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Women's Social Networks and Birth Attendant Decisions: Application of the Network-Episode Model

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Abstract

This paper examines the association of women's social networks with the use of skilled birth attendants in uncomplicated pregnancy and childbirth in Matlab, Bangladesh. The Network-Episode Model was applied to determine if network structure variables (density / kinship homogeneity / strength of ties) together with network content (endorsement for or against a particular type of birth attendant) explain the type of birth attendant used by women above and beyond the variance explained by women's individual attributes. Data were collected by interviewing a representative sample of 246 women, 18–45 years of age, using survey and social network methods between October and December 2008. Logistic regression models were used to examine the associations. Results suggest that the structural properties of networks did not add to explanatory value but instead network content or the perceived advice of network members add significantly to the explanation of variation in service use. Testing aggregate network variables at the individual level extends the ability of the individual profile matrix to explain outcomes. Community health education and mobilization interventions attempting to increase demand for skilled attendants need to reflect the centrality of kinship networks to women in Bangladesh and the likelihood of women to heed the advice of their network of advisors with regard to place of birth.

Keywords

Bangladesh; Network-Episode Model; Social networks; Skilled birth attendants; Health seeking behavior; Utilization; childbirth; Maternal mortality

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Introduction

The World Health Organization (WHO) estimates that 358,000 women die annually from pregnancy- and childbirth- related complications, with a disproportionate number (99%) occurring in developing countries (World Health Organization, 2010). Preventable and treatable conditions such as hemorrhage, eclampsia, obstructed labor and sepsis are the leading causes of maternal deaths worldwide, the majority of which occur during the first 24 hours of birth (Khan et al., 2006; Ronsmans & Graham, 2006). Studies estimate that 15% of all pregnant women will develop a life-threatening complication and that most complications cannot be predicted (Ronsmans et al., 2002; Ronsmans et al., 2004). The Healthy People 2020 Maternal, Infant and Child Objective 5 (United States Department of Health and Human Services, 2011) and the United Nations Millennium Development Goal 5 (MDG-5) (United Nations, 2006) have identified the reduction of maternal mortality as a public health priority.

Given the extent, cause, timing and unpredictability of obstetric complications, the most effective strategy to reduce maternal mortality is for every woman to be assisted by a skilled birth attendant (SBA) who is supported or backed by emergency obstetric care (De Brouwere & Van Lerberghe, 2001; Paxton et al., 2005; Paxton et al., 2003). SBAs are accredited health professionals, such as a midwife, doctor or nurse, who are educated and trained to proficiency in the skills needed to manage normal pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns (Thomson, 2005). Success of skilled attendance is dependent not only upon the availability but also the use of SBAs during childbirth. Although lack of availability of SBAs restricts use in many developing country settings, data from India (Griffiths & Stephenson, 2001; Sunil et al., 2006), China (Anson, 2004), Vietnam (Duong et al., 2004), Uganda (Amooti-Kaguna & Nuwaha, 2000) Guatemala (Glei et al., 2003) and Nigeria (Esimai et al., 2002) also indicate women choose homebirth with unskilled attendants despite access to SBA services.

This paper reports the results of research on why women in Bangladesh choose to use an SBA for delivery in an area where services are available. Previous studies on the use of SBAs have employed health behavior or health care utilization models, such as the Theory of Reasoned Action (Fishbein & Ajzen, 1975) or the Social Behavioral Model (Andersen & Newman, 1973). This study applied a Network Episode Model (NEM; Pescosolido, 1991) to more fully examine the influence of socio-structural context on decision-making. The NEM postulates that health care decisions are made within the context of interpersonal interactions within one's social network, and that such interactions fundamentally involve the interplay between social network structure (configuration of network ties) and content (beliefs and attitudes of network members). The NEM has been successfully used to examine health service utilization decision-making for illness episodes, such as mental illness (Pescosolido et al., 1998; Vera et al., 1998). In this study we explore the utility of the NEM in explaining women's health service utilization decision-making in uncomplicated pregnancy and childbirth. The main hypothesis derived from the NEM is that network structure variables (density / kinship homogeneity / strength of ties) *together* with network content (endorsement for or against a particular type of birth attendant) explain the type of birth attendant used by women above and beyond the variance explained by women's individual attributes. The premise is that the direct effects of socio-demographic characteristics on patterns of use will decrease once network factors are taken into account and that the structure of networks *interacts* with the cultural content of networks to either facilitate or hinder use (Pescosolido, 1991).

Background

A social network is a structure composed of a group of people, some of who are connected by a set of one or more relations (Knoke & Yang, 2008). In developing countries across the world, women exchange information about the accessibility of health services and about the quality of those services, and they assess their families and peers' approval or disapproval of the use of health services—all within their social networks. As a consequence, social networks play a crucial role in, first, recognizing the need for health services and, second, in facilitating or constraining the use of those services (Andersen & Newman, 1973; Berkanovic & Telesky, 1982; Berkman et al., 2000; Pescosolido, 1992).

In Bangladesh, Hossain and Ross (2006) found that nearly 70% of women surveyed indicated the need to seek approval from other family decision-makers to use hospital services. Paul and Rumsey (2002) identified husbands as the gatekeepers of maternal healthcare particularly in patriarchal family systems, and Haider (2000) found that the decision to select a birth attendant rests predominantly with husbands and guardians. In a review of the literature on care practices for mothers and newborns in Bangladeshi homes, Darmstadt (2006) found that fathers generally took decisions for seeking care outside the home from a trained provider in the event of complications. Further, the 2007 Bangladesh Health and Demographic Survey indicated almost one-third of currently married women age 15–49 years had no final say, even on decisions concerning their own health, with 32.3% reporting that their husbands make the final decision (National Institute of Population Research and Training, 2009). Together these findings suggest that a better understanding of the decision-making process during childbirth might be gained by examining the influence of social networks, independently and together with individual level attributes.

Conceptual Framework

The NEM (Pescosolido, 1991) provides the conceptual underpinning for this study. The NEM is a dynamic framework of healthcare utilization and compliance, derived from decision-making, social exchange and social network theory. According to the model, interpersonal interactions within social networks form the principal mechanism through which decision-making related to health events occurs and these interactions are shaped by network characteristics such as structure and content (Kincaid, 2004). The NEM extends the more individually focused, rational choice set of models, by reformulating questions of health care decision-making (or utilization) as a result of social interaction while continuing to profit from the explanatory power of economic or rational action. Bridging the structure versus agency debate, the NEM reignites the stagnant health seeking behavior research agenda which MacKain and colleagues argues has become an “...*somewhat over-utilized and under-theorized tool* [italics added]” (2004) p 137. The analytical focus is placed on a set of relationships rather than individuals while at the same time continuing to account for individual attributes.

The choice of network structural characteristics for this study was informed by previous research that found associations between network variables (e.g., density, tie strength and the composition of a women's social network) and health care utilization decision-making. Deri (2005) demonstrated the importance of social networks in acquiring knowledge about health care facilities, among immigrants in Canada, for the initial decision to seek medical attention and for use of preventive services. She constructed variables that accounted for the quality and quantity characteristics of networks. The quantity characteristic captured the size of the network, the proximity of network members to one another and language group variation. The quality characteristic captured elements such as cultural differences in beliefs about health and medicine. Devillanova (2006), among undocumented immigrants in Milan,

estimated that reliance on a strong social tie for information about health care utilization reduced the amount of time it took to initiate the first health care contact, controlling for all available individual and ethnic characteristics. Researchers St. Clair et. al. (1989) found women from Baltimore were less likely to use prenatal care if they were embedded in strong-tie, non-disperse networks where most members were immediate family or relatives. Further, Berkanovic and Telesky (1982) found that general characteristics of social networks (e.g., frequency of contact, network size, amount or support obtained from network members, degree to which individual depends on others for advice) may affect the decision to seek care only when the opinion of social network members is incongruent with an individual's beliefs. Networks with higher degrees of density, kinship membership and tie strength are thought to form more norm-reinforcing groups such that women embedded in these networks are more likely to behave in ways expected by the network. Conversely women in sparse networks with greater diversity and weaker ties are less likely to comply with the advice offered in the network (Pescosolido, 1991, 1992; Pescosolido & Levy, 2002).

Study Setting

The study was conducted in Matlab, Bangladesh, a rural subdistrict located 55 km southeast of the capital city, Dhaka. Approximately 90% of the population is Muslim, the remainder is Hindu, and almost all residents speak in *Bangla*, the official national language. The principal economic activities are agriculture and fishing. Remittances from men who migrate to the city or abroad for work are another source of income. The primary modes of transportation are by foot, rickshaw, country boat, or three-wheeled taxi. Patrilineal and virilocal family is the traditional type of family-unit, although changes to kinship organization are occurring due to the rapid socioeconomic transitions, including employment opportunities in cities and abroad. Kinship networks, however, remain a universal aspect of the social structure, and division of labour is predominantly gender-based in rural villages, with exceptional patterns among the poorest and most educated women. There were 31,527 women 15–49 years of age residing in the 67 villages that make up the four blocks of the Matlab service area. An estimated 2,700 births occur each year. Facility-based SBA services are available to women, essentially free of charge, 24 hours a day. In the Matlab context, use of a SBA is equivalent to delivery in a facility.

Data and Methods

The Institutional Review Board approved the study for the Protection of Human Subjects at Emory University and the Ethical Review Committee at the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B).

Population and Sample

The population of interest was Bangladeshi women 18–49 years of age residing in the Matlab Health Service Area who had an uncomplicated pregnancy and delivery resulting in a live birth between July 26, 2008, and October 31, 2008 (the 3 months prior to data collection). Exclusion criteria included the actual presence or perception of antepartum or intrapartum risk factors or complications and history of chronic or underlying physical conditions known to be associated with birth complications. The sampling frame, taken from the Maternal and Child Health database in Matlab, consisted of 699 women. A stratified sample was taken by place of delivery. In order to obtain an equal number of home and facility births, home births were oversampled relative to the proportion in the population. Among the 699 women in the sampling frame, 490 delivered in a facility and 209 delivered in the home. Two random samples were generated, one from the list of women who delivered in a facility and the other from the list who delivered at home, for a total of 268

women. Recruitment and screening resulted in a final sample size of 246 women, of which 124 delivered in the home and 122 in a facility. Two cases had missing data on the network variables to be tested. Therefore, data from 244 women was available for analysis.

Recruitment and Protocol

Four research officers, assisted by two porters, contacted potential informants in their homes in a face-to-face visit, the customary research practice in the study area. The research officers attempted to make visits at a time expected to be most convenient for informants (e.g., mid-morning and mid-afternoon as to avoid call to prayer and peak hours of domestic activity). Following oral voluntary informed consent, structured interviews using prepared guides were conducted. Data collection occurred over an 11-week period between October and December 2008. The interview time ranged from 45 minutes to 2 hours and 13 minutes (mean \pm SD = 1 hour 20 minutes \pm 17 minutes). Each bilingual interviewer administered the instrument orally in Bangla and documented the informant responses directly on the instrument form in English. After each day of data collection the research team debriefed about the interview process, shared successes and hardships and planned the logistics for the next day of data collection. Each completed questionnaire was reviewed for completeness, consistency and clarity by the principal investigator (first author).

Measurement

Egocentric Network Ties—Women were asked to list the names of people to whom they spoke about place of delivery during pregnancy. Supplementary interviewing techniques enhanced recall of names. These techniques included nonspecific probing (“anyone else?”), and use of the free-listed names as semantic cues (Brewer, 2002; Brewer et al., 2002). Probing continued until we had a list of 20 names of network alters for each respondent. Respondents then provided attributes of each alter (gender, age, education, etc.) and the relationship with each alter (mother, sister-in-law, husband, neighbor, etc.).

Network Characteristics—Following name generation, respondents distinguished kin from non-kin and indicated how close they were to each network member using a hierarchical mapping technique that employed a diagram of concentric circles described by Antonucci (1986). Then, women indicated whether each network member advised them to deliver at home (with an unskilled attendant) or in a facility (with a SBA). Advice to deliver in a facility only in the event of complications was considered “at home advice” because the sample was restricted to women without complications. Finally, they were asked to indicate the extent to which their named alters knew one another. A grid or matrix facilitated recording of this information. For theoretical and analytical purposes, the network characteristics were categorized by structure (the existence of ties between network members, the extent to which kin make up the network, and how close the respondent is to each network member) and content (the advice to deliver in a facility or at home).

Place of Delivery—The dependent variable was place of delivery, either in a facility with an SBA or at home with an unskilled attendant.

Household socio-economic status—We constructed a wealth index using asset ownership, based on a procedure described by Gwatkin and colleagues (2000), that is widely used in economic analyses in developing countries. Scores for households were calculated with standard techniques based on principal component analysis on the reported ownership of household possessions, main sources of income, lighting, water, cooking fuel and type of toilet using data from the Matlab 2005 Census (ICDDR, 2005). Resulting asset scores were categorized into five wealth quintiles ranging from one (poorest) to five (richest).

The variables used in the analysis are summarized in Table 1.

Analysis

Descriptive statistics summarized the data, and a set of hierarchical logistic regression models, predicting place of delivery, were used. Model 1 tested the explanatory value of women's individual attributes (i.e., parity, education and economic status) which were significantly associated with place of birth at the bivariate level. Age was not included because it is highly correlated with parity ($r = .82$). Model 2 tested the additional explanatory value of the network structural variables (i.e., density, kinship homogeneity and strength of tie), and Model 3 tested the additional explanatory value of the network content variable (i.e., SBA endorsement). The models were compared using the -2 log-likelihood (-2 LL), block and classification statistics. Interaction terms were created between each measure of structure and content and tested in the full model. All analyses were performed using SPSS software version 17.0 (SPSS Inc., 2008). A significance level of $\alpha = .05$ was selected.

Results

Table 2 shows the individual attributes of the sample by place of delivery. Participants' ages ranged from 18–43 (mean \pm *SD*, 24.7 ± 5.1) years. Nearly all (99%) were currently married with a mean marital age of 17 (± 2.5 , Range 12–28) years and almost all (90%) marriages were arranged and resulted in relocation to the husband's residence (94%).

While the women were similar in many respects, there were important and significant differences between the groups, by place of delivery. Compared with women who delivered in a health facility, those who delivered at home were poorer and less well educated. They also had a higher parity and in terms of service use, they had fewer number of antenatal care visits.

The average network among women in this study consisted of dense, relatively strong-tie, kinship-based relations. The average SBA endorsement across all networks was 0.72 (*SD* .30, median .83). The average density was .77 (*SD* .20, median .80). The average strength of tie was .58 (*SD* .11, median .58). The average kinship homogeneity was .74 (*SD* .24, median .75). In other words, on average 77% of alters were reported to know one another and 74% of relations were identified as kin. Further, the ties consisted of very close to somewhat close relations. Table 3 presents the distribution for each of the network characteristics by place of delivery. There were no associations between the network structural variables (i.e., density, kinship homogeneity and strength of tie) and place of birth. The network content variable (SBA Endorsement), however, was significantly ($p < .001$) associated with place of birth.

The logistic regression models (Models 1, 2 and 3) are presented in Table 4. [Note: The individual level factors most consistently associated with receiving SBA care in Bangladesh, reported in the published literature, reviewed include parity, education, household wealth, maternal age and antenatal care use. Maternal age was excluded from this analysis because of a high correlation with parity and antenatal care use was not included because of its lack of significance at the bivariate level]. A test of Model 1 against a constant only model was marginally significant, $\chi^2(6, N = 244) = 12.59, p = 0.05$ indicating the individual attributes, as a set, do not reliably distinguish between women who deliver at home and those who deliver at a facility. None of the women's individual attributes in Model 1 were statistically significant. A test of Model 2 with the addition of network structural variables (i.e., density, kinship homogeneity, strength of ties) did not significantly improve the prediction of SBA use. Accordingly, both the -2 LL ratio test between Model 1 and 2 ($p = 0.49$) and the block statistic ($p = .49$) were not significant. A test of Model 3 with the addition of the network

content variable (i.e., SBA endorsement) did significantly improve the prediction of SBA use. The -2LL ratio test between Model 2 and 3 ($p < .001$) and the block statistic ($p < .001$) were both significant, indicating the model improved from the previous step. Further, the overall percent of cases correctly classified was 72.2%, a 12.6% improvement over the chance level (59.6%). The results suggest that the odds of facility delivery *increased* for women with high vs. low SBA endorsement ($OR = 5.97$, 95% $CI = 3.27-10.92$) controlling for all other variables in the model.

Results of a logistic regression model including the interaction terms between each of the three measures of network structure and one measure of network content (data not shown) indicate that the interaction between density and SBA endorsement ($p = .73$), kinship homogeneity and SBA endorsement ($p = .59$), and strength of tie and SBA endorsement ($p = .07$) were not significant. The impact of network content (i.e., the perceived advice of the network for or against facility birth) on place of delivery was not modified by the structure of the network (i.e., kinship composition, tie strength, and density).

Discussion

To better understand patterns of health service use in uncomplicated pregnancy and childbirth we tested the NEM's central hypotheses on the relative contribution of network variables in relation to individual characteristics and the interactive nature of network structure and content. The findings demonstrate that place of birth decisions can be explained from network content, though not structure, and that network content has more explanatory value than individual attributes alone, lending partial support to the utility of the NEM.

Yet, according to the NEM the network structural variables were expected to have greater explanatory value than our results demonstrated. Further, the joint effect of network structure and content was thought to affect use. There are a number of possible reasons why structural characteristics did not discriminate between users and non-users of SBAs in this study. First, the data are from rural Bangladesh, a traditional society where social networks primarily consist of dense, strong-tie, kinship-based relations. In contrast, in contemporary societies personal ties are usually socially diverse, spatially diverse and comprise a low-density mixture of friends and relatives (Wellman & Wortley, 1990). For example, in Toronto, Wellman found that when density scores ranged from 0.76–1.00, 73.7% of the network was comprised of kin. When density was 0.51–0.75, 56.9% were kin and when density fell to 0–0.25, only 36.4% were kin (1979). In this study, with a density of 0.77 and 75% of network members identified as kin, the finding that the densest networks tend to be comprised mainly of kin is corroborated and lends support to the premise that the village social structure in rural Bangladesh society remains centered in a system of kinship relations.

The unique characteristics of Matlab provide another possible explanation. Matlab is the principal field station of the ICCDR, B and home to a series of maternal and child health program trials and the longest standing Health and Demographic Surveillance System in the developing world. Behrman and colleagues suggest that network structure is likely to have a large effect on behavior as long as the behavior is not already widely disseminated in a community (Behrman et al., 2002). A proposition that is consistent with typical diffusion models that postulate that the marginal effects of social interactions are likely to be smaller in the later stages than in the earlier phases of an innovation (Valente, 1995). In Matlab, the use of skilled care for delivery has shown a steady upward trend since the late 1980's — increasing from 7.3% during 1987–1989 to 50.9% in 2005 (Chowdhury et al., 2009). Use of facilities for delivery was approximately 69% in 2008 at the time of data collection for this

study, indicating diffusion of SBA use in Matlab was in a later stage. Community mobilization activities that rely heavily on community health workers to convey the importance of facility based delivery care and assist women in the development of birth plans, together with a gradual upgrading of the four ICDDR,B facilities to provide basic emergency obstetrical care, help explain the observed trend toward increased utilization.

Further, the measures used in the analysis may have failed to capture the distinct structural features that make a difference in utilization patterns; for example: the dispersion of the network, or the ease with which network members can make face to face contact; the multiplexity or the degree to which ties serve more than one function; and/or reciprocity or the extent to which supports and obligations are equal among members (Berkman et al., 2000; St Clair et al., 1989). We don't know, in other words, if these measures would have strengthened the explanatory power of network structure. Moreover, women may be in advantageous or disadvantageous positions within the global (overall) structure of their network. Gayen and Raeside (2007) found that the more central a woman's position in her network, the less likely she was to use professional assistance at childbirth. The study used Freeman's degree centrality (1978–1979) a measurement that shows the extent to which individuals are connected to the rest of the network. Social network theory suggests that centrally located individuals are more likely to know about and adopt innovation earlier than those who are more isolated in information networks. The finding that high degree centrality is a norm-enhancing feature of the global network demonstrates that attributes of social networks can have diverse effects depending on the context and health outcome in question. The present study focused on ego-centered networks, thus data on global network features such as degree centrality was not captured.

Unobserved community variation might further explain the structural variables' lack of explanatory power. In a previous study that examined the influence of network structure and content on use of family planning (Kohler et al., 2001), the extent of women's involvement in market activities determined whether the content or structure of the network was most relevant. Embedding the social networks of women in Bangladesh in a larger context requires that future studies focus on women's involvement in decision-making and labor markets. Such studies might involve the macro-level political, social and cultural influences that impact women's participation in society at large.

Although, the network structural variables used in our analysis were not significantly associated with place of birth, the network content variable, representing perceived norms, was highly significant. As expected, the non-users of SBAs perceive their network to collectively have a relatively low SBA endorsement while the users perceive their networks to collectively have a relatively high SBA endorsement. These group differences in utilization make sense in a society, like Bangladesh, where family, local culture and tradition are valued over individual identity (McLaughlin & Braun, 1998). Despite rapid modernization and urbanization the authority of the group over the individual does not appear weakened with regard to the decision about where and with whom to give birth. The results demonstrate that women behave in accordance with their perceptions of the advice given to them by key members of their discussion networks, regardless of whether the advice supports home or facility delivery. Consistent with some of the first empirical research on social networks and health care use (Horwitz, 1977; Reeder et al., 1979), the type of advice given by the social network, not the network structure, is important in predicting use of health services. Yet, the network influence is not the only reason women do not use facility-based SBA services in Matlab. Data from in-depth interviews indicate that the availability of reliable transportation, the timeliness of women's recognition and response to labor onset and ready access to an unskilled attendant also characterize non-users (Edmonds, 2010).

Limitations

Cross-sectional study designs are based on observations at one point in time and thus lack control over exposure to the independent variable, prohibiting the formation of pure experimental and control groups. Data analysis is required to isolate the impact of the independent variables on the dependent variables. While this approach makes it more difficult to measure the causal effects that can be attributed to the presence of independent variables, it does allow observation in more naturalistic settings and testing of hypotheses that do not lend themselves easily to experimental treatment. Accordingly, the results from our regression only reveal multivariate associations and do not infer causality.

Further, the existing data cannot differentiate between the propensity of women to behave in a way that varies with the advice of their networks and the propensity of women to perceive their network members to be more similar to them than they actually are. The false consensus effect can be described as an egotistic bias in social perception resulting in inaccurate assessment of social norms (Dawes, 1990; Marks & Miller, 1987). A large body of literature in social psychology has demonstrated that people tend to misperceive or overestimate others' attitudes and behaviors as being more similar to their own attitudes and behaviors than they are in reality. Thus, the perception of network members' endorsement for or against facility use may be a projection of the women's behavior versus the actual attitudes of their network members. Further, women's perceptions of the advice provided in their discussion networks may not coincide with the actual advice provided (Killworth & Bernard, 1976). Valente and colleagues (1997) in a social network study of contraceptive use demonstrated that it is not the correctness of the respondent's knowledge about her network partners use of contraceptive but rather what women perceive about their network partners use that matters most. Their sample allowed an analysis of women's contraceptive use according to both the women's perception of her network partners' contraceptive behavior and the network partners' actual behavior. In our study, the sample did not allow for such comparisons. The degree to which women were correct in their perception of their network members' endorsement for or against SBA use is unknown. The finding that social network content predicts place of birth decisions is subject to debate involving the false consensus effect.

Another limitation of the present study is that the social network ties were either present or absent, reciprocity between pairs was not measured and mutuality was assumed. Verification of the women's perception of her network members' advice and behavior from the perspective of nominated alters would enhance the reliability of the data since we know that data based on recall is less reliable than data based on observation, and that people are generally very inaccurate in reporting their past interactions with other people (Bernard et al., 1984). Inaccuracies take two forms: forgetting persons with whom they have interacted and falsely recalling interactions that never occurred (L.C Freeman et al., 1987).

Despite these limitations, the significance of network content, in the analysis, places emphasis on the role that the collective advice of others perceived by women (correctly or not) may play in birth decisions in the Matlab context. This finding highlights the need to look beyond typical individual attributes when assessing the determinants of health service use. While typical individual attributes (e.g., household wealth, education and ANC care) remain important, our data shows that when network variables are added to the profile matrix of respondents, network content explains more of the variance than the individual factors alone. In testing aggregate network variables at the individual level, we extend the ability of the individual profile matrix to explain outcomes as suggested by McCarty (2002).

Yet, the overall results raise questions about the direct role of structural factors in influencing women's decisions to use health services in settings where dense, strong tie kinship based networks predominate and where the utilization behavior is already widely disseminated throughout the area. The negative finding is not sufficient to dismiss the premise that social networks affect perceptions, beliefs and actions through a variety of structural mechanisms that are socially constructed through relations among people. However, the recent exclusive focus on structure in the broader social science literature may be unwarranted. We agree with Pescosolido's suggestion that network theory and research take both a social psychological and a structural focus that embraces both qualitative and quantitative approaches (Pescosolido & Levy, 2002; Pescosolido & Rubin, 2000)

Conclusion

Application of the NEM demonstrated that the explanatory power for network variables was beyond the power of typical individual attributes, lending support to previous research that found network characteristics to add significantly to the explanation of variation in service use. The application of the NEM needs to be extended and tested in other health seeking behaviors to further delineate the relative role of network structure and content on service utilization and the degree to which network effects are context specific.

Community health education and mobilization interventions attempting to increase demand for SBA use should reflect the centrality of kinship networks on women in Bangladesh and the likelihood of women to heed the perceived advice of their network of advisors with regard to place of birth. Therefore, health messages and interventions need to be aimed as much, if not more, toward women's social networks than the childbearing women themselves.

Research Highlights

- The Network-Episode Model was applied to examine associations of social networks with the use of skilled birth attendants in Bangladesh.
- The perceived advice of network members adds significantly to the explanation of variation in service use.
- Testing aggregate network variables extends the ability of the individual profile matrix to explain outcomes.
- Interventions, to increase demand for skilled birth attendants, need to reflect the centrality of kinship networks on women.

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Table 1

Summary of Variables Used in Analyses

Women's Individual Attributes	
Age	Interval, age in years
Parity	Interval, number of live births
Education	Interval, highest grade completed
Socioeconomic status	Ordinal, 1–5 (based on asset scores and wealth quintiles)
Antenatal Care Visits	Interval, number of antenatal care visits completed
Social Network Structure Characteristics	
Density	Interval, proportion, number of ties among individuals in a woman's network divided by the total number of possible ties, values range from 0–1, where 1 is maximum density where all alters nominated knew one another. The total number of ties was summed and divided by the number of potential ties $N(N-1)/2$ where N is the number of network members.
Kinship Homogeneity	Interval, proportion, number of individuals in a woman's network who are kin divided by the total number of individuals, values range from 0–1, where 1 is maximum homogeneity. Answers to the name interpreter question "Do you consider [name] to be kin?" were aggregated and standardized across the network, resulting in a final network score with values between 0 (no kin in network) and 1 (all kin in network).
Strength of Tie	Interval, proportion, rating of how close a woman feels to individuals nominated in her network on a Likert-type scale from 0–3. Answers to the name interpreter question "How close do you feel to [name]?" were aggregated and standardized across the network, resulting in a final network score with values between 0 (low strength) and 1 (high strength).
Social Network Content Characteristic	
SBA Endorsement	Interval, proportion, where individuals in a woman's network advise her to deliver, 0=home 1=facility. Answers to the name interpreter question "Where did [name] advise you to deliver?" were aggregated and standardized across the network. The responses were scored as follows: 1 point for facility and 0 for home. The highest score represents a woman whose alters all advised her to use a facility for delivery. The lowest score represents a woman whose alters all advised her to deliver in the home.
Outcome	
SBA Use-Place of Birth	Nominal, 0=home with a unskilled attendant, 1=facility with a skilled birth attendant

Table 2

Summary of Individual Characteristics of Sample

Individual Characteristic	Total Sample (N=246)	Home Delivery (n=124)	Facility Delivery (n=122)	p value
Age (mean (SD); years) [†]	24.68 (5.1)	24.83 (5.0)	24.53 (5.3)	.47
Parity (mean (SD); birth number) [†]	2.19 (1.1)	2.32 (1.1)	2.06 (1.1)	.04*
Education (mean (SD); grade completed) ^{***}	6.56 (3.4)	5.90 (3.4)	7.24 (3.4)	.00*
Asset Score (mean (SD); quintile) [†]	3.1 (1.4)	2.82 (1.4)	3.28 (1.4)	.01*
Ever-Use Facility ^{***}				.52
Yes	121 (49.4%)	58 (25.8%)	63 (51.6%)	
No	124 (50.6%)	65 (52.8%)	59 (48.4%)	
Antenatal Care (mean (SD); encounters) [†]	3.35 (0.92)	3.24 (.97)	3.47 (.87)	.02*
Residence During Pregnancy (n/%) [‡]				.07
Marital	134 (54.5%)	70 (56.5%)	64 (52.5%)	
Nuclear	78 (31.7%)	43 (34.7%)	35 (28.7%)	
Natal	34 (13.8%)	11 (8.9%)	23 (18.9%)	

Note: Significance levels for differences between home and facility delivery groups

* p .05

*** 1 case missing

[†] p value calculated by Mann-Whitney U test

[‡] p value calculated by chi-square for independence

Table 3

Summary of Descriptive Network Data

Network Characteristic	Total (N = 244)	Home Delivery (n = 123)	Facility Delivery (n = 121)	<i>p</i> value **
SBA Endorsement (mean (SD))	.72 (.30)	.58 (.31)	.87 (.20)*	.000
Density (mean (SD))	.77 (.20)	.77 (.22)*	.79 (.19)	.790
Strength of Tie (mean (SD))	.77 (.11)	.76 (.10)	.78 (.11)	.367
Kinship Homogeneity (mean (SD))	.74 (.23)	.77 (.21)	.72 (.26)	.228

Note:

* 1 missing case

** *p* value based on Spearman's Rho Correlation Coefficient

Table 4

Summary of Logistic Regression Analysis, Models for Individual Characteristics, Network Structure and Content Characteristics Predicting Place of Birth, Odds of Facility Delivery (N=244)

Predictors	Model 1			Model 2			Model 3		
	B	Odds Ratio [†]	95% CI Lower Upper	B	Odds Ratio [†]	95% CI Lower Upper	B	Odds Ratio [†]	95% CI Lower Upper
Constant	1.68			1.95			.017		
Parity	0.09	1.09	0.85 1.40	0.11	1.11	0.86 1.44	0.17	1.18	0.90 1.56
Education	-0.08	0.93	0.84 1.02	-0.08	0.92	0.84 1.01	-0.08	0.93	0.84 1.03
Assett Score (1 vs 5)	-0.80	0.45	0.17 1.17	-0.77	0.46	0.17 1.23	-0.72	0.49	0.17 1.39
Assett Score (2 vs 5)	-0.24	0.78	0.33 1.85	-0.27	0.76	0.32 1.81	-0.09	0.92	0.36 2.34
Assett Score (3 vs 5)	-0.32	0.73	0.32 1.67	-0.31	0.74	0.32 1.71	-0.02	0.98	0.39 2.46
Assett Score (4 vs 5)	-0.31	0.73	0.32 1.64	-0.33	0.72	0.32 1.62	-0.27	0.77	0.31 1.87
Density				0.09	1.09	0.62 1.94	0.19	1.21	0.65 2.27
Kinship Homogeneity				-0.41	0.66	0.37 1.18	0.03	1.03	0.54 1.98
Strength of Ties				-0.19	0.82	0.49 1.39	0.01	1.01	0.57 1.79
SBA Endorsement*							1.79	5.97	3.27 10.92
Overall Predicted	59.6%			57.6%			72.2%		
Model	-2 LL	Chi-Square	df	-2 LL	Chi-Square	df	-2 LL	Chi-Square	df
	327.05	12.59	6	324.61	15.03	9	286.87	52.77	10
			.05			.09			<.0001

Note: CI = confidence interval, B = beta coefficient, LL = log likelihood.

* p < 0.01

[†] Odds ratios have been adjusted for all other predictors in the model. Model 1: R² = .05 (Cox & Snell), .07 (Nagerkerke). Homer and Lemeshow (df 8) = 1.0. Model 2: R² = .06 (Cox & Snell), .08 (Nagerkerke). Homer and Lemeshow (df 8) = .18. Model 3: R² = .19 (Cox & Snell), .26 (Nagerkerke). Homer and Lemeshow (df 8) = .52.