nodes represent cutpoints

Figure 4: Social network in Cluster D



*red nodes represent cutpoints

network confirms the possibility of cross gender interactions and the potential for further penetration of health workers in men's networks if consciously targeted as part of the family planning programme.

Table 2. Basic network structure indicators for each cluster

	Government programme		ICDDR,B programme	
	Cluster A	Cluster B	Cluster C	Cluster D
Observation	83	106	145	96
Isolates	3	1	3	1
Number of components (>2 actors)	3	2	3	1
Mean no. of connections	2.2	2.3	3.5	2.7
Proportion of actors with one connection*	47.0%	50.0%	23.4%	36.5%
Density (std. dev.)	0.3 (0.4)	0.2 (0.3)	0.4 (0.3)	0.2 (0.3)
Total number of bi-components > 2 actors	5	4	8	4
% of actors in bi-components of > 2 actors	32.5%	36.8%	74.5%	56.3%
No. of nodes acting as cut points in bi-components of > 2 actors	1	1	3	3
No. of nodes acting as cut points	29	32	28	25

Subgroups

Subgroups were used to determine the influence of actors in the immediate neighbourhood. Cohesive subgroups are “subsets of actors among whom there are relatively strong, direct, intense, frequent, or positive ties” (Wasserman and Faust, 1994: 249). Hence, members of a cohesive group are more likely to share similar beliefs or exercise social influence that promotes reciprocity and compromise (Wasserman and Faust, 1994).

Each cohesive subgroup was analysed using the definitions of component and bi-component levels. In a component, each member is connected by at least one relationship, and there are no external connections. The measure is limited by the fact that any two distinct substructures linked by a single connection are classified in the same component. To break the network structure into relatively more cohesive groups, the notion of bi-components was used. A bi-component is a component without cutpoints. A cutpoint is a pivotal point or weak spot in a graph that holds two or more groups together (Hanneman and Riddle, 2005), shown as red nodes in Figure 1-4. Bi-components can be better measures of information exchange in a network because no one member forms a lynchpin that the other members must communicate through. Furthermore, since messages can be relayed through multiple members, bi-components also provide a basis for social influence (Wasserman and Faust 1994). Table 2 shows, the network structure across each cluster.

Each network was composed of less than four components, with a minimum of three members, and 80% or more of the members were part of the main component with the highest proportion in Cluster D. This high level of connectivity indicates the potential for uninterrupted information flow between different parts of the network. Bi-components are subgroups without cutpoints, which means there are always at least two ways to get from any point to any other point. The results show that a minimal number of actors formed bi-components of three or more actors, except in Cluster C (Table 2). For example, in Cluster A, 59 bi-components were found in the men’s network, but only five bi-components contained

more than two actors. 32.5% of the actors in the network were embedded in these five bi-components. Even fewer bi-components of more than two actors were identified in the men's network in Cluster B. A slightly different pattern emerged in the ICDDR,B area, where at least half the actors were part of a bi-component. In Cluster C, membership in bi-components was highest, reaching 74.5%. Excluding the female contacts in Cluster C reduced the proportion of members embedded in bi-components from 74.5% to 66.4%. While these results suggest that the cohesiveness of the network diminishes after deleting the female connections in Cluster C, the men's networks in the ICDDR,B showed a greater degree of cohesion than the government area. Even so, both the government and ICDDR,B area witnessed several actors that did not belong to any bi-component.

Density

Ego network density (referred to as density hereafter) was calculated by the number of actual connections divided by the total number of possible connections in actors' immediate neighbourhood. Density is measured on a scale from 0 to 1, with a maximum density of 1 when all the members of a neighbourhood have a direct relationship with every other member. Low-density networks coincide with weakly-connected, yet divergent, ties, which improves the potential for social learning as compared to high-density networks (Kohler et al., 2001).

Density calculations in Table 2 confirm the visual patterns of sparsely connected structures evident in most areas on the graphs. A large proportion of men had only one connection; thus, excluding a large proportion of actors from density calculations, which examines the patterns of contacts amongst nominated network partners. The remaining respondents had density scores between 0.2 and 0.4. Such low-density networks indicate that men's networks are mostly composed of weak connections between socially distant individuals. However, Clusters C and D demonstrated the least number of actors with less than two connections, suggesting a slightly more cohesive pattern of relations in this village. Also, Cluster C had the highest density score even after excluding the substantially higher number of female respondents present in this cluster, suggesting a more cohesive network structure in this village (lending support to the findings obtained through bi-component analysis). Nonetheless, the overall density scores coupled with bi-component measures show diffuse network relations possibly between weakly connected set of actors in each cluster.

Centrality

Centrality broadly represents the degree to which the members of the network are connected to other members in the network and was used to measure the distribution of power across each cluster. The more centrally connected a member, the more opportunities they have to communicate with other members; hence, the greater their power within the network (Hanneman and Riddle, 2005). Although power arises from occupying advantageous positions in the network, the source of power varies according to the measure of centrality employed. The network view of power is purely relational, ignoring multiple complexities. Nonetheless, empirical work has demonstrated significant associations between centrality measures and power (Mizruchi 1994).

Degree centrality is a simple count of each member's direct connections. The member with the highest degree centrality can be seen as the focal point of communication, since they can

Table 3. Centrality

	Government programme		ICDDR,B programme	
	Cluster A	Cluster B	Cluster C	Cluster D
Degree centrality (std. dev.)	2.2 (1.6)	2.3 (1.7)	3.5 (2.3)	2.7 (1.8)
Max. degree centrality score	6	7	12	9
Group degree centrality	4.7%	4.6%	3.0%	6.8%

directly communicate with the largest number of other members. Their power is derived from the greater autonomy these connections afford (Hanneman and Riddle, 2005).

In this sample, the average degree centrality ranged from two to four connections, but reached 12 in Cluster C, largely as a result of the involvement of the community health workers (Table 3). Still, 12 direct relationships only represent 8% of the connections in the network. Group centrality indexes the actual degree centrality and the number of network members with the highest possible theoretical maximum centrality of 100% (Wasserman and Faust, 1994). High group centrality indicates that a few powerful members dominate the network; low group centrality reflects a more balanced distribution of power. The maximum group centrality score evidenced in this network was only 7% for Cluster D.

In purely structural terms, the overall analysis suggests that these men's social networks are weakly connected with limited structural inequalities. The corresponding theory in social network analysis states that weak connections are likely to form between socially distant individuals. However, to further understand the quality and content of social relations, homophily is invoked.

Homophily

Homophilous connections refer to interactions between people with similar attitudes and socio-economic backgrounds (McPherson et al., 2001). Density and homophily are intertwined because interactions between similar people – in terms of class, gender, race and so on – are often more effective channels of communication, which usually provides breeding ground for overlapping or dense connections to emerge (McPherson et al., 2001). Patterns of dense and homophilous connections also tend to more readily support close ties, such as kinship and confidant relations. Conversely, heterophilous relationships typically occur between socially distant individuals or weak ties, providing a greater opportunity for the cross-fertilisation of ideas (McPherson et al., 2001). Scholars have found evidence of homophily in terms of socioeconomic attributes and geographic proximity in a range of relationship types (McPherson et al., 2001; Boulay and Valente, 2005; Agadjanian, 2002; Barnett et al., 2016), but homophily in the context of men's family planning interactions is under-explored. Homophily effects are not only important in examining social connections, but also need to be considered when making causal inferences about the influence of social networks on contraceptive behaviour. For example, individuals facing similar socio-economic circumstances may be more likely to forge a connection and make similar choices. Not accounting for this may lead to the wrongful inference that the behaviour of a group has a causal impact on contraceptive decisions (Behrman et al., 2002).

Table 4. Homophily

	Government programme		ICDDR,B programme	
	Cluster A	Cluster B	Cluster C	Cluster D
Pearson's correlation between age and social connections	-0.13*	-0.09*	-0.08*	-0.06*
Pearson's correlation between education and social connections	-0.04**	-0.01	-0.05*	-0.06*
Proportion of connections to non-relatives	66%	53%	50%	64%
Proportion of connections outside the village	29%	41%	32%	33%
Pearson's correlation between a <i>bari</i> residence and social connections	0.14*	0.13*	0.30*	0.13*

*Significant at 1% level **Significant at 5% level

The variables used to measure homophily in this analysis were age, education, *bari* location and type of relationship, that is, whether or not two members were related along kinship lines. No direct measures of economic status were available. Wherever applicable, to measure the degree of similarity between the observed pattern of connections and socio-economic characteristics beyond what is expected simply by chance, QAP correlations were used (Hanneman and Riddle, 2005). The QAP coefficient is calculated using standard methods of Pearson's correlations, but the significance test is based on 10,000 randomised trials to avoid biased estimation due to the interdependent nature of the social network data. The results of the homophily analysis appear in Table 4.

The average age of each participant was 38 years, with a standard deviation of 12 years; 94% were married. In Bangladesh, the average marital age for men is 25 (Bangladesh Bureau of Statistics 2015), which suggests the sampling strategy was biased in capturing men with substantial experience in fertility issues.

The QAP correlation tests revealed a weak, but significant, negative correlation between being connected in the network and the absolute age difference (Table 4). The strongest correlation occurred in Cluster A (-0.13). Even weaker results were repeated for absolute difference in educational attainment and being connected.

The data on *bari* was used to capture geographic proximity, as well as socio-economic status among network contacts. On average, only 30% of the observed connections were formed within the same *bari* across all clusters. But a weak significant association was noted in Table 4 between membership in the same *bari*, as well as being socially connected with the correlation coefficient ranging from 0.13 to 0.30. The tendency of forming connections within the *bari* was strongest in Cluster C. Excluding female network relations from the network reduced the correlation coefficient to 0.12 from 0.30; suggesting that the tendencies to network within the same *bari* were driven more strongly by women's connections with each other.

The type of relations between respondents was divided into the broad categories of kin and non-kin. The kinship relations included cousins, brother's wife, brother's children, sisters and aunts and non-kin relations mostly included friends. Over 60% of the relations in Clusters A and D were with non-kin. Cluster B had 53% and Cluster C had 50% of non-kin relations. Cluster C was also observed to have the densest relationship structures, which may be linked to a stronger propensity to network with kin than with non-kin.

All of this suggests substantial support for the homophily hypothesis that diffuse networks are likely to result between socially distant individuals. While the structural features of weak ties have been clearly articulated and rigorously defined, the qualitative features of strength of ties are more difficult to predict. Granovetter (1973: 1361) defined the strength of a tie as a "combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterize the tie," while leaving "operational measures of and weights attaching to each of the four elements...to future empirical studies". A number of these measures have since then been operationalised along with new parameters (Marsden and Campbell, 2012).

We explore the strength of a connection using previously reported indicators of frequency of contact and exchange of aid (Marsden and Campbell, 2012). The strength of connection was examined using the frequency of contacts between the contact person and the ego, as well as whether the contact was approached for assistance. Approximately 80% of the respondents reported to speak to a contact person daily, without much variation noted by the type of tie. 74% of the respondents reported to have received money, food or medicines from the listed contact person. This did not vary whether the tie was kin or non-kin. The results on frequency of contact may be driven by features such as common occupation, but exchange of aid is unlikely to occur amongst weak connections. These preliminary investigations caution against the categorisation of the strength of connections purely on the basis of structural patterns observed in the data.

Discussion

The 1994 International Conference on Population and Development brought gender relations, men's sexual rights and the role of men in reproductive decision making to the forefront (United Nations, 1994). Consequently, research has begun to pay attention to the importance of male reproductive attitudes, providing increasing evidence of the importance of men in family planning choices in Bangladesh. Investigations into fertility rates from a diffusion perspective further challenge theories to move beyond the couple by evidencing the embeddedness of fertility decisions in the broader social space. Even so, Bangladeshi national programs continue to ignore men as a social group with a stake in family planning and singularly focus on women within the paradigm of low female mobility; hence, denying the opportunity to build new pathways for a more inclusive and sustainable future for family planning (Hasan et al. 2015).

The results of this research show that Bangladeshi men do talk about family planning with their male counterparts in both the ICDDR,B and the government area and are largely supportive of small family norms. The visual representations of these discussion networks are characterised by chain-like structures, which indicates these conversations are usually held between one or two confidants who are loosely connected to each other. Men form low-density social networks that are not divided into small fragmented groups, but connected by 'cutpoints' that serve as bridging connections between the network's members. Hence, new

information flows through the social networks with relatively few impediments compared to denser social networks.

The results of this analysis reveal consistent network patterns between men participating in both the government and the ICDDR,B programmes, with some important exceptions. One region covered by the ICDDR,B programme showed a stronger tendency toward dense relationships than the other groups, which may be related to the ICDDR,B's strong presence in the region or socio-economic factors. This cause could only be ascertained by gathering more data from the area.

These insights from network theory are complemented by an analysis of homophily. Most connections over family planning issues occur between friends, not relatives. They span the divide of age, education and cross geographical boundaries to include men in other neighbourhoods and villages. Moreover, these networks do not contain any glaring power imbalances and overwhelmingly demonstrate support for contraceptive initiatives. Compatible with the structural properties, socio-spatial patterning of relations indicates connections between dissimilar individuals rather than dense connections between homophilous groups. However, while the structural mapping of the networks indicates that relations are between weak connections; examining strength of connection provides no support for this hypothesis.

Comparable research on women's networks is less promising, as their networks are mostly composed of dense connections among relatives (Gayen and Raeside, 2010; Bhatia and Salignac, 2018). Male social networks may, therefore, provide a potentially rich, but untapped, channel of communication for effectively and efficiently disseminating population control initiatives.

This research only touches the surface of men's interactions with each other. The analysis in this study relies on social network analysis, making assumptions about the content and the quality of the interactions. A great deal of further research is required to determine the structure and content of interactions about family planning between men in different contexts. Furthermore, the snowball sampling approach provides a rich overview of men's networks, but Matlab's unique context makes it difficult to generalise these results. For example, it may be that the presence of ICDDR,B in the area has fundamentally altered men's networks in the intervention and non-intervention area. Even so, the results show that men are interested in family planning. Additionally, combining a social network approach with richer socio-economic information provided a more potent methodology for investigating social connections in communities. Full exploration of the socio-economic correlates of men's networks and the extent to which interactions between men can influence family planning initiatives was beyond the scope of this work. Also, snowball sampling strategy may have biased the sample towards men with more favourable view on family planning. The results, nevertheless, indicate a potential-rich network resource to draw more resistant men to family planning. Lastly, men's networks are embedded in a broader social space and intertwined with women's social networks through their wives. This aspect is yet to be explored. The intertwined nature of reproductive health, men's attitudes and the well-being of families makes future research in this area more important than ever and provides tremendous opportunities for public health, men's rights and increased gender equity.

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