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Social Networks, Decision Making and Use of Skilled Birth Attendants to
Prevent Maternal Mortality in Matlab, Bangladesh

By

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An abstract of
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ABSTRACT

Social Networks, Decision Making and Use of Skilled Birth Attendants to
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Background: Worldwide an estimated 529,000 women die annually from pregnancy-and
childbirth-related complications. Use of a skilled birth attendant (SBA) is an effective means to
reduce maternal mortality. However, SBA services remain underused even in settings where
SBAs are available.

Purpose: This retrospective, cross sectional, two-phased study employed ethnographic
decision tree modeling (EDM) and social network analysis to: 1) test the utility of the Network-
Episode Model (NEM) in explaining women's health service utilization decisions in
uncomplicated pregnancy and childbirth, and 2) examine the predictive power of women's self-
identified decision-making criteria on choice of birth attendant.

Sample: A representative sample of 246 Bangladeshi women, 18-45 years of age,
disproportionately stratified by place of birth, residing in the Matlab Health Service Area, who
had an uncomplicated pregnancy and delivery resulting in a live birth in the 3 months prior to
data collection participated in the main phase. A purposive sample of 25 women participated in
the preliminary phase.

Method: In-depth and structured interviews using survey and social network techniques
were conducted. Descriptive statistics were used to categorize individual and pregnancy episode
attributes. The association between the structure and content of women's discussion networks and
place of birth was assessed with logistic regression. The association between the decision criteria
and place of birth was assessed with ethnographic decision models and logistic regression.

Findings: Network content was more strongly associated with place of birth than a
woman's individual attributes. Indicators of network structure were not associated with place of
birth nor did they modify the relationship between network content and place of birth. A women's
intention during pregnancy, her perception of time in labor, transportation and *dai* availability
were the decision criteria predictive of SBA use along with marital age.

Discussion: The NEM together with the EDM has utility in the study of decision
processes that result in preventive health seeking behaviors. Yet, the effect of network structure
may be overestimated in certain cultural contexts. Findings can inform future research and public
health practice.

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CHAPTER 1

INTRODUCTION

Chapter one introduces the dissertation project. The chapter is organized according to the statement of the problem, specific aims, conceptual framework, relevance of the study, and concludes with a summary.

Statement of the Problem

This project investigated the influence of social networks on women's decisions to use skilled birth attendants (SBA) and the criteria used by women in these decisions. 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). The World Health Organization (WHO) estimates that 536,000 women die annually from pregnancy-and childbirth-related complications, with a disproportionate number (99%) occurring in developing countries (WHO, 2007). 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 (K. S. Khan, D. Wojdyla, L. Say, A. M. Gulmezoglu, & P. F. A. Van Look, 2006; Carine Ronsmans & Graham, 2006). Studies estimate that 15% of all pregnant women will develop a life-threatening complication and that most complications cannot be predicted (Carine Ronsmans, Campbell, McDermott, & Koblinsky, 2002; Carine Ronsmans, De Brouwere, Dubourg, & Dieltiens, 2004). The Healthy People 2010 Objective 16-2 (United States Department of Health and Human Services, November 2000) 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 SBA who is

supported or backed by emergency obstetric care (De Brouwere & Van Lerverghe, 2001; Lule, et al., 2005; Miller, Sloan, Winikoff, Langer, & Fikree, 2003; A. Paxton, Maine, Freedman, Fry, & Lobis, 2005; Anne Paxton, Maine, Freedman, & Smith, 2003; WHO, 2004). Success of this strategy is dependent not only upon the availability but also the use of SBAs during childbirth. While lack of availability of SBAs restricts use in many developing country settings, data from recent studies suggest uptake is low even in settings where services are available (K. Afsana & Rashid, 2001; S. M. Ahmed, 2001; S. M. Ahmed, Adams, Chowdhury, & Bhuiya, 2000; M. E. Chowdhury, et al., 2006; Duff, Lamping, & Ahmed, 2001; E. A. Goodburn, R. Gazi, & M. Chowdhury, 1995; B. K. Paul & Rumsey, 2002a; Raghupathy, 1996). To reduce the gap between need and use, where SBAs are available, research is needed to understand why women are using or not using SBAs for delivery and what can be done to increase appropriate utilization.

The study was conducted in Matlab, Bangladesh, where SBAs and emergency obstetric care are available and yet 50% of women continue to give birth in the home attended by relatives and other unskilled or semi-skilled attendants (HDSS, 2006). Matlab provided an ideal setting to study prenatal decision processes in support of the development of improved strategies and interventions that promote timely and appropriate obstetric service use (e.g., SBA's).

Previous studies investigating use of SBAs have employed health behavior or health care utilization models that focus on individual attributes and rational decision-making, such as the Theory of Reasoned Action or Anderson's Social Behavioral Model (R. Andersen & J. Newman, 1973; Camerer & Fehr, 2006; Elder, Ayala, & Harris, 1999; Fishbein & Azjen, 1975; B. A. Pescosolido, 1992). These models identify both individual attributes and external environmental influences on health service use. However, they do not fully account for the intrapersonal, family and community interactions thought to facilitate or constrain service use; a social context in which individual determinants are known to operate (Mackian, Bedri, & Lovel, 2004).

The study employed a Network Episode Model (NEM) framework to more fully examine the influence of socio-structural context on decision-making. The NEM has been successfully

used to examine health service utilization decision-making for illness episodes, such as mental illness (Bernice A. Pescosolido, Wrights, Alegria, & Vera, 1998; Vera, et al., 1998). However, no known studies have used the NEM to examine health service utilization decision-making in the case of a normal biological process, such as pregnancy and uncomplicated childbirth. The NEM model 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). Research has demonstrated that interpersonal interactions can facilitate or hinder use of healthcare. Here, the NEM was extended to examine health service utilization decision-making in the case of a normal biological process, such as pregnancy and uncomplicated childbirth. The study investigated the influence of the structure and content of women's social networks on SBA utilization decisions. Further, it delineated, through ethnographic decision tree modeling, the specific criteria used in decision-making in a rural, developing country setting.

Specific Aims

The specific aims, associated hypotheses (H), and research questions (RQ) are as follows: Aim 1: To explore the utility of the NEM in explaining women's health service utilization decision-making in uncomplicated pregnancy and childbirth.

H1: Network structure variables (density / 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 to a greater extent than women's individual attributes.

H1a: Women embedded in dense social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

H1b: Women embedded in homogeneous social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

H1c: Women embedded in social networks comprised of strong ties (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

Aim 2: To determine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth.

RQ1: What decision criteria predict the choice to deliver with a SBA or not with a SBA?

RQ2: What sequence of discrete decision criteria best predicts the choice to deliver with or without a SBA?

Conceptual Framework

The Network-Episode Model (NEM) provides the conceptual framework for this study. The NEM is a dynamic conceptual framework of healthcare utilization and compliance, derived from decision-making, social exchange and social network theory. The NEM was developed by Dr. Bernice Pescosolido, a medical sociologist and professor in the Department of Sociology at Indiana University, to specify the nature of influence of social networks on health care decisions among people with mental illness (B. A. Pescosolido, 1992). 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). Thus the model places individual agency (e.g., a women's decision about SBA use) within the context of social interactions, bridging the structure versus agency debate.

The NEM combines three distinct yet interrelated topics -lay decision-making, health seeking behavior and health care utilization. Simply stated, lay decision-making involves the study of how people make judgments and choices in naturalistic or field settings, including the analysis of choice behavior. Economists focus on a specific end-point of formal service use and employ the term, 'health care utilization behavior'. 'Health-seeking' generally refers more narrowly to seeking services or remedies for a specific service, ailment or illness. 'Help-seeking' is used in a more comprehensive way to refer to the use of both formal supports and informal

supports, including family, kinship networks, friends, traditional healers and/or religious leaders. In many cases, 'help-seeking' is used interchangeably with 'health-seeking'.

The NEM provides a framework for health-seeking behavior. Decision-making both precedes and co-occurs with health seeking behavior. It is a on-going process with *final decisions* coming into focus at critical points in time resulting in action or inaction (Buetow, 2005). Use of health services in discrete or continuous forms is considered an outcome. In this study, decision-making is conceptualized as a process and the behavior as a act of bringing about the final decision or outcome, use or non-use of a facility during uncomplicated childbirth. During the childbearing period utilization decisions are made to access routine preventive care or for emergency care as a result of a problem (Matthews, Brookes, Stones, & Hossain, 2005). This study is focused on the former.

Four basic assumptions underlie the NEM model. First, all societies hold a vast reserve of people who can be and are consulted during an illness episode. Second, bounded rationality rather than economic rationality underlies decision making (Garro, 1998). Economic rationality is based on subjective expected utility (SEU) theory. SEU theory assumes that decision makers are aware of all alternatives among which a choice can be made, are able to subjectively estimate accurate probabilities of consequences associated with each alternative, and possess a utility function allowing them to order by preference all the possible outcomes of a choice (Fjellman, 1976). It is assumed people have well-established preferences. Bounded rationality revises the SEU assumptions to account for the fact that perfectly rational decisions are often not feasible due to the finite computational ability humans have available for making them. According to Herbert Simon, human information processing abilities are more limited than those assumed by economic theory. People settle for the first acceptable alternative within their cognitive limits and the structure of the environment rather than optimize all possible alternatives (Simon, 1955). Rather than consider all possible alternatives, people use mental shortcuts or heuristics to make choices that are good enough but not necessarily optimal. The third assumption of the NEM is

that the process of decision-making for individuals is dynamic, accounting for changes in the dimensions of time and space. And, fourth the mechanism underlying the decision making process is interaction that is embedded within social networks. That is, people through their network ties recognize need for services provide information about access and options for care, and mobilize support to facilitate or constrain movement toward use of formal or traditional services (B. Pescosolido, 1991).

Rationale for Selecting the NEM as the Conceptual Framework

The NEM was selected as the conceptual framework for the study after a review of the health-care seeking (utilization) literature revealed that the more prominent public health behavioral theories were inappropriate or conceptually incomplete, as the focus of health behavior has primarily been at the individual level (Crosby, Kegler, & DiClemente, 2002) with exceptions noted below. The majority of health-seeking behavior theories and empirical studies from public health, investigating the way people make decisions about their patterns of health seeking, assume that individuals engage in rational decision-making processes or use analytical methods that require such a perspective. Health seeking behavior is seen as rooted in the individual. Social or environmental influences when accounted for are conceptualized as factors in a linear analytical model with the individual as the unit of analysis. Limitations of these models include static conceptualization of individual attributes that fail to fully explain the variance seen in behavior and the subsequent lack of social and environmental context for the development of effective interventions tailored to the situation, issue and context of interest. Instead, the emphasis on behavior change continues to predominately promote individual agency over social structure thus encouraging a depoliticized approach to population health (MacKain, 2003).

The NEM offers an alternative to the more familiar models employed to examine health care utilization behavior such as the Theory of Reasoned Action (TRA) and Anderson's Socio-Behavioral Model (SBM) (R. Andersen & J. F. Newman, 1973; Fishbein & Azjen, 1975). The Theory of Reasoned Action (TRA), was developed in 1967 to understand the relationship

between attitudes and voluntary behavior and to serve as a framework for behavior change interventions (Fishbein, 1967). The theory evolved into the Theory of Planned Behavior (TPA), with the addition of perceived behavioral control as a variable, thought to be important when behavior was shown not to be completely voluntary (Ajzen, 1991). Perceived behavioral control refers to people's beliefs about their ability to perform a given behavior, commonly referred to as self-efficacy, a concept proposed in Bandura's Social Cognitive Theory (Bandura, 1982).

Overall, the TPA suggests that a person's behavior is determined by one's intention to perform the behavior. Intention is the cognitive representation of an individual's readiness to perform a behavior, and it is considered to be an immediate antecedent to behavior. People's intention is determined by their attitude towards a specific behavior, their subjective norms, and their perceived behavioral control. A subjective norm is a person's perception of what others believe that he or she should do and is otherwise known as an injunctive norm. In the model, subjective norms only influence behavior indirectly through intention (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Azjen, 1975). Ajzen and Fishbein conceptualize subjective norms as "coercive social influences with which individuals feel motivated to comply". (Rimal & Real, 2003, p. 187). The theory does not, however, describe the social composition from which these subjective norms emerge. Furthermore, with a focus on individual intention it fails to account for external constraints on behavior. Thus, the theory lacks explanatory power when intention and behavior are incongruent. To summarize, the TRA is a cognitively oriented theory with an emphasis on individual socio-psychological determinants, requiring the adoption of the assumptions of SEU theory where reasoned processes underlie attitudes and actions.

Anderson's Social-Behavioral Model (SBM) is the most frequently cited model employed to explain access to health services/health services utilization (Aday & Andersen, 1974; R. Andersen & Newman, 1973). The SBM, which is more structurally oriented than the TRA, initially conceptualized decision-making in terms of 1) predisposing factors (demographic, social structural, and attitudinal-belief variables); 2) enabling factors (availability of services and

characteristics of the community); and 3) need factors (perceived and evaluated illness) (Aday & Andersen, 1974; R. Andersen & J. Newman, 1973). Categories for environmental variables (societal determinants and the health services systems) added to the model in a widely cited journal article by Anderson and Newman, however, are often overlooked by many researchers (1973). While the model includes social structure, the SBM focuses on access to care as an outcome and locates decision-making in the individual. Anderson has suggested that social networks, social interaction and quality of social relationships "rightly fit" into the model and should be incorporated (Andersen, 1995). However, "*there is a difference between seeing social norms and social networks as influences on decisions or individuals, as rational theory suggests, and seeing social interaction in bounded networks as the mechanism that underlies action* [italics added]" (B. Pescosolido, 1992, p. 1104). Anderson does, however, note that the existing empirical work on health care utilization fails to consider the effects of social interaction or networks (Andersen, 1995).

Prediction of healthcare utilization is the goal of most studies guided by the SBM at the expense of explanation. These studies often use nationally representative databases that lack contextual variables and use individuals as the unit of analysis (Phillips, Morrison, Andersen, & Aday, 1998). Explanations of variation in service utilization are often based on socio-demographic characteristics and severity of an individual's condition at the expense of treatment seeking processes (Mechanic, 1979). For example, a paper on the determinants of the use of maternal health services in rural Bangladesh guided by "Anderson's conceptual framework of health seeking behavior" found the following significant associations: women with secondary or higher education (odds ratio 1.8), women with husband's who work in business/service jobs (odds ratio 1.8), and women with life threatening conditions (odds ratio 2.2) were more likely to seek the care of a doctor or nurse than women without these characteristics (Chakraborty, Ataharul Islam, Islam Chowdhury, Wasimul Bari, & Hanum Akhter, 2003). Note that the study authors did not report confidence intervals around the odds ratios. The study, which finds needs

variables (life threatening illness) to be the strongest predictor, however, lacks an explanation for these observed differences and offers no insight into the process of health seeking.

Both the TRA and SBM conceptualize group influence or interpersonal relations only as additional factors considered by individuals engaged in rational decision-making. The assumption is that good health is a common goal and differences in health behavior are a result of individual's cognitive and affective determinants (e.g., motivations, intentions and beliefs) on *choice;* a choice that is only partially impacted by the social environment. The NEM model, on the other hand, postulates that the major mechanism at work in decision-making derives from interpersonal interaction rather than individual rationality. The intent of the NEM is not to replace these prominent models but to complement them by adjusting the focus of investigations on group level interaction. It seeks to overcome the primary limitation of existing research which is the over emphasis on individual level factors at the expense of interpersonal interactions, social influence and social structures. Less developed in our research on health seeking behavior are the differing characteristics of the social situational context in which individuals are embedded (Currie & Wisenberg, 2003; McKinley, 1972). Thus, the selection of the NEM for this study fills a gap in the health seeking behavior literature.

Empirical tests of Anderson's model (SBM) explain on average an estimated 20% of variance in service use. This limited explanatory power is attributed to the focus on individual variables (Stiffman, Pescosolido & Cabassa, 2004). The NEM may provide a stronger conceptual basis for how known determinants combine and result in specific behavior. The explanatory potential of the NEM may be particularly evident in this study due to the socio-cultural context of the area and the nature of childbirth itself. In more collectively oriented societies, like Bangladesh, family, local culture and tradition are valued over individual identity (McLaughlin & Braun, 1998). Furthermore, the likelihood of shared decision-making is increased in certain conditions including: when one or more network members are unwilling to make decisions with relative autonomy, when the sources of the influence are close, and when maintenance of relationships is

critical (Buetow, 2005). These factors characterize women in cultural contexts where female

autonomy is limited and dependence on kinship is high, such as in Bangladesh (Balk, 1994).

Finally, social norms exert the most influence under conditions of uncertainty, as during

childbirth when predicting complications in individual women is uncertain (Lapinski & Rimal,

2005). The NEM thus may prove to be a strong explanatory model of childbirth decisions in

collectively oriented communities with populations with low individual autonomy. On the other

hand, explanation of 20% of the variance in service use may be one of the highest levels

achievable when employing general variables (even social network variables) due to the

contingency in individual decisions.

Overall, a model, such as the NEM, may propagate a better understanding of health behavior

and in turn developing and evaluating health delivery interventions. The NEM extends the more

individually focused, rational choice set of models, by reformulating questions of health care

decision making (or utilization) according to insights 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 argues has become a "*over utilized and under theorized tool* [italics added]" (2003, p.

2). The analytical focus is placed on a set of relationships rather than individuals while at the

same time continuing to account for individual attributes.

Conceptual Domains of the NEM

The original and full NEM theoretical model contains three conceptual domains: the

social context/episode base, the social support system and the illness career (Figure 1.1). The first

domain, the social context/episode base, includes the background characteristics of the individual

and the nature of the event or illness. Background individual characteristics include gender, age,

education, work status, marital status, income, occupation and personal health history. Attributes

of the health episode include severity, visibility, duration and the acute or chronic nature of the

episode. The second domain, the social support system, consists of the social network delineated

by structure (composition of ties or relations), function (what ties or relations do) and content

(what actors or individuals believe, their ideations). The third domain, the illness career, is

conceptualized in terms of key entrances, exits, timing and sequences. Building on the life course

perspective, the illness career acknowledges the existence of pathways to care and lays out five

stages through an illness episode (i.e., recognition, utilization, initial compliance, outcome and

secondary compliance). Initial compliance represents the willingness to accept and follow

medical advice whereas secondary compliance is the decision to continue in a long-term

treatment plan. All of the three conceptual domains are dynamic in nature and influence each

other by interaction at critical points, which in turn influence decisions and outcomes (B.

Pescosolido, 1991).
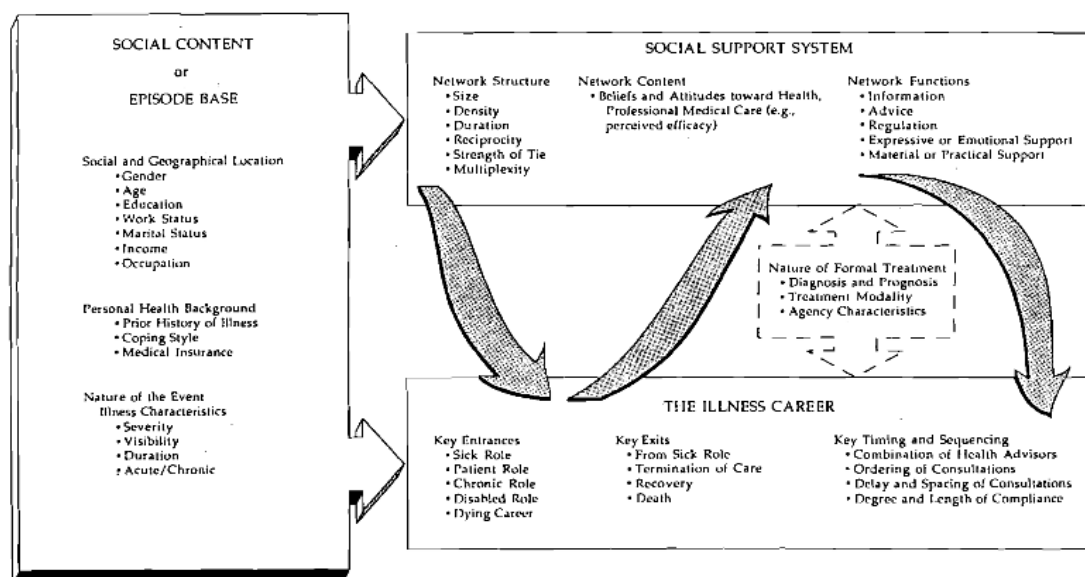
Figure 1.1 The Network-Episode Model of Utilization and Compliance, Pescosolido, 1991.

An additional component, included within the NEM but not well described, is the

decision process itself. In a SBA decision, within any local context both stated and unstated

criteria are activated, including not only who within the network participates in the decision-

making process but also the stated and unstated rules or criteria by which a decision is reached

regarding a birth attendant. Moreover, the decision-making process is dynamic and recursive. As a woman's pregnancy progresses to term, decision criteria are activated and decisions are made and may be altered depending on evolving circumstances of the woman's situation and environmental constraints.

Decision Criteria and Ethnographic Decision Modeling

Ethnographic decision tree modeling (EDM), a context-sensitive analytic strategy, was employed to capture and predict the criteria used by women and their network members to select a woman's birth attendant rather than the outcome of the decision alone (Oh & Park, 2004; Wu, Chao Yu, Yang, & Che, 2005). The EDM strategy is frequently used by anthropologists and, to a lesser extent, by nurse scientists (Oh & Park, 2004; Wu, et al., 2005). It assumes that the decision makers themselves are the experts on how they make the decisions and that people have the ability to report on real life decisions in terms of alternatives evaluated, dimensions of contrast and sequencing of comparisons (Gladwin, 1989). Ethnographic fieldwork techniques elicit from the individual decision makers their decision criteria (Bernard, 2006). The criteria are then analyzed, combined, clustered and ordered by the researcher in the form of a composite decision tree table, flow chart and/or a set of "if-then" rules based on individual decision processes. After construction, the composite model is validated in a different yet representative sample from the same population from which the model-building sample was selected. The result is a set of organizing principles and criteria used in decision-making according to a specific sequence that best represents the decision process of all individuals in a group. Patterns of decision-making are revealed for users and nonusers, illustrating within group variability and adding depth to the otherwise dichotomous place of birth outcome. Together with women's individual attributes and social network characteristics, the EDM strategy is well suited to capture the decision-making criteria represented by the NEM conceptual framework.

Network-Episode Model Hypotheses

Hypotheses related to how the major conceptual domains of the NEM shape and in turn are shaped by one another are generated from the model. The influence of specific configurations of social network structure, function and content on health seeking behavior is also proposed. In this study not all of the hypotheses derived from the NEM are being examined. However, they are outlined below to provide a complete conceptual backdrop. The first hypotheses are descriptive in nature regarding the networks themselves.

Hypothesis 1A. The search for care is socially organized. That is, a complex but limited

set of patterns and sequences of network ties (seeking both lay and medical advisors)

exist. Further, these patterns and sequences are associated, to some, degree with social

characteristics such as age, education and gender.

Hypothesis 1B. Social networks are in a dynamic state of flux. Illness episodes affect the

individual's ability to maintain old ties or generate new ones.

The second set of hypotheses involves the effect of structure, content and function of network ties on seeking formal care, timeliness of seeking care and compliance with care.

Hypothesis 2A. The structure of networks interacts with the cultural content to affect the

use of medical practitioners, delay in seeking care and compliance with medical

regimens.

Hypothesis 2B. The functions of the network interact with the cultural content to affect

the use of medical practitioners, delay in seeking care and compliance with medical

regimens.

The third hypothesis addresses the impact of discrepancies between perceived and actual network structure, content and function.

Hypothesis 3. The greater the congruity between client's perceptions of network

configurations and actual configuration, the more likely that network effects will coincide

with expectations under the Network-Episode Model.

The fourth set of hypotheses addresses the dynamics of network changes on compliance.

> *Hypothesis 4A*. Changes in network structure and function will affect compliance depending on the cultural content of the network.

> *Hypothesis 4B*. Changes in network attitudes toward formal medical care will influence compliance.

Finally, the fifth set of hypotheses specifies the effects of traditional socioeconomic variables on utilization and compliance.

> *Hypothesis 5A*. Socio-demographic characteristics like age and gender will be related to the structure, function and content of networks. For example, a women's age may be reflective of her social location in her household, which in turn determines opportunities for network formation and interaction.

> *Hypothesis 5B*. Socio-demographic characteristics on utilization and compliance will decrease once network factors are taken into account (B. Pescosolido, 1991).

The hypothesis most germane to the study (2A), postulates that network structure and content together influence health care utilization decisions. More specifically, network structure calibrates exposure to and the extent of influence while the network content determines the direction of influence, (i.e., either toward or away from a particular heath care utilization option) (B. A. Pescosolido, 2006). For example, a woman whose network is comprised of densely inter-connected, personal ties among individuals with similar attitudes and opinions about what constitutes a proper birth attendant is more likely to behave in ways endorsed by her network members. If these attitudes and opinions are favorable to SBA use, then the woman is more likely to use a SBA. Hypothesis 5B is also pertinent to this research study. Women's network characteristics are expected to explain more of the variance in the decision to use an SBA than her individual attributes alone.

Modified Network-Episode Model

The NEM, as a mid-range theoretical framework, must be adapted to specific research aims. Social network influence is not a process of even intensity; rather networks are situation-, issue- and context-specific (Agadjanian, 2002). Consequently the conceptual and theoretical orientation of the research determines the nature of the social network under investigation and the measures that are most relevant to the outcome of interest. For the purposes of this study, the full NEM was modified to fit the utilization of SBAs (situation) during childbirth (issue) in Matlab, Bangladesh (context) as described below.

First, the NEM was tailored to include a condition warranting preventive healthcare, namely routine childbirth. This study is the first known study to test the utility of the NEM in the context of prevention, rather than illness. Childbirth as a *wellness* episode is unique. While birth necessitates health care for an optimal outcome and is characterized by a degree uncertainty, the physiological condition and course of pregnancy and act of childbirth are not illnesses. The causal nature, set duration and ability to anticipate routine childbirth differentiate childbirth from an acute illness. Therefore, the first domain—the social context/episode base— includes characteristics of pregnant women and routine childbirth known to impact behavior. These include parity, pregnancy risk factors, antenatal care history, place and type of attendant at previous births and previous childbirth outcomes.

Second, the cross-sectional, retrospective design tests only a portion of the full NEM, reducing its full explanatory potential. A snapshot of data at one point in history, limits the study's ability to capture the dynamic nature of the *wellness career* of pregnancy and childbirth. For example, data on how past pregnancy outcomes influence current pregnancy behavior and how social influence, generated by interaction with traditional and allopathic providers, determines ideology are not fleshed out, rather restricted to simple associations. Furthermore, network functions are not explicitly depicted in the modified model. The network functions of the full NEM are a distinct component of the social support system and include information, advice,

regulation, emotional support and material or practical support. Network function in this study is broadly conceptualized as involvement in the decision-making process. While the people involved in the decision about where to give birth likely provide social support, the main study design did not make use of these distinctions.

Finally, the decision-making process embedded in the NEM was pulled out and expanded upon through the use of a naturalistic Ethnographic Decision Modeling. The goal was for the combination of qualitative and quantitative modeling approaches to enhance understanding and improve predictive accuracy of preventive health seeking behavior of women theoretically consistent with the NEM.

As a result of the modifications described above, the domains of the modified NEM, referred to as the Social Network Model of Social Interaction and Healthcare Utilization Decision-Making are: 1) women's individual and pregnancy episode attributes, 2) network characteristics comprised of relevant structural and content related measures; and 3) the decision process (Figure 1.2). Use of skilled birth attendants and the patterns of decision criteria involved in the decision making process are the major outcomes of interest. In the study setting (Matlab, Bangladesh) use of skilled birth attendance directly corresponds to use of a facility for childbirth. While a formal definition of facility-based deliveries is lacking, the term generally implies having a permanent health facility where deliveries are conducted by skilled, professional care providers (Fretheim & Hviding, 2008).
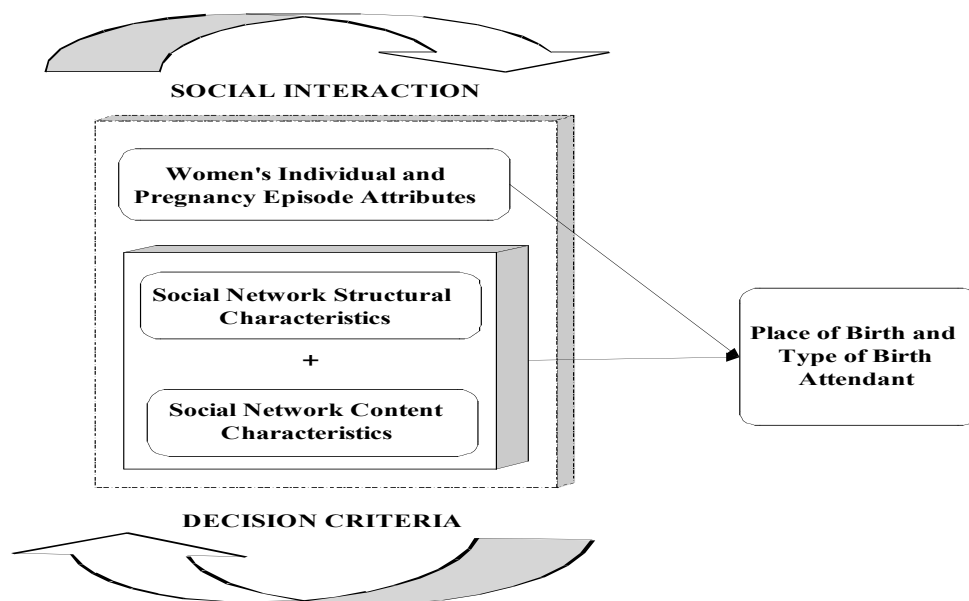
Figure 1.2 Social Network Model of Social Interaction and Healthcare Utilization Decision-Making, Adapted from the Network-Episode Model of Utilization and Compliance.

A conceptual description of the variables contained in each of the domains of the Social

Network Model of Social Interaction and Healthcare Utilization Decision-Making are as follows:

Women's Individual Attributes and Pregnancy Episode Attributes refers to individual

characteristics of a woman, embedded in her network and include a) socio-demographic

characteristics include age, marital age, gender, marital status, socio-economic status (SES), and

place of residence, b) obstetric history includes parity, ever-use of an SBA and antenatal care use,

and c) intention regarding use of an SBA is the women's determination to act in a certain way or

do a certain thing.

Social Network Structural Characteristics refers to the configuration of social relations and

positions among individuals (Cook & Whitmeyer, 1992). Structural properties emerge out of the

network member attributes and tie attributes. Structural characteristics include: density,

homogeneity/heterogeneity, and strength of tie include a) density is the total number of ties in a

woman's network divided by the total possible number of ties the woman's network, b)

homogeneity/heterogeneity is the degree to which the socio-demographic characteristics of

network members in the women's social network are similar or dissimilar, c) strength of ties is the degree of closeness the women feels toward each of the ties in her network.

Social Network Content Characteristics refers to the ideology (beliefs, attitudes, opinions, perceptions) of the network members toward the decision task. In this study, content focuses on the positive or negative endorsement of skilled birth attendance in childbirth.

Social Interaction refers to a dynamic, changing sequence of interpersonal social action within a social network. The principal mechanism through which decision-making occurs within the network.

Decision-Criteria refers to a patterned set of considerations and constraints used by the decision makers themselves to make a choice. Decision criteria reveal shared standards of choice of most individuals in a group that result in the decision outcome.

Place of Birth and Type of Attendant refers to the primary outcome of the investigation is utilization of a facility for childbirth. In the study setting, place of birth directly corresponds to a particular type of birth attendant. Facility births occur with a SBA and home births occur with unskilled birth attendants (e.g., relatives, neighbors, traditional birth attendants).

Relevance of NEM in the Broader Context of Maternal Health

Placed in the broader context of maternal health and the global Safe Motherhood initiative, the NEM provides a framework with which to unpack the socioeconomic and cultural factors that influence service use and the decision to seek care, components of the "Three Delays Model" (Figure 1.2.). The Safe Motherhood initiative, launched at an international conference in Nairobi in 1997, is a global campaign to reduce maternal mortality. The "Three Delay Model" is the most frequently cited framework in the safe motherhood research, programming and evaluation literature. Placing the study's aims in relation to the model is relevant for communication purposes with the multiple disciplines involved in the Safe Motherhood initiative. Thaddeus and Maine first described the model in 1994 to conceptualize delays women in labor experience in successfully being treated for complications, the three delays include:

1. Delay in deciding to seek care,

2. Delay in identifying and reaching a facility, and

3. Delay in receiving adequate and appropriate treatment at the facility (Thaddeus & Maine, 1994).

The model groups factors influencing the delays into three main categories: socioeconomic and cultural factors, accessibility of facilities, and quality of emergency obstetric care. Each influences a family's decision to seek care, their ability to reach care, and the quality of care they receive once they get there.

Delay one or deciding to seek care within the context of a women's social network was the focus of the present study's inquiry. Yet, it is important to point out the major conceptual difference between the aims of this research and the "Three Delay Model". The "Three Delay Model" was developed to explain delays women experience during delivery in the face of complications when medical treatment is required to prevent mortality. The model does not seek to explain health care utilization decisions in uncomplicated birth situations. What is common, however, are the socio-cultural factors influencing decisions to seek care together with the idea that broader structural factors impact decision-making. For example, the decision, might be influenced by environmental (accessibility) factors and the quality of care at a facility (Thaddeus & Maine, 1994).

Factors Affecting Service Use
and Outcome   **"Delays"**

Socioeconomic and Cultural Factors		Delay 1 Deciding to Seek Care

| Accessibility of Services | | Delay 2 Reaching Care |

| Quality of Emergency Obstetric Care | | Delay 3 Receiving Quality Emergency Obsteteric Care |

Death
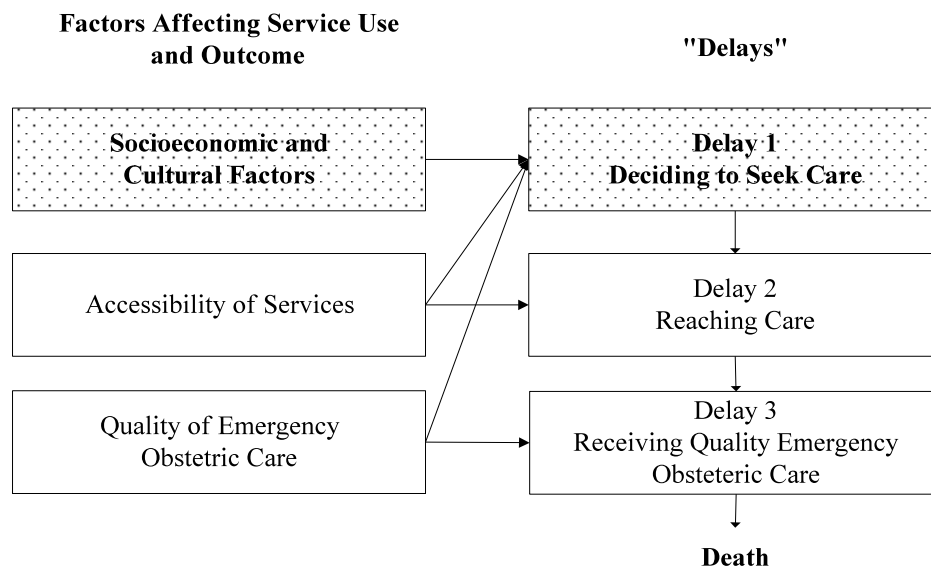
Figure 1.3 Three-Delay Model, Based on Thaddeus and Maine, 1994.

Relevance of the Proposed Study

The study with contribute to the body of literature by examining the utility of the NEM to explain health care utilization decisions during a wellness event (childbirth) in a unique cultural setting with a vulnerable population (women). Adoption of the NEM as the conceptual framework for the study fills a gap in the health seeking and health care utilization literature by attempting to elucidate the predications of group level outcomes, such as use of a SBA from individual sets of relationships or social networks. [Note: Social influence a conceptually complex phenomenon, is defined as any influence on individual feelings, thoughts or behaviors that is exerted by real or implied pressure or actions of others (Norwak, Siamrej, Lante, 1990).] In this study the NEM does not attempt to model social influence processes; rather it seeks to model the outcome of the interactions between the structure and content of the social networks in which individuals are embedded.

The long-term goal of the study is to reduce the high levels of maternal death and disability observed in vulnerable populations. Results may have immediate local impact in

Bangladesh through the design of tailored outreach interventions that address key demand side barriers and facilitators to service use in the study area. For example, interventions may target health messages that are aimed as much, if not more, toward social networks than individuals based on an understanding of social structures that facilitate or impede service use in childbirth. Exploration of the utility of the NEM model has broader implications for health care decision-making if the NEM demonstrates explanatory power for network variables beyond the power of individual attributes. Additional value will be provided if the NEM and ethnographic decision tree modeling together delineate which network characteristics and decision criteria are most useful for understanding such decisions. Overall, the innovative network approach of the study is applicable to investigations of social influences on health care service utilization in the context of prevention as well as illness. The use of SBA is but one example of preventive health service utilization. A study of disparities in prenatal care use in the United States is another example. There are numerous others.

Summary

The NEM provides a conceptual and theoretical orientation from which to help generate answers to the overall study question, why do some women seek SBA for childbirth (and some do not) in an area where professional services are available and are known to prevent maternal mortality and other women do not? The study will apply the NEM to use of a preventative obstetric service (i.e., SBA use) during childbirth. The model identifies configurations of social network characteristics that can potentially facilitate or impede health care use and are hypothesized to explain more of the variance in utilization than individual attributes alone. Social interaction/influence is theorized to be the mechanism through which health care utilization behavior occurs. A modified version of the NEM, including the use of EDM to reveal patterns of decision making, will be examined in this study. The NEM together with the EDM may have more explanatory power than previous models (e.g., TRA, SBM) particularly in collectively

oriented communities among populations with limited individual autonomy. Using the NEM this study will examine the following aims, hypotheses and research questions:

Aim 1: To explore the utility of the NEM in explaining women's health service utilization decision-making in uncomplicated pregnancy and childbirth.

H1: Network structure variables (density / 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 to a greater extent than women's individual attributes.

H1a: Women embedded in dense social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

H1b: Women embedded in homogeneous social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

H1c: Women embedded in social networks comprised of strong ties (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

Aim 2: To determine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth.

RQ1: What decision criteria predict the choice to deliver with a SBA or not with a SBA?

RQ2: What sequence of discrete decision criteria best predicts the choice to deliver with or without a SBA?

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CHAPTER 2

BACKGROUND AND SIGNIFICANCE: A REVIEW OF THE LITERATURE

Chapter two is organized into three sections. In section one, the background and significance of maternal mortality and the global strategy of skilled birth attendant (SBA) utilization to reduce maternal mortality are reviewed, both in general and specific to Bangladesh. The paradox of decreasing maternal mortality and low SBA use in Bangladesh is also discussed. In section two, factors known to influence the use of SBAs in Bangladesh are summarized. In section three, an overview of the effect of social networks and health service utilization is provided and supported by empirical findings. A review of the decision task and the influence of social networks on the decision to utilize a SBA within the socio-cultural context of Bangladesh conclude the section.

Section One

Maternal Mortality

Worldwide more than 536,000 women die of pregnancy-related causes, a leading cause of death among women ages 15-49. For every woman or girl who dies, between 20 and 30 more develop short and long term reproductive morbidities such as obstetric fistulas, a ruptured uterus, or pelvic inflammatory disease (2007). The Tenth Revision of the International Classification of Diseases (ICD-10) defines a maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy or its management but not from accidental or incidental causes (WHO, 2007). The ICD is the international classification used to code and classify mortality data from death certificates. A considerable proportion (15-25%) of these deaths result from conditions that also threaten the newborn's life (Akalin, Maine, de Francisco, & Vaughan, 1997). Nearly two-thirds of maternal deaths worldwide are due to five direct causes: hemorrhage, sepsis, complications from unsafe abortion, eclampsia and obstructed labor (Carine Ronsmans & Graham, 2006). Indirect causes,

accounting for one-third of maternal deaths, include existing diseases exacerbated by pregnancy or diseases developed during pregnancy, such as iron deficient anemia, heart disease, HIV/AIDS and malaria (K. S. Khan, D. Wojdyla, L. Say, A. M. Gulmezoglu, & P. F. Van Look, 2006).

The maternal mortality ratio (MMR), the most frequently cited measure of maternal death, is defined as the number of maternal deaths in a population during a given year per 100,000 live births. Maternal mortality ratios represent the largest public health discrepancy in the world with the burden of mortality falling disproportionately on the poorest countries. Maternal mortality ratios range from less than 10 in more developed countries to over 1,000 in least developed countries.

While some pregnancies carry more risk than others, predicting complications in individual women is uncertain. Studies show that most women who develop complications have no known risk factors. It is estimated that 7.5%-15% of all pregnancies result in major obstetric complications (de Bernis, et al., 2005; Grisaru-Granovsky, Shaya, Hersch, & Samueloff, 2004; M. Koblinsky, Timyan, & Gay, 1993; A. Paxton, et al., 2005). Thus, even when a women is in good health and receives adequate antenatal care, there is no way to know she will develop complications. Therefore, all pregnant women must be considered at-risk.

Skilled Birth Attendants, a Global Strategy to Reduce Maternal Mortality

To reduce maternal mortality, it is generally agreed that all women must have access to and use essential obstetric care. Wagstaff and Cleasonin, in their report to the World Bank, estimate that almost 75% of current maternal mortality can be prevented with essential obstetric care (2004). The two major elements of essential obstetric care are a skilled birth attendant (SBA) at every delivery and emergency obstetric care (EmOC) for complicated deliveries. This study is focused on the use of a SBA at every delivery. Graham estimated that maternal mortality could be reduced by 13-33% if all women were assisted by a SBA (2001). The fifth Millennium Development Goal (MDG-5), set by 189 countries in the year 2000, calls for a reduction in maternal mortality by three quarters by the year 2015 from 1990 levels (United Nations, 2006).

One of the two indicators to track progress in meeting this goal is the proportion of women who use a SBA during delivery (Sachs, et al., 2004).

A SBA is defined as an accredited health professional, such as a midwife, doctor or nurse, who is 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). Traditional birth attendants (TBA), trained or not, are excluded from the category of skilled attendant, despite evidence of small, positive, significant associations between TBA referral behavior and maternal service use (Sibley, Sipe, & Koblinsky, 2004). TBA refers to traditional, independent (of the formal health system), non-formally (by the formal health system) trained and community-based providers of care during pregnancy, childbirth and the postnatal period (World Health Organization, 2004).

Globally, a skilled attendant at every birth is recommended by all of the major international and women's health organizations such as the World Health Organization (WHO), the International Confederation of Midwives (ICM) and the Federation of International Gynecology and Obstetrics (FIGO) (Thomson, 2005). This recommendation is based on an inverse relationship between the proportion of deliveries assisted by a skilled attendant and the maternal mortality ratio. Historical data complemented by epidemiological studies, program evaluations and data modeling indicate that countries successful in reducing maternal mortality have emphasized the role of skilled attendants during childbirth such as Sri Lanka and Malaysia in the 1950's and more recently Honduras, Egypt and Indonesia (Seneviratne & Rajapaksa, 2000). The ICM and FIGO propose one person with midwifery skills per population of 5,000 be available although the ratio is lower in countries successful in reducing maternal mortality (MA Koblinsky, 2003). Countries in the South East Asia with maternal mortality ratios (MMRs) less than 100 have at least 85% of deliveries conducted by SBAs (e.g., Thailand 85%, Sri Lanka 95%). It was agreed at the special session of the United Nations General Assembly in 1999, that

globally 80%, 85% and 90% of all births should be assisted by skilled attendants by 2005, 2010 and 2015 respectively (United Nations, 1999). The overall association of SBA use and reduction of maternal mortality provides the evidence under pinning the recommendation that a skilled attendant assist every birth (irrespective of site of birth) (Bale, Stoll, & Lucas, 2003). However, no randomized control trials exist and historical data reviewed retrospectively are an inherently weak form of evidence.

The emphasis on SBA use is based on the assumption that during labor, delivery and in the immediate postpartum period a skilled attendant will able to provide the following signal functions: 1) safe conduct of a normal delivery using aseptic techniques; 2) active management of the third stage of labor; 3) immediate care of the newborn, including resuscitation as needed for complications; 4) management of postpartum hemorrhage through use of parenteral oxytocics and abdominal massage; 5) manual removal of the placenta; 6) management of eclampsia through provision of parenteral antihypertensives; 7) management of postpartum infection through use of parenteral antibiotics; 8) assistance with vaginal delivery through the use of a vacuum extractor; and 9) management of incomplete abortion through manual vacuum aspiration procedures. In addition to preventing complications, SBAs provide the critical link between identification of women having complications and referral to more comprehensive emergency obstetric care. They also are trained to deliver other essential clinical services to prevent common maternal morbidities.

For the global strategy to be effective, SBAs must be available and used by all pregnant women during delivery. While lack of availability restricts use in many settings, data from studies in Bangladesh indicate that SBAs may remain underused in settings where services are available (K. Afsana & Rashid, 2001; N. Chakraborty, et al., 2003; M. E. Chowdhury, et al., 2006; R. I. Chowdhury, et al., 2007; Halder, Saha, Kabir, Halder, & Saha, 2007; M. A. Islam & Nielsen, 1993; M. A. Koenig, et al., 2007; Parkhurst & Rahman, 2000; Parkhurst, Rahman, & Ssengooba, 2006b; B. K. Paul & Rumsey, 2002a). Recent studies from India (Griffiths &

Stephenson, 2001; Sunil, Rajaram, Zottarelli, & Zottarelli, 2006), China (Anson, 2004), Vietnam (Duong, et al., 2004), Uganda (Amooti-Kaguna & Nuwaha, 2000) Guatemala (Glei, Goldman, & Rodriguez, 2003) and Nigeria (Esimai, Ojo, & Fasubaa, 2002) also indicate women choose homebirth with unskilled attendants despite assess to SBA services. Bangladesh is a case in point.

Maternal Mortality and Skilled Birth Attendant Use in Bangladesh

Bangladesh is a low-income country currently ranked 139th out of 177 countries in terms of human development. Nearly half of the population (44%) lives in absolute poverty, defined as having an income of less than $1 US a day (United Nations Development Program, 2006). Like many low-income countries Bangladesh has a high number of maternal deaths, the seventh highest overall number in the world. The most recent estimates for 2005 show that 21,000 women die each year in Bangladesh, a MMR estimated at 570 deaths per 100,000 live births (range of uncertainty 380-760) (World Health Organization, 2007). This most recent estimate is controversial because it reverses a decline in the WHO maternal mortality estimates over a ten year period from 850 in 1990 (World Health Organization, 1996) to 380 in 2000 (World Health Organization, 2000).

A woman's lifetime risk of dying from pregnancy-related causes in Bangladesh is currently estimated as 1 in 51 compared to 1 in 4,800 in the United States or 1 in 11,000 in Canada (WHO, 2007). Lifetime risk of maternal death takes into account both the probability of becoming pregnant and the probability of dying as a result of the pregnancy cumulated across a woman's reproductive years. As elsewhere, leading causes of maternal death in Bangladesh are postpartum hemorrhage, sepsis and obstructed or prolonged labor (M. Islam, R. Chowdhury, & H. Akhter, 2006). Moreover, Bangladesh has one of the lowest rates of utilization of SBA in the world. SBAs assist only 14% of deliveries and despite a national policy to encourage women to delivery in a health facility only 9% of deliveries take place in facilities (Bangladesh Ministry of Health and Family Welfare, 2005). The met need for EmOC care is defined as the proportion of women

with complications who receive emergency treatment out of pregnant women expected to have complications-about 15% of pregnant women. In Bangladesh, only 5% of women with complications seek care in health facilities, thus the met need for EmOC is low. To achieve MDG-5, it is estimated that Bangladesh must decrease their MMR from 574 in 1990 to 143 in 2015 and increase the percentage of SBA assisted deliveries from 5% to 50% by the year 2010 (Government of Bangladesh & United Nations County Team in Bangladesh, 2005). The challenge is daunting. Untrained traditional birth attendants, locally known as *dais*, continue to play a major role, assisting with more than 60% of deliveries, trained TBAs assist in 11% of deliveries. Relatives, friends or neighbors assist in the remaining 6% of births (National Institute of Population Research and Training, 2009). Furthermore, there are inequities in access to SBA services at the extremes of the socio-economic spectrum. For example, 4% of women in the lowest wealth quintile compared to 48% in the highest wealth quintile had professional attendance at birth. This gap widens when economic status, education and residence are taken into account. For example, 86% of urban women with secondary or higher education in the highest asset quintile have professional attendants at birth while only 2% of rural women with no education in the lowest asset quintile (Collin, Anwar, & Ronsman, 2007). Inequalities such as these are impediments to meeting MDG-5 in Bangladesh indicating utilization behavior is not equally distributed within a population and certain groups within a society are more or less challenged.

Maternal Mortality and Skilled Birth Attendant Use in Matlab

Matlab, is a rural sub-district southeast of the capital Dhaka. Vital statistics are available from Matlab because of the ICDDR,B Health and Demographic Surveillance (HDSS) system. Since 1966, the HDSS has maintained the registration of births, deaths, and migrations, in addition to carrying out periodical censuses; it is distinctive to Bangladesh and the developing world for its duration, scope and depth of data provided.

The HDSS Surveillance area in Matlab is divided into a government (control) area and a

service (intervention) area, establishing a unique infrastructure for community-based health and

population research among 142 villages populated by 224,039 people (ICDDRB, 2009). The

service (intervention) area, also known as the Matlab Health Service Area (MHSA) is further

divided into four blocks (A, B, C, and D) and provides coverage to approximately 113,660 people

of whom 31,527 are women age 15-49 (ICDDRB, 2009). Nearly 30 years ago, (1977), a

Maternal and Child Health and Family Planning Program (MCH-FP) was initiated. Since its

inception, data collection on child and reproductive health has occurred. Community Health

Research Workers (CHRWs) obtain these data by visiting each household monthly in their

assigned areas and filling out event registration forms in addition to providing health promotion

and prevention services. The activities of CHRWs are supervised by Field Research Supervisors

and quality of collected information is monitored through independent data verification in the

field. This system of collecting data is known as the Record Keeping System and the data is

referred to as the Matlab Health Services Area program records. See a map of the MHSA below.
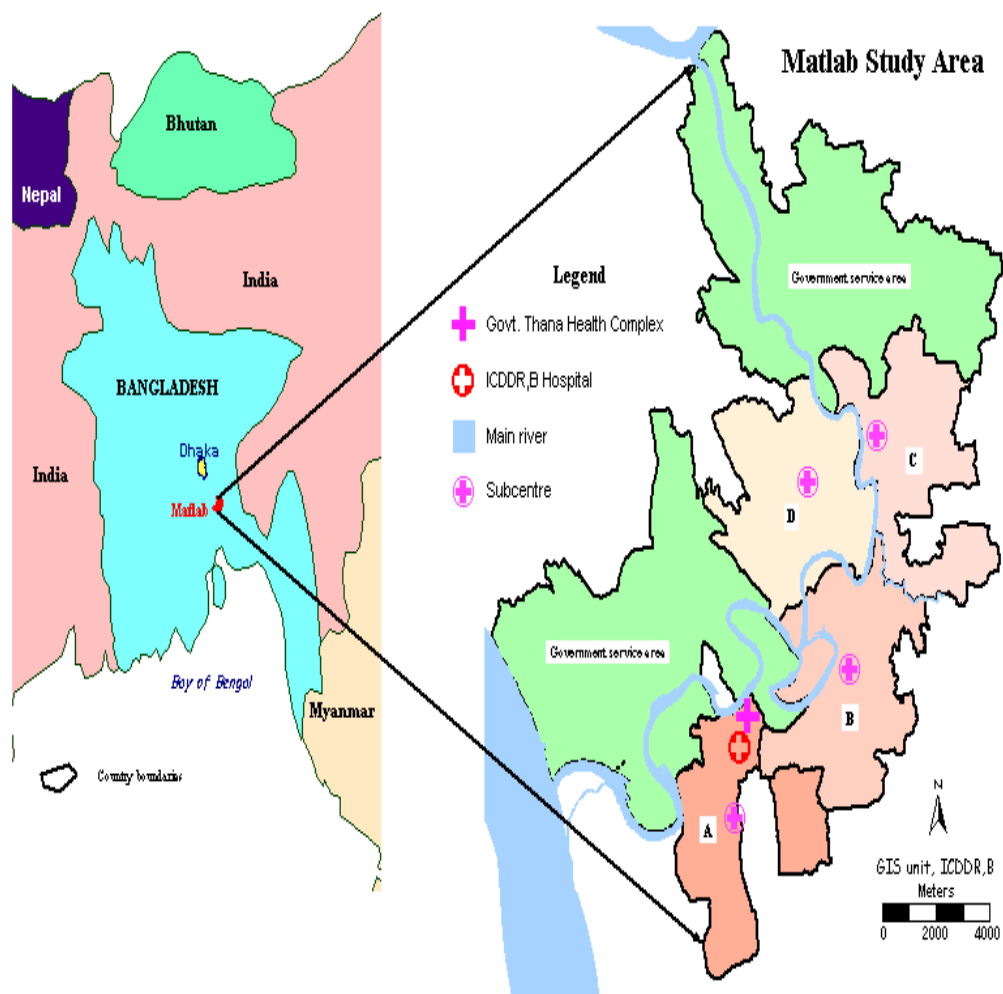
Figure 2.1. Map of the Matlab Study Area.

Consistent with national statistics, maternal deaths have been declining in Matlab. Between 1976–1980 and 2001–2005, 215,779 pregnancies and 769 maternal deaths were recorded in the HDSS area. The maternal mortality rate declined by 68% in the MHSA (from 412 to 131 deaths per 100,000 pregnancies) (M. E. Chowdhury, et al., 2007). Women in the MHSA have free access to SBAs through ICDDR,B's four health sub-centers and town hospital as well as the government Thana health complex in Matlab and the government district hospital located in Chandpur. Matlab town hospital is equipped to provide basic emergency obstetric care (EmOC) functions and the government district hospital in Chandpur is equipped to provide comprehensive EmOC functions.

The HDSS shows that both the MMR is lower and SBA use rate is higher in Matlab than in other parts of the country. At the time this research began in 2005, the MMR was 131, yet, 52% of the estimated 2,700 births each year still occurred at home, assisted by unskilled birth attendants and relatives (Centre for Health and Population, 2006).

The Paradox of Decreasing Maternal Mortality and Low SBA Use in Bangladesh

Bangladesh national statistics indicating a decline in MMR without a corresponding increase in the proportion of deliveries assisted by a SBA are perplexing in view of the global emphasis on the SBA strategy for mortality reduction. A recent article analyzing the reduction of maternal mortality in the MHSA over 30 years suggests, "*The fall can not be fully explained by uptake of skilled birth attendance, since this remains low both in Matlab and nationally. Increased access to emergency obstetric care—a cornerstone of the Bangladesh safe motherhood strategy—has probably contributed, together with access to menstrual regulation* [italics added]" (M. E. Chowdhury, et al., 2007, p. 1327). In terms of access to emergency obstetric care the conclusion was primarily based on a rise in the caesarean section rates from 0.1% to 4.2% in the government area (control) and 0.2% to 6.8% in the Matlab service area (intervention) between 1990 and 2005. In settings where access to surgical procedures is very low, caesarean sections

are accurate tracers of use of essential obstetric services. The minimum internationally identified

need for caesarean section is 5%, the maximum is 15% (Althabe & Belizan, 2006; World Health

Organization, 1985). Nationally, the proportion of deliveries by caesarian section has increased

from 3.5% in 2004 to 8% in 2009 according to the Bangladesh Demographic and Health Surveys

(2005, 2009). These national surveys calculate the percentage of live births during the five years

preceding each survey. The hypothesis that access to emergency obstetric care was the key factor

in the decline is also supported by a study investigating the reduction of maternal mortality after

the introduction of a community-based maternity care system in Matlab (C. Ronsmans, Vanneste,

Chakraborty, & van Ginneken, 1997) and a reanalysis of the data from the first study to document

a decline in Matlab (Maine, D, Akalin, MZ, Chakraborty, J, de Franscisco, A, Strong, M, 1996).

Although debated, community midwives operating between 1987 and 1996 might also have

contributed by facilitating access to emergency care (M. E. Chowdhury, et al., 2007; Maine,

Akalin, Chakraborty, de Francisco, & Strong, 1996).

In addition to increase access to EmOC, the decline in the MMR nationally has been

partially attributed to an effective government policy implemented in 1975 providing for early,

safe abortion services, namely "menstrual regulation" (M. E. Chowdhury, et al., 2007). Abortion

is illegal in Bangladesh but paramedical personnel on an outpatient basis may perform "menstrual

regulation" by vacuum aspiration, within eight weeks of the last menstrual period. The

Bangladesh Government does not feel this service conflicts with current abortion laws as it provides

"menstrual regulation" as a family planning method, not as an abortifacient (Dixon-Mueller, 1988).

Fertility reduction, higher education attainment of women, increase in antibiotic use and selective

underreporting of adult female deaths have also been cited as factors in the documented reduction

of maternal mortality along with broader female empowerment and poverty reduction efforts

across the country (M. E. Chowdhury, et al., 2007). While difficult to pinpoint one responsible

cause for the fall in maternal mortality, the situation calls into question one of the major strategies

to achieve MDG-5 and a component of essential obstetric care, the need for a SBA at each

delivery. This situation suggests that further investigation is required to determine the relative contributions of SBA for all women and access to EmOC for women with life-threatening complications to maternal mortality reduction. It also highlights the likelihood that broader socio-cultural forces are operating, as described in the next section within the context of a review of factors influencing use of SBAs.

<div style="text-align:center">Section Two</div>

Factors Influencing the Use of Skilled Birth Attendants in Bangladesh

In Bangladesh, numerous studies and reports exist describing women's experiences, views, beliefs and behaviors in relation to the appropriate attendant and place of birth. These documents identify a wide range of factors that contribute to the observed low use of professional services, to delays in a decision to seek professional care, or refusal to seek skilled care. The breadth and depth of the topic, its context-specificity, the lack of comprehensive, standard index terms and the range of methodologies used discouraged a systematic review of the literature in its entirety. Therefore, the aim for this literature review was to identify prominent findings representing a comprehensive range of factors influencing use of SBAs. The review was conducted incrementally through electronic databases (PubMed, OVID, Global Health and Medline) and hand searching of relevant articles over the course of two years (2008-2010). ICDDR,B publications were located through a review of its library database in Dhaka. The review was restricted to studies conducted in Bangladesh and published in the English language. No constraints were placed on date. Both qualitative and quantitative studies were included. The studies reviewed are summarized below and described in Appendix A. A total of twenty-nine studies were identified, 9 were qualitative, 16 were quantitative and 4 were mixed-method in design. Matlab was the study setting for eight of the studies. Secondary data analysis using national household surveys or existing MHSA program records was the methodology employed by eight of the studies.

The framework used for organizing the factors identified in the review is the 'Three Delay Model' described and displayed in Chapter 1. Although not entirely mutually exclusive, the model domains are commonly used to organize factors impacting health services utilization and include socio-cultural, environmental, and health services factors.

Socio-cultural domain (including demographic). Socio-cultural, including demographic, factors statistically correlated with women's use of SBAs in Bangladesh include: *wealth quintile* (Anwar, Killewo, Chowdhury, & Dasgupta, 2004; M. Chowdhury, et al., 2006; Halder, et al., 2007; M. A. Koenig, et al., 2007; National Institute of Population Research and Training, 2009); *maternal education* (Anwar, et al., 2004; N. Chakraborty, et al., 2003; M. Chowdhury, et al., 2006; R. Chowdhury, Islam, Gulshan, & Chakraborty, 2007; ICDDRB, 2005; M. A. Islam, R. I. Chowdhury, & H. H. Akhter, 2006; B. K. Paul & Rumsey, 2002b; M. Rahman, Barkat-e-Khuda, & Reza, 1999; National Institute of Population Research and Training, 2009) *maternal age* (Anwar, et al., 2004; National Institute of Population Research and Training, 2009; S. Rahman, 2000); *marital age* (N Chakraborty, et al., 2003; M. A. Islam, R. I. Chowdhury, & H. H. Akhter, 2006); *parity* (N Chakraborty, et al., 2003; Khanum, Islam, Quaiyum, & Millsap, 2002; National Institute of Population Research and Training, 2009); *gravida* (Anwar, et al., 2004); *use of antenatal care* (Hlady & Fauveau, 1992/1993; National Institute of Population Research and Training, 2009; B. K. Paul & Rumsey, 2002a); *television ownership* (M. Rahman, Barkat-e-Khuda, & Reza, 1999); *husband's age* (Khanum, et al., 2002); *husband's occupation* (N. Chakraborty, et al., 2003; Khanum, et al., 2002); *husband's newspaper reading* (Khanum, et al., 2002) *husband, father or paternal education* (M. Chowdhury, et al., 2006; ICDDRB, 2005; B. K. Paul & Rumsey, 2002b); *husband's concern regarding birth complications* (R. Chowdhury, Islam, Gulshan, & Chakraborty, 2007); *urban or rural residence* (R. Chowdhury, et al., 2007; National Institute of Population Research and Training, 2009); *division of residence* (National Institute of Population Research and Training, 2009); *religion* (Anwar, et al., 2004; M. Rahman, et al., 1999); and *previous experience, anticipation or actual experience of birth complications*

(K. Afsana & Rashid, 2001; N Chakraborty, et al., 2003; E. Goodburn, A. Gazi, & M. Chowdhury, 1995; B. K. Paul & Rumsey, 2002b). Of the aforementioned factors the ones most consistently associated with receiving SBA care were: maternal education, antenatal care utilization, maternal age, parity and wealth quintile, all of which are easily measured and included in large national household surveys such as the Bangladesh Demographic and Health Survey (BDHS) and the Bangladesh Maternal Health and Maternal Mortality Survey.

One of the most relevant determinants of service utilization to the present study is a woman's anticipation, perception or experience of pregnancy-related complications-an indicator of illness severity or need for services. Paul and Rumsey report that women who have previously experienced, or think they might experience, a complication are 20.79 times more likely to seek professional assistance during birth than women who have not experienced or expect to experience complications (2002b). Chakraborty and colleagues report that women with life-threatening complications are 2.2 (95% CI 1.5-3.18) times more likely to seek care from a doctor or nurse (in the home or a facility) to treat perceived illnesses of complications during pregnancy (2003). This determinant was controlled for in the present study through sample selection because of the high probability of care seeking among women with complications.

While emergency care seeking is common, preventive care seeking is less so, as home delivery is consistent with the traditional social norm that conceptualizes childbirth as a "normal" and "natural" event not in need of medical intervention unless serious complications occur (K. Afsana & Rashid, 2001; E Goodburn, et al., 1995; M. A. Koenig, et al., 2007; Muna, Ross, Laston, & Bhuyian, 2002; J. O. Parkhurst, et al., 2006; B. K. Paul & Rumsey, 2002a). A qualitative study by Parkurst, Rahman and Ssengoba states, "*It would appear that Bangladeshi women can use health facilities, but it may take the idea of a 'complication' to justify its use in a social environment valuing independent home birth* [italics added]" (2005, p. 443). Gayen and Raeside found that in rural villages across Bangladesh the dominant norm that professional health care is not needed in childbirth is supported and enhanced by immediate network influence

(2007).

Additional socio-cultural factors impacting SBA use include a broad array of beliefs, attitudes and behaviors indentified in the qualitative literature but not easily measured in surveys. These include traditional taboos opposing biomedical practices (K. Afsana & Rashid, 2000, 2001; T. Blanchet, 1984; Chaudhury & Chowdhury, 2008), fear of episiotomies and cesarean sections (K. Afsana & Rashid, 2001; SA Ahmed, Khanum, & Islam, 1998; AMR Chowdhury, Mahbub, & Chowdhury, 2003; Parkhurst & Rahman, 2000) and the opposition to the standard delivery position used by trained attendants (lying on the back rather than the traditional squatting position) (K. Afsana & Rashid, 2001; L. S. Blum, et al., 2006; E. Goodburn, R. Gazi, & M. Chowdhury, 1995). Fear of delivering in the road on the way to a facility (ICDDRB, 2005) , shameful physical examination (especially by male doctors) and related privacy concerns are also barriers to seeking care outside the home (K. Afsana & Rashid, 2001; T Blanchet, 1984; G. L. Darmstadt, et al., 2006; Hossain & Ross, 2006; ICDDRB, 2005).   Privacy concerns are enforced by the traditional Muslim practice of Purdah, discussed in more detail in section three of this chapter.

Traditional beliefs about malevolent spirits also continue to influence the choice of birth attendant to some extent (T Blanchet, 1984; E Goodburn, et al., 1995; Rahman SA, Parkhurst, & Normand, 2003). Women fear exposure to evil spirits during pregnancy and childbirth. When the progression and outcome of childbirth are attributed to supernatural intervention such as spirits (e.g., *alga, bhut, upri)*, seeking SBA services may not be perceived as warranted or appropriate. In such cases home-based care from traditional sources, such as a *kobiraj* and *fakir* (herbal and religious type healers) may be sought along with spiritual remedies including prayer, amulets (*tabij*) and blessing by holy water (*pani puri*) or holy blow, that is water blown upon while saying spells. More persistent than beliefs about malevolent spirits, Paul observed that the vast majority of people in rural Bangladesh believe childbirth is an act of God (Allah) and thus do not expect

delivery complications and do not seek professional treatment (2000), consistent with religious fatalism or a limited sense of control over health outcomes.

With few exceptions, all of the studies reviewed focused on individual attributes of women. Individual women, however, are embedded in strong family and household ties that serve as the primary source of social interaction and characterize Bangladeshi society. Accordingly, social relations, encompassing a broad array of interpersonal and household factors, underlay many of the beliefs, attitudes and behaviors shown to impact SBA use. For example, qualitative findings indicate women's decision-making authority in the household tends to be low and often husbands and in-laws are responsible for the final decision about place of birth (Chaudhury & Chowdhury, 2008; Khanum, et al., 2002; Muna, et al., 2002). Women need approval to seek care outside the home and may face objections, discouraging attitudes and refusals by influential persons in the household (SA Ahmed, et al., 1998; Hossain & Ross, 2006). An ethnographic study found disapprovals by influential persons in the household and the discouraging attitude of the neighboring women acted as impediments to seeking care during delivery in an urban area of Bangladesh (AMR Chowdhury, et al., 2003). Women who decide to go to a facility need accompaniment and if they have children need a caregiver in their absence (SA Ahmed, et al., 1998), requiring the consent and cooperation of family members. Lack of care for children and concern about leaving family members behind are additional barriers to facility use (SA Ahmed, et al., 1998; AMR Chowdhury, et al., 2003). To overcome environmental barriers such as distance, transportation and costs network support is required (Muna, et al., 2002; S Nahar & A Costello, 1998; Parkhurst, Rahman, & Ssengooba, 2006a). A qualitative study attempting to understand women's failure to comply with referrals to EmOC, found that only women with supportive decision makers could overcome cultural, economic and logistical barriers to referrals to EmOC facilites (Muna, et al., 2002)

The literature reviewed has recognized the importance of social relations, but generally has not provided empirical evidence to assess the role and relative importance on the decision to

use a SBA. The present study addresses this gap. What is known about the decision task and the influence and interaction among decision makers in the Bangladeshi context is described in more detail in section three of this chapter.

Environmental domain. Availability of facilities, geographic distance to the nearest available facility (Hlady & Fauveau, 1992/1993), transportation options (B. K. Paul & Rumsey, 2002a) and cost (Borghi, et al., 2006; M. Mahabub-Ul-Anwar, Rob, & Talukder, 2006/2007; S. Nahar & A. Costello, 1998; Parkhurst & Rahman, 2000; Schuler, et al., 2002) were all shown to impact SBA utilization in Bangladesh, each of which is discussed below in more detail. First, physical availability of obstetric services, a primary constraint to use of SBAs in other rural areas of Bangladesh, is not a primary factor in Matlab due to the long-term presence of ICDDR,B sponsored health facilities and the government district hospital in Chandpur, staffed by SBAs. Yet, the provision of skilled attendance does not necessarily guarantee use.

Distance to the nearest health facility acts as either a disincentive to seeking care in the first place and/or as an actual obstacle to reaching care once a decision is made. Two quantitative studies identify distance as a predictor of SBA use in Matlab, where distance was inversely related to use of an SBA. In the first study, women living 1.1–2 km away from a facility were 55% less likely to use SBA at birth compared to women living less than 1 km away (OR 0.45 95% CI 0.39-0.51) (Anwar, et al., 2004). In the second study, use of a midwife dropped by more than half for women living 1 km from a health center (OR 0.44 95% CI 0.41-0.48) (M. Chowdhury, et al., 2006). The relationship held true whether a midwife was called to the home or the woman accessed services in the health center (ICDDRB, 2005).

Transportation difficulties can augment the effect of distance and include lack of transport options and poor road infrastructure. Transport difficulties are referenced more often in the qualitative than the quantitative studies. Ahmed and colleagues report that 6% of households surveyed reported not using a facility for delivery because of transportation difficulties (1998). Delay in arranging transportation is also mentioned in a study examining factors that delay care-

seeking for complications (Chaudhury & Chowdhury, 2008). Blum reports that during the dry

season the only option was to travel by foot or rickshaw and due to the poor conditions of the

road a good deal of travel by foot is required, in a discussion on home-based delivery with skilled

attendants in Matlab (2006). A more descriptive variable related to both distance and

transportation is travel time. None of the studies reviewed reported travel time with one

exception. A study in Matlab examining delay in healthcare-seeking episodes for serious

illnesses (not just maternal complications) reported that time to reach a healthcare facility was

longest (average 150 minutes) for pregnancy related complications (Killewo, Anwar, Bashir,

Yunus, & Chakraborty, 2007). Distance and transportation remain obstacles to maternal health

service demand and use in Matlab and throughout Bangladesh.

Finally, the cost of using a facility or SBA services can include costs of transportation,

medication and supplies, official and unofficial provider fees, costs of staying over night in the

town where the facility is located as well as the opportunity costs of travel and waiting time lost

from productive activity of both the woman and her accompaniments (Thaddeus & Maine, 1994).

Nearly all the qualitative studies reviewed mention cost as a barrier to use of SBA or facility

services (K Afsana, 2004; K. Afsana & Rashid, 2001; Chaudhury & Chowdhury, 2008; Muna, et

al., 2002; S Nahar & A Costello, 1998). Cost, (perceived or actual) is related to ability to pay or

household wealth. The quantitative studies addressed cost through the inclusion of some measure

of socioeconomic status (SES), such as asset scores or wealth quintiles (Banu RS, 2008; M.

Chowdhury, et al., 2006; R. Chowdhury, et al., 2007; R. Mahabub-Ul-Anwar & Talukder,

2006/2007), where SES is inversely related to use of an SBA. Two such studies specifically

assessed the inequality between rich and poor in maternal health service use in Matlab. In the first

study, mothers in the least poor quintile were 3.4 times more likely to use a SBA than most poor

quintile mothers after adjusting for the effects of other covariates (R. Mahabub-Ul-Anwar &

Talukder, 2006/2007). In the second study, the adjusted risk ratio between the wealthiest and

poorest quintiles was 1.49 (95% CI 1.16-1.91) when midwives were providing services in the

home compared to 1.66 (95% CI 1.41-1.96) at peak of facility based care in the MHSA (M.

Chowdhury, et al., 2006).

Health service domain. Factors in the health services domain include the actual or

perceived quality of obstetric care such as adequacy of facilities (i.e., infrastructure, equipment,

supplies) and staffing (i.e., their number and competence) (Thaddeus & Maine, 1994).

Misbehavior by staff, lack of privacy, lack of qualified/skilled staff, lack of emergency supplies

are widely considered important to explaining the underutilization of rural public health facilities

in Bangladesh (K Afsana, 2004; Blum, Sharmin, & Ronsmans, 2006; J. O. Parkhurst, et al., 2005;

S. Rahman, 2000). ICDDR,B facilities in the MHSA have made sustained and significant

improvements in the quality of obstetric services therefore reports of poor quality have declined.

There were no identified studies that addressed the technical quality of obstetric services in

Matlab. Perceived quality remains an important determinant of care seeking in other areas of

Bangladesh, as primarily discussed in the qualitative studies (K. Afsana & Rashid, 2001; SA

Ahmed, et al., 1998; Chaudhury & Chowdhury, 2008; Hossain & Ross, 2006).

All of the aforementioned factors shown to be associated with SBA use were primarily

among women with complications (perceived or actual). The sample selection or inclusion

criteria of the studies reviewed selected for woman with complications and/or the presence of

complications, which was measured directly as a determinant of emergency-care seeking. The

literature search did not, however, locate any studies focused on uncomplicated delivery where

SBA use was sought for preventative purposes. This finding is supported by Gabrysch and

Campbell's recent review of the literature of the determinants of delivery service care that states,

"*While it is important to clarify conceptually how the various influential factors might affect the*

three delays for both preventive and emergency care, we did not identify any studies on the topic

that distinguished between preventive and emergency care-seeking [italics added]" (Gabrysch &

Campbell, 2009, p. 3 of 18).

Given the complexity of factors influencing SBA use, a better understanding of both the decision process and its outcome might be gained by examining the influence of women's social relations both independently and also in relation to the factors described above, controlling for severity of condition (i.e., no complications) and availability of services (i.e., free, quality professional obstetric). In the next section, the stage for such a study will be set by outlining what is known about social networks and health care utilization decisions supported by empirical examples. The context of the decision task to use a SBA will be discussed, including what is known about the importance of social relations in the Bangladesh cultural context.

<div align="center">**Section Three**</div>

Social Networks and Health Service Utilization

Simply stated, a social network is a group of people (network members or actors) and the social relationships between and among them (ties). Social networks are thought to play a crucial role in recognizing need for services, providing information about access and options for care, and mobilizing support to facilitate or constrain movement toward use of formal or traditional services (R. Andersen & J. Newman, 1973; R. Berkanovic & C. Telesky, 1982; Berkman, Glass, Brissette, & Seeman, 2000; B. Pescosolido, 1992). Networks may alter the demand for services by affecting the perceived efficacy or desirability of the available services (Deri, 2005). For example, women may exchange information about health care access and quality, the advantages or disadvantages of service use and/or assess their family and peers' approval or disapproval all within their social networks.

Social networks are thought to influence decisions regarding health service utilization through two distinct processes-social learning and social influence. Social learning refers to the exchange of information and joint evaluation of information and ideas within a network, emphasizing the role of communication in reducing uncertainty (Kohler, Behrman, & Watkins, 2001; Madhavan, Adams, & Simon, 2003). For example, discussion with other women in one's network may increase a women's perception of risk and decrease her uncertainty about the safety

of facility-based services. Social influence is defined as any influence on individual feelings, thoughts or behaviors exerted by real or implied pressure or actions of others (Norwak, Siamrej, Lante, 1990). Social influence extends beyond social learning and suggests that to avoid conflict and win approval with the referent group, individuals will behave according to the perceived dictates of gatekeepers and promoters of social norms (Montgomery & Casterline, 1996). For example, a woman's network members may express their disapproval of her preference to use a facility for childbirth by suggesting she lacks courage or that a difficult birth will result if she leaves the home. On the other hand they may encourage facility use by suggesting doctors and midwives can ensure her safety and care.

More broadly, Berkman's conceptual model of how social networks impact health suggests networks operate through four primary pathways: 1) provision of social support 2) social influence 3) social engagement and attachment, and 4) access to resources and material goods (Berkman, et al., 2000). Not mutually exclusive, in this set of social exchange based pathways, social learning is not distinguished from social influence. Similar pathways are outlined by Levy (1983).

In all of these models, it is assumed that individuals are embedded in a dynamic structure of social relations in which selected people provide significant reference points in the decision making process. *The model used for the present study, the NEM, does not specify the processes inherent in social interaction; rather it focuses on the structure, function and content of social interactions as determinants of behavior*. That is, implicit processes of social interaction are not formally addressed.

Empirical Evidence: Social Networks and Health Utilization Decision-Making

A review of the literature employing social networks to understand health care utilization supports the collective, social element of health seeking behavior. The term *social network* was used as a metaphor with lists of people considered networks in many of the earlier studies. Today these lists would not be discussed in social network terms unless it was known whether and how

the people on the lists connected with one another. Nonetheless, research on the impact of social networks on health services utilization behavior dates back to the late 1960 and early 1970's with the major works of Suchman (Suchman, 1964), Kadushin (Kadushin, 1966), McKinley (McKinley, 1970, 1973), Salloway (Salloway & Dillion, 1973) and Horwitz (Horwitz, 1977, 1978), although Friedson's work is generally credited as the first to propose a relationship between social network structure and healthcare utilization (Friedson, 1960, 1961).

Friedson actually coined the term *lay referral system*. He argued that individuals experiencing illness symptoms would seek and receive advice from a close relative before seeking help from more remote and expert people, particularly for vague symptoms and when their own culture differs greatly from the biomedical culture. Friedson contended that lay referral networks function as providers of advice, treatment, support, assurance and material aid. Consistent with Friedson's position is Granovetter's strength of weak ties argument, a classic in the social network literature. Weak ties are defined as casual acquaintances. Strong ties are defined as close friendships and family relations. Granovetter suggests that highly dense, strong tie networks in which an individual consults with few people may lead to a delay in health seeking when group opinion is uniform and supportive of the individual to stay well within the resources of the group. Weak ties, with their diverse contacts may provide new, confusing and disparate information causing the individual to seek professional advice sooner (Granovetter, 1973). Granovetter's position suggests that both the structure and content of networks matter.

Empirical study findings confirmed that social networks indeed influenced health-seeking behavior, however, contradictions and lack of coherence were left unexplained (B. Pescosolido, 1991). Certain aspects of social networks were shown to be responsible for either facilitating or hindering use of medical services. Yet, which aspects of a social network were most explanatory (i.e., structure or content), how social networks varied for different uses of services in different populations and the central mechanism responsible for the effects remained in question. Furthermore, there was difficulty in defining, measuring and comparing networks among

different populations (Mechanic 1979). The lack of specificity in findings remained until

theoretical and methodological advances in sociological concepts and analytic methods such as

social capital, diffusion of innovation; social networks analysis and advanced modeling were

applied. Advances, such as these, reignited research in the area of social networks and health care

utilization decision-making and informed the development of Pescosolido's Social Organizational

Strategy (SOS) framework and the NEM model in 1991.

Since the development of the NEM several empirical tests of subsets of the model were

conducted. These studies provide evidence for the NEM derived hypotheses on the interaction

between structure and content of an individual's social network in explaining variations in health

seeking behavior. Furthermore, they illustrate how a directive to merge the "*the insights and

tools from the qualitative illness career and quantitative contingency traditions* [italics added]"

can advance our understanding of health care decision making and health seeking behavior (B.

Pescosolido, 1991, p. 179). Two exemplary studies are described below.

Pescosolido first tested the NEM model in a study conducted in Puerto Rico among a poor

population with mental illness (B. A. Pescosolido, Wright, Alegria, & Vera, 1998). Unlike

Kadushin, who found consulting informal, supportive advisors known as "the friends and

supporters of psychotherapy" led to increased use of formal mental health services via direct

pathways among upper-class individuals (Kadushin, 1966), Pescosolido observed that among the

poor, large and supportive networks decreased resort to formal services and increased the overall

number of advisors sought via circuitous pathways (B. Pescosolido, Wright, Alegria, & Vera,

1998). She documented distinct patterns of service use that were based not only on severity of

mental health problem but on the interaction between the size of one's network, the perceived

level of available social support and the beliefs about mental health care. Previous researchers

had found contradictory results. That is, social networks either facilitated entry into formal care or

delayed or deterred the use of formal services. Pescosolido's NEM and empirical findings help to

clarify these contradictions by showing how network structure interacts with network content to

determine patterns of help seeking and service utilization patterns.

Bussing and colleagues, guided by the NEM, explored health seeking among parents of children with attention-deficit/hyperactivity disorder (ADHD) utilizing a mixed-method approach to generate explanations of known gender and race/ethnicity variation in treatment rates (Bussing, Koro-Ljungberg, Gary, Mason, & Garvan, 2005). Inductive analysis based on grounded theory, and deductive quantitative analysis from data derived from application of the NEM, was triangulated subsequently with standard demographic characteristics. Combining qualitative and quantitative methods in the same design, was used to "contribute differently constructed, but equally important insights about ADHD help-seeking steps and about the values and preferences of parents" (Bussing, et al., 2005). Specifically, the structure (composition, strength of tie) and function (type of transaction) of the social networks parents consulted about their child's condition were examined together with parent's perceptions of their children's sick role by each of four racial and gender groups (male/female, African American/Caucasian).

The study found health seeking patterns were shaped not only by race and gender; rather by variation in the structure and function of the networks contacted for consultation, patterns that were supported and further explained by qualitative analysis of differences in parental sick role perceptions. For example, a high reliance on a lay care for African-American girls corresponded to the parental sick role perception of "misbehavior" that prompts behavioral modification and punishment not doctors visits (Bussing, et al., 2005). Also, the networks of African-American parents were smaller in size and provided different functions in comparison to the networks of Caucasian families. By examining the structure and function of networks together with parental perceptions of symptoms, new insights into known treatment inequities were highlighted. These insights went beyond immutable determinants of gender and race/ethnicity often identified as statistical correlates to utilization of services. The study delineated groups of people by social network structure and treatment preferences within traditional conceptualizations of race and gender to achieve a set of clinical recommendations in order to strengthen the therapeutic

relationship and circumvent potential barriers to treatment. The authors suggest clinicians assess

who serves as an advisor to each set of parents regarding their child's mental health, and establish

the advisor's prevailing attitudes toward professional interventions in order to identify, address

and possibly avert noncompliance (Bussing, et al., 2005). Findings from such studies suggest

which services best match typical client patterns, patterns that may or may not be significantly

related to standard social correlates such as gender and race/ethnicity (B. Pescosolido, et al.,

1998).

In addition to the aforementioned studies, the following findings suggest the impact of

specific characteristics of social networks on healthcare utilization decisions. Findings from the

below cited studies were used to inform the selection of the network variables for the present

study. For example, Deri demonstrated the importance of social networks in acquiring knowledge

about health care facilities among immigrants in Canada primarily for the initial decision to seek

medical attention and for services more preventive in nature (2005). One estimate indicates a

reduction of about 30% of the time to first visit. 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 the language density of the

network. The quality characteristic captured characteristics such as cultural differences in beliefs

about health and medicine (2005). Devillanova (2006), estimated that reliance on a strong social

tie for information about health care utilization reduced the time of the initial contact, after

controlling for all available individual and ethnic characteristics in undocumented immigrants in

Milan. Researchers St. Clari et. al., (1989) found women from Baltimore were more likely to

underutilize prenatal care if they were embedded in strong-tie, non-disperse networks where most

members were immediate family or relatives with limited exposure to positive views regarding

the value of such care. Berkanovic and Telesky 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 (1982). Taken together these findings suggest associations between networks variables such as density, tie strength and the composition of a women's social network (homogeneity/heterogeneity) with health care utilization decision-making.

Beyond health utilization, the effects of social networks on a wide variety of health behaviors have been the focus of extensive investigations. Health behaviors that might be spread within social networks include smoking, eating, exercise, sexual activity, alcohol consumption and drug use as well as the propensity to get health screenings or comply with treatment plans (Smith & Christikas, 2008). A long tradition of mostly egocentric studies has documented how reproductive health behaviors and related knowledge are impacted by social network characteristics. For example, Behrman, Kohler, and Watkins, in a longitudinal study in rural Kenya, found the effect of social networks (i.e., number of family planning users in the network) on attitudes and behaviors regarding family planning were significant even when controlling for unobserved factors (e.g., homophily) that might determine the social network itself (2002). Godley, in rural Thailand, studied the effects of kinship networks on women's contraceptive choice and found that the more external kinship ties households have the more likely women in these households are to use modern forms of temporary contraception. Not only does the number of ties matter, the type and location of the extended kinship ties have differential effects on the methods individual women choose (2001). Fonseca-Becker and Valente, in a cross-sectional study in Boliva, found that network variables (i.e., gender composition of networks and network size) added significantly to the predictive power of socioeconomic variables for certain types of breastfeeding knowledge (2006). In another study on breastfeeding the hypotheses that a mother's perception of influence from referents in her social network would predict her choice of breast or formula feeding and that the actual duration of lactation would be positively influenced by perceived support from the social network were supported (Kaufmann & Hall, 1989).

In contrast to egocentric studies using dyadic analysis, sociocentric studies have examined

superdydadic effects on health. In a recent and well-known study, Christikas & Fowler examined

the spread of obesity among family and friends using adult data from the Framingham Heart

Study. Obesity appeared to spread among family and friends in a similar fashion to infectious

disease. If a person's friend became obese, it increased the likelihood that he/she would become

obese by 57% (95% CI 6-123%) with larger effects found for same sex friends. (Christikas &

Fowler, 2007). Modeled after this seminal study, Valente, Fujimoto, Chou and Spruitz-Metz,

found that overweight adolescents in Los Angeles were more likely to have overweight friends

than their normal weight peers. Their findings also suggested overweight girls named more

friends and were slightly less likely to be named as a friend than normal weight girls (Valente,

Fujimoto, Chou, & Spruitx-Metz, 2009). All of the above mentioned studies demonstrate the

value of investigating the impact of social networks and highlight ways to improve health through

exploitation of network phenomena in a variety of contexts. Added to these, the present study

considers the influence of network structure and content on decisions regarding SBA use.

Decision Task and Use of Skilled Birth Attendants in Bangladesh.

In order to illustrate how a social network approach might help further explain use of

SBA's in Bangladesh, a description of the decision task within the local social context was first

necessary. In this study the final decision is the location or place of delivery with two main

alternatives, home and facility. The decision task is a process that results in the final decision or

outcome. The decision process is hypothesized to be a series of decisions made by a woman in

conjunction with her influential social network members throughout pregnancy and childbirth,

that is the decision process is distributed across the woman's social network over time (Buetow,

2005; B. Pescosolido, 1992). The process is non-linear, recursive and characterized by time

pressure, uncertainty and high personal stakes with multiple players and potentially shifting goals,

characteristics of naturalistic decision making processes (Lipshitz, Klein, Orasanu, & Salas,

2001). Adoption of the NEM, allows for a dynamic conceptualization with static hypotheses that

essentially freeze the larger stream of decision-making and social interaction processes to examine the effect of social networks on a particular act, in this case the final decision.

In Bangladesh, as previously described, pregnancy and delivery are perceived as normal states, not illness conditions that merit medical attention. Home delivery constitutes the socially acceptable norm with over 90% of all deliveries occurring in the home (K. Afsana & Rashid, 2001; M. A. Koenig, et al., 2007; A. C. Moran, et al., 2007; J. O. Parkhurst, et al., 2006; B. K. Paul & Rumsey, 2002a). Consequently, planning for delivery in a health facility is still not common. According to the 2001 Bangladesh Maternal Services and Maternal Mortality Survey (National Institute of Population Research and Training, 2003), almost two-thirds of women surveyed had neither discussed nor made a decision regarding assistance at delivery, even among those in their third trimester, more than half had not reached a decision. Preliminary data from the Dinajpur SafeMother Initiative conducted in Northwestern Bangladesh in 1998-2001 revealed that 61% of pregnant women' families had no plan to manage obstetric complications (Hossain & Ross, 2006). Evidence for general lack of planning and late decision-making regarding where women should spend their final weeks of pregnancy and ultimately deliver was also found in Indian urban slums (Matthews, Brooks, Stones, & Hossain, 2005). One explanation attributes the belief that women are incapable of predicting the future and a perception of risk that is deeply rooted in a culture of fatalism (Muna, et al., 2002). Contrary to findings that suggest lack of planning is normative, an ethnographic analysis of SBA utilization conducted in two poor communities of rural and urban Bangladesh in 2001, found that all women, made some preparations for deliveries from the day they became pregnant, including decisions about place of delivery and birth attendant (AMR Chowdhury, et al., 2003). Stanton (2004), suggests variation in the study and sample designs contribute to such inconsistencies, in a article about methodology and birth preparedness, an area for future exploration. The preponderance of evidence, however, suggests early planning is not common.

Bangladeshi women appear to wait for labor to progress and signs and symptoms to

become apparent before making a final decision on whether to seek the care of an SBA. Delaying

a decision is a known strategy for coping with uncertainty, allowing time to observe signs and

symptoms before determining what actions are warranted, especially when the single best option

is not clear (Lipshitz, et al., 2001; Ryan, 1998). In a pluralistic healthcare system, like the one in

Bangladesh, delay can also allow time for home-based care. For example, a male family member

is sent out to purchase treatment from a pharmacy to be administered at home or a traditional

provider such as a village doctor is sent for and treatment provided in the home (A. Moran, et al.,

2007). However, time is limited due to the *physiological* course of labor. Once a complication

occurs, is recognized and care seeking initiated it is often too late to seek the help of a SBA

(Thaddeus & Maine, 1994).

Assessment of the decision task is aided by an understanding of the kinship patterns and

women's position within a typical household as the following discussion highlights. The basic

social structure in Bangladesh society is centered on a system of patriarchal kinship relations.

Kinship is viewed as a set of role expectations, behaviors and perceptions. Family members are

highly dependent on each other, through the sharing of assets, labor and emotions (Aziz Ashraful,

1979). The two most important definable units in Bangladesh society are household (*ghar*) and

homestead (*bari*) (Aziz Ashraful, 1979). The patrilineal and patrilocal joint, extended, or nuclear

are the typical family units that live together in a household. Nuclear families are increasing with

large scale migration from rural to urban areas in recent times (A. Chowdhury, 1995), as are

female headed households due to male migration inside and outside the country for work

opportunities. In rural areas, such as Matlab, several linked families live together in *bari*. Kin

relationships exist among the members of almost all the households living in a *bari*, by affinial or

blood connections (A. Chowdhury, 1995). The average household size in Bangladesh is 4.7 with

rural household size marginally larger than urban household size (4.8) (National Institute of

Population Research and Training, 2009).

For women, gender role expectations govern patterns of interaction. Women are traditionally regarded as inferior to men, a position that is stressed from their birth (A. Chowdhury, 1995). Beliefs about male supremacy and authority are generated and maintained by the patriarchal culture of Bangladesh and by conservative interpretation of Islamic law, or Shari'a (Rozario, 2006). Islamic law is interpreted in ways that direct marriage, divorce, civil rights, legal status, inheritance patterns, dress code, and education. Extreme gender-role expectations are strictly prescribed through these religious interpretations.

In addition to religious dictates, the almost universal institution of marriage within the Bangladesh context prescribes gender-role expectations. Young women marry and move into their husbands' household in many cases reducing natal home ties. Marriage marks a point in women's life when childbearing becomes socially acceptable. The age at first marriage is used as a proxy for first exposure to sexual intercourse and thus the potential for pregnancy (National Institute of Population Research and Training, 2009). Women who are unable to conceive are blamed for infertility and infertility provides husbands with grounds for divorce or taking another wife (Bharia, 1981). Men are considered the head of the household and their wives are required to be obedient to them and their kin. In almost all marriages the husband is older than the wife, in 44% of couples the husband is at least ten years older (National Institute of Population Research and Training, 2005). Begum wrote, "*Arranged marriage, difference in age at marriage, and patrilocality subordinate the position of women in relation to their husbands from the onset of marriage* [italics added]" (1987, p. 13). In their marital home women are subjected to the authority of their husbands, their husband's brothers, husband's brother's wives their husband's mother and unmarried sisters. Married women are expected to perform the roles of wife and mother and display the qualities of obedience, patience, endurance and sacrifice in return for economic and social security (A. Chowdhury, 1995). While society has changed to some extent especially in urban Bangladesh with new occupations open to women, old attitudes are still strong. At the time of the present study the majority of women of reproductive age in rural

Bangladesh remain unemployed and those that are employed incorporate paid work into their

lives without abandoning their family and household responsibilities.

The structure and nature of Bangladeshi society, especially in rural areas, discourages

women to travel unaccompanied and is hypothesized to account for women's lack of decision

making power within the family, barriers to use of healthcare in pregnancy and childbirth (M. T.

Islam, Hossain, Islam, & Haque, 2005). Purdah, a traditional Muslim practice that secludes

women and enforces social standards of female modesty, further reinforce prevailing norms and

practices that circumscribe women's ability to choose and obtain treatment (SM Ahmed, Adams,

Chowdhury, & Bhui-ya, 2000). During pregnancy and the postpartum period restrictions

institutionalized by the system of purdah are pronounced. Purdah is intended to cover women's

physical form and segregate members of the opposite sex, effectively restricting personal, social

and economic activities outside her home. The female body is considered a source of shame and

during and after childbirth pollution in part due to the presence of blood believed to be impure

(Blancet, 1984; Bremmer & Van Den Broek, 1995). Pregnancy is seen as a vulnerable and

potentially dangerous time despite not being considered an illness state (Darmstadt, Syed, Patel,

& Kabir, 2006). Leaving the home during pregnancy and postpartum periods is also thought to

increase risk of exposure to evil spirits (e.g., *alga batash*). It is understood that women should

refrain from leaving their home as the pregnancy becomes obvious to reduce vulnerability to

outside forces and because the sight of a pregnant women's form is shameful (E Goodburn, et al.,

1995). The same study found a number of activities that women in Bangladesh are supposed to

avoid during pregnancy, including going outside at night or afternoon, going out with one's hair

down, or allowing the end of one's sari to trail on the ground (Goodburn et al., 1995).

With regard to health seeking, a woman may neglect her own health needs in order to save a

family from financial hardship and disruption to subsistence activities. In a comparative study

conducted of BRAC beneficiaries (i.e., members of BRAC's integrated Rural Development

Program) and non-beneficiaries, it was found that gender differentials in the context of health-

seeking behavior persisted among the beneficiaries despite participation in the program. Women sought treatment significantly less often than men, reflecting the strong influence of patriarchy in rural Bangladesh society on health seeking behaviors of women (S. Ahmed, et al., 2000). A gender difference was also observed in treatment seeking behavior in a household study in the rural area of Chakaria, Bangladesh. It was found that while women reported a diseases more often then men, treatment seeking was significantly higher for men compared to women in all age groups (Country Team of the Future Health Systems Research Programme Consortium at ICDDR, 2008).

Decision Makers and Use of Skilled Birth Attendants in Bangladesh

As described earlier, interpersonal or social networks influence health services utilization decisions, and decisions about SBAs in Bangladesh are no exception. In Bangladesh, evidence suggests that women do not seek care alone but instead rely on a supportive social environment both for decision making and for actions that enable service use, drawing on their social networks for information about where to seek health care and financial resources (J. Parkhurst, et al., 2006b). 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 identified husbands as the gatekeepers of maternal healthcare particularly in patriarchal family systems (2002). Similarly, Haider found that the decision to select a birth attendant resting predominantly with husbands and guardians (2000). Darmstadt in a review of the literature on care practices for mothers and newborns in Bangladeshi communities and homes found that fathers generally took decisions for seeking care outside the home from a trained provider in the event of complications (2006). The 2007 BHDS indicated about one-third of currently-married women age 15-49 years had no final say even on decisions that concern their own health with 32.3% reporting their husband makes the final decision (National Institute of Population Research and Training, 2009). These findings are consistent with evidence from other developing countries where women are not the primary decision makers in matters relating to their own

health; rather, they rely on other members of their social networks, particularly their husbands, for health care decision-making (K Afsana, 2004; F I Asowa-Omorodion, 1997; Grossmann-Kendall, Filippi, & De Koninck, 2001; Pitchforth, van Teijlingen, Graham, Dixon-Woods, & Chowdhury, 2006). A qualitative study in rural Bangladesh found that when labor pain started, women usually asked their elder sisters-in-law or neighboring women for assistance. While these elder females provided direct care and assistance to the laboring women their decision-making role was limited to providing suggestions, advice or encouragement to the husband, who was responsible for the final decision (BRAC Research and Evaluation Division & University of Aberdeen, 2001, p. 48).

Involvement of specific kin members appears to be associated with maternal age and birth order. Data from the 2007 BDHS suggests that at young maternal ages (< 20 years) or first order births, parents and in-laws involvement in the decision is prominent, declining in significance with increasing age or parity. For example, 48% of first order births and 47% of women less than 20 years of age report involvement of their parents in the decision to seek treatment for life threatening complications compared to 28% for second and third order births and 26% for women 20-34 years of age (National Institute of Population Research and Training, 2009). The same pattern is evident with respect to decision making for non life-threatening complications.

Interaction Among Decision Makers and Use of Skilled Birth Attendants in Bangladesh

The attitudes and beliefs of network members (ideational content) in evaluating the need for a certain type of care under conditions of uncertainty may be driving the normative influences enacted in social decision-making process. The following example illustrates how the involvement of the above referenced decision makers can potentially impact the decision-making process. Among the reasons women gave for not seeking treatment for obstetric complications-*perceived to be life threatening from the women's perspective*-was the perception that treatment was not necessary or the condition was not serious enough (39%) (National Institute of Population Research and Training, 2003). One explanation for this apparent discrepancy is that

different family members were involved in evaluating the need for services (M. Koenig, et al., 2007). Social network members play a key role in legitimizing or rejecting "illness" claims (Parsons, 1951). Family members may give false assurances and question a woman's motive for seeking care, raising self-doubt and compounding the uncertainty inherent in childbirth. The pressure to conform, which may occur within a group, can cause a woman to suppress her individual doubts. Furthermore, when multiple actors take part in the process the need to reach consensus within a group can cause additional conflict and delay with new advisors being called upon and previous advice rescinded and changed. Disapprovals by influential persons in the household and the discouraging attitude of the neighboring women acted as impediments to seeking care during delivery in an urban area of Bangladesh (BRAC Research and Evaluation Division & University of Aberdeen, 2001).

It may be, however, that the decision to seek the care of a SBA also depends on the composition of the women's network at the time of labor. In a study of social and cultural factors leading to maternal mortality in Karachi, Pakistan, one of the delays in reaching a facility for pregnant women in distress was attributed to the husband not being home at the time of need (Jafarey & Korejo, 1995). Where a woman is physically residing when labor begins will determine the composition of individuals around her. In Bangladesh it is customary and preferred for women to return to their natal home for their first delivery. In these cases a women's natal kin are likely to play a greater role in the decision making process. Parkhurst and Rahman found that if a woman was staying in her own family's household her parents may have more say on matters of delivery care (2005). Important to note, first births are more likely to use facilities for delivery (National Institute of Population Research and Training, 2009), indicating the woman's natal family may be helping her obtain the best possible care.

Furthermore, analysis of in-depth interview with users of facility services in Bangladesh illustrates how at critical points in childbirth, members of women's extended social network (beyond close family and neighbors) may play a greater role in decision making than core

members of her network, highlighting how links to key individuals outside the village or bari, such as a community health worker, may be useful in facilitating decision-making (J. Parkhurst, et al., 2006a). Parkhurst and Rahman suggest that individuals outside the immediate household who may not normally be considered key decision makers (i.e., weak ties), may play a greater role due to their social status or knowledge of available services such as teachers, educated individuals and police officers (2005). These findings suggest the capacity and possibility to mobilize resources at a specific moment in time and space is partially dependent on the composition and characteristics of one's given network. This may be especially relevant for women in cultures where female autonomy including decision-making power is low as described previously within the context of Bangladesh's kinship structure.

Summary

Bangladesh has the seventh highest overall number of maternal deaths in the world. Use of a SBA to improve identification and management of these conditions is an effective means to reduce maternal mortality. However, SBA services remain underused even in settings where SBAs are available and health facilities are of relative good quality. In Matlab, where SBA services are available, 52% of the estimated 2,700 births each year still occur at home, assisted by unskilled birth attendants and relatives, while the remainder of births occurs in a health facility with a SBA (Centre for Health and Population, 2006). The overall question is why do some women use SBA and other women do not use SBAs in settings where services are available and known to prevent maternal mortality? The question explores the gap between access and utilization of a preventive health service.

Numerous studies have attempted to answer the question resulting in the identification of a variety of socio-cultural, environmental and health service factors. While these works make important contributions with respect to identification of relevant variables the conceptual and methodological limitations of these studies have left a gap in the literature and in turn our understanding of the demand for SBA use in Bangladesh. These limitations include: a focus on

only the most complicated pregnancies and births; a restricted set of variables focused on

individuals and not interaction between individuals; reports on population characteristics that

correlate with behavior but do not investigate cognitive and social factors that lead to the

behavior; sole use of secondary data analysis; qualitative evidence of social-cultural factors not

substantiated by quantitative findings and above all a lack of data to quantify the relative

importance of interactions compared to individual attributes.

The existing body of evidence on social networks, healthcare utilization and decision-making

has demonstrated that interpersonal interactions facilitate or hinder use of healthcare. Evidence

from Bangladesh suggests that family and community members are influential in the demand for

and referral to formal delivery care. Thus, it is likely social network characteristics play an

influential role in decisions about SBA use in Matlab, Bangladesh, particularly among women

who experience uncomplicated childbirth and women who are embedded in kinship networks

within a cultural context that regards them as inferior and limits their individual autonomy. A

better understanding of the decision-making process during childbirth might be gained by

examining the influence of social networks, independently and together with known individual

level factors, controlling for severity of the condition and availability of professional services

(i.e., medical facilities).

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CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

In chapter three a study overview is provided followed by a description of the study area, design and methodology for the preliminary and main phases of the study. The chapter concludes with a discussion of the study assumptions, challenges and limitations.

Study Overview

This retrospective, cross sectional study employed social network analysis (SNA) and ethnographic decision tree modeling (EDM) to: 1) test the utility of the Network-Episode Model (NEM) in explaining women's health service utilization decisions in uncomplicated pregnancy and childbirth, and 2) examine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth. Bangladeshi women 18-45 years of age residing in the Matlab Health Service Area (MHSA) of Bangladesh who experienced a live birth in the 3 months prior to data collection were invited to participate. The study occurred in partnership with the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B) through Emory University Nell Hodgson School of Nursing, Center for Research on Maternal and Newborn Survival (CRMNS). The Institutional Review Board (IRB) approved both phases of the study for the Protection of Human Subjects at Emory University and the Ethical Review Committee (ERC) at the ICDDR,B.

The study had two phases: a preliminary phase (June - August 2007) and a main phase (September 2008 - January 2009). Sigma Theta Tau Alpha Epsilon Chapter, Emory University Laney Graduate School, and Emory University Global Health Institute funded the preliminary phase. The main phase was funded through the National Institute of Nursing Research, National Research Service Award (# 1F31NR010650-01) and an American Nurses Foundation Nursing

Research Grant (#2008-084). The funding sources had no role in the study design, data collection, analysis, interpretation or writing of the results.

Description of the Study Area-Matlab, Bangladesh

Bangladesh is located in the northeastern part of South Asia. The country is surrounded by India except for the southern coastline on the Bay of Bengal and a short southeastern border with Myanmar. Situated at sea level, on the deltas of two large rivers flowing from the Himalayas (i.e., Ganges-Padma, Brahmaputra-Jamuna and Megna), the land is prone to frequent flooding and cyclones. The geography keeps parts of the country isolated during the annual monsoon season from July through early October. During an average flood year, close to 18% of Bangladesh's land mass is covered my flood waters, while in severe flood years coverage can be up to 40% (SM Ahmed, 2005). A wide network of water-based public transportation including country boats and ferries exists. Land based transportation occurs by foot, bike, rickshaw, three-wheeled mini taxi, bus or private motorcar on a road network that is in poor condition and poorly maintained. During the British rule from 1757 Bangladesh was part of the British Indian providences of Bengal and Assam and became East Pakistan after the end of British rule in 1947 with the partition of India. The People's Republic of Bangladesh officially emerged as a sovereign state on March 26, 1971 when Bengali East Pakistan seceded from its union with West Pakistan, the result of a brutal nine-month War of Liberation, precipitated by a language movement. Bangladesh is considered a democratic republic with a parliamentary form of government. It is one of the largest Muslim countries in the world with nearly 90% of the people believing in Islam (mostly Sunni), the official national religion.

Bangladesh is considered one of the world's most densely populated nations, with over 156 million people living on an area about the size of the state of Iowa (144 thousand square miles). Overcrowding and scarcity of essential resources follow. Poverty is deep and widespread. Nearly half of the population (41%) lives in absolute poverty, defined as having an income of less than $1 US a day (United Nations Development Program, 2007, p. 229). Electricity is sporadic in

rural areas and only 47% of the entire population has access to electricity. Approximately 76% of the total population lives in rural areas (Bangladesh Bureau of Statistics, 2007). Two in five households (40%) live in structures with walls made of natural material. Tin is the most common roofing material and the majority of floors consist of earth or bamboo (National Institute of Population Research and Training, 2009). In 2006 the national life expectancy for both sexes was 65.4 years with urban (68.0) and rural (64.6) differential. For females, the national life expectancy was 65.9 years, with urban (68.3), rural (65.7) differential. Females constitute about 48.1% of the total population of which 77.3% live in rural areas (Bangladesh Bureau of Statistics, 2007).

Bangladesh is administratively divided into 6 divisions, 64 districts, 481 *upazilas*, 599 *thanas*, 4,498 unions, 13,500 wards and 64,001 villages (Bangladesh Bureau of Statistics, 2007). Matlab *thana,* the study site*,* is in the Chandpur district, located about 55 kilometers southeast of the country's capital, Dhaka. Being flat and low-lying, it is subject to annual flooding by many canals and rivers that cross the area. The area is representative of rural, deltaic areas throughout Bangladesh. A large system of dams was constructed on the banks of the rivers Meghna and Dhonagoda for the purposes of flood control, drainage and irrigation (ICDDRB, 2009). Locally, households are referenced according to whether they are located within or outside the dam embankment, a important feature in the agricultural economy (Vaughn, 1997). Travel within Matlab is mostly by foot, rickshaw, three-wheeled mini taxi or country boat. All residents speak in *Bangla,* the official national language. The principal economic activities are agriculture and fishing. Remittances sent from men who migrate into the city or abroad for work opportunities are another source of income for households in the area. Patrilineal and virilocal family is the traditional type of family unit found in rural Bangladesh although changes to kinship organization are occurring due to the rapid socio-economic transitions including employment opportunities in cities and abroad. Kinship networks, however, remain a universal aspect of the social structure and division of labor remains predominantly gender-based in rural villages with exceptional

patterns among the poorest and most educated women.

As described in Chapter 2, Matlab is internationally recognized due to the ICDDR,B Health and Demographic Surveillance System (HDSS). The HDSS area is divided into a government (control) area and a service (intervention) area creating a unique infrastructure for community-based health and population research. The service (intervention) area is known as the Matlab Health Service Area (MHSA) and is divided into four blocks (A, B, C, and D) and consists of 67 villages. A map of the area is provided in Chapter 2 (Figure 2.1). Access to the HDSS and MHSA program databases facilitated generation of the samples required for the preliminary and main study phases.

Matlab was an especially appropriate site for the study because access, the most significant barrier to SBA utilization, is controlled for in this area. That is, women in the MHSA have free access to SBAs through ICDDR,B's four health sub-centers and town hospital as well as the government Thana health complex in Matlab and the government district hospital in Chandpur, a 40 minute drive via motored vehicle. When the study was designed, in 2005, 52% of the estimated 2,700 births each year occurred at home assisted by unskilled birth attendants and relatives, while the remainder of births occurred in a health facility with a SBA (Centre for Health and Population, 2006). The proportion of births occurring in a facility, at the time of data collection had increased to almost 69%, corresponding with a large health service research project entitled: *Comprehensive maternal, neonatal and child health care to reduce mortality: a programmatic approach through a continuum of care to increase facility based delivery in a rural community in Matlab, Bangladesh*. This large project started in 2006 and will continue until 2010. Emory University, School of Nursing's CRMNS currently collaborates with ICDDR,B on this project. The study was nested within this larger health service research project. The aims, designs and methods of the preliminary and main study phases are discussed in the following sections, beginning with the Preliminary Phase.

Preliminary Phase of Study

The preliminary phase of study, conducted in June-August 2007, had two aims: 1) to identify and document the decision criteria used when making birth attendant decisions for routine childbirth and 2) to identify and document involvement of social network members in the decision-making process.

Design

A retrospective, cross-sectional research design and ethnographic decision modeling were employed to address the specific aims.

Approach

Ethnographic decision modeling (EDM) is a naturalistic, hierarchical cognitive modeling technique that answer questions about *how* certain groups of people make real-world decisions and *why* certain decisions are made (Gladwin, 1989). The technique incorporates anthropological and psychological approaches. It assumes decision makers themselves are the experts on how they make decisions and that people have the ability to report on real life decisions in terms of alternatives evaluated, dimensions of contrast and sequencing of comparisons. Ethnographic fieldwork techniques, such as in-depth interviewing and participant observation, elicit from individuals their decision criteria within a narrative about the decision making process itself. The process and criteria are then analyzed requiring the researcher to think deductively and inductively at the same time. Criteria are combined, clustered and ordered by the researcher in the form of a composite decision tree table, flow chart and/or a set of "if-then" rules based on individual decision processes. After construction, the composite model is validated or tested against actual choice data in a different yet representative sample from the same population from which the model-building sample was selected. The result is a set of decision criteria and a composite model of specific criteria according to a sequence that best represents the decision process of all individuals in the sample. EDM simplifies the procedures people use in their decision making while providing a descriptive and predictive approach to modeling behavior.

This type of analysis can stand alone, or as in the case of the present study help interpret and complement the findings of other techniques.

Researchers have used EDM's to model a variety of health-related decision processes such as home case management of acute illness in a rural Cameroonian village (G. W. Ryan, 1998), illness treatment in a rural Tarascan community (Young, 1990), treatment-seeking behavior in Guatemala (Weller, Ruebush, & Klein, 1997), pathways of decision-making among Mayan traditional birth attendants (Anderson, Anderson, Franklin, & Dzib-Xihum de Cen, 2004), decisions of women considering hysterectomy (Wu, Chao Yu, Yang, & Che, 2005), treatment seeking among Korean cancer patients (Oh & Park, 2004), and nursing assessment of postpartum bleeding in the Dominican Republic maternity ward (Foster, Regueira, & Heath, 2006). EDM models are easiest to build for questions about behaviors that can be answered with *yes* or *no* responses or narrowly limited task domains; however, they have been used to explore more complex behavioral outcomes (Ryan & Bernard, 2006), such as the decision to use a SBA. In general, EDMs should be consistent with individual's own explanations and principles of action and should mimic to some degree how informants describe their decision-making process (Ryan & Bernard, 2006). An analytic and interpretive balance between the composite model and individual models is the aim.

If the decision model successfully predicts 85-90% of the individual choices of those in the model testing sample, it is assumed to be an adequate model (Gladwin, 1989, p. 16). Errors are calculated on each path and a simple success rate is calculated by dividing the total number of successes by the total number of cases on all paths. For example, Foster calculated error rates based on responses to the model-testing questions. Responses are compared with the preliminary decision tree. Any item on the questionnaire with which any respondent disagreed is considered an error (Foster, et al., 2006). Errors do not necessarily invalidate the model or limit the utility of the technique instead they can highlight ways that individual behavior deviates from group norms

and point the way to more detailed investigations into the sources of such errors (H. Matthews & Hill, 1990).

Sample

The following section specifies the population, sample, and sample size for the preliminary study phase.

Population and Sample. The population of interest was Bangladeshi women of 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 May 26, 2007 and August 10, 2007. A purposive sample of community dwelling women from the population of interest was identified during August 2007. The sample was drawn from the MHSA Maternal and Child Program database with the assistance of a local database manager in Matlab.

Inclusion and Exclusion Criteria. The inclusion criteria included ever-married women ages 18-49 years who experienced an uncomplicated pregnancy and live birth in the 3 months prior to data collection with the ability to speak and understand Bangla. The exclusion criteria were the actual presence or perception of antepartum or intrapartum risk factors or complications, history of chronic or underlying physical conditions known to be associated with birth complications and major cognitive impairments.

Sample Size. The sample size was 25, divided between women who had delivered in the home (n=12) and in a facility (n=13). The sample was selected to be as representative as possible of the population of interest, equally divided among women who delivered in the home and a facility. Data collection concluded at twenty-five interviews because respondents were converging on consensus and the central limit theorem states that normal approximation is typically good with twenty-five observations or more. There were also pragmatic concerns about time and budget.

Instrument

An interview guide, comprised of fifty-four questions, was designed to elicit information about the respondent's pregnancy and decision process regarding place of birth for her most recent delivery including who was involved. A series of closed-ended, structured questions asked about the respondent's social and demographic characteristics, obstetric history, antenatal care and birth planning for her last delivery. Open-ended questions asked for the relations (e.g. mother, sister-law, husband) who provided respondent's with support in pregnancy and during labor and delivery. Specific culturally relevant probes generated responses about the types of support provided by each relation mentioned, following the example of Adams and colleagues (2006). Initially, the probes were derived a priori from House's widely cited functional definition of social support. House defined it as an interpersonal transaction involving one or more of the following: emotional concern, instrumental aid, information, and appraisal (House, Kahn, McLeod, & Williams, 1985). The probes evolved as specific examples of support emerged. In the later stages of interviewing, questions were based on the analysis of early information in order to find contradictory, confirmative and alternative examples. Responses were recorded using a matrix of the most common kin and non-kin relations and their local Muslim and Hindu terms as described in Aziz's seminal work on kinship in Bangladesh (Aziz Ashraful, 1979). A list of relations with examples of the type of support received was generated after each interview. Finally, a series of open-ended questions were asked about the decision making process itself. In the later stages of interviewing, questions were based on the analysis of early information in order to find contradictory, confirmative and alternative examples.

The interview guide was translated into Bangla and then pre-tested on three women in Matlab. Based on observations in the field and suggestions by a Bangladeshi research officer, there were revisions to the wording and translation. An English version of the final interview guide is provided in Appendix B.

Recruitment, Selection and Training of Research Team

The research team consisted of the principal investigator (PI), a research officer and a porter. Recruitment for the research officer occurred through an existing research network between ICDDR,B and the CRMNS at Emory University. The selected research officer was a female, masters prepared anthropologist, bilingual in Bangla and English. She had accrued five years experience conducting in-depth interviews and focus groups among villages in the study area. At the time of the study, she was a contract employee of ICDDR,B, known to the Director of the CRMNS. After an introduction and overview of study aims, orientation occurred by working closely together during pre-testing and translation of the interview guide and throughout the course of data collection. A male porter with previous field experience was hired, upon the recommendation of the research operations manger in Matlab. After completion of the interviews, a second research officer was contracted with to assist with translation and transcription of the data. She was also a masters prepared anthropologist, bilingual in Bangla and English.

Recruitment, Screening and Informed Consent of Subjects

Active household recruitment of potential participants occurred. This is a process in which members from the eligible population are located and invited to participate in the study by research staff. The staff travel within a community household-by-household assisted by sample rosters stratified at the village level. The porter, familiar with the area, helped locate each household, arrange transportation and communicate with household heads. He also accompanied the PI and research officer to each interview.

Standard disclosure procedures, described below, were followed to obtain voluntary, verbal informed consent. First, the PI and research officer contacted potential informants in their homes, which is a customary research practice in the ICDDR,B MHSA. At the time of the visit, it was confirmed that potential informants meet the eligibility criteria using a prepared screening form. Major components of the screening process included: establishing the participant's residency in

Matlab, verifying the date and place of delivery and assessing for the absence of actual or perceived complications during pregnancy and delivery. Then, the purpose of the study was explained, what participation entailed, potential risks and benefits of participation, and measures used to ensure informant confidentiality. Potential informants were assured that their participation was completely voluntary, withdrawal from the study could occur at any time without negative repercussions, participation had minimal risk, and participation in the study had no known benefits apart from the important knowledge gained and applied to the health of women and newborns in their communities. Participants were told that any identifying information would be removed from the data following the interview. Finally, potential informants were asked if they had any questions and if they would like to take part in the study. For those who wished to participate, the interview was conducted or re-scheduled at a more convenient time.

Data Collection

Following Informed Consent, the research officer conducted the interviews in Bangla. The individual in-depth interviews were guided by Spradley's ethnographic techniques, supplemented by participant observation (1979). Data collection occurred no more than three months after the index birth. The PI observed each interview.

One to two interviews were conducted per day. All interviews were conducted in the home. The average duration of the interviews was 70 (*SD* 9.9) minutes. The research officer and PI debriefed after each interview day for approximately 45 minutes per interview. All interviews were audio taped using an Olympus Digital DS-2300 recorder, field notes served as a backup method of retrieving data. Each interview was transcribed verbatim and translated assisted by transcription software (Olympus America Inc., 2007). The research officer who conducted the interviews transcribed the interviews in Bangla, the other translated the transcription into English. Finally, the research officer who conducted the interviews also verified the completed English transcripts together with the PI. All data was de-indentified.

Analysis

The data were stored and the analysis occurred at Emory University on a password-protected computer. Socio-demographic and reproductive health variables were entered and analyzed in SPSS 16.0 (SPSS Inc., 2007) using simple frequencies (e.g., mean, $\pm$ standard deviation for continuous variables; frequencies and percentages for categorical variables). Electronic versions of the transcripts were transferred into Word documents (Microsoft, 2007) from the DSS transcription software. The transcripts were grouped according to place of delivery together with the field note summaries. The transcripts were then read repeatedly together with the field notes to extract an initial understanding of the data. Since specific birth choices were discussed in the interviews, blind review of the data was not possible.

To meet the first aim of the preliminary study—obtaining decision criteria for use in subsequent ethnographic decision modeling—a constant comparison approach was used. This is a process through which data from individual cases or subjects are compared and contrasted with one another to discover similarities and differences (H. R. Bernard, 2006). Line-by-line content analysis was conducted searching for examples of decisional themes, which were highlighted and later manually coded. Individual responses were reviewed, categorized and ranked, according to reasons for use and reasons for non-use. Constraints to use, often embedded in the narratives, were also identified. Similarities and differences between the benefits of home delivery and the reason for non-use as well as the benefits of facility delivery and the reasons for use were identified. The data was compared across cases to find confirmations, contrasts and/or contradictions.

A decision map for each informant was developed based on individual reasons, constraints and outcomes. Reflecting on the data from the individual cases, an evolving set of organizing principles and decision criteria for use of a SBA as well as constraints on behavior that cause the decision maker to pick the other alternative or non-use of SBA (e.g., with a relative, friend or TBA) were then identified for the entire sample. The goal was to identify the specific decision

criteria used by most individuals, a parsimonious description of aggregate decision patterns in the form of composite decision model regarding use or nonuse of SBAs. Mapping of the decision process and development of a composite EDM was in accordance with Gladwin's methodology described above (Gladwin, 1989).

To meet the second aim of the preliminary study, social network member involvement in the decision process was documented by kinship relation and type of support provided during pregnancy and childbirth. There are over 250 documented kin terms used by Bengalis in the Matlab area (Aziz Ashraful, 1979). These kin terms have multiple meanings and extend to non-kin villagers. A glossary of the most common kin relations and their local Muslim and Hindu terms was created at the start of the preliminary study to facilitate understanding and data collection. Descriptive kinship terms were documented in relation to the respondent (woman). Culturally relevant examples of support described the dyadic characteristics (type, source) of women's perceived social support in Matlab, Bangladesh during pregnancy. That is, what type of support was received (e.g., informational, material, emotional, etc.) and who provided the support (e.g., mother, sister-in-law, husband, etc) on the level of pairs (e.g., respondent and each of her nominated network members). Type of support was documented according to the source of support.

The outcomes of this phase were a composite decision tree model, and data to develop culturally relevant name generator and name interpreter questions. The outcomes provided the information needed to develop the instrument for use in the main phase of the study, as well as a detailed logistics and implementation plan. The PI also gained exposure and experience with the research site and host organization, ICDDR,B.

Main Phase of Study

Specific Aims

The main phase of the study, conducted between September and December 2009, had two aims: 1) to explore the utility of the NEM in explaining women's health service utilization

decision-making in uncomplicated pregnancy and childbirth; and 2) to determine the predictive

power of women's self-identified decision-making criteria on choice of birth attendant in the

event of uncomplicated pregnancy and birth.

Design

The main phase of study employed a retrospective, cross-sectional design to address the

above stated aims. The exploratory research design is useful when researchers need to understand

ways in which human attributes and environmental characteristics interact to control behavioral

responses (Portney & Watkins, 2000). The three main purposes of the exploratory research are to

describe relationships, to predict the effects that variables have on each other, and to test

relationships that are supported by theory (Portney & Watkins, 2000).

Approach. The study employed techniques of social network analysis. Social network

analysis is an interdisciplinary, multidisciplinary method with original ties to the disciplines of

psychology, anthropology and sociology. The terms *networking* and *social networking* have wide

public appeal and are frequently used metaphorically and in pop culture. However, in the social

sciences, network analysis is considered a distinct theoretical and methodological approach to

investigating substantive problems such as underutilization of preventive healthcare. Central to

the method is the identification, measurement and testing of hypotheses about the structural forms

and fundamental contents of relations among actors (Wasserman & Faust, 1994). The approach

rests on three underlying assumptions: 1) social phenomena can not be solely understood by

individual characteristics, 2) social relations among individuals affect individual perceptions,

beliefs and actions through a variety of structural mechanisms that are socially constructed, and

3) social networks reflect dynamic processes (Knoke & Yang, 2008).

Social networks are essentially groups of people and the relationships among the people.

Typically, a network contains a group of individuals and some type of description of the relations

linking the individuals. The individuals are often referred to as actors, nodes or vectors and the

relations among individuals are referred to as ties or edges (henceforth, I will use the terms actor

and tie). The ties can be directional or symmetrical and when there is more than one type of tie between actors, multiplex. The ties can consist of sharing an attribute, such as gender or sharing spatial proximity, such as living in the same village. The ties can also be defined by flow or exchange. Such properties can be generated from the interaction among individuals or from their reactions to similar experiences (Borgatti, 2008). The ties between two actors can operate directly or indirectly via an intermediary actor. So in a structure comprised of a set of actors, one or more ties may connect some but not all members of a given network.

The extent to which the ties in a given network of actors are examined depends on the boundary of the network or the inclusion rules of data collection. The specification of network boundaries distinguishes whole or sociocentric networks from personal or egocentric networks. Sociocentric studies examine the comprehensive structure of role relations in a social system of interest such as all students in a high-school classroom, all licensed health care providers in a hospital or all attendees of a fundraising event. Egocentric studies examine relations from the standpoint of particular actors (termed egos). Rather than focusing on all ties in a social system, egocentric network studies seek to provide views of the network as perceived by the individual egos and their relations (alters) (Wellman & Berkowitz, 1988, p. 27). The present study employed a egocentric network strategy, involving the subjective perception of the ego as stated above and the analytical-imposition strategies of the researcher, as described below.

A researcher employing network designs of any type must make explicit decisions about three elements: 1) sampling units, 2) relational form and content, and 3) level of data analysis. While also guided by a project's theoretical concerns and research objectives these three elements shape the measurement and analytic strategies of network studies (Knoke & Yang, 2008, pp. 9-14). Decisions about these elements in relation to the present study are discussed below.

As with all egocentric studies, the sampling unit consisted of individuals (postpartum women). A boundary around a smaller subset of network ties from a women's larger global personal network was drawn using an exchange approach. The exchange approach provides clear

criteria for inclusion and exclusion of ties based on the theoretically relevant components of

social support (Milardo 1988 as cited in Marin & Hampton, 2007). Proponents of this approach

contend that those people who provide regular supportive interactions are an important subset of a

personal network (McCalliser and Fischer 1978 as cited in Marin & Hampton, 2007). In the

present study a subset of women's personal networks was examined based on communication

exchanges (talks) regarding place of birth. Boundaries were set during data collection relying on

respondent recall stimulated by name generator questions and supplementary interviewing

techniques, which are discussed in more detail in the section describing the instrument used in the

main phase of the study.

The relational form was non-directional from which tie strength between the women and

her nominated network members was determined. Non-directional form refers to ties that are

either present or absent, reciprocity between pairs is not measured and mutuality is assumed. Tie

strength was based on a measure of "closeness", or the emotional intensity of the relationship

found by Marsden and Campbell to be the best indicator of the concept of strength of tie among

those available (1984).

Finally, the level at which to analyze the structure of the data involves choices about

sociocentric or ego networks, as discussed above. This study used an egocentric network

approach. Egocentric data can be further defined by: an ego-network level, constituted by the

ego's characteristics and overall network features; and an ego-alter level, constituted by the

characteristics of each alter and alter-ego ties (Carrasco, Hogan, Wellman, & Miller, 2006, p. 6).

In the main phase of the study, both levels of egocentric data were examined, one zone away

from the ego. One zone means that the network consists of the women and all of her nominated

actors, as well as the direct relations among her nominated actors. This is in contrast to second or

higher zones that consist of all the actors of the women's actors and so forth.

Sample

The following section specifies the population, sample, and sample size for the main study phase and the power analysis that was used to determine the sample size.

Population and Sample. The population of interest was Bangladeshi women of 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 sampling frame, taken from the Maternal and Child Health database in Matlab, consisted of 699 women. A disproportionate stratified sample was taken by the main dependent variable in the study—place of delivery. Stratified sampling is used to allow for comparisons among subgroups in the population when one or more of the subgroups are relatively uncommon. In the present study, 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 based on the inclusion and exclusion criteria resulted in a final sample size of 246 women, of which 124 delivered in the home and 122 in a facility.

Inclusion and Exclusion Criteria. The inclusion criteria included ever-married women ages 18-49 years who experienced an uncomplicated pregnancy and live birth in the 3 months prior to data collection with the ability to speak and understand Bangla. The exclusion criteria were the actual presence or perception of antepartum or intrapartum risk factors or complications, history of chronic or underlying physical conditions known to be associated with birth complications and major cognitive impairments.

Sample Size and Power Analysis. A sample size to achieve adequate statistical power to estimate the parameters for Specific Aim 1 Hypothesis 1 was calculated using Number Cruncher Statistical Systems- Power Analysis and Sample Size (NCSS-PASS) software analysis program

(Hintze, 2007). The analysis was conducted based on plans for a logistic regression model with categorical independent variables and a fixed odds ratio of 2.0 and with continuous independent variables and a fixed 1.5 odds ratio for one standard deviation change. A sample size of approximately 254 women ensures 80% statistical power using a two-sided statistical test with an $\propto = 0.05$

Instrument

  Key Variables. The study instrument was designed to capture data on key variables (Table 3.1). These variables are divided into five domains that correspond with the NEM conceptual framework. The five domains are: 1) women's individual and pregnancy episode attributes, 2) social network structural characteristics, 3) social network content characteristics, 4) decision criteria, and 5) outcome. The outcome of interest was the dichotomous -use/non-use of facility during a women's most recent delivery.

Table 3.1. *Description of Study Variables*

Women's Individual Attributes	
Variable	Level of Measurement and Description
Age	Interval, age in years
Marital Age	Interval, age in years
Education	Interval, highest grade completed
Regular Exposure to Media	Nominal, 1 = yes, 2 = no (receive weekly news from television or radio)
Socioeconomic status	Ordinal, 1-5 (based on asset scores and wealth quintiles)
Residence	Nominal, 1 = natal home, 2 = marital home, 3 = nuclear home
Parity	Interval, number of live births
Distance to Health Facility	Interval, km to nearest health facility from household
Number of Living Children	Interval, number of living children
Ever-use of Trained Medical Provider	Nominal, 1 = yes, 0 = no
Antenatal Care Visits	Interval, number of visits
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".
Homogeneity -Kin	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".
Strength of Tie	Interval, proportion, rating of how close a women feels to individuals nominated in her network on a Likert-type scale from 0-3. Network value ranges from 0-1, where 1 is maximum 'Strength of Tie".
Social Network Content Characteristics	
SBA Endorsement	Interval, proportion, where individuals in a woman's network advise women to deliver, 0 = home, 1 = facility. The item response is averaged over the network for use in the analysis. Network value ranges from 0 – 1, where 1 is maximum "SBA Endorsement"
Decision Criteria	
Decision Criteria	Nominal, 1 = yes, 2 = no. Women were given binary response options (yes/no) to a set of close-ended questions based on self-identified criteria for place of birth decision derived from in-depth narratives in the preliminary study.
Outcome	
Birth Place	Nominal, 0 = home, 1 = facility

More detail on the construction of several of the key variables is provided below.

Socioeconomic status. Household socio-economic status was defined by constructing a wealth index using asset ownership, based on a model described by Gwatkin and colleagues (2000) and 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 (ICDDRB, 2005a). Resulting asset scores were categorized into five wealth quintiles ranging from one (poorest) to five (richest).

Intention. Intention was measured by the following single question, *During your pregnancy where did you want to deliver?* Responses were regarded as trichotomous: home, facility or facility only in the event of complications response. For analysis purposes responses were collapsed into home or facility. Facility only in the event of complications was regarded as home since the population being studied was women without pregnancy or delivery complications.

SBA Endorsement. A simple summative score from one dichotomous item was used to create the SBA endorsement measure. Respondent's answers to the 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 sum of valid (non-missing) responses was divided by the number of valid responses, resulting in a final network score with values between 0 (no endorsement) and 1 (full endorsement strength). The highest score represents a women whose alters all advised her to use a facility for delivery. The lowest score represents a women whose alters all advised her to deliver in the home.

Density. Density was calculated by dividing the number of ties in a given women's network by the number of potential ties. For analytic purposes it was assumed that missing data meant the absence of a tie. There was incomplete network data, defined as having less than 20 named alters, in 14 cases. The range was from 0 to 1, where 0 represented low density, where all

alters nominated did not know one another and 1 represented a very dense network, where all alters nominated knew one another. The valued data in the network grid was dichotomized into "these two people know one another" (coded as "1") or "these two people don't know one another (coded as "0"). The total number of ties (T) was summed and divided by the number of potential ties N (N-1)/2 where N is the number of network members.

Strength of Tie. A simple summative score from a single three point categorical item was used to create the strength of tie measure. Respondent's answers to the question "*How close do you feel to [name]?*" were aggregated and standardized across the network. The responses were scored as follows: 1 point for very close; 0.5 point for somewhat close; and 0 for not close. The sum of valid (non-missing) responses was divided by the number of valid responses, resulting in a final network score with values between 0 (low strength) and 1 (high strength).

Homogeneity. A simple summative score from one dichotomous item was used to create the homogeneity (kinship) measure. Respondent's answers to the question "*Do you consider [name] to be kin?*" were aggregated and standardized across the network. The responses were scored as follows: 1 point for yes and 0 for no. The sum of valid (non-missing) responses was divided by the number of valid responses, resulting in a final network score with values between 0 (no kin in network) and 1 (all kin in network).

The data collection tool was comprised of six parts. Data were captured for each of the key variables in the five domains as described above (Table 3.1). Each part of the tool is described below.

Part 1 contained seven structured screening questions to confirm eligibility in the study sample. The screening process included: establishing the participant's residency in Matlab, verifying the date and place of delivery and assessing for the absence of actual or perceived complications. For place of birth (the study outcome) women were given a dichotomous response option (facility/home) to one close-ended question based on recall of the place of birth. The response was verified with data from the Matlab Health Service area program records.

Part II contained nine obstetric history questions; thirty-four social, demographic and life history questions; eight mobility questions; twelve decision making authority questions and twenty-five questions about the decision making process itself, derived from the ethnographic decision model. All the questions in part two were structured. The questions pertaining to obstetric history, socio-demographic background and life history were used to calculate women's individual and pregnancy episode attribute variables. Questions on the decision process itself were based on the decision criteria identified in the preliminary phase of the study. Women were given a dichotomous response option (yes/no) to a set of twenty-two close-ended questions based on recall of their own decision process. Responses to these questions were used to validate the EDM model.

Part III contained structured guidance for name generation questions to elicit a free list of people the women knows. Name generators are free lists of people (names) recalled by the informant (H. Bernard, 2008). The people or names are the domain of interest. In the study of ego networks, name generators are the standard method to enumerate networks and delineate the compositional and structural variables of a network (Marin & Hampton, 2007). The number and wording of name generators are critical considerations, affecting the definition of the network and the consequent inferences which can be made (Campbell & Lee, 1991; Marin & Hampton, 2007). In the present study, one exchange-based name generator and supplementary interviewing techniques were used (Brewer, 2002). Supplementary interviewing techniques enhanced recall of items and included nonspecific probing, reading back to the respondent items she free listed and using free-listed names as semantic cues (Brewer, 2002; Brewer, Garrett, & Rinaldi, 2002). Respondents were asked to name up to twenty people they talked to about place of delivery during their pregnancy using the following question: "*During your pregnancy, who did you talk to you about where to deliver*?" At the point when the respondent was initially finished spontaneously listing names the interviewer asked a question like, "*What other people do you know, who you talked to about where to deliver*". Next, the interviewer slowly read back the list

of people the respondent had spontaneously mentioned under the guise of checking for accuracy of the interviewer's written record, taking the opportunity to prompt nonspecifically once more. Finally, the interviewer asked the respondent to think about other people she knows who are like the people she has already named, using each name on the list. This final semantic cuing process is thought to exploit a natural associative process hypothesized to drive free listing (Brewer, 2002; Brewer, et al., 2002). If the respondent had not listed twenty people in response to the name generator and non-specific probes, a series of specific probes were used including: "*Did you ever talk to a CHRW? Did you ever talk to a Village Doctor*? and *Did you ever talk to a Kobiraj*?*" Names were tracked according to whether they were generated spontaneously, after the non-specific probes, or after the specific probes.

Part IV contained name interpretation questions to elicit attribute data on the people listed in the free listing exercise described in *Part III*. Once the name generator produced a name list, name interpreter questions were used to elicit information about: 1) characteristics of each alter including kinship, place of residency and their advice regarding use of an SBA (SBA endorsement); and 2) the relationship between the women and her nominated alters including role relation and strength of tie. Visual aids were provided to respondents as a memory aid when answering questions that involved a scaled response set. The visual aids were presented and explained to the respondents prior to asking the questions. Each research officer had laminated copies of the visual aids. Responses to these questions provided individual profiles of the women's personal network members and were used to calculate network composition and content variables.

Part V contained questions to elicit information about the relationship among alters listed in the free listing exercise described in *Part III*. A grid or matrix facilitated recording of this information. The first fifteen persons from the name generation process were entered into a matrix grid. Respondents were asked to indicate the extent to which these persons are acquainted with each other on a four point graded scale (who knows whom within each network). The

responses were scored as follows: 0 if the alters did not know one another, 1 if they met from time to time, 2 if they knew each other well, 3 if they were very close and 77 if the respondent did not know. Responses to these questions were used to calculate network structure (i.e., density).

Part VI contained seven questions for the research officers about the interview process itself, including completion status, date, time and setting of the interview along with sequence (first, second, third) of the interview for the day. Two questions to evaluate the accuracy of the respondent's answers and the seriousness and attentiveness of the respondent during the interview were included. Space at the end of the tool was provided for comments and observations.

Translation, Back-Translation and Pretesting

The study instrument was translated, back translated and pretested before use. Translation and back translation involved: development of the interview instrument in English, translation into Bangla, and back translation from Bangla into English by another bilingual person whose native language was English. The translation was aided by Bijoy software that enabled the Bangla font. The PI worked side-by-side with the research officers throughout the translation process to ensure clarity of concepts. To ensure that the survey instrument was culturally appropriate and understood by the research officers and informants alike, the translated instrument was pre-tested by the research team. Pre-testing consisted of eleven days of data collection with seventeen respondents. The team went into the field in alternating pairs in order to develop consistency in interviewing technique. After each day, the team debriefed, questions were clarified and interview techniques discussed and refined. Information from the pre-testing activities was then used to edit and finalize the study instrument before data collection began. The final English version of the study instrument is provided in Appendix C.

Recruitment, Selection and Training of Research Team

The research team consisted of the PI, a senior research officer, four junior research officers and two porters. The senior research officer worked with the PI on the preliminary study, thus she was familiar with the study aims and had an existing rapport with the PI. The PI and the

senior research officer oversaw the hiring process for the four junior research officers employed for the data collection phase of the project. First, the advertisement was posted on August 10, 2008 on ICDDRB's web site and hard copies were placed in various employment posting locations at ICDDRB's local campuses. Eighty-four applicants responded to the advertisement. A short list of seven candidates was determined by matching the candidate's qualifications with the advertisement. Seven candidates made the short list and six took a written test (standard Human Resource procedure at ICDDR,B), one was absent and thus disqualified. The written test was administered and scored on September 7, 2008. The PI, senior field officer and an external field manager for another project scored the written exams. One candidate was dropped after the written exam due to a low score. Five candidates were invited for an interview on September 11, 2008. Three ICDDR,B staff (one for human resources, one was the senior field research officer for the study, and one was a staff member from another department) were present as well as the PI. The ICDDR,B staff scored the interviews based on criteria established by human resources. Four final candidates were chosen. The hiring data commenced on September 21, 2008. The senior research officer and three of the four research officers had masters-level training in anthropology and one research officer had master level training in home economics and human population. All five members of the research team were native Bangla speakers fluent in English. Four members of the team were unmarried and Muslim. The senior research officer was married and Hindu. The average age of the research officers was 27.25 years. Their research field-based experience ranged from six months to five years.

The senior research officer together with the manager of research operations in Matlab identified porters to join the team. Two, locally based male porters were contracted with on a weekly basis to provide support to the field team. One had previous experience locating households for data collection purposes. Both were not literate in English so the village rosters, used to locate households, were translated from English into Bangla. The porters, to facilitate transportation around the study area, rented two bikes, for use.

The PI conducted a one-week orientation and training program at the ICDDR,B office in Dhaka. The program occurred during the month of Ramadan so the office closed at three pm and four members of the team were fasting. Consideration was given to these circumstances. The program included confidentiality and human subjects protections and an overview of the study aims, instrument, the prescribed pattern of questions, methods to assist recall, protocols for recording responses, and methods to resolve inconsistencies in reported information. Techniques in establishing rapport with participants through sharing past experiences was encouraged. While expectations around data collection standards were held firm, authority was relaxed to allow for free exchange of ideas and participation in process. Case scenarios and role-play exercises were used to practice interviewing skills. An emphasis was placed on standardization of content and sequence including asking the questions exactly as worded on the questionnaire. The orientation and training schedule is provided in Appendix D. Upon completion of the training each research officer received a field bag containing the necessary supplies.

Recruitment, Screening and Informed Consent of Subjects

Active, household recruitment of potential participants from the sample occurred. Standard disclosure procedures were followed to obtain voluntary verbal informed consent. First, the four research officers (interviewers), assisted by a porter, contacted potential informants in their homes in a face-to-face visit, the customary research practice in the ICDDR,B MHSA. 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). At the time of the visit, interviewers confirmed that potential informants meet the eligibility criteria using a prepared set of screening questions. Major components of the screening process included: establishing the participant's residency in Matlab, verifying the date and place of delivery and assessing for the absence of major complications during pregnancy and delivery. Then, the research officers explained the purpose of the study, what participation entailed, potential risks and benefits of participation, and measures used to ensure informant

confidentiality. They assured potential informants their participation was completely voluntary,
withdraw from the study could occur at any time without negative repercussions, participation
had minimal risk, and participation in the study had no known benefits apart from the important
knowledge gained and applied to the health of women and newborns in their communities. The
research officers also explained participants would be given a unique study identification number,
that any personal information might be used to identify them would be removed from the data
following the interview, and that the information gathered would be combined with that of all
participants during the analysis. Finally, potential informants were asked if they had any
questions and if they would like to take part in the study. For those who wished to participate, the
research officers conducted the interview or scheduled a convenient time to return.

Data Collection

Following informed consent, the research officers conducted the face-to-face structured
interviews. Data collection occurred over an 11-week period between October and December
2008. On average 61 interviews were conducted by each research officer. Between one and three
interviews were conducted a day. The interview time ranged from 45 minutes to 2 hours and 13
minutes (mean $\pm$ SD= 1 hour 20 minutes $\pm$ 17 minutes). The majority of the interviews (91%)
were conducted inside the respondent's home and the remaining (9%) outside of the respondent's
home. Each interviewer administered the instrument orally and documented the informant
responses directly on the instrument form in English. Completed instruments were examined for
missing data, extreme data values and legibility before concluding the interview. 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 accuracy, consistency and completeness with the PI.

To observe the interview process and assure consistency and quality of data collection, the PI
and senior research officer accompanied each research officer into the field on two separate
occasions. Approximately 7% of the total interviews conducted were observed. In addition, every

tenth interview was audio tape-recorded and reviewed by the senior field officer who assessed the interview for completeness, consistency, clarity and content. Individualized feedback was given based on the results of the quality review. A one-day retraining occurred midway through the data collection process, focusing on prevention of error and consistency among the research officers. The content was based on trends found in the review of the audiotapes, observations in the field, and concerns identified in the daily debriefing process.

Analysis

All data were entered into either SPSS or Excel. The data were then subjected to univariate analysis to check for impossible or improbable data values using range and consistency checks. The type and extent of missing data was examined. Missing data were handled as follows: five missing cases for asset score were replaced with 3 (mean asset score was 3.05); nine missing cases for distance to facility were replaced with the mean distance of 1.92 km.; two missing cases for husband's education was replaced by the mean 6.67 grades completed; and one missing case for transportation was replaced with a 1 for yes based on a review of answers to other questions from the study instrument.

Descriptive statistics were used to summarize the data (e.g., mean, $\pm$ standard deviation for continuous variables; frequencies and percentages for categorical variables). Exploration of the data revealed that many variables did not meet the assumptions for use of parametric procedures; therefore chi-square test for independence and Mann-Whitney U tests were used for select group comparisons, as appropriate. A significance level of $\propto = .05$ was selected for all analysis, although it is noted when variables are significant at the $\propto = .01$ level. All analysis were performed using SPSS software version 17.0 (SPSS for Windows, 2008).

The dependent variable of interest was the dichotomous variable use of a facility for delivery, which in the study setting was equivalent to the use of a SBA. The alternative was home delivery attended by a TBA, relative neighbor or friend (referred to as *dai*). Potential independent factors were analyzed by bivariate analysis, followed by a series of multivariate logistic

regressions. Multivariate logistic regression estimates the odds of occurrence of a dichotomous

independent variable while adjusting statistically for the influence of multiple independent

variables. Odds ratios for each significant explanatory variable were examined to determine how

the odds of facility delivery increase or decrease given the presence or absence of a particular

variable. An estimated odds ratio of 1 indicates that the use of an SBA is no different from the

reference category. If the estimated odds ratio is > 1, the likelihood of SBA use is relatively

higher than the reference category. Independent variables were tested in the regression based on

the results of bivariate analysis, their known influence on health seeking behavior and their

contribution to the reduction of log likelihood. Previous research has demonstrated the

importance of controlling for age, parity, economic and educational status when determining

determinants of delivery care. The sample size of 244, used for the analysis, met Tabachnick and

Fidell (2007) general guidelines for determining the number of predictors in a regression. They

recommend that N or the sample size should be equal to or greater than $50 + 8m$, where m is the

number of independent variables or predictors in the model.

Specific Aim 1: To explore the utility of the NEM in explaining women's health

service utilization decision-making in uncomplicated pregnancy and childbirth.

Descriptive summary statistics of the network variables were run (i.e., SBA endorsement,

density, homogeneity and strength of tie). Two cases had missing data on one or more of the

network variables to be tested. Therefore, data from 244 women were available for analysis for

H1a-H1c. The binary or categorical versions of the network variables were used in all the

analyses. The one exception is in the post-hoc analysis for Specific Aim one, where SBA

endorsement is analyzed in its continuous form. SBA endorsement, density, strength of tie and

homogeneity variables all had a range from 0 (low) to 1 (high). The reference group, low, was

coded as "0" and the response group, high, was coded as "1". For the outcome variable, women

who delivered in the home were coded as "0" and women who delivered in a facility were coded

as "1".

H1: *Network structure variables (density / 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 to a greater extent than women's individual attributes.*

Two sets of nested logistic regression models were run. Model 1 and 2 make up the first set and Model 3 and 4 the second set. Model 1 tested the explanatory value of the following women's individual attributes: parity, education and economic status all of which were significantly associated with place of birth at the binary level. Age was not included because it is highly correlated with parity (.822). Model 2 tested the additional explanatory value of the network variables (i.e., SBA endorsement, density, homogeneity and strength of tie). Models 1 and 2 were compared using the -2 log-likelihood and classification statistics

Next, a second set of models was run using the individual attributes found to be significant in the final analysis for Specific Aim 2, Research Question 2, which tested a broader range of individual variables including the ethnographic decision criteria. Model 3 tested the explanatory value of the following women's individual attributes: marital age, perception of rapid progression of labor, available transportation, intention, and *dai* available in area. Model 4 tested the additional explanatory value of the network variables (i.e., SBA endorsement, density, homogeneity and strength of tie). Models 3 and 4 were compared using the -2 log-likelihood and classification statistics.

Evaluation of adequacy of expected frequencies for the categorical predictors revealed no need to restrict the goodness-of-fit tests (no two-way tables had more than 20% of cells with less than five). The continuous variable (i.e., marital age) met the assumption of linearity of the logit- the interactions between these predictors and their logs were not significant when tested in the model. To assess for multicollinearity, the variance inflation factor (VIF), tolerance statistic and condition index were examined. Residuals were examined to isolate points for which the model fit poorly and isolate points that exerted an undue influence on the model.

H1a*: Women embedded in dense social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.*

Descriptive measures of density and SBA endorsement were calculated for each network sample and compared by place of birth using nonparametric tests. The average network density and SBA endorsement scores were then divided into high and low categories based on the median split. Women's embedded in highly dense networks were used to run a chi-square test between SBA endorsement (binary form) and place of birth. The four groups in the chi-square were women who delivered in the home with either high or low SBA endorsement and women who delivered in a facility either high or low SBA endorsement. Next, a logistic regression model was run to test the interaction between density and SBA endorsement.

H1b: *Women embedded in homogeneous social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.*

Descriptive measures of kinship homogeneity and SBA endorsement were calculated for each network sample and compared by place of birth using nonparametric tests. The average network homogeneity and SBA endorsement scores were then divided into high and low categories based on the median split. Women's embedded in relatively homogenous kinship-based networks were used to run a chi-square test between SBA endorsement (binary form) and place of birth. The four groups in the chi-square were women who delivered in the home with either high or low SBA endorsement and women who delivered in a facility either high or low SBA endorsement. Next, a logistic regression model was run to test the interaction between homogeneity and SBA endorsement.

H1c: *Women embedded in social networks comprised of strong ties (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.*

Descriptive measures of strength of tie and SBA endorsement were calculated for each network sample and compared by place of birth using nonparametric tests. The average network strength of tie and SBA endorsement scores was divided into high and low categories based on

the median split. Women's embedded in networks comprised of relatively strong ties (high strength of tie category) were used to run a chi-square test between SBA endorsement (binary form) and place of birth. The four groups in the chi-square were women who delivered in the home with either high or low SBA endorsement and women who delivered in a facility either high or low SBA endorsement. Next, a logistic regression model was run to test the interaction between strength of tie and SBA endorsement.

Post-Hoc Analysis for Specific Aim One. The significance of SBA endorsement in predicting place of birth prompted an additional analysis. A direct binomial logistic regression model was built and tested using place of birth as the outcome and SBA endorsement as the independent variable. A second direct binomial regression model was built and tested using place of birth as the outcome and SBA endorsement (continuous form) and intention as the independent variables. Furthermore, a SPSS Macro for Simple Mediation was run to determine whether intention mediated the relationship between SBA endorsement and place of birth. A mediator is a third variable that changes the association between an independent variable and an outcome variable (Baron & Kenny, 1986). The mediation effect was tested using three approaches: the Baron and Kenny method, Sobel test, and a bootstrapping sampling distribution. Hayes's macro Version 3.1 for SPSS has the ability to estimate indirect effects when the outcome variables is binary, adds checks for singularities and constants when bootstrapping to reduce matrix inversion errors and implements the Fairchild R-squared measures for indirect effects (Hayes, 2009). The test for a mediator effect was set up as follows: the independent variable or "X" was SBA Endorsement, the outcome variable or "Y" variable was Place of Birth, and the mediator variable or "M" was Intention. Finally, a correlation matrix with all the network variables in their continuous form using Spearman's rho nonparametric correlation test was run to examine the associations between density, strength of tie and homogeneity and SBA endorsement.

Specific Aim 2: To test the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth.

The self-identified decision making criteria were derived from in-depth narratives from the preliminary study. Two analytical approaches were used. First, a logistic regression model was fit using responses generated from the interview to validate the set of decision criteria. Second, the composite EDM model was tested using responses from a select set of questions representing only the criteria used to formulate the model, questions that represented the common reasons identified across all interviews. Outcomes from both analytical approaches were compared and discrepancies explored.

RQ1*: What decision criteria predict the choice to deliver with a SBA (facility delivery) or not with a SBA (home delivery)?*

In preparation for the regression analysis and model development, descriptive and bivariate analysis was performed on the binary decision criteria. Frequencies and percentages were used to summarize the data. Separate chi-square tests were conducted to first determine which of the criteria were significantly associated with place of birth. Fisher's Exact test calculated significance values for criteria with cell counts < 5. Unadjusted odds ratios with 95% confidence intervals were calculated for the likelihood of home delivery.

Eight cases had missing data on one or more of the variables to be tested. Therefore, data from 237 women were available for analysis: 122 women who delivered in the home coded as "0", and 115 women who delivered in a facility coded as "1". For each decision criteria question, the reference group (a "no" response) were coded "0" and the response group (a "yes" response) were coded "1".

A direct binomial logistic regression was used to determine which of the twenty-two dichotomous decision criteria predicted place of birth, controlling for the potentially confounding variables of age, marital age, asset score, parity, education, husband's education, number of antenatal care visits, regular exposure to media and distance to the nearest health facility. In an

analysis using the direct enter procedure all of the predictor variables are entered into the equation simultaneously. The decision criteria included in the model were selected because of their significant association with place of birth at the bivariate level. The covariates were selected because of their significant association with place of birth at the bivariate level or in the case of age, a theoretical significant variable. To assess for multicollinearity in the initial model, the variance inflation factor (VIF), tolerance statistic and condition indices were examined. The VIF indicates whether a predicator has a strong linear relationship with the other predictors, all values should be less than 10 and the average VIF not substantially greater than 1. The tolerance value is the reciprocal of the VIF (1/VIF), tolerance values below 0.2 indicate a potential problem. The condition indices are square roots of the ratios of the largest eigenvalues to individual ith eigenvalues. Conventionally, a condition number greater than 50 (30 to be conservative) indicates significant multicollinearity (Field, 2009, pp. 241-251).

The presence of multicollinearity was established and an evaluation of a pair-wise correlation co-matrix was conducted to determine the source variables. In addition to evaluating the results of the correlation co-matrix, a reevaluation of the binary analysis results for sparse data and separation of groups was conducted. As a result, six variables were omitted: age, husband's education, asset score, belief that home delivery is less expensive than facility delivery, report of having enough time to reach a facility once in labor, and belief that home services are better than facility services.

After omission of the correlated variables a simpler binomial regression model was specified, using the direct entry approach, controlling for the potentially confounding variables of marital age, parity, education, number of antenatal care visits, regular exposure to media and distance to the nearest health facility. Seven decision criteria were placed in the model decision criteria including: worry that facility services cost more than home services, advice from an influential person to stay home, worry about going to facility because of lack of privacy,

availability of a *dai* in the area, intention, perception of rapid progression of labor, and availability of transportation.

To assess for multicollinearity in the simplified model, the variance inflation factor (VIF), tolerance statistic and condition index were examined. Residuals were examined to isolate points for which the model fits poorly and isolate points that exert an undue influence on the model.

Finally, in attempt to develop a more parsimonious model and cross-validate results from the direct method model, a logistic regression with the same set of predictors was repeated using a forward stepwise approach. In this approach, predictors are sequentially added to a constant only model based on the significance of the score statistic. If a predictor is not making a statistically significant contribution to how well the model predicts the outcome it is not added. The entry criterion was set at 0.05.

To assess for multicollinearity in the parsimonious model, the variance inflation factor (VIF), tolerance statistic and condition index were examined. Residuals were examined to isolate points for which the model fits poorly and isolate points that exert an undue influence on the model. A comparison of direct (full) and stepwise (reduced) models based on goodness-of-fit statistics and classification was conducted.

RQ2: *What sequence of discrete decision criteria best predicts the choice to deliver with (at a facility) or without (at home) a SBA?*

The composite ethnographic decision model (EDM) derived in the preliminary phase of the study was tested or validated to determine what sequence of discrete decision criteria best predict a typical women's choice to deliver in a facility or at home.

Responses to the validation questions and actual outcomes were compared to decision predictions by following individual cases down the decision tree and examining the degree to which end points in the tree corresponded to women's own accounts (H. Bernard, 2006). When two or more validation questions were used to test one decision tree criterion, a "yes" response to

any one of the validation questions resulted in a "yes" pathway prediction. Any incongruence was considered an error. Correct predictions and errors were calculated along each path of the tree and summed to determine the predictive accuracy of the model. The predictive accuracy represents the extent to which the model predicted actual decisions. Gladwin's standard for an adequate model was applied. If the decision model successfully predicts 85-90% of the individual choices of those in the model testing sample, it is assumed to be an adequate model (Gladwin, 1989, p. 16). To assess the performance of the model, the percentage of predicted and actual decisions were compared. In addition, measures of correspondence between predicted and actual decisions were corrected for those that could be classified correctly by chance, measuring the proportionate reduction of error. A goodness-of-fit measure, tau, was calculated from the number of cases correctly classified and the expected decisions based on the actual decisions taken (Klecka 1980).

Post-Hoc Analysis for Specific Aim Two. Results from RQ1 and RQ2 prompted an additional analysis. The self-identified decision criteria that potentially influenced women's perceptions of having enough time to reach a facility were explored using a forward stepwise logistic regression approach controlling for the potentially confounding variables of marital age, education and parity. The six potential decision criteria were selected for inclusion in the regression because of their relevance to whether or not women reported having enough time to reach a facility. The variables included: perception of rapid progression of labor (< 3 hours from onset of labor pains), labor starting at night, labor starting when it was raining, waiting more than one hour to inform someone of labor pains, waiting more than one hour for an influential person to make a final decision, and having adequate transportation.

The relevance of having enough time to reach a facility is far greater among women who intend to deliver in a facility as compared to women who intend to deliver at home, among women without complications. Therefore the analysis was conducted on the group of women who intended to deliver in a facility, a subset of the total sample ($n = 184$). Evaluation of adequacy of

expected frequencies for the categorical predictors revealed no need to restrict the goodness-of-fit

tests (no two-way tables had more than 20% of cells with less than 5). The continuous variables

met the assumption of linearity of the logit-the interactions between these predictors and their

logs were not significant when tested in the model. The interaction of rapid progression of labor

and adequate transportation was not significant. There were no indicators of multicollinearity.

After examination of the residuals, all the original data were retained.

Protection of Human Subjects

During fieldwork ethical considerations were taken into account and multiple standards

were used in order to protect participants in the study. Participation in the study was voluntary

and participants could refuse to answer any or all of the questions without consequences to

themselves, their families or community. Provision of health services provided by ICDDR,B were

assured regardless of participation in the study. Participants were assured that any information

obtained from the instrument would be kept confidential and their names or the names of their

network members would not be associated with the data. Participation in the study posed no

greater than minimal risk. There were no known financial, legal or social risks to participants.

There were known adverse affects on the rights and welfare of participants. Potential risks

include the inconvenience of time and fatigue during the interview. The timing and pace of the

interview was adjusted with the activities of the women so that data collection did not interfere

with their *dai*ly household chores. Interviewers reviewed the informed consent protocol,

answered any questions, and obtained their verbal informed consent to participate in the audio-

recorded interview. Verbal informed consent was obtained prior to the interview. In-laws and

other relatives were often informed of the study as well so they would not become curious or

suspicious and in turn distracting during the interview. Informed consent followed the Emory

University IRB for the Protection of Human Subjects approved form. Each interviewee signed

the form documenting that verbal consent by the participant was given. The study protocol and

consent forms were approved by Emory University IRB and ICDDR,B ERC. A copy of the

English version of the consent form is provided in Appendix E.

To protect the privacy and confidentiality of all study participants after data collection

data were coded rather than using participant names; participant names and signed consent forms

were stored separately from the data; data were stored in locked files and on a password protected

computer that was only accessible to the PI. No names or other identifying information was used

when reporting or publishing the data.

<div align="center">**Assumptions, Challenges and Limitations**</div>

Assumptions

The assumptions of this study derive from the conceptual and analytical models, the

Network-Episode Model (NEM), social network analysis, and Ethnographic Decision Modeling

(EDM). As described in Chapter 1, the assumptions underlying the NEM include that 1) all

societies hold a vast reserve of people who can be and are consulted during a health/illness

episode, 2) bounded rationality rather than economic rationality underlies decision making

(Garro, 1998a, 1998b; Kincaid, 2004; Williamson, 2000), 3) the process of decision-making for

individuals is dynamic, including the dimensions of time and space, and 4) the mechanism

underlying the decision making process is interaction in social networks. That is, people through

their social networks recognize need for services, provide information about access and options

for care, and mobilize support to facilitate or constrain movement toward use of formal or

traditional services (Pescosolido, 1991).

The EDM assumes decision makers themselves are the experts on how they make

decisions and that people have the ability to report on real life decisions in terms of alternatives

evaluated, dimensions of contrast and sequencing of comparisons. The EDM provides insights

into cognitive decision processes embedded in the structure of social network, effectively

combining structural and individual influences on the decision process. In the construction of the

decision models it is assumed that all women have some concern or uncertainty about their safety

and survival during childbirth and that all women in the Matlab Services Research Area are advised by CHRWs to plan to use a facility for delivery.

The assumptions of social network analysis are similar to the above stated EDM assumptions and include that 1) social phenomena cannot be solely understood by individual characteristics, 2) social networks affect perceptions, beliefs and actions through a variety of structural mechanisms that are socially constructed by relations among individuals, and 3) social networks reflect dynamic processes.

With regards to the main analytical method employed, binary logistic regression, several assumptions and considerations are necessary. First, a dichotomous dependent is assumed (the independents can be of any type). Second, the assumption of linearity in logistic regression assumes that there is a linear relationship between any continuous variables and the logit of the outcome variable. Third, there is independence of errors meaning that cases of data are not related. Fourth, predictors are not highly correlated. Fifth, sampling adequacy is needed, meaning that for cells formed by the categorical independents, all cell frequencies are ≥ 1 and no more than 20% of cells are < 5. Finally, proper specification of the model is assumed, meaning inclusion of all relevant variables and exclusion of all irrelevant variables (Tabachinick & Fidell, 2007).

Important to note as a final assumption, the study context and thus the study outcome reflect an implicit bias towards Western-style medical care or SBA care in a health facility.

Challenges and Limitations

Several challenges and limitations were relevant to the conduct of this study. These included: lack of previously validated and reliable measures; inherent limitations of a retrospective cross-sectional design; validity of the survey instruments; measurement error; respondent burden; use of self-report and sample size. These are described, below.

First, previous studies, both qualitative and quantitative, in Matlab have addressed determinants of facility deliveries or use of a SBA. However, no ego network studies were found

that examined the relationship of social network characteristics and use of SBAs. The lack of

culturally relevant network studies was a challenge because of the subsequent lack of reliable

measures to determine who the influential people in a women's network are and to assess the

subjective norms of SBA use among them. To address this challenge the preliminary study pre-

tested measures of SBA endorsement and strength of tie. Modified versions of these measures

were then used in the main study.

Second, cross-sectional designs are based on observations at one point in time and thus

lack control over exposure to the independent variable. These designs prohibit 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. Another limitation of the design is the inability for

the data collected at one point in time to capture the inherently dynamic process of social

influence that shape social networks. One way to improve the ability of cross-sectional studies to

yield dynamic data is to take repeated measures over time. However, the effects of social

influence are not necessarily linear and additive and thus even repeated measures overtime are

unable to capture dynamic processes such as feedback loops and the rise of emergent effects

when multiple sources and targets of influence interact over time (Mason, Conrey, & Smith,

2007). More recent multi-theoretical multi level models and longitudinal network studies are

attempting to do this.

Third, validity of the survey instruments was another challenge. Validity of an instrument

means that it measures what it is designed to measure (Spector, 1981). Two sources of

nonrandom error threaten the validity of survey tools in cross-cultural contexts: the failure to

recognize that information is contextually based; and cultural reinterpretation where the

interviewer's question is constructed from a cultural frame of reference different from that of the

respondent. Using accurate language/terminology in the interview instrument and understanding the meaning of terms in the local context reduced this source of error. In the preliminary study, particular quotation and terminology was kept verbatim along with the English translation to help keep the cultural connotations intact. The input of social scientists native to Bangladeshi culture, use of native speakers as interviewers, professional translation and transcription, daily debriefing with the interviewers and pre-testing of the instrument contributed to validity and presumably a reduction in errors.

Fourth, the uses of retrospective accounts were potential sources of error in this study. Retrospective accounts of social networks and decision-making events during childbirth are prone to informant bias. Informant bias is the discrepancy between self-reported and actual behaviors (Knoke & Yang, 2008, p. 35). The retrospective design calls for participants to recall behavior and complex dimensions of relationships during a particular time period. Information possessing abilities are limited and some people can not cognitively handle the large amount of data required to report their behavior (R. Bernard, Killworth, Sailer, & Kronfield, 1984). Researchers have found 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 (R. Bernard & Killworth, 1977; R. Bernard, Killworth, & Sailer, 1981; R. Bernard, et al., 1984). Inaccuracies take two forms: forgetting persons with whom they have interacted and falsely recalling interactions that never occurred (Freeman, Romney, & Freeman, 1987). Informants tend to forget infrequent or weak ties and falsely recall frequent or strong ties. Also, egocentric network studies are vulnerable to missing data because people often fail to describe ties among their nominated alters or are not asked about them in such as way as to fully capture the network structure (McCarty, Killworth, & Rennell, 2007). Missing relations among alters tend to be weak ties (Burt, 1987). People do tend to remember long term or typical patterns of interaction with people rather well (Freeman, et al., 1987). Familiarity with the interview topic (Romney & Weller, 1984; Romney, Weller, & Batchelder, 1986) and provision of recall aid to informants during

interviews can facilitate informant recall (R. Bernard, et al., 1984). People are also better at remembering events that occur recently rather than those in the distant path (McKinley, 1972). Some research suggests that long term maternal recall of pregnancy related events is both reproducible and accurate, including mode of delivery, onset of labor, arrival at the hospital and actions of others (Githens, Glass, Sloan, & Entman, 1993; Quigley, Hockley, & Davidson, 2007; Simkin, 1992; Tomeo, et al., 1999).

The subject matter of childbirth and the kinship structures of women in Matlab defend this study against threats to informant bias to some extent. Childbirth is a salient event in the lives of women and the central social structure in the area primarily consist of strong tie relations. Methods to enhance accuracy and completeness were implemented. First, interviewers were trained using a semi-structured interview approach to allow for semantic cues, clarification of ambiguous responses and answers to respondents questions. Second, the interval of recall was limited to three months. Third, self-reported socio-demographic, obstetric history and outcome variables were verified with the Matlab Service Area program records.

Fifth, cognitive burden is another challenge associated with nearly all social network studies. Respondents must report data on their own relationships to alters, linkages between alters and provide a proxy report on characteristics of alters. Providing this information about a series of alters can be repetitive, tedious and time consuming (Carrington, Scott, & Wasserman, 2005). A respondent evaluating all possible alter-alter ties, in a network of 10 alters will require 45 evaluations (McCarty, et al., 2007). In the present study, women evaluated all possible alter-alter ties in networks of 15 alters, requiring 105 evaluations. The main daily complaint of the respondents and interviewers alike was the repetitive nature of the questioning. To reduce the complexity, the instrument was administered face-to-face initially using one free recall name generator. Respondents were asked name interpreter questions on only a subset of alters, alters who exchanged social support with the women during pregnancy and childbirth as established in the preliminary phase of this study. The questions were asked *by alters* (questions were asked

about each alter going from alter to alter until the end of the list of alters is reached), as recent studies have found higher reliability and validity with this method as compared to *by question*. Interviewers were trained in non-specific probes for additional alters especially those outside of the women's household such as community health research workers and neighbors.

Sixth, a major weakness in the study is the dependency on women's self-reports to document their decision process, to identify their network members, and to document their network members' attitudes regarding SBA use. All self-reported data are subject to variation resulting from the specific time questions are asked, respondent's mood, mental state, memory and relationship to the interviewer. There are further challenges with regard to the EDM assumption that people have the ability to report on real life decisions in terms of alternatives evaluated, dimensions of contrast and sequencing of comparisons. One such challenge is that decisions made routinely become pre-attentive plans or scripts and are thus not easily brought to the level of consciousness (Gladwin, 1989). Yet, decisions about place of birth during childbirth are not routine and may occur only two to three times on average in a women's lifetime in Bangladesh (given the current fertility rate), unlikely to become routinized into a script. However, evidence from the field of cognitive psychology does suggest that individuals do not have access to higher order mental processes involved in the evaluation, problem solving and initiation of behavior (Nisbett & Decamp-Willson, 1977). People's reports may not reflect the process of thinking but the result of their thinking (Nisbett & Decamp-Willson, 1977). This evidence casts doubt on people's ability to report directly on the workings of their own cognitive processes much less the coordinated mental activity of others involved in the decision, calling into question the validity of women's perceptions of their network alters opinions of SBA use.

Brewer found that respondent's recall alters in social clusters based on foci of activity such as family, workplaces and neighbors. Aiding respondent recall with reminders of such foci might encourage more complete recall (Brewer 1995, Fled 1981). Ryan, however, points out that aided recall has not been shown to specifically reduce errors in recall rather to increase the

amount of recall. He suggests, "more recall seems better than less because if patterns exist, they are likely to emerge from more data" (G. Ryan, 1998, p. 214). A disadvantage of training interviewers in aided recall is the subsequent variability in the extent of probing by interviewers resulting in interviewer effects on the network size and subsequent measures (Carrington, et al., 2005). Careful training to ensure a level of standardization in probing was conducted during the initial training and ongoing quality control efforts. However, flexibility in interviewing technique was encouraged to ensure the respondent's ability to understand and respond. Research officers were instructed to build on and consider responses provided in previous sections of the interview to check for consistency and clarify responses.

In the present study, the social network content characteristic is defined as the ideology (attitudes and opinions) of a women's personal network toward the decision task, measured by the positive or negative endorsement of a SBA in childbirth. The measurement is based on a woman's perceptions of her network member's (alters) opinions and behaviors rather than on reports by alters themselves. Thus, the measure is subject to a phenomenon known as "the false consensus effect", whereby people tend to assume others think and behave more like them then they actually do, overestimating the degree to which their own behavior, attitudes, beliefs are shared by other people (Ross, Greene, & House, 1977). Arnett argues that spurious correlations between peer influence and adolescent smoking initiation, documented in numerous correlational and longitudinal studies, have resulted in the widespread belief that peer influence is the primary cause of adolescent smoking behavior (2007). Studies that use adolescent reports of the smoking behavior of their friends, tend to exaggerate the similarity between the adolescent behavior and their friends behavior (the false consensus effect) (Arnett, 2007). Arnett also attributes the spurious findings to selective association, homophily or the tendency for people to choose one another as friends based on similarities (2007). While selective association does not likely operate on women's kinship networks in Bangladesh since these networks are inherited and not chosen, concerns about the accuracy of proxy measures and the subsequent inferences on the impact of

social processes on the decision to use a SBA are a major concern. Verification of the women's perception of her network member's advice and behavior from the perspective of nominated alters would enhance the reliability of the data, using ego-centered networks occupying two zones. Practical and resource considerations precluded using a two-zone design. However, selective verification of nominated alters would have enhanced the validity of the data. Alternative approaches used to assess reliability include test-retest comparison and alternative question formats.

Finally, the size of the sample did not permit analyzing the data more proficiently for some of the variables due to small cell frequencies. The assumption of proper specification in a logistic regression model was violated as several potentially relevant variables (i.e., belief that health facilities had poor quality services, having accompaniment to a facility and belief that home services were not better than facility services) were excluded due to lack of sample adequacy.

Summary

The existing body of literature indicates that social network characteristics likely influence the place of delivery to a greater extent than individual characteristics among women who experienced an uncomplicated childbirth in Matlab, Bangladesh. This descriptive, exploratory, retrospective cross-sectional study was designed to test the applicability of the NEM, including Ethnographic Decision Tree Modeling, in a wellness context by determining the relative influence of women's social network characteristics on a health care utilization decision in childbirth and by assessing the predictive value of specific decision criteria on the outcome.

The study was completed in two phases: a preliminary phase and a main study phase. A purposive community based sample of women 18-49 years of age who experienced an uncomplicated birth within three months of the interview were recruited to participate. In depth and structured interviewers by Bangladeshi research officers affiliated with ICDDR,B and the CRMNS at Emory University School of Nursing were conducted. Social network analysis and

ethnographic decision tree modeling were the analytically techniques employed. Decision

modeling, correlation and regression analysis were used. The results of the preliminary and main

study phases are presented in the next Chapter.

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Chapter 4

RESULTS

The purpose of chapter four is to report the results of the data analyses for the preliminary and main study phases. The results for each research question and hypotheses are presented along with the results from pertinent post-hoc analyses. Significant and non-significant findings are included. Data are displayed in Tables 4.1 - 4.15 and Figures 4.1 - 4.3. The chapter begins with the preliminary phase results followed by the main phase results and concludes with a summary.

Preliminary Study Phase Data Analysis

This section reports results of the preliminary study phase.

Social and Demographic Characteristics of Participants

The preliminary study sample ($N = 25$) included 12 home deliveries and 13 facility deliveries. Of those who gave birth in a facility, 100% ($n = 13$) delivered at an ICDDR,B sub-center or Matlab hospital. Of the 12 women who delivered at home, 6 delivered in their marital home, 5 in their natal home and 1 in her nuclear home. Of the natal home deliveries, 4 were first births and 1 was a second birth. Table 4.1 displays the characteristics of the study sample. Participants' ages ranged from 18 to 39 (mean $\pm$ *SD*, 25.7 $\pm$ 6.6) years. All were married. The majority was Muslim (92%) with a Hindu minority (8%). The average parity for the sample was 2.4 ($\pm$ 1.3, Range 1-6). The parity distribution was as follows: 32% para 1, 28% para 2, 20% para 3, 12% para 4 and 8% para 5-6. The average number of years of school attended was 6 ($\pm$ 4); 20% attended between 1-5 grades, 56% attended between 6-10 grades and 1 women (4%) completed the twelfth grade. In response to a question about how well the respondent could read or write 12 (48%) responded with ease, 6 (24%) with difficulty and 7 (28%) not at all. Over half of women (52%) reported that they were not regularly exposed to the media (e.g., watch television or listen to the radio at least once a week). Asset scores, a proxy for socioeconomic

status, ranged from 1-5 with 1 being the lowest wealth quintile and 5 being the highest. The average asset score was 3.3 (*SD* 1.4); 12% were in the lowest quintile, 20% in the second quintile, 20% in the third quintile, 28% in the third quintile and 20% were in the highest quintile The mean household size was 7.8 (*SD* 2.5). Husbands were the head of the household in 11 cases, father-in-laws in 9 cases, and fathers in 3 cases. Two women indicated "other" for household head. In one such case the woman's brother-in-law was the head of the household. Her husband spent most of his time in another village where he had a medicine shop. In the second case the mother-in-law was the head of the household because the father-in-law was deceased and the husband was working abroad.

Table 4.1

Descriptive Characteristics of the Preliminary Study Sample

Characteristic (n/%)	Total Sample (N = 25)	Home Delivery (n = 12)	Facility Delivery (n = 13)
Age (years)[a]			
18-21	8 (32%)	5 (41.7%)	3 (23.1%)
22-25	5 (20%)	2 (16.7%)	3 (23.1%)
26-29	4 (16%)	3 (25.0%)	1 (7.7%)
≥ 30	7 (28%)	2 (16.7%)	5 (38.5%)
Parity			
1	8 (32%)	7 (58.3%)	1 (7.7%)
2	5 (28%)	2 (16.7%)	5 (38.5%)
3	3 (20%)	2 (16.7%)	3 (23.1%)
≥ 4	8 (8%)	1 (8.3%)	4 (23.1%)
Education Attainment			
Never attended	5 (20%)	2 (16.7%)	3 (23.1%)
1-5 grades (primary)	5 (20%)	2 (16.7%)	3 (23.1%)
6-10 grades (secondary)	14 (56%)	7 (58.3%)	7 (53.8%)
11-12 grades	1 (4%)	1 (8.3%)	0 --
Literacy			
Easily	12 (48%)	7 (58.3%)	5 (38.5%)
With difficulty	6 (24%)	3 (25.0%)	3 (23.1%)
Not at all	7 (28%)	2 (16.7%)	5 (38.5%)
Regular Exposure to Media			
Yes	12 (48%)	5 (41.7%)	7 (53.8%)
No	13 (52%)	7 (58.3%)	6 (46.2%)
Religion			
Muslim	23 (92%)	11 (91.7%)	12 (92.3%)
Hindu	2 (8%)	1 (8.3%)	1 (7.7%)
Asset Score			
1 (lowest)	3 (12%)	2 (16.7%)	1 (7.7%)
2	5 (20%)	1 (8.3%)	4 (30.8%)
3	5 (20%)	2 (16.7%)	3 (23.1%)
4	7 (28%)	5 (41.7%)	2 (15.4%)
5 (highest)	5 (20%)	2 (16.7%)	3 (23.1%)
Type of Household			
Marital	18 (72%)	8 (66.7%)	10 (76.9%)
Nuclear	5 (20%)	2 (16.7%)	3 (23.1%)
Natal	2 (8%)	2 (16.7%)	0 --

Note. [a]1 missing case

Results for Preliminary Study Aim 1

This section reports the results for preliminary study aim one, which sought to identify and document the decision criteria used when making birth attendant decisions for routine childbirth in the form of an Ethnographic Decision Tree model.

The decision to use a SBA in childbirth is a complex process involving decision rules, goals and roles of a woman and her social network members. The decision is also a non-linear, process that changes over the course of the pregnancy up to the point of labor. This made discerning the appropriate time (in relation to decision criterion) to initiate the decision model challenging. In addition, framing of the decision, the alternatives, and the stages of the decision process had to be consistent across the sample. The final decision (use or non-use of a facility for childbirth) was modeled according to two separate decision phases. Gladwin suggests that related decisions in a time series be identified and the logical ordering modeled (Gladwin, 1989). The first stage modeled the decision to have a birth plan to delivery in a facility ("plan-to-go" model). The second stage modeled the decision to use a facility ("actual-go" model). These two stages anchor the models in specific time periods, the first during pregnancy and the second in the time from initiation of labor through delivery. The criteria for both phases represent the considerations and constraints individuals described in "choosing" to deliver at home or at a facility. Each criterion represents a reduced and concise summary of the perceived factors and constraints considered in the decision-making process.

Analyses of the narratives revealed that women moved back and forth between a discussion of their intention, their social network member's preferences, actual preparations made (if any) and events that occurred once labor was recognized. A multi-stage model provided the best fit to the woman's narratives about the decision process. It is reasonable to assume that based on the physiological duration of pregnancy, women can anticipate childbirth (during a 9 month gestation) and therefore develop a preference or intention about where and with whom to deliver. Furthermore, women go into labor after a predictable duration of pregnancy (38-42

weeks) in the case of normal delivery. So, the phases correspond to both the way women talk about their experience and to the biological sequence of pregnancy and childbirth.

The first phase modeled the decision to have a birth plan to deliver in a facility. For example, during pregnancy women either had a plan, preference or intention to go to a facility or did not (or only had a plan in the event of complications). Figure F.1 in Appendix F represents the composite decision tree based on a sequence of decision criteria for the first phase. Participants consistently described the following major decision criteria for the first phase of the decision: 1) cost 2) influential advice 3) birth support 4) beliefs and fears and, 5) family support during pregnancy.

Whether or not women actually followed their plan or intention is a behavior that logically follows the first phase. The second phase modeled the decision to actually use a facility. During labor, facility use for delivery either occurred or did not occur. Figure F.2 in Appendix F represents the composite decision tree based on a sequence of decision criteria for the second phase. Participants consistently described the following major decision criteria for the second phase of the decision: 1) intention 2) presence or absence of perceived complications 3) time (perception of not enough time) 4) transportation, 5) family support during labor, and 6) compliance with referrals (if any).

Results for Preliminary Study Aim 2

This section reports the results for preliminary study aim two to identify and document involvement of social network members in the decision-making process. The assumption was that supportive relations are likely involved and influential in the decision process.

A total of 19 unique relations were perceived as sources of support. The average number of supportive relations mentioned was 9.96 (*SD* 1.9, Range 6-15). All of the relations were described using descriptive kin terminology, with two exceptions, community health research workers (CHRWs) and neighbors. Overall the most frequently mentioned supportive female kinship relations were: mother, sister, mother-in-law, husband's sister, husband's

brother's/cousin's wives and husband's uncle's wives. In the Bangladeshi context, husband's brother's/cousins wives are referred to as *jals,* a kinship term that translates into sister-in-law. The most frequently mentioned supportive male kinship relations were husband, father and father-in-law. The two most frequently mentioned supportive non-kin relations were: community health research workers (CHRWs) and neighbors. CHRWs are employed by ICDDR,B and visit households bimonthly in their assigned areas to collect demographic data and to provide health promotion and preventive services. The mean number of supportive relations that were trusted regarding information and advise about pregnancy and labor and delivery was 6 (*SD* 1.5, Range 3-9).

Women perceived nine distinct types of support provided to them during their pregnancy and delivery period. These include: practical help with routine activities, information and advice, emotional support and assurance, provision of monetary and material goods, logistic communication, prayer and spiritual rituals, nutritional support, and accompaniment. Specific examples of each type are presented in Table 4.2. The four most frequently mentioned support categories in rank order were 1) provided practical help with routine activities, 2) provided information/advice/suggestions, 3) gave emotional support and assurance, and 4) provided monetary and material goods.

Table 4.2

Types of Support with Examples Perceived by Pregnant Women in Matlab, Bangladesh

Type of Support	Examples
Practical Help with Routine Activities	Milked cows, prepared fishes
	Cleaned and strained the rice
	"Brought water from tubewell for cooking in the big pots"
	Fed other children
	Washed cloths
	Went to market when husband not home
	Helped with heavy work during harvest season, husking paddy
	Made fire for cooking
Information and Advice	"Do not go to roof to hang cloths"
	"When ill take rest"
	"Give prayer five times a day"
	"Take food properly"
	"Do not work with cold water"
	"Do not stay in field at night because of evil spirits"
	"Keep a match with you when you go out at night"
	"Call husband to do the heavy work"
	"Abide by father-in-law and mother-in-law, words they say"
Emotional Support and Assurance	"Do not worry" "*Chinta koro ha*"
	Inquired about how she is feeling
	"Do not be tense"
	Gossiped
	"If you have a problem I will go with you to facility"
	Talked with her when she feels unsure
	Massaged body with mustard oil
	Tell me if you have any physical problems, inform of discomfort or changes
Monetary and Material Goods	Paid for urine test to confirm pregnancy
	Bought and delivered medications
	Paid rickshaw fare to clinic
	Paid costs for antenatal care
	Paid *kobiraj* for amulets and rituals
	Saved money in case of complication
Logistic Communication	Went out to locate *dai*
	Informed others in household of pregnancy and labor pains
	Phoned mother to come to marital home when labor started
	Went to find rickshaw puller or country boatman
Prayer and Spiritual Rituals	Gave holy blow and gave blessed water
	Brought amulets from *kobiraj*
	Brought blessed molasses to increase labor pains
Nutritional Support	Gave milk and tea during labor pains
	Brought special foods from *bazzar* upon request such as grapes and guavas
	Made foods she likes when sick
Accompaniment	Accompanied and assisted with bathing in pond
	Accompanied at night to latrine
	Accompanied to facility or met at facility
	Stayed at facility during labor

Main Study Phase Data Analysis

This section reports on the results from the main study phase.

Social and Demographic Characteristics of Participants

The main study sample included 124 home deliveries and 122 facility deliveries. Of those who gave birth in a facility, 25% (n = 29) delivered at one of four sub-centers, 74% (n = 91) delivered at Matlab hospital and 1.5% (n = 2) delivered at private facilities. Characteristics of the sample are reported in Table 4.3. Participants' ages ranged from 18-43 (mean $\pm$ SD, 24.7 $\pm$ 5.1) years. Nearly all (99%) were currently married with a mean marital age of 17 ($\pm$ 2.5, Range 12-28) years. Almost all (90%) of the women's marriages had been arranged and resulted in relocation to the husband's residence (94%). The sample had an average parity of 2.2 ($\pm$ 1.1), 34.3% of women were para 1 (indicating the index birth was a women's first birth), 29.8% were para 2, 23.3% were para 3 and 12.7% were $\geq$ para 4.

The majority of the women were Muslim (88%) and the rest were Hindu (12%). The average asset quintile, a proxy measure of wealth, was 3 ($\pm$ 1.4), 17.8% were in the lowest wealth quintile, 20.7% were in the second quintile, 19.9% were in the third quintile, 22.0% were in the fourth quintile and 19.5% were in the highest wealth quintile. Their husbands had completed on average 6.7 ($\pm$ 4.4) grades and 73% had completed at least a primary education. Their fathers had completed on average 4.4 ($\pm$ 4.2) grades and only 48% had completed at least a primary education. The women, on the other hand, had completed on average 6.6 ($\pm$ 3.4) grades; 25.3% completed 1-5 grades, 54.7% 6-10 grades and 7.8% 11-14 grades. Still, 12.2% reported never attending school and 15% of women reported not being able to read or write a letter (i.e., literacy). Moreover, over half of women (57.3%) reported that they were not regularly exposed to the media (e.g., watch television or listen to the radio at least once a week). The majority (87.3%) were housewives and the rest were students (6.9%). Only 2 women (0.8%) worked outside the home, one as a shop assistant and the other as a teacher at a government school.

The number of usual household members (respondent excluded) during pregnancy ranged from 1 to 16 (mean $\pm$ *SD* = 5 $\pm$ 2.1). The number of households in each *bari* ranged from 1-10 (mean $\pm$ *SD* = 4 $\pm$ 2.8). Husbands were considered the household head in 49% of cases and in-laws in 22% of cases. In the majority of cases (61%) husband's kin lived in the respondent's *bari*. Nearly half (48%) of respondent's husbands worked outside the rural Matlab Upazilla during their pregnancy, 15% worked abroad and 20% in a city of which 15% worked in Dhaka.

During the most recent pregnancy 55% of respondent's lived in their marital home, 31% in their nuclear home and 14% in their natal home. The majority (75%) reported living with their mother-in-law (MIL) during pregnancy, indicating their MIL lived in their marital home or within the bari where their nuclear home was located. At the time of labor and delivery, the proportion of women residing in their marital home decreased to from 55% to 43% and the proportion residing in their natal home increased from 14% to 28%. Of those who resided in their natal home at the time of labor and delivery, 44% were first births. The proportion residing in their natal home at the time of labor and delivery decreased as birth order increased (44% para 1, 23% para 2, 19% para 3 and 12% para 4). Among all women, 91%, spent at least some time in their natal home during their pregnancy. The linear distance from a respondent's household to the nearest ICDDR,B health facility ranged from .09 to 5.25 (mean $\pm$ *SD*, 1.9 $\pm$ 1.0) km. Close to 20% lived $\leq$ 1 km away, 32.5% lived 1.1-2.0 km away, 26% lived 2.1-3.0 km away, and 9.3% lived $\geq$ 3.1 km away from the nearest ICDDR,B health facility. In 12.6% (n = 21) of cases distance was not available in the geographic information system.

Table 4.3

Descriptive Characteristics of the Main Study Sample

Sample Characteristic	Total Sample ($N = 246$)	Home Delivery ($n = 124$)	Facility Delivery ($n = 122$)	p value
Age (mean (*SD*); years)[a]	24.68 (5.1)	24.83 (5.0)	24.53 (5.3)	.47
Age (n/%; years)				
18-21	85 (34.7%)	38 (30.9%)	47 (38.5%)	--
22-25	67 (27.3%)	34 (27.6%)	33 (27.0%)	
26-29	45 (18.4%)	26 (20.3%)	19 (15.6%)	
≥ 30	48 (19.6%)	25 (20.3%)	23 (18.9%)	
Parity (mean (*SD*); birth number)[a]	2.19 (1.1)	2.32 (1.1)	2.06 (1.1)	.037*
Parity (n/%)				
1	84 (34.3%)	34 (24.7%)	50 (41%)	--
2	73 (29.8%)	38 (30.9%)	35 (28.7%)	
3	57 (23.3%)	36 (29.3%)	21 (17.2%)	
≥ 4	31 (12.7%)	15 (12.2%)	16 (13.1%)	
No. Living Children (mean (*SD*))[a]	2.09 (1.1)	2.23 (1.1)	1.95 (1.1)	.019*
Marital Age (mean (*SD*); years)[a]	17.29 (2.5)	16.67 (1.9)	17.91 (2.8)	.001*
Marital Age (n/%; years)				
<15	30 (12.2%)	15 (12.2%)	15 (12.3%)	--
15-18	158 (56.3%)	91 (74.0%)	67 (54.9%)	
18-21	45 (18.4%)	17 (13.8%)	28 (23.0%)	
22-25	12 (4.9%)	-	12 (9.8%)	
Marital Status				
Married	244 (99.2%)	124 (100%)	120 (98.4%)	--
Widowed	1 (0.4%)	--	1 (0.8%)	
Deserted	1 (0.4%)	--	1 (0.8%)	
Type of Marriage (n/%)[b]				
Arranged	228 (92.7%)	119 (96%)	109 (89.3%)	.054
Love	18 (7.3%)	5 (4%)	13 (10.7%)	
Religion (n/%)[b]				
Muslim	216 (87.8%)	109(87.9%)	107 (87.7%)	.962
Hindu	30 (12.2%)	15 (12.1%)	15 (12.3%)	
Education (mean (*SD*); grade completed)[a,†]	6.56 (3.4)	5.90 (3.4)	7.24 (3.4)	.001*
Education (n/%); grade completed)[a,†]				
Never attended	30 (12.2%)	18 (14.6%)	12 (9.8%)	--
1-5 years	62 (25.3%)	37 (30.1%)	25 (20.5%)	
6-10 years	134 (54.7%)	63 (51.2%)	71 (58.2%)	
11-14 years	19 (7.8%)	5 (4.1%)	14 (11.5%)	
Literacy (n/%)[b]				
Easily	168 (68.3%)	76 (61.3%)	92 (75.4%)	.067
With difficulty	40 (16.3%)	24 (19.4%)	16 (13.1%)	
Not at all	38 (15.4%)	24 (19.4%)	14 (11.5%)	

Sample Characteristic	Total Sample (N = 246)	Home Delivery (n = 124)	Facility Delivery (n = 122)	p value
Husband Education (mean (SD); grade completed)[a]	6.67 (4.4)	5.61 (4.3)	7.75 (4.3)	.000*
Father Education (mean (SD); grade completed)[a]	4.11 (4.2)	3.58 (3.9)	4.68 (4.3)	.053
Asset Score (mean (SD); quintle)[a]	3.1 (1.4)	2.82 (1.4)	3.28 (1.4)	.011*
Asset Score (n/%)				
1 (lowest)	43 (17.8%)	29 (23.6%)	14 (11.8%)	--
2	50 (20.7%)	25 (20.3%)	25 (21.0%)	
3	48 (19.9%)	25 (20.3%)	23 (19.3%)	
4	53 (22.0%)	25 (20.3%)	28 (23.5%)	
5 (highest)	47 (19.5%)	18 (14.6%)	29 (24.4%)	
Regular Exposure to Media (n/%)[b]				
Yes	105 (42.7%)	45 (36.3%)	60 (49.2%)	.039*
No	141 (57.3%)	79 (63.7%)	62 (50.8%)	
Head of Household (n/%)[b]				
Husband	121 (49.2%)	68 (54.8%)	53 (43.4%)	.434
Father-In-Law	56 (22.8%)	25 (20.2%)	31 (25.4%)	
Mother-In-Law	23 (9.3%)	4 (3.2%)	9 (7.4%)	
Respondent	19 (7.7%)	10 (8.1%)	13 (10.7%)	
Father	13 (5.3%)	10 (8.1%)	9 (7.4%)	
Other	17 (5.7%)	7 (5.6%)	7 (5.7%)	
No. Usual Household Members (mean (SD))[a]	4.96 (2.1)	4.91 (2.1)	5.02 (2.1)	.685
No. Number of Households in Bari (mean (SD))[a]	4.17 (2.8)	4.31 (2.8)	4.03 (2.7)	.488
Relocated to Husband's Home After Marriage (n/%)[b]				
Yes	230 (93.5%)	114 (91.9%)	116 (95.1%)	.317
No	16 (6.5%)	10 (8.1%)	6 (4.9%)	
Ever-Use Facility[a]				
Yes	121 (49.4%)	58 (25.8%)	63 (51.6%)	.524
No	124 (50.6%)	65 (52.8%)	59 (48.4%)	
Antenatal Care (mean (SD); encounters)[a]	3.35 (0.92)	3.24 (.97)	3.47 (.87)	.022*
Antenatal Care (n/%; encounters)				
None	5 (2.0%)	3 (2.4%)	2 (1.6%)	--
1	7 (2.9%)	4 (3.3%)	3 (2.5%)	
2	19 (7.8%)	10 (8.1%)	9 (7.4%)	
3	76 (31.0%)	46 (37.4%)	30 (24.6%)	
4	138 (56.3%)	60 (48.8%)	78 (63.9%)	
HBLSS Exposure (mean (SD); classes attended)[a]	3.37 (1.09)	3.50 (1.0)	3.23 (1.2)	.019*
Residence During Pregnancy (n/%)[b]				
Marital	134 (54.5%)	70 (56.5%)	64 (52.5%)	.077
Nuclear	78 (31.7%)	43 (34.7%)	35 (28.7%)	
Natal	34 (13.8%)	11 (8.9%)	23 (18.9%)	

Sample Characteristic	Total Sample ($N = 246$)	Home Delivery ($n = 124$)	Facility Delivery ($n = 122$)	p value
Lived with Mother-in-Law During Pregnancy (n/%)[b]				
Yes	185 (75.2%)	96 (77.4%)	89 (73.0%)	.417
No	61 (24.8%)	28 (22.6%)	33 (27.0%)	
Time Spent with Natal Kin During Pregnancy (n/%)[b]	224 (91.1%)	111(89.5%)	113 (92.6%)	
Yes	22 (8.9%)	13 (10.5%)	9 (7.4%)	.393
No				
Residence During Delivery (n/%)[b]				
Marital	105 (42.7%)	49 (39.5%)	56 (45.9%)	.495
Nuclear	73 (29.7%)	37 (29.8%)	36 (29.5%)	
Natal	68 (27.6%)	38 (30.6%)	30 (24.6%)	
Husband Place of Work During Pregnancy (n/%)[b]				
Matlab Upazilla	127 (51.6%)	67 (54.0%)	127 (51.6%)	.386
City (in country)	49 (19.9%)	26 (21.0%)	49 (19.9%)	
Abroad (out of country)	37 (15.0%)	19 (15.3%)	37 (15.0%)	
Other Upazilla	33 (13.4%)	12 (9.7%)	33 (13.4%)	
Distance (km) from Nearest ICDDR,B Health Facility (n/%)[c]				
≤ 1	48 (19.5%)	12 (9.7%)	36 (29.5%)	.000*
1.1-2.0	80 (32.5%)	46 (37.1%)	34 (27.9%)	
2.1-3.0	64 (26.0%)	40 (32.3%)	24 (19.7%)	
≥ 3.1	23 (9.3%)	14 (11.3%)	9 (7.4%)	
unknown	31 (12.6%)	12 (9.7%)	19 (15.6%)	

Note. * significance levels for differences between home and facility delivery groups. [a] *p* value calculated by Mann-Whitney U [b] *p* value calculated by chi-square [c] *p* value calculated by point-biserial correlation [†]1 case missing

The samples for the preliminary and main study phases were comparable. Mann-Whitney U tests were conducted to test group comparisons. The samples did not significantly differ with regard to age ($p = .581$), education ($p = .273$), parity ($p = .767$) and asset score ($p = .338$). Furthermore, the distributions for marital status and religion were alike. This data establishes that the sample used to build the decision tree model was not significantly different from the sample used to test the decision tree model. The testing of the EDM model is described in the Results for Specific Aim 2 section below.

Differences in Social and Demographic Characteristics by Place of Delivery

While the women as a whole 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 ($p = .011$), less well educated ($p = .001$), their husbands' did not achieve as high a level of education ($p = .000$), and they reported being less exposed to media on a regular basis ($p = .05$). These women also married at a younger marital age ($p = .000$), had a higher parity ($p = .037$) and number of living children ($p = .019$). In terms of service use, they had fewer number of antenatal care visits encounters ($p = .022$), though they did attend community-based and (childbirth education) classes slightly more often than the women who delivered in a facility attended ($p = .019$).

The average linear distance from a respondent's household to the nearest ICDDR,B health facility was 1.9 km (*SD* 1.0) and 67.8% of participants lived > 1.1 km from the nearest ICDDR,B facility. Close to 20% lived ≤ 1 km away, 32.5% lived 1.1-2.0 km away, 26% lived 2.1-3.0 km away, and 9.3% lived ≥ 3.1 km away from the nearest ICDDR,B health facility. In 12.6% of cases ($n = 21$) distance was not available in the geographic information system. Overall, there was an inverse relationship between distance and facility use (point-biseral correlation $r = -.261$, $p < .001$). Differences between the groups by place of delivery using 1.1 km as a cut point were significant X^2 (1, $N = 246$) = 18.18, $p < .001$. For women living in households ≤ 1.1 km from the nearest ICDDR,B facility the odds of facility delivery *increased* (*OR* 1.87, 95% *CI* =

1.5-2.4) relative to women living in households > 1.1 km from the nearest facility. Among the subgroup women with an intention to deliver in a facility ($n = 185$) the same pattern was found. This finding indicates that even when a health facility is within a village and a woman intends to use it, utilization will still vary based on the distance to a facility.

The women were asked to state where they wanted to deliver (intention) prior to their actual delivery. Differences between the groups, by intention, were significant X^2 (1, $N = 246$) = 60.10, $p < .001$). The odds of home delivery among women who intended to deliver at home was 25 (95% $CI = 8.7$-72.2) times the odds of home delivery among women who intended to deliver at a facility. Differences between the groups were significant for educational attainment X^2 (3, N = 246) = 11.26, $p = .010$ and marital age X^2 (3, $N = 246$) = 15.00, $p = .002$. Games-Howell post-hoc procedure was used to for all pair-wise comparisons because group variances were unequal. Analysis showed that women who delivered in the home and intended to deliver in the home were less educated ($M = 5.75$ years) than women who delivered in a facility and intended to deliver in a facility ($M = 7.29$ years). Moreover, women who delivered at home who intended to deliver in a facility had a significantly lower age at marriage ($M = 16.50$ years) than women who delivered in a facility and intended to deliver in a facility ($M = 17.91$ years).

Results for Main Study Specific Aim 1

This section presents the results for Specific Aim 1, to explore the utility of the NEM in explaining women's health service utilization decision-making in uncomplicated pregnancy and childbirth, and the related hypotheses.

Descriptive data for the network variables are presented in Table 4.4. The average SBA endorsement across all networks was 0.72 (*SD* .30), the median 0.83. The average density was .77 (*SD* .20) and the median was .80. The average strength of tie was .58 (*SD* .11) and the median was .58. The average kinship homogeneity was .74 (*SD* .24) and the median was .75.

Spearman rho correlations between the network variables and place of birth indicated no associations with density, strength of tie or kinship homogeneity. There was, however, a

significant association between SBA endorsement ($p < .001$) and place of birth. Figure 4.1

displays the difference in place of delivery by level of perceived SBA endorsement of advisors in

a women's social network.

Table 4.4

Summary of Descriptive Network Data

Network Characteristic	Total (N = 244)	Home Delivery (n = 123)	Facility Delivery (n = 121)	p value[a]
SBA Endorsement (mean (SD))	.72 (.30)	.58 (.31)	.87 (.20)[b]	.000
Density (mean (SD))	.77 (.20)	.77 (.22)[b]	.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. [a] Spearman's rho [b]1 missing case
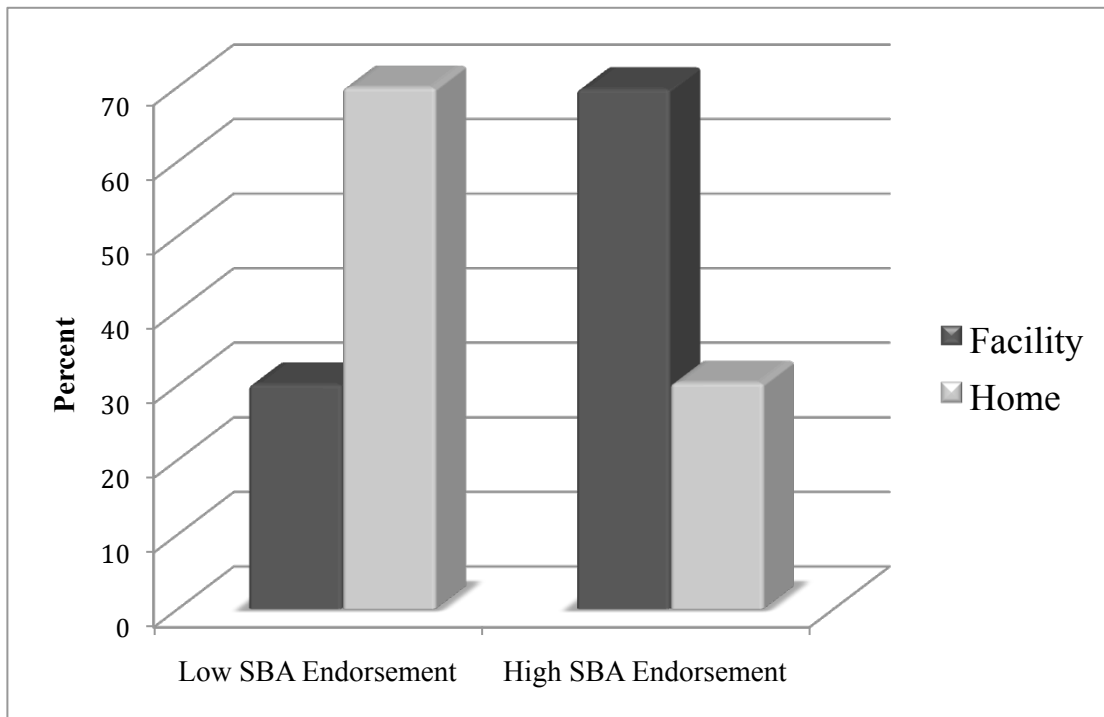
Figure 4.1 Percentage of women who delivered in a facility and who delivered at home by the level of perceived SBA endorsement of advisors in social network.

H1: Network structure variables (density / 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 to a greater extent than women's individual attributes.

The first set of nested logistic regression models (Models 1 and 2) examining women's individual attributes and network variables with place of birth are presented in Table 4.5. [Note: The individual level factors most consistently associated with receiving SBA care in Bangladesh from the literature reviewed include parity, education, household wealth, maternal age and antenatal care use. Maternal age and parity were highly correlated (.822) so age was excluded from this analysis 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 not statistically significant, X^2 (6, $N = 244$) $= 12.59$, $p = 0.05$ indicating the individual predictors, as a set, do not reliably distinguish between women who deliver at home and those who deliver at a facility. Overall classification, on the basis of a constant alone, was 50.2%, with only slight improvement to 59.6% with the addition of the individual predictors. None of the women's individual attributes in Model 1 were statistically significant. A test of Model 2 against a constant only model was statistically significant, X^2 (10, $N = 244$) $= 52.51$, $p < .001$. Overall classification, on the basis of the constant only was 50.2%, improving to 71.0% with the addition of the network variables. However, according to the Wald criterion, only SBA endorsement (a network variable) reliably predicted the decision of whether to deliver at home or in a facility. The results suggest that the odds of facility delivery *increased* for women with high vs. low SBA endorsement (*OR* $= 5.93$, 95% *CI* $= 3.25$-10.82) controlling for all other variables in the model. A comparison of Models 1 and 2 shows a reduction in the -2 log likelihood (-2LL) test from 327.05 to 287.13, an increase in the percent correctly classified from 59.6% to 71.0% and an increase in the Nagerlkerke R^2 from .067 to .257. The addition of the network variables in Model 2 appears to explain the type of

birth attendant to a greater extent than the women's individual variables alone, yet only the

network content variable-SBA endorsement-significantly contributed to the improvement.

Table 4.5

Summary of Logistic Regression Analysis, Models 1 and 2 (Direct Enter Procedure) for Individual Attributes and Network Variables Predicting Place of Birth, Odds of Facility Delivery (N =244)

	Model 1				Model 2			
			95% *CI*				95% *CI*	
Predictors	*B*	Odds Ratio^a	Lower	Upper	*B*	Odds Ratio^a	Lower	Upper
Constant	-1.68				-1.99			
Parity	-.085	.92	.715	1.18	-1.61	.852	.646	1.12
Education	.076	1.08	.983	1.18	.074	1.08	.973	1.19
Assett Score (1 vs. 5)	.805	2.24	.852	5.87	.711	2.04	.710	5.83
Assett Score (2 vs. 5)	.244	1.28	.541	3.01	.089	1.09	.426	2.80
Assett Score (3 vs. 5)	.316	1.37	.599	3.14	.037	1.04	.414	2.60
Assett Score (4 vs. 5)	.314	1.37	.609	3.07	.255	1.29	.530	3.14
SBA Endorsement					1.78	5.93*	3.25	10.82
Density					.104	1.11	.590	2.09
Homogeneity					.063	1.07	.550	2.06
Strength of Ties					-.004	.996	.560	1.77
Overall Predicted	59.6%				71.0%			
Model	-2 Log Likelihood	Chi-Square	*df*	*p*	-2 Log Likelihood	Chi-Square	*df*	*p*
	327.05	12.59	6	.050	287.13	52.51	10	< .001

Note. Model 1: R^2 = .050 (Cox & Snell), .067 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .702. Model 2: R^2 = .193 (Cox & Snell), .257 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .780, *B* = beta coefficient. ^{a} adjusted for all other predictors in the model. * *p* < .01

The second set of nested logistic regression models (Models 3 and 4) examining women's individual decision criteria and network variables with place of birth are presented in Table 4.6. A test of Model 3 against a constant only model was statistically significant, X^2 (5, $N =$ 237) = 153.65, $p < .001$, indicating the predictors, as a set, reliably distinguish between women who deliver at home and those who deliver at a facility. Overall classification, on the basis of a constant alone, was 50.2% improving to 82.4% with the addition of the individual variables. According to the Wald criterion, marital age, perception of rapid labor, transportation, intention and *dai* availability reliably predicted the decision of whether to deliver at home or in a facility. [Note: A more detailed discussion of these predictors and their effect size are found under Specific Aim 2, Research Question 1]. A test of Model 4 against a constant only model was also found to be significant. However, according to the Wald criterion, none of the network variables, including SBA Endorsement, made a significant contribution. The same individual variables in Model 3 were found to be significant in Model 4-marital age, perception of rapid labor, transportation, intention and *dai* availability.

A comparison of Model 3 and Model 4 based on goodness-of-fit statistics and classification reveal minor differences. Model 3 model had a -2LL (181.99) and overall classification of 82.4% compared with the -2 LL (179.45) and overall classification of 83.3% produced by Model 4. While Model 4's -2 LL is slightly lower and classification slightly higher, Model 3 is preferred because it is more parsimonious. A parsimonious model best predicts utilization with the least number of variables but still achieves a satisfactory goodness-of-fit, that is, the model does not cause a significant increase in the -2LL. It is likely the additional degrees of freedom account for the slight differences between the models.

Table 4.6

Summary of Logistic Regression Analysis, Models 3 and 4 (Direct Enter Procedure) for Individual Attributes and Network Variables Predicting Place of Birth, Odds of Facility Delivery (N = 244)

Predictors	Model 3				Model 4			
			95% *CI*				95% *CI*	
	B	Odds Ratio[a]	Lower	Upper	*B*	Odds Ratio[a]	Lower	Upper
Constant	-5.21				-5.60			
Marital Age	.211	1.24*	1.04	1.46	.230	1.26*	1.06	1.50
Rapid Progression of Labor	-2.10	.127*	.059	.276	-2.13	.119*	.053	.266
Transportation Available	2.23	9.30*	3.70	23.69	2.21	9.07*	3.43	24.01
Intention Facility	3.23	25.16*	7.54	83.99	2.94	18.09*	5.18	69.03
Dai Available in Area	-2.00	.136*	.036	.508	-2.03	.131*	.034	.510
SBA Endorsement					.397	1.49	.637	3.48
Density					.551	1.74	.751	4.01
Homogeneity					-.135	.874	.370	2.07
Strength of Ties					.021	1.02	.483	2.16
Overall Predicted	82.4%				83.3%			
Model	-2 Log Likelihood	Chi-Square	*df*	*p*	-2 Log Likelihood	Chi-Square	*df*	*p*
	181.99	157.651	5	<.001	179.45	160.19	9	<.001

Note. Model 3: R^2 = .475 (Cox & Snell), .633 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .487
Model 4: R^2 = .480 (Cox & Snell), .640 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .183
[a] adjusted for all other predictors in the model. *p < .05

H1a: Women embedded in dense social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

Among women embedded in highly dense networks, the chi-square test indicated a significant association with place of birth X^2 (1, N = 118) = 23.24, p < .001. The odds of a woman with high SBA endorsement delivering in a facility are 6.9 (95% CI = 3.04-15.64) times higher than a woman with low SBA endorsement. These results indicate that women embedded in dense social networks are more likely to use the type of birth attendant endorsed by their network. However, among women embedded in less dense networks (less than then the median of .80), the chi-square test also indicated a significant association with place of birth X^2 (1, N = 127) = 16.19, p < .001. The odds of a women in this group with high SBA endorsement delivering in a facility are 4.5 (95% CI = 2.12-9.57) times higher then a women with low SBA endorsement. Results of the logistic regression model show the interaction between homogeneity and SBA endorsement is not significant (B = .194, SE = .563, Wald .119, df 1, p = .731). Therefore, density does not modify SBA endorsement's impact on the type of birth attendant used.

H1b: Women embedded in homogeneous social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

Among women embedded in highly homogeneous kinship networks, the chi-square test indicated a significant association with place of birth X^2 (1, N = 122) = 22.44, p < .001. The odds of a woman with high SBA endorsement delivering in a facility are 6.8 (95% CI = 2.96-15.71) times higher than a woman with low SBA endorsement. These results indicate that women embedded in homogenous kinship-based networks are more likely to use the type of birth attendant endorsed by their network. However, among women embedded in less homogeneous kinship networks (less than then the median of .78), the chi-square test also indicated a significant association with place of birth X^2 (1, N = 123) = 16.64, p < .001. The odds of a women in this group with high SBA endorsement delivering in a facility are 4.9 (95% CI = 2.24-11.05) times higher then a women with low SBA endorsement. Results of the logistic regression model show

the interaction between homogeneity and SBA endorsement is not significant ($B = .315$, $SE =$ .588, Wald .287, df 1, $p = .592$). Therefore, homogeneity does not modify SBA endorsement's impact on the type of birth attendant used.

H1c: Women embedded in social networks comprised of strong ties (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.

Among women embedded in strong tie networks, the chi-square test indicated a significant association with place of birth X^2 (1, $N = 124$) $= 9.84$, $p < .002$. The odds of a woman with high SBA endorsement delivering in a facility are 3.25 (95% $CI = 1.54$-6.87) times higher than a woman with low SBA endorsement. These results indicate that women embedded in strong tie networks are more likely to use the type of birth attendant endorsed by their network. However, among women embedded in weaker tie networks (less than then the median of .77), the chi-square test also indicated a significant association with place of birth X^2 (1, $N = 121$) $= 30.62$, $p < .001$. The odds of a women in this group with high SBA endorsement delivering in a facility are 8.97 (95% $CI = 3.96$-20.28) times higher then a women with low SBA endorsement. Results of the logistic regression model show the interaction between strength of tie and SBA endorsement is not significant ($B = -1.01$, $SE = .565$, Wald 3.21, df 1, $p = .073$). Therefore, strength of tie does not modify SBA endorsement's impact on the type of birth attendant used.

Post-Hoc Analysis Specific Aim 1. Results of the simple logistic regression with SBA Endorsement as the predictor variable and place of birth as the outcome are presented in Table 4.7. A test of the full model against a constant only model was statistically significant, X^2 (1, $N = 244$) $= 39.47$, p $< .001$, indicating that SBA Endorsement distinguishes between women who deliver at home and those who deliver at a facility. In the constant only model the -2LL was 339.64, compared to a -2LL of 300.16 in the model with SBA Endorsement. The Cox and Snell R^2 was 0.149 and the Nagerlkerke R^2 was 0.198. Overall classification, on the basis of a constant alone, was 50.2% with improvement to 69.8% in the model with SBA Endorsement. The results

show that the odds of facility delivery increased for women with high SBA Endorsement (*OR* = 5.34, 95% *CI* = 3.10-9.21).

Table 4.7

Summary of Simple Logistic Regression Analysis for SBA Endorsement, Odds of Facility Delivery (N = 244)

Predictors	*B*	*S.E.*	Wald	*df*	Sig.	Odds Ratio	95% *CI* Lower	Upper
Constant	-.84	.20	18.40	1	.000	.43		
SBA Endorsement	1.68	.28	36.23	1	.000	5.34	3.10	9.21
Overall Predicted	69.8%							

Model	-2 Log Likelihood	Chi-Square	*df*	*p*
Constant Only	339.64	39.47	1	< .001
Final	300.16			

Note. R^2 = .149 (Cox & Snell), .198 (Nagerlkerke)

Results of the direct logistic regression with SBA Endorsement and women's intention (regarding place of delivery during pregnancy) as the predictor variables and place of birth as the outcome show both to be significant. A test of the full model against a constant only model was statistically significant, X^2 (2, $N = 245$) = 86.29, $p < .001$, indicating the predictor variables as a set distinguish between women who deliver at home and those who deliver at a facility. In the constant only model the -2LL was 336.83, compared to a -2LL of 250.54 in the model with SBA Endorsement and intention. According to the Hosmer and Lemeshow test, the model fit fairly well (Goodness-of-Fit Statistic (*df* 6) = .381). The Cox and Snell R^2 was 0.299 and the Nagerlkerke R^2 was 0.399. Overall classification, on the basis of a constant alone, was 50.6% with improvement to 73.7% in the model with SBA Endorsement and intention. The results show that the odds of facility delivery *increased* as SBA Endorsement increased (*OR* = 9.90, 95% *CI* = 2.67-36.72), holding intention constant and *increased* for women with an intention to deliver in a facility (*OR* = 14.72, 95% *CI* = 4.13-52.50), holding SBA endorsement constant.

The interaction term between SBA endorsement and intention was not significant. However, results of the test for simple mediation show a significant test statistic 3.67 (*SD* .08) *p* < .001, indicating that the association between SBA endorsement and place of birth is significantly reduced by the inclusion of intention as a mediator. For the mediation estimates to be valid, it must be assumed that there is no measurement error in the variable representing intention. Additionally, it must be assumed that there are no unmeasured common causes of intention and place of birth. Finally, it must be assumed that place of birth does not cause intention.

Results of the correlation matrix of the network variables are presented in Table 4.8.

Kinship homogeneity and density are the two network variables significantly associated with

SBA Endorsement. Kinship homogeneity is negatively associated with SBA Endorsement ($r = -.257$, $p < .01$), indicating that as SBA Endorsement increases, homogeneity decreases. Density is

also negatively associated with SBA Endorsement ($r = -.139$, $p < .05$), although to a lesser

degree, indicating as SBA endorsement increases, density decreases. Density, and kinship

homogeneity are strongly positively associated ($r = .548$, $p < .001$), indicating that as the number

of network members who are kin increase the density among network ties also increases.

Table 4.8

Summary of Correlation Matrix of Network Variables (N = 244)

	Correlation Coefficient[a]			
Network Variables	SBA Endorsement	Density	Homogeneity	Strength of Tie
SBA Endorsement	--	-.139*	-.334**	.032
Density		--	--	.548**	.021
Homogeneity		--	--	--	.091
Strength of Tie		--	--	--	--

Note. [a]Spearman's rho * $p < .05$ level ** $p < .01$

Results for Main Study Specific Aim 2

This section presents the results for Specific Aim 2, to determine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth, and the related research questions.

RQ1: What decision criteria predict the choice to deliver with a SBA (facility delivery) or not with a SBA (home delivery)?

Results of the initial descriptive and bivariate analysis are shown in Table 4.9. Twelve of the twenty-two decision criteria were significantly associated with place of birth. Two of the twelve decision criteria (belief that health facilities had poor quality service and having accompaniment to a facility) had cell values < 1 and were omitted from the subsequent regression analysis. The remaining ten criteria were included in the regression model along with nine socio-demographic covariates determined to be significant at the bivariate level (Table 4.3).

Table 4.9.

Results of Descriptive and Bivariate Analysis for Ethnographic Decision Questions by Place of Birth, Odds of Home Delivery

#	Decision Criteria Question	Total Sample (*N* = 246)	Home Delivery (*n* = 124)	Facility Delivery (*n* = 122)	*p*	*OR*	95% *CI*
01.	During your pregnancy did you think delivering at home was less expensive than delivering at a facility?						
	Yes	22 (8.9%)	16 (12.9%)	6 (4.9%)	.03	2.90	1.1,
	No	224 (91.1%)	108 (87.1%)	116 (95.1%)		1.00	7.6
02.	During your pregnancy did you worry that going to a facility would cost too much money?						
	Yes	20 (8.1%)	15 (12.1%)	5 (4.1%)	.02	3.20	1.1,
	No	226 (91.9%)	109 (87.9%)	117 (95.9%)		1.00	9.2
03.	During your pregnancy did your husband or other family members ever refuse to provide money to go to a facility for delivery?						
	Yes	5 (2.0%)	5 (4.0%)	0 (0.0%)	.06	--	--
	No	241 (98%)	119 (96.0%)	122 (100%)			
04.	During your pregnancy did anyone in your life ever forbid you to go to a facility?						
	Yes	21 (8.5%)	10 (8.1%)	11 (9.0%)	.79	0.90	.39,
	No	225 (91.5%)	114 (91.9%)	111 (91.0%)		1.00	2.0
05.	During your pregnancy did any influential person in your life (such as a mother-in-law, sister-in-law, or husband) advise you to stay at home for delivery?						
	Yes	58 (23.6%)	44 (35.5%)	14 (11.5%)	<.001	4.24	2.1,
	No	188 (76.4%)	80 (64.5%)	108 (88.5%)		1.00	8.3
06.	During your pregnancy, did you think health facilities had poor quality services?						
	Yes	6 (2.4%)	6 (4.8%)	0 (0.0%)	.03	--	--
	No	240 (97.6%)	118 (95.2%)	122 (100%)			

#	Decision Criteria Question	Total Sample (N = 246)	Home Delivery (n = 124)	Facility Delivery (n = 122)	p	OR	95% CI
07.	During your pregnancy, did you think home services were better than facility services for delivery?						
	Yes	25 (10.2%)	24 (19.4%)	1 (0.8%)	<.001*	29.0	3.9,
	No	221 (89.8%)	100 (80.6%)	121 (99.2%)		1.00	218.4
08.	During your pregnancy, did you worry about going to facility because of lack of privacy (break *purdah*)?						
	Yes	58 (23.6%)	39 (31.5%)	19 (15.6%)	.003*	2.50	1.3,
	No	188 (76.4%)	85 (68.5%)	103 (84.4%)		1.00	4.6
09.	During your pregnancy, did you worry about going to a facility because of surgical procedures (cutting)?						
	Yes	115 (46.7%)	60 (48.4%)	55 (45.1%)	.603	1.14	.69,
	No	131 (53.3%)	64 (51.6%)	67 (54.9%)		1.00	1.9
10.	During your pregnancy, was there a *dai* in your area (household, *bari*, or close to your *bari*) to assist with a home delivery?						
	Yes	210 (85.4%)	120 (96.8%)	90 (73.8%)	<.001*	10.7	3.6,
	No	36 (14.6%)	4 (3.2%)	32 (26.2%)		1.00	31.3
11.	During your pregnancy, was someone available to accompany you to a facility?						
	Yes	231 (93.9%)	117 (94.4%)	114 (93.4%)	.765	1.17	.41,
	No	15 (6.1%)	7 (5.6%)	8 (6.6%)		1.00	3.3
12.	During your pregnancy, where did you want to deliver?						
	Home	61 (24.8%)	57 (46.0%)	4 (3.3%)	<.001*	14.0	5.3,
	Facility	185 (75.2%)	67 (54.0%)	118 (96.7%)		1.00	37.5
13.	Did you have enough time to reach a facility once your labor pains started?						
	Yes	170 (69.1%)	50 (40.3%)	120 (98.4%)	<.001*	0.01	.003
	No	76 (30.9%)	74 (59.7%)	2 (1.6%)		1.00	, .048

#	Decision Criteria Question	Total Sample (N = 246)	Home Delivery (n = 124)	Facility Delivery (n = 122)	p	OR	95% CI
14.	Did you labor progress very quickly or rapidly? (delivered < 3 hours after labor pains started)						
	Yes	122 (49.6%)	89 (71.8%)	33 (27.0%)	<.001*	6.86	3.9,
	No	124 (50.4%)	35 (28.2%)	89 (73.0%)		1.00	11.9
15.	Did your labor pains start at night (when the sky was dark)?						
	Yes	142 (57.7%)	74 (59.7%)	68 (55.7%)	.53	1.18	0.7,
	No	104 (42.3%)	50 (40.3%)	54 (44.3%)		1.00	2.0
16.	Was it raining when your labor pains started?						
	Yes	46 (18.7%)	22 (17.7%)	24 (19.7%)	.70	0.88	.0.5,
	No	200 (81.3%)	102 (82.3%)	98 (80.3%)		1.00	1.7
17.	Did you wait more than one hour to inform someone about your labor pains once you knew you were in labor?						
	Yes	46 (18.7%)	24 (19.4%)	22 (18.0%)	.79	1.09	0.57,
	No	200 (81.3%)	100 (80.6%)	100 (82.0%)		1.00	2.1
18.	Once your labor pains started, did you have to wait more than one hour for someone to make a final decision about where to deliver?						
	Yes	22 (8.9%)	13 (10.5%)	9 (7.4%)	.39	1.47	0.60,
	No	224 (91.1%)	111 (89.5%)	113 (92.6%)		1.00	3.58
19.	During your labor, did you have a major problem that made you go to a facility for delivery?						
	Yes	5 (2.0%)	5 (4%)	0 (0.0%)	.06	--	--
	No	241 (98%)	119 (96%)	122 (100%)			
20.	During your labor, was transportation available to reach a facility? [†]						
	Yes	183 (74.7%)	74 (60.2%)	109 (89.3%)	<.001*	0.18	0.91,
	No	62 (25.3%)	49 (39.8%)	13 (10.7%)		1.00	.0.36
21.	When you were in labor, did you have someone available to accompany you to a facility?						
	Yes	236 (95.9%)	114 (91.9%)	122 (100%)	.00*	--	--
	No	10 (4.1%)	10 (8.1%)	0 (0.0%)			

#	Decision Criteria Question	Total Sample ($N = 246$)	Home Delivery ($n = 124$)	Facility Delivery ($n = 122$)	p	OR	95% CI
22	When you were in labor, did you have someone at home to take care of the children? ‡						
	Yes	142 (57.7%)	78 (62.9%)	64 (52.5%)	.163	0.43	0.13,
	No	13 (5.3%)	9 (7.3%)	4 (3.3%)		1.00	1.45
	Not Applicable	91 (37.0%)	37 (29.8%)	54 (44.3%)			

Note. OR = unadjusted odds ratio, *CI* = confidence intervals for odds ratio. * Significance levels for differences between home and facility delivery groups indicated by *p* values derived from Pearson Chi Square test or when cell counts < 5 by Fisher's Exact test. [†]1 missing. [‡] Item responses for # 22 that were coded "not applicable" were recoded as "yes" responses for chi-square and odds ratio calculations.

Results of the initial multivariate logistic regression analysis using the direct enter procedure are presented in Table 4.10. A test of the full model against a constant only model was statistically significant, X^2 (16, N = 245) = 218.73, p < .001, indicating that the predictors, as a set, distinguish between women who deliver at home and those who deliver at a facility. In the constant only model the -2LL was 339.64, compared to a -2LL of 114.61 in the full model. According to the Hosmer and Lemeshow test, the model fit well (Goodness-of-Fit Statistic (df 8) = .842). The Cox and Snell R^2 was 0.60 and the Nagerlkerke R^2 was 0.80. Overall classification, on the basis of a constant alone, was 51.7%. The improvement to 90.5% in the final model with the addition of all the predictors reflected correct classification of 90.8% for women who delivered at home (sensitivity) and 90.2% for women who delivered at a facility (specificity).

According to the Wald criterion, four independent variables and one covariate predicted the decision of whether to deliver at home or in a facility in the full model. Odds ratios for each significant explanatory variable were examined to determine how the odds of facility delivery increase or decrease given the presence or absence of a particular variable. The results show that the odds of facility delivery *increased* for women who believe that facility services are better than home services (*OR* = 48, 95% *CI* = 2.60-892.66), intend to deliver in a facility (*OR* = 38, 95% *CI* = 8.50-171.64), perceive that they have enough time to reach a facility (*OR* = 173, 95% *CI* = 30.31-981.70), and have available transportation (*OR* = 5, 95% *CI* = 1.58-18.41), controlling for all other variables in the model. Also, women with the lowest asset score were less likely to deliver in a facility compared to those with the highest asset score (*OR* = .107, 95% *CI* = .013-.851), controlling for all other variables in the model.

Table 4.10

Summary of Initial Multivariate Logistic Regression Analysis (Direct Enter Procedure) for Decision Criteria and Demographic Covariates Associated with Place of Birth, Odds of Facility Delivery (N = 237)

Predictors				Adjusted Odds Ratio	95% CI	
	B	*SE*	Wald		Lower	Upper
Constant	-14.31	4.19	11.65	.000		
Home Less Expensive	-2.12	1.28	2.75	.120	.010	1.47
Facility Cost Concerns	1.08	1.61	.45	2.93	.125	68.67
Advise to Stay Home	.097	.729	.018	1.10	.264	4.60
Thought Facility Services Better	3.72	1.62	5.30	41.40*	1.74	985.33
Privacy Concerns	.173	.804	.046	1.19	.246	5.74
Dai Not in Area	-2.19	1.22	3.24	.112	.010	1.22
Intention Facility	3.68	.867	18.00	39.67*	7.25	217.14
Enough Time Once in Labor	4.97	.999	24.71	143.29*	20.23	1014.70
Rapid Progression of Labor	-.585	.712	.676	.557	.138	2.25
Transportation	2.06	.679	9.19	7.84*	2.07	29.65
Assett Score (1 vs. 5)	-2.04	1.08	3.59	.130*	.016	1.07
Assett Score (2 vs. 5)	-.304	1.03	.087	.738	.098	5.55
Assett Score (3 vs. 5)	-.981	.914	1.15	.375	.063	2.25
Assett Score (4 vs. 5)	-.135	.978	.019	.874	.128	5.94
Education	-.202	.122	2.74	.817	.643	1.04
Age	.078	.130	.365	1.08	.839	1.40
Marital Age	.231	.174	1.77	1.26	.896	1.77
Media Exposure	.452	.642	.495	1.57	.447	5.53
Husband Education	.030	.087	.115	1.03	.868	1.22
# ANC Visits	.402	.316	1.61	1.49	.804	2.78
Distance to Health Facility	-.256	.295	.756	.774	.434	1.379
Parity	-.196	.587	.111	.822	.260	2.60
Overall Predicted				90.5%		

Model	-2 Log Likelihood		Chi-Square	*df*	Sig.
Constant only	326.894				
Final	98.703		228.191	22	< .001

Note: *p < .05

That some of the odds ratios appeared unusually large and confidence intervals implausibly high suggests multicollinearity and the inflation effect of sparse data on the parameter estimates and standard errors (for perception of enough time to reach a facility, belief that facility services are better than home services and intention to deliver in a facility). Results of the analysis for multicollinearity indicated the variance inflation factor (VIF) for these variables ranged from 1.09 and 3.66. The average VIF was 1.75 with several greater than the standard threshold of 2. Tolerance statistic values for the independent variables were between 0.27 and 0.92 with an average of 0.69, several of which were below the standard threshold of 0.45. The condition index was 56.12, above the criteria of < 30. Evaluation of the regression equation using these statistics suggested multicollinearity was present so the model was modified.

Evaluation of the pair-wise correlation co-matrix revealed high correlations between age and parity (.822), respondent education and husband's education (.618), and asset score and education (.487). Among the decision criteria, a high correlation was found between the belief that home delivery was less expensive than facility delivery and worry that facility would cost too much money (.845). Perception of rapid progression of labor was also highly correlated with reports of not enough time to reach a facility once in labor (.548). Therefore, due to the correlations the following five variables were omitted: age, husband's education, asset score, belief that home delivery was less expensive than facility delivery, and not having enough time to reach a facility once in labor.

A re-evaluation of the binary analysis revealed near complete separation and sparse data in two of the variables included in the initial model. Women who delivered in a facility reported having enough time to reach a facility once in labor, and, women who delivered at a facility did not report believing that home services were better than facility services. Therefore, due to lack of response variation these two variables were also omitted. [Note: The variable representing a women's perception of having enough time to reach a facility once in labor was omitted both

because of the high correlation with the variable representing perception of rapid progression of labor and because of lack of response variation.]

A simpler model was then built and tested after omission of variables that were sources of multicollinearity or had sparse data in one or more cells of a chi-square table using the direct enter procedure. These data are presented in Table 4.11. A test of this model against a constant only model was statistically significant, X^2 (13, $N = 237$) = 163.95, $p < .001$, indicating the predictors, as a set, reliably distinguish between women who deliver at home and those who deliver at a facility. In the constant only model the -2LL was 325.34, compared to a -2LL of 164.39 in the full model. According to the Hosmer and Lemeshow test, the model fit well (Goodness-of-Fit Statistic (df 8) = .831). The Cox and Snell R^2 was 0.50 and the Nagerlkerke R^2 was 0.67. Overall classification, on the basis of a constant alone, was 51.5%. The improvement to 85.2% in the final model with the addition of the all the predictors reflected correct classification of 86.1% for women who delivered at home (sensitivity) and 84.3% for women who delivered at a facility (specificity).

The average VIF for the independent variables was 1.22 (Range 1.04-1.42) with no values above the standard threshold of 2. Tolerance statistic values for the independent variables were between all > 0.40 with an average of 0.83 (Range 0.70-0.96). Evaluation of the regression equation using these statistics suggested multicollinearity was no longer a serious problem and simplification through omission of the correlated variables was effective.

According to the Wald criterion, four independent variables and one covariate reliably predicted the decision of whether to deliver at home or in a facility in the full model. Odds ratios for each significant explanatory variable were examined to determine how the odds of facility delivery increase or decrease given the presence or absence of a particular variable. The results show that the odds of facility delivery *increased* with each year increase in marital age (*OR* = 1.38, 95% *CI* = 1.12-1.70), *increased* for women who reported an intention to deliver in a facility (*OR* = 14.43, 95% *CI* =3.83-54.35) and *increased* for women who reported available

transportation at the time of labor (*OR* = 9.80, 95% *CI* = 3.51-27.33), controlling for all other variables in the model. The odds of facility delivery *decreased* for women who reported the perception of rapid progression of labor (*OR* = 0.09, 95% *CI* =0.40-0.22) and *decreased* for women reporting that a traditional birth attendant (*dai*) was available in the area to assist with a home delivery (*OR* = 0.21, 95% *CI* = 0.06-0.86), controlling for all other variables in the model.

Table 4.11

Summary of Reduced Multivariate Logistic Regression Analysis (Direct Enter Procedure) for Decision Criteria and Demographic Covariates Associated with Place of Birth, Odds of Facility Delivery (N = 237)

Predictors	B	SE	Wald	Adjusted Odds Ratio[a]	95% *CI* for Odds Ratio	
					Lower	Upper
Constant	-10.28	2.61	15.57	.000		
Marital Age	.324	.107	9.23	1.38**	1.12	1.70
Media Exposure	.354	.424	.699	1.43	.621	3.27
Parity	.223	.201	1.24	1.25	.844	1.85
Education	.052	.067	.606	1.05	.924	1.20
Distance to Health Facility	-.288	.207	1.93	.750	.499	1.13
# ANC Visits	.418	.261	2.58	1.52	.912	2.53
Facility Cost Concerns	-.588	.857	.470	.556	.104	2.98
Advise to Stay Home	-.699	.556	1.58	.497	.167	1.48
Privacy Concerns	-.018	.536	.001	.982	.344	2.81
Rapid Progression of Labor	-2.36	.436	29.14	.095**	.040	.223
Transportation Available	2.29	.524	18.99	9.79**	3.51	27.33
Dai Available in Area	-1.53	.701	4.76	.217*	.055	.857
Intention Facility	2.67	.677	15.56	14.43**	3.83	54.35
Overall Predicted	85.2%					

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Constant Only	328.35			
Final	164.40	163.95	13	< .001

Note: R^2 = .499 (Cox & Snell), .666 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .831.
[a] adjusted for all other predictors in the model. * $p < .05$, ** $p < .01$.

Finally, a more parsimonious model was built and tested using a stepwise procedure. These data are reported in Table 4.12. A test of the final regression model against a constant only model was statistically significant, X^2 (5, $N = 237$) = 153.65 $p < .001$, indicating the retained predictors, as a set, reliably distinguish between women who deliver at home and those who deliver at a facility. In the constant only model the -2LL was 328.35 compared to a -2LL of 174.70 in the final model. According to the Hosmer and Lemeshow test, the model fit well (Goodness-of-Fit Statistic (df 8) = .303). The Cox and Snell R^2 was 0.477 and the Nagerlkerke R^2 was 0.636. Overall classification, on the basis of a constant alone, was 51.5%. The improvement to 82.7% in the final model with the addition of the retained predictors reflected correct classification of 86.9% for women who delivered at home (sensitivity) and 78.3% for women who delivered at a facility (specificity).

VIF for the independent variables were between 1.02 and 1.1. The average VIF was 1.07 (Range 1.02-1.1) and no values were below than the standard threshold of 2. Tolerance statistic values for the independent variables were on average 0.94 (Range 0.90-0.98). The condition index was 26.78, below the standard criteria of less than 30. Evaluation of the regression equation using these statistics suggested multicollinearity was not a serious problem.

According to the Wald criterion, the same four independent variables and one covariate found to be significant in the direct entry model (Table 4.11) were retained in the forward stepwise model (Table 4.12) including marital age, perception of rapid labor, transportation, intention and *dai* availability. Odds ratios for each significant predictor were examined to determine how the odds of facility delivery increase or decrease given the presence of a particular variable. The results show that the odds of facility delivery *increased* with each year increase in marital age ($OR = 1.30$, 95% $CI = 1.08$-1.54), *increased* for women who reported available transportation at the time of labor ($OR = 8.98$, 95% $CI = 3.48$-23.14), and *increased* for women who reported an intention to deliver in facility ($OR = 23.64$, $CI = 6.93$-80.67). On the other hand, the odds of facility delivery *decreased* for women who reported a perception of rapid progression

of labor, (*OR* = 0.11, 95% *CI* = 0.05-0.25) and *decreased* for women reporting that a *dai* was

available in the area to assist with a home delivery (*OR* = 0.16, 95% *CI* = 0.04-0.60), controlling

for all other variables in the model.

Table 4.12

Summary of Parsimonious Multivariate Logistic Regression Analysis (Forward Stepwise Procedure) for Decision Criteria and Demographic Covariates Associated with Place of Birth, Odds of Facility Delivery (N = 237)

Predicators	*B*	*SE*	Wald	Adjusted Odds Ratio	95% *CI* for Odds Ratio	
					Lower	Upper
Constant	-5.98	1.97	9.26	.003		
Marital Age	.254	.091	7.80	1.29*	1.08	1.54
Rapid Progression of Labor	-2.18	.402	29.51	.113*	.051	.248
Transportation Available	2.20	.483	20.65	8.98*	3.48	23.14
Intention Facility	3.16	.626	25.51	23.64*	6.93	80.67
Dai Availability	-1.86	.685	7.39	.155*	.041	.595
Overall Predicted	82.7%					

Model	-2 Log Likelihood	Chi-Square	*df*	Sig
Constant Only	328.35			
Final	174.69	153.65	5	< .001

*Note. R^2 = .477 (Cox & Snell), .636 (Nagerlkerke). Homer and Lemeshow (*df* 8) = .303.
* *p* < .01.

A comparison of direct (full, Table 4.11) and stepwise (reduced, Table 4.12) models based on goodness-of-fit statistics and classification reveal minor differences. The full regression model had a -2LL (164.39) and overall classification of 85.2% compared with the -2LL (174.70) and overall classification of 82.7% produced by the reduced regression model. While the full model's -2LL is slightly lower and classification slightly higher, the reduced model is preferred because it is more parsimonious. A parsimonious model best predicts utilization with the least number of variables but still achieves a satisfactory goodness-of-fit, that is, the model does not cause a significant increase in the -2LL compared to the full model.

RQ2: What sequence of discrete decision criteria best predicts the choice to deliver with (at a facility) or without (at home) a SBA?

A crosswalk of the original codes used to code the narratives, the criteria used to formulate the decision tree model and the questions used to validate the model are presented in Tables 4.13 and 4.14. When two or more validation questions were used to test one decision tree criterion, a "yes" response to any one of the validation questions resulted in a "yes" pathway prediction.

Table 4.13

Phase I Decision Tree Codes, Criteria and Validation Questions

Codes	Decision Tree Model Criteria	Validation Questions
Cost	Is a facility less expensive than a home delivery or is money available for a facility delivery?	During your pregnancy did you think delivering at home was less expensive than delivering at a facility?
		During your pregnancy did you worry that going to a facility would cost too much money?
		During your pregnancy did your husband or other family members ever refuse to provide money to go to a facility for delivery?
Social Influence	Did an influential person advise against going to a facility during your pregnancy?	During your pregnancy did anyone in your life ever forbid you to go to a facility?
		During your pregnancy did any influential person in your life (such as a mother-in-law, sister-in-law, or husband) advise you to stay at home for delivery?
Birth Support	Was family or birthing support not available in the home/*bari* to assist with a home delivery?	During your pregnancy, was there a *dai* in your area (household, *bari*, or close to your *bari*) to assist with a home delivery?
Beliefs, Fear	Did fear, a poor impression, or lack of comfort prevent you from planning to go to a facility?	During your pregnancy, did you think health facilities had poor quality services?
		During your pregnancy, did you think home services were better than facility services for delivery?
		During your pregnancy, did you worry about going to facility because of lack of privacy (break *purdah*)?
Family Support-Pregnancy	Was family support not available to accompany or attend at a facility delivery?	During your pregnancy, was someone available to accompany you to a facility?

Table 4.14

Phase II Decision Tree Codes, Criteria and Validation Questions

Codes	Decision Tree Criteria	Validation Questions
Intention	Did you have a preference, plan or intention to deliver in a facility?	During your pregnancy, where did you want to deliver?
Time	Did you have enough time to get to a facility once labor started?	Did you have enough time to reach a facility once your labor pains started?
Complications	Did you perceive complications?	During your labor, did you have a major problem that made you go to a facility for delivery?
Transportation	Was transportation adequate?	During your labor, was transportation available to reach a facility?
Family Support-Labor	Was family support to accompany and attend at a facility available during labor?	When you were in labor, did you have someone available to accompany you to a facility?
Compliance	Did you comply with the treatment plan at the facility?	If you were referred to a facility outside of Matlab, did you go?

As previously discussed in the preliminary study results section, the EDM consisted of two phases. The first phase modeled the decision of regarding intention to deliver in a facility during the pregnancy period, referred to as the "plan-to-go" model. Figure 4.2 represents the composite decision tree based on a sequence of criteria for the first decision, validated with data from the main study. Overall, the predictive accuracy of this model was 69.9% with 74 errors. The model performed 40% better than chance (*tau* = .40). However, if all participants were classified as planning to use a facility the predictive accuracy would be 75.2%, rendering the first phase of the EDM inaccurate. The sequence and criteria from the first phase of the EDM failed to significantly predict whether or not women had a plan (intention) to go to a facility.

{Plan to go, Don't plan to go}

Is a facility delivery **less expensive** than a home delivery or is **money available** for a facility delivery?

n = 218   YES   NO   n = 28

PLAN TO GO UNLESS.....   DON'T PLAN TO GO UNLESS.....

Did an **influencial person advise** against going to a facility during your pregnancy?

Was **family or birthing support** NOT available in the home/bari to assist with a home delivery?

n = 44   YES   NO   n = 174   n = 1   YES   NO   n = 27

NO PLAN   PLAN TO GO   NO PLAN

Correct = 21, 47.7%
Errors = 23, 52.3%

Did **fear**, a **poor impression**, or **lack of comfort** prevent you from planning to go to a facility?

Correct = 1, 100%
Errors = 0

Correct: 14, 52%
Error: 13, 48%

n = 36   YES   NO   n = 138

NO PLAN

Correct 13, 36.1%
Errors: 23, 63.9%

Was **family support** NOT available to accompany or attend at a facility delivery?

n = 8   YES   NO   n = 130

NO PLAN   PLAN TO GO

Correct: 3 37.5%
Errors: 5, 62%

Correct: 120, 92.3%
Errors: 10, 8.8%

Figure 4.2 Phase I Decision Tree Model, "Plan-to-Go".

The second phase modeled the decision to actually use a facility during labor, referred to as the "actual-go" model. Figure 4.3 represents the composite decision tree based on a sequence of criteria for the second decision, validated with data from the main study. Overall, the predictive accuracy of this model was 87.8% with 23 errors. The model performed 76% better than chance (*tau* = .76). If all participants were classified as using a facility the predictive accuracy would be 49.6%, providing evidence for the validity of the second phase of the EDM. Two of the decision tree criterion in the "actual-go" model-family support and compliance-did not distinguish users from non-users. Therefore, a more parsimonious model would exclude family support and compliance, and retain intention, time, transportation and complications in the sequence presented in Figure 4.3.

{Use facility; Do not use facility}

Did you have a **preference, plan or intention** to deliver in a facility?

Observed
Use Facility: 122, 49.6%
Don't Use Facility: 124, 50.4%

n = 185   YES   NO   n = 61

Did you have enough **time** to get to the facility once labor started?

Did you perceive **complications**?

n = 51

YES   NO

NO USE

YES   n = 57

n = 134

n = 4

NO USE

Correct: 49, 96.1%
Errors: 2, 3.9%

Correct: 53, 93%
Errors: 4, 7%

Was **transportation** adequate?

n = 24

n = 114   YES

NO

NO USE

Was **family support** to accompany and attend at a facility available during labor?

Correct: 11, 45.8%
Errors: 13, 54.2%

n = 114   YES   NO   n = 0

NO USE

Did you **comply** with the treatment plan at the facility?

Predictive Accuracy
# correct: 216, 87.8%
# errors: 23, 9.3%
tau=.76

n = 114   YES   NO   n = 0

USE

NO USE

Correct: 103, 90.4%
Errors: 4, 9.6%

Figure 4.3. Phase II Decision Tree Model, "Actual-Go".

The data from the second phase of the EDM suggest consistencies in the self-identified criteria used in place of birth decisions including intention, time (perception of having enough time to reach facility once in labor), transportation, and perceived complications. These decision factors are expressed in a sequenced or hierarchical tree model to describe an aggregate decision process and to predict utilization actions at the time of labor.

Comparison of Results for RQ1 and RQ2. The results of the two different analytical methods of modeling the decision criteria about actual place of delivery were compared (i.e., regression analysis and decision tree methods). The multivariate logistic regression analysis controlling for common socio-demographic covariates demonstrated the importance of intention, transportation, perception of rapid progression of labor, availability of a *dai* and marital age; correctly classifying approximately 82.7% of cases (Table 4.12). The EDM "actual-go" model emphasized intention, perception of enough time to reach a facility, transportation availability and perception of complications in a specific sequence correctly classifying 87.8% of cases (Figure 4.3). Variables representing intention to use a facility, availability of transportation, and time were common to both modeling approaches as predictors of service use. However, the regression approach indicated that women's intention to use a facility, availability of transportation and time (i.e., perception of a rapid progression of labor) had the strongest effect; whereas the decision tree approach ordered these variables according to informant reports of their own decision processes, first distinguishing users from nonusers by intention, followed by time (i.e., perception of not enough time to reach a facility once in labor) then transportation.

Additional variables found to be significant in the regression analysis included availability of a *dai* in the area to assist with a home delivery and marital age. Perception of complications further distinguished users from non-users in the EDM. The variable, complications, was not included in the regression model. Only four women reported having a problem that prompted facility use. These four cases were outliers as the sample was derived from a population of women without actual or perceived complications as determined in the

screening process. These women passed the screening criteria only to report later that they had a major problem that prompted to go to a facility for delivery, likely representing error in the data recording process since all four actually delivered in the home. Removal of these cases did not change the results of the model.

The results for Specific Aim 2 suggest that the decision about place of birth among women who have uncomplicated births in the Matlab Health Service Area is based on where they intend to delivery, availability of transportation and whether or not they perceive there is enough time to reach a facility including the perception of the rapid progression of labor. Specifically, women who intend to deliver at home, do not have transportation and who perceive that time is insufficient to reach a facility, or who believe that they are having a rapid progression of labor, are more likely to deliver at home rather than at a facility. Moreover, women who have a *dai* available in the area to assist with a home birth, and married at a younger age are more likely to deliver at home.

Post Hoc Analysis Results Specific Aim Two. Women's perception of not having enough time once in labor to reach a facility (henceforth referred to as the time predictor) had a significant influence in the EDM "actual-go" model. This novel finding prompted an additional analysis of the time predictor among women who intended to use a facility ($n = 184$). The self-identified decision criteria that potentially influenced women's reports of time were explored using a forward stepwise logistic regression approach controlling for the potentially confounding variables of marital age, education and parity. These data are presented in Table 4.15. A test of the full model with a constant only model (the value of Y when the value of all predictors is 0) was statistically significant X^2 (9, $N = 185$) = 89.35, $p < .001$. In the constant only model the -2LL was 215.27 compared to a -2LL of 125.92 in the final model. According to the Hosmer and Lemeshow test, the model fit fairly well (Goodness-of-Fit Statistic (df 9) = .952). The Cox and Snell R^2 was 0.377 and the Nagerlkerke R^2 was 0.546. Overall classification, on the basis of a constant alone, was 73%. The improvement to 82.6% in the final model with the addition of the

predictors reflected correct classification of 90.3% for women who perceived they had enough time and 62.0% for those who perceived they did not have enough time to reach a facility.

According to the Wald criterion, two independent variables and one covariate reliably predicted the perception of having enough time to reach a facility once in labor among women with an intention to deliver in a facility. Women who perceived not having enough time to reach a facility once in labor were significantly more likely to report perception of a rapid progression of labor ($OR = 34$, 95% $CI = 10.70\text{-}107.64$) and less likely to report having available transportation ($OR = 0.14$, 95% $CI = 0.05\text{-}0.41$), while perception of not having enough time to reach a facility once in labor decreased with each year increase in marital age ($OR = 0.80$, 95% $CI = 0.65\text{-}0.98$) controlling for all other variables in the model. These data suggest women's perception of rapid progression of labor, availability of transportation, and marital age influences whether or not they perceive they have enough time to reach a facility once in labor, a leading predictor of place of birth decisions.

Table 4.15

Summary of Multivariate Logistic Regression Analysis (Forward Stepwise Procedure) for Decision Criteria and Demographic Covariates Associated With Time to Reach Facility Among Women Who Intended Facility Delivery, Matlab, Bangladesh (Odds of Not Having Enough Time) (N = 184)

Predictors					95% *CI* for Odds Ratio	
	B	*SE*	Wald	Adjusted Odds Ratio	Lower	Upper
Constant	2.14	1.84	1.35	8.50		
Marital Age	-.23	.10	4.77	.80*	.65	.98
Rapid Progression of Labor	3.53	.59	35.82	33.94**	10.70	107.64
Available Transportation	-1.98	.56	12.60	.138**	.05	.41
Overall Predicted	82.6%					

Model	-2 Log Likelihood		Chi-Square	*df*	Sig.
Constant Only	215.27				
Final	125.92		89.35	9	< .001

Note: R² = .377 (Cox & Snell), .546 (Nagelkerke). Homer and Lemeshow = .952. *p < .05, **p < .01

Summary

Social and Demographic Characteristics

The main study sample included 124 home deliveries and 122 facility deliveries. Participants' ages ranged from 18-43 years. Nearly all were currently married with a mean marital age of 17 years. Almost all of the women's marriages had been arranged and resulted in relocation to the husband's residence. The women were on average para 2.2. The majority of the women were Muslim and the rest were Hindu. The average asset quintile, a proxy measure of wealth, was three. Respondent's had completed on average 6.6 grades still, 12% reported never attending school and 15% of women reported not being able to read.

Differences in Social and Demographic Characteristics by Place of Delivery

While the women as a whole 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, less well educated, their husbands' did not achieve as high a level of education, and they reported being less exposed to media on a regular basis. These women also married at a younger age, had a higher parity and number of living children. In terms of service use, they had fewer number of antenatal care visits encounters. Overall, there was an inverse relationship between distance and facility use. For women living in households ≤ 1.1 km from the nearest facility the odds of facility delivery *increased* relative to women living in households > 1.1 km from the nearest facility. Distance, however, was not found to be significant in the multivariate analyses.

Network Variables

The overall SBA endorsement represented a relatively high endorsement of SBA or facility use. The average network consisted of dense, relatively strong-tie, kinship-based relations. On average 77% of alters knew one another and 75% of relations were identified as kin. The ties consisted of very close to somewhat close relations. There was no association

between place of birth, density, strength of tie and kinship homogeneity. SBA endorsement was the only network variable significantly associated with place of birth.

Specific Aim 1

The first hypothesis for Specific Aim one stated, *Network structure variables (density / 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 to a greater extent than women's individual attributes.* Adding network variables to a model containing parity, education and economic status appears to explain the type of birth attendant to a greater extent than the women's individual variables alone, yet only the network content variable-SBA endorsement-significantly contributed to the improvement. The addition of the network variables in a model containing intention, transportation, perception of rapid progression of labor, availability of a *dai* and marital age offered no additional explanation to choice of birth attendant. After controlling for these variables the effect of SBA endorsement was no longer significant. Overall, the network structural variables together with the network content variable had no significant impact on the results. The first hypothesis is partially supported by the data.

The second hypothesis for Specific Aim one stated, *Women embedded in dense social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks*. There was no significant interaction between density and SBA endorsement. The network variable density does not modify the effect of SBA endorsement on the type of birth attendant used. The second hypothesis is not supported by the data.

The third hypothesis for Specific Aim one stated, *Women embedded in homogeneous social networks (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.* There was no significant interaction between homogeneity and SBA endorsement. The network variable homogeneity does not modify the effect of SBA endorsement on type of birth attendant used. The third hypothesis is not supported by the data.

The fourth hypothesis for Specific Aim one stated, *Women embedded in social networks comprised of strong ties (structure) are more likely to use the type of birth attendant endorsed (content) by their networks.* There was no significant interaction between strength of tie and SBA endorsement. The network variable strength of tie does not modify the effect of SBA endorsement on the type of birth attendant used. The fourth hypothesis is not supported by the data.

Overall, the logistic regression models with interaction terms suggest that the network properties tested (i.e., density, homogeneity, strength of tie) do not modify the effect of alters' views about where a woman should deliver behavior (i.e., SBA endorsement as perceived by the woman).

Post-Hoc Analysis Specific Aim One

In a model with just SBA Endorsement as a predictor, the odds of facility delivery *increased* for women with high SBA Endorsement. In a model with both SBA Endorsement and intention, the odds of facility delivery *increased* for women as SBA Endorsement increased and *increased* for women with an intention to deliver in a facility. Furthermore, intention mediated, and therefore helped to explain, the relationship between SBA Endorsement and place of birth. In a correlation matrix of network variables, kinship homogeneity and density were significantly negatively associated with SBA Endorsement, indicating that as SBA Endorsement increases from low to high, both density and to a greater extent kinship homogeneity decrease.

Specific Aim 2

The first research question of Specific Aim 2 asked, *What decision criteria predict the choice to deliver with a SBA (facility delivery) or not with a SBA (home delivery)?* The results of the regression analyses show that the odds of facility delivery *increased* with each year increase in marital age, *increased* for women who reported available transportation at the time of labor, and *increased* for women who reported an intention to deliver in facility. The odds of facility delivery *decreased*, however, for women who reported a perception of rapid progression of labor,

and *decreased* for women reporting that a *dai* was available in the area to assist with a home delivery, controlling for all other variables in the model (Tables 4.11 and 4.12).

The second question of Specific Aim 2 asked*, What sequence of discrete decision criteria best predicts the choice to deliver with (at a facility) or without (at home) a SBA?* Intention, perceived time, transportation, and perceived complications are relevant factors in the decision tree model (Figure 4.3) to describe an aggregate decision process and to predict utilization actions at the time of labor. [Note: Due to the sample selection, perception of complications was not a pertinent variable in this study although it is an indicator of need for services and is associated with high levels of facility care and skilled attendants in the literature].

Comparison of RQ1 and RQ2 Results

Time, intention and transportation were identified in both modeling approaches as predictors of service utilization. The regression approach indicated that intention had the strongest effect followed by transportation and time (rapid progression of labor). The EDM approach ordered the variables according to informant reports of their decision processes, first distinguishing users from nonusers by intention, followed by time (did you have enough time to reach a facility) and then transportation.

Post-Hoc Analysis Specific Aim Two

The results suggest the odds of not having enough time to reach a facility once in labor *increased* for women who reported perception of rapid progression of labor and *decreased* with each year increase in marital age and *decreased* for women who reported having available transportation, controlling for all other variables in the model (Table 4.15). The data suggest women's perception of rapid progression of labor is influencing whether or not they have enough time to reach a facility once in labor, a leading predictor of place of birth decisions.

Chapter Summary

In this chapter an analysis of the data collected for the preliminary and main study phases was presented. First, the sample was compared by place of birth on social, demographic,

household and reproductive health variables. Data were then presented to answer the research questions and hypotheses associated with the study aims. Relevant to the preliminary study, an ethnographic decision model was constructed. Relevant to the main study, predictors of SBA use were explored and the ethnographic decision model validated. Finally in conjunction with the main study, we explored associations between individual and network variables. In the next chapter pertinent significant and non-significant findings are discussed.

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Chapter 5

DISCUSSION

Chapter 1 outlined the specific aims and described the conceptual framework. Chapter 2 described the background and significance of skilled birth attendant (SBA) utilization to prevent maternal mortality. A review of the literature on factors preventing and enabling the use of SBAs in Bangladesh was summarized including a description of the decision task and the influence of social networks within the socio-cultural context of Bangladesh. Chapter 3 described the design, methods and analysis used in the study. Chapter 4 described the results of the study. This final chapter discusses the findings from the study, the utility of the Network Episode Model (NEM), the study strengths and limitations, and concludes with a discussion of the implications for future research and public health programming.

Social and Demographic Characteristics

The key social and demographic characteristics of the preliminary and main study samples are summarized below. The sample characteristics by place of birth are compared to national data from the 2007 Bangladesh Demographic and Health Survey (BDHS) and other relevant research findings.

The preliminary study sample included 12 home deliveries and 13 facility deliveries. Respondents' ages ranged from 18 to 39 years. All were married. The majority of women were Muslim and the rest were Hindu. The average parity for the sample was 2.4, 32% were para 1, 28% were para 2, 20% were para 3, 12% were para 4 and 8% were para 5-6. The average number of years of school attended was 6 ($\pm$ 4). In response to a question about how well the respondent could read or write 12 (48%) responded with ease, 6 (24%) with difficulty and 7 (28%) not read or write at all. Over half of women (52%) reported that they were not regularly exposed to the media (e.g., watch television or listen to the radio at least once a week). Asset scores, proxies for socioeconomic status, ranged from 1-5 with 1 representing the lowest wealth quintile and 5

representing the highest. The average asset score was 3.3 (*SD* 1.4); 12% were in the lowest

quintile, 20% in the second quintile, 20% in the third quintile, 28% in the third quintile and 20%

were in the highest quintile

The main study sample included 124 home deliveries and 122 facility deliveries.

Respondents' ages ranged from 18-43 years. Nearly all were currently married with a mean

marital age of 17, below Bangladesh's legal marital age of 18 years. Almost all of the women's

marriages had been arranged and resulted in relocation to the husband's residence, characteristics

of patrilocal kinship systems. The religious makeup of the sample was analogous to the general

population in Bangladesh with a Muslim majority and Hindu minority. The average parity for the

sample was 2.2 ($\pm$ 1.1). The distribution of parity was as follows: 34.3% of women were para 1,

29.8% were para 2, 23.3% were para 3 and 12.7% were $\geq$ para 4. While women completed on

average 6.6 ($\pm$ 3.4) grades, 12.2% reported never attending school and 15% of women reported

not being able to read or write a letter (i.e., literacy). Moreover, over half of women (57.3%)

reported that they were not regularly exposed to the media (e.g., watch television or listen to the

radio at least once a week). The average asset quintile, a proxy measure of wealth, was 3, 17.8%

were in the lowest wealth quintile, 20.7% were in the second quintile, 19.9% were in the third

quintile, 22.0% were in the fourth quintile and 19.5% were in the highest wealth quintile.

The preliminary and main study samples were comparable. The samples did not

significantly differ with regard to age, education, parity and asset score. Furthermore, the

distributions for marital status and religion were alike. These data indicate that the sample used to

build the Ethnographic Decision Model (EDM) (in the preliminary study phase) was not

significantly different from the sample used to test the EDM model (in the main study phase), a

critical assumption underlying the EDM design.

The profile for the main sample characteristics by place of birth was similar to the

national data from the 2007 Bangladesh Demographic and Health Survey (BDHS). Compared

with women who delivered at home, those who delivered at a facility were from a higher wealth

quintile, had more education and a lower parity. They also had a greater number of antenatal care encounters.

There were additional differences in the main study sample by place of birth that were not reported in the 2007 BDHS report but consistent with reports by other researchers. For example, women who delivered at home had husbands who did not achieve as high a level of education compared to women who delivered in a facility (Chakraborty, Ataharul Islam, Islam Chowdhury, Wasimul Bari, & Hanum Akhter, 2003; ICDDRB, 2005b; Islam, Chowdhury, & Akhter, 2006). They also reported being less exposed to media on a regular basis, which is consistent with a finding that showed women were more likely to deliver at home if their household owned a television (M. Rahman, Barkat-e-Khuda, & Reza, 1999).

Discussion of Findings

Specific Aim 1

The results from the analyses conducted for Specific Aim 1 are discussed below. Specific Aim 1 was to explore the utility of the NEM in explaining women's health service utilization decision-making in uncomplicated pregnancy and childbirth. The findings from a series of logistic regression models demonstrate that place of birth decisions can be predicted from network content and not network structure and that network content is more strongly associated with place of birth than individual attributes alone, lending partial support to the utility of the NEM in a wellness context.

Density, strength of tie and homogeneity of kin were selected as measures of network structure because they were shown empirically to be associated with utilization of health services (Berkanovic & Telesky, 1982; Fonesca-Becker & Valente, 2006; Kohler, Behrman, & Watkins, 2001; Langlie, 1977; McKinley, 1973; Salloway & Dillion, 1973; St Clair PA, Smeriglio VL, Alexander CS, & Celentano DD, 1989; Valente, Watkins, Jato, Van Der Straten, & Tsitsol, 1997). The average network among women in this study consisted of dense, relatively strong-tie, kinship-based relations. On average 77% of alters knew one another and 75% of relations were

identified as kin. The ties consisted of very close to somewhat close relations. These findings

support the assertion that the densest networks tend to be those comprised of mainly kin

(Wellman, 1979) and show that women in Matlab during pregnancy perceive themselves as being

embedded in dense, discussion networks made up of primarily by kin. SBA endorsement was

selected to reflect network content or women's perception of the type of advice given to them by

network members regarding place of birth. The average scores for SBA endorsement reflect that

women in this study perceived their network members to provide a high endorsement of SBA or

facility use. There was no association between the above mentioned network structural variables

and place of birth. Network content (SBA Endorsement), however, was significantly associated

with place of birth, a finding discussed in more detail below together with the three main findings

derived from Specific Aim 1.

Finding 1: Network variables were more strongly associated with place of birth than

individual attributes alone (i.e., parity, education, asset score); yet, among network

variables only network content (i.e., SBA endorsement) was statistically significant.

This finding highlights the need to look beyond individual factors when assessing the

determinants of health service use, factors most consistently reported in the literature on SBA

utilization. With that said, there are a few possible explanations for the lack of association

between the structural variables and service use given the existing data and its ability to

discriminate. First, the data show homogeneity of the structural characteristics. In other words,

the structural variables lacked variation or between group differences. Supporting this

explanation, Fawcett contends that homogeneity reflects the statistical artifact that in a relational

proposition a connection exists between low variability in one measure and an overall association

of low magnitude (1999). Density measures from two earlier studies demonstrating more

variability are highlighted below.

Wellman's principal findings on personal networks in an urban area of Toronto—East

Yonkers—related density scores to the percent of network members who were kin. He 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, his

finding that the densest networks tended to be those that were comprised mainly of kin is

confirmed.

Fisher's study (as cited in (Degenne & Forse, 1999) found that network density decreases

as the number of social contexts (e.g., social circles) rise, and that the number of social contexts

increase with urbanization. Social contexts are defined as chains of acquaintanceships linked by

common participation in social and cultural activities (Kadushin, 1966). Fisher estimates that

social networks confined to a single context, such as kinship, average a density of 0.84. Density

falls to 0.65 if two contexts are spanned, falls to 0.49 with three contexts and to 0.38 with the

involvement of four contexts. The average density of the rural based networks in this study

averaged .77 (*SD* .20). Based on Fisher's estimates, the density score indicates one dominant

social circle (i.e., kinship) with a trend toward socialization in two contexts possibly from social

interaction with modern health providers (e.g., CHRWs and midwives).

The lack of association between the structural variables and SBA use is inconsistent with

a previous study that examined the influence of network structure on use of prenatal care (St Clair

PA, et al., 1989). Women were more likely to underutilize prenatal care if they were embedded in

strong-tie, non-disperse networks where most members were immediate family or relatives with

limited exposure to positive views regarding the value of such care. In this case structure

interacted with network content. However, there were no significant differences between utilizers

and underutilizers in the density of their networks. No known studies were available on SBA

utilization for comparison with the structural measures employed in this study. Gayen and

Raeside (2007) did, however, examine the association of social networks with the experience of

neonatal death and the type of birth assistance in rural Bangladesh, yet only report on one social

network variable, degree centrality, precluding a reliable comparison.

Utilization of SBAs for childbirth, a relatively modern health service, appears to co-exist with relatively traditional social network structures. The variables represent rural Bangladesh as a traditional society where social networks primarily consist of dense, relatively strong-tie, kinship-based relations. This is in contrast to more contemporary societies where a person's network ties are usually socially diverse, spatially diverse and are of a low-density mixture of friends and relatives (Wellman, 1998, 1990). Because the social structure in rural Bangladesh remains centered on a system of patriarchal kinship relations, the lack of structural variation then is not surprising.

The unique health service characteristics of Matlab provide another possible explanation for the lack of association between the structural variables and place of birth in this study. Behrman and colleagues suggest that structural network characteristics are likely to have larger effects on behavior as long as the behavior is not already widely disseminated (Behrman, Kohler, & Watkins, 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 (e.g., SBA use) (Valente, 1994). 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 (M. Chowdhury, Ahmed, Kalim, & Koblinsky, 2009). Use of facilities for delivery was approximately 69% in 2008 at the time of data collection for this study, indicating a later state for the diffusion of SBA use in Matlab.

The possibility also exists that the measures used in the analysis failed to capture the distinct structural features that make a difference in utilization patterns. For example: the size of the network, or the number of people with whom the ego nominates; 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, Glass, Brissette, & Seeman, 2000; St Clair PA, et al., 1989). The addition of these measures may 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. With global network data, the macrostructure through which influence and information flow is mapped or studied (Smith & Christikas, 2008). Gayen and Raeside found that the more central a woman's position in her network, the less likely she was to use professional assistance at childbirth (Gayen & Raeside, 2007). The study used Freeman' degree centrality a measurement that shows the extent to which individuals are connected to the rest of the network (Knoke & Yang, 2008). 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. However, Gayen and Raeside suggest, "[The] negative association of women's higher connectedness in their social networks and the use of professional association indicate that the dominant social norm of professional help 'not needed' at childbirth is strengthened by the greater connectivity to the social system from which this norm extends" (2007, p. 912). Their finding that high degree centrality is a norm-enhancing feature of the global network demonstrates that attributes of social networks can be beneficial or not 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 were not captured.

Unobserved community variation in service use might further explain the structural variables lack of explanatory power. For example, 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 require that future studies focus on women's involvement in decision-making and labor markets as well as the macro-level political, social and cultural influences that impact women's participation in society at large.

While the network structural variables 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 to be weakened, on where and with whom to give birth. Adherence to normative obligations remains despite a growing change in the norm itself (home-based to facility-based delivery). The results demonstrate that women behave in accordance with how they perceive 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, Marcus, & Seeman, 1979), the type of advice given by the social network, not the network structure, is important in predicting use of health services. However, the influence of network content or SBA Endorsement on place of birth in this study is subject to a major design limitation as discussed below.

A limitation of the present study is the fact that a positive correlation between a women's behavior and the average endorsement of her reference group does not provide conclusive evidence of network effects. The existing data cannot differentiate between the propensity of women to behave in a way that varies with the advice of her network and the propensity of women to perceive their network members to be more similar to them than they actually are (i.e., false consensus effects). 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 literature in social psychology has demonstrated that people have a tendency to misperceive or overestimate other's attitudes and behaviors as more similar to their own attitudes

and behaviors than exists in social reality. For example, research on college students' perceptions of peer norms suggest that students who overestimate the prevalence of sexual activity and drug use are more likely to engage in sexual activity and use drugs themselves (Bauman & Geher, Winter 2002-2003). Typically, the false consensus effect is demonstrated by revealing a correlation between an individual's attitude or behavior and their estimates of the proportion of other people in a group with similar attitudes and behaviors. Dawes states, "The rationale for this definition [false consensus effect] is that, because there is only one true endorsement rate, systematic deviations from it in the direction of one's own behavior constitute a bias" (1990, p 179). In this study, a woman's behavior was correlated with her perception of her network member's advice ($r = .469$, p < .001), indicating the possibility of a false consensus effect. 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. However, Valente and colleagues 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 (1997). 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 the present 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.

Despite this limitation, the significance of SBA endorsement emphasizes the role that content can play in interpersonal interactions over the structure in the place of birth decisions in the Matlab context. If place of birth decisions are at least in part a function of the perceived advice given within a personal network the next questions are: What other network characteristics are associated with SBA endorsement (perceived or actual)? Do certain relations

play a more influential role in utilization decisions than the total discussion network? Does the gender composition of the network influence the content of advice? Uncovering patterns of SBA endorsement according to network composition is a next analytical step in exploring the formation of normative obligations in this case. It is worth noting that a correlation matrix of content and structural variables displayed a significant negative association between kinship homogeneity and density with SBA Endorsement. In other words, as SBA Endorsement scores increased from low to high, both density and to greater extent kinship homogeneity decreased, evidence of an association between network structure and network content. Yet, the overall results raise questions about the direct role of structural factors in influencing the decision to use health services in a setting where dense, strong tie kinship based networks dominate and where the utilization behavior is already widely disseminated throughout the area.

Finding 2: The decision criteria derived from Ethnographic Decision Modeling (EDM) were more strongly associated with place of birth than SBA endorsement (network content).

The influence of SBA endorsement was attenuated by the presence of four decision criteria, derived from the EDM and one covariate (Table 4.5). According to the overall NEM conceptual model guiding the study, the decision criteria operate within the context of the social network interactions—interactions that consist of structure and content. Limited statistical procedures prevented a more complete examination of the embedded nature of the decision criteria within interpersonal interactions as implied by the conceptual model. It appears that very specific conditions (e.g., perception of the onset and rate of labor progress, availability of transportation and the presence of a *dai*) that occur in and around the time of birth may weigh more heavily than normative obligations. If this is true then health-seeking behavior reflects not only social network influence but also the influence of various other factors unique to the particular occasion, situation and action. These conditions are discussed further under Specific Aim 2 findings.

Finding 3: Network structural variables (i.e., density, kinship homogeneity, and strength of tie) did not modify the effect of network content on place of birth (i.e., SBA endorsement).

Hypotheses 1a-1c (H1a-H1c) state that women embedded in dense social networks (H1a), homogenous social networks (H1b) or networks comprised of strong ties (H1c) are more likely to use the type of birth attendant endorsed (content) by their networks. It was expected that high-density networks were more likely to form non-reinforcing behavior than lower density networks. Similarly, homogenous kinship networks and those composed of stronger ties were also expected to affect the likelihood of the ego acting in accordance with the norms of the network. In other words, it was expected that women's ability to deviate from the prevailing norm regarding place of birth would be constrained in highly connected, strong-tie, homogenous networks. Contrary to the hypotheses, the logistic regression models with interaction terms showed that the structural properties tested (density, homogeneity, strength of tie) did not modify the effect of alters views of what woman's behavior should be with respect to place of birth (SBA endorsement as reported by the woman). This finding is inconsistent with the proposition derived from the conceptual model used to guide the study, which suggests that network structure together with network content influence behavior. Possible explanations for this finding, given the available data, include homogeneity, a later stage of innovation, measurement error and unobserved community variation as discussed under Finding 1 above. It could also be that structural variables do not play a role in health care utilization decisions in specific contexts.

Specific Aim 2

Specific Aim 2: determine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth. The data derived from a combination of EDM and logistic regression modeling techniques indicate that place of birth decisions are largely determined by intention, transportation, and time (either not enough time to reach facility once in labor or the perception of a rapid progression of

labor). Other significant determinants include the availability of a *dai* in the area and marital age.

For organizational purposes, each determinant is discussed in more detail below in rank order of

effect size according to the results of the multivariate logistic regression analysis (Table 4.12).

The observed relationship between SBA use and measures of intention and time represent novel

findings in this area of research. Therefore, the discussions related to intention and perception of

time is covered in greater detail relative to those related to transportation, *dai* availability and

marital age, reproductions of findings from previous studies on SBA use in Bangladesh.

Intention. A woman's intention to deliver at home or in a facility was one of the

strongest predictors in the place of birth decision-making process in both the bivariate and

multivariate analyses. While, intention is discussed in great length in the theoretical literature no

empirical studies with intention as a factor influencing SBA use in Bangladesh were located.

Intention as a predictor of health service use is consistent with the Theory of Planned

Behavior, which posits that a person's behavior is most proximally determined by one's intention

to perform the behavior (Fishbein & Azjen, 1975). This study provides some empirical evidence

in support of this theory, with intention corresponding with behavior in 71.1% of the sample.

However, a gap exists between women's intended and actual place of delivery suggesting the

behavior was not completely under volitional control. Behavior did not correspond with intention

in 28.9% of the sample. Among women with a stated intention to deliver in a facility ($n = 185$)

36% of them delivered at home. Among women with a stated intention to deliver at home ($n = 61$), 7% delivered in a facility. This "switching behavior" is consistent with descriptions of

women's plans for and actual place of delivery in rural Karnataka, India (Z. Matthews, Mahendra,

Kilaru, & Ganapathy, 2001; Z. Matthews, Ramakrishan, Mahendra, Kilaru, & Ganapathy, 2005).

Forming an intention to use a facility for childbirth does not guarantee realization of the intention

and is not linearly related to behavior. Practical barriers such as availability of transportation

(discussed below) are impediments to service use that may prevail over positive intentions, a

finding that is consistent with the literature on intention and uptake of mammography (Rutter,

Steadman, & Quine, 2006) and supports the finding that availability of transportation influences

service use in relation to childbirth. In addition to the unstable environmental conditions endemic

to Bangladesh, a certain degree of uncertainty is associated with the progression of labor. The

inability of women to follow through on their stated intentions might be explained by their

reactions to this ambiguity. The literature suggests that presence of ambiguity enhances

normative influences. A positive intention, formed during pregnancy, is necessary but not

sufficient in the decision process that result in actual facility use. However, this finding, based on

retrospective questioning, is subject to several limitations discussed below.

Preferences are often constructed in the process of being elicited and are subject to the

respondent's need to be consistent, social influence and social desirability bias. Retrospective

reports of intention can be constructed in such a way to fit with the action taken, match the wishes

of influential family members, or please the interviewer. For example, McKinley proposes,

"when verbal statements of retrospective behavior are collected at the same time as, for example,

statements of beliefs and attitudes, it is just as reasonable to conclude that behavior causes belief

as that belief causes behavior" (1972, p. 118). The degree to which retrospective reconstruction

influenced response patterns in this study is unknown.

In measuring behavioral intention, prospective reports are favored over retrospective

reports as are short over long intervals of time between measures of intention and behavior.

Generally, the longer the time gap, the lower the correlation between intention and behavior

(Sutton, 1998). While it is likely some women remain constant about their preference to deliver at

home or in a facility throughout pregnancy, other women may change depending on the evolving

circumstances of the situation and environmental constraints. Research indicates that the temporal

stability of an intention, an important aspect of strength, moderates the relationship between

intention and behavior such that relatively stable intentions predict behavior better than relatively

unstable intentions (Ajzen, Czasch, & Flood, 2009). Thus, the classification of intention relies on

the exact time of questioning relative to the behavior of interest as well as how the variable is

operationalized.

Ajzen (1991) recommends that intention be best conceptualized as a subjective probability continuum and measured on a 7-point likelihood scale. He also recommends measures of intention and behavior both be measured with equivalent generality or specificity (Ajzen, et al., 2009). In the present study intention was measured retrospectively using a single item dichotomous response format. Measurement occurred in this way for several reasons. First, asking women where they intended to deliver in several different formats is challenging in the case of a highly specific behavior such as SBA use. Second, in order to have equivalent response options between intention and the behavior, intention was treated as an all or none phenomenon (intention or no intention to deliver in a facility) in the same way use of SBA was measured (use or do not use SBA). Third, a common scale format was used for the set of questions, of which intention item was a part, for the purposes of consistency. Despite these explanations, the validity of the measure used in the present study may be called into question.

The Mediating Effect of Intention. Given the association between network content and place of birth (result from Specific Aim 1) and intention and place of birth (result from Specific Aim 2), a further analysis was conducted to explore if the relationship between SBA endorsement and place of birth was mediated by intention. Consistent with the NEM, social network member's advice of where a women should deliver (i.e., network content or SBA endorsement) in part shapes intention, which partially mediates the direct relationship between network content and place of birth. As in any cross-sectional study, interpretations of causality must be made with caution. However, given the theoretical and empirical evidence from this study, intention is at least one of the mediators in the relationship between SBA endorsement and place of birth. Intention is likely a more proximal indicator of place of birth decisions than SBA endorsement whose influence is both direct and indirect through intention.

Transportation. The availability of appropriate transportation was a significant factor in the place of birth decision-making process in the bivariate and multivariate analysis, indicating

that transportation affects use of SBA services. This finding extends the findings of several investigators that showed transportation difficulties were responsible for not using a facility for delivery or for delays in care seeking for childbirth complications (S Ahmed, Islam, Mitra, Khanum, & Khuda, 1999; Chaudhury & Chowdhury, 2008; Paul & Rumsey, 2002).

Transportation acts as a key link between the potential and actual use of services and may influence the use of less trained but more easily accessible providers. Unlike in high income countries where ambulances and other emergency vehicles are part of a publically funded system (Babinard & Roberts, 2006), in Matlab ambulances are only used to transport women between health facilities not from their homes. Travel within Matlab to a health facility occurs by a combination of foot, rickshaw, three-wheeled mini taxi and country boat. Complicating matters, roads do not provide access to many remote villages and during the rainy season transportation becomes even more difficult due to coverage of the land-mass by flood waters. Available transportation is an essential to the utilization of SBA services for preventive care seeking in Matlab.

Participates in the study gave birth between July and November, months corresponding to the rainy and autumn seasons. The rainy season or *Barsa* spans June-August, the autumn season or *Sarat* spans September-October and late autumn or *Hemanto* spans October-November. During the rainy season and early autumn much of the land mass is flooded and most villages are only accessible by boat. During the late autumn season the rain subsides and is replaced by cooler weather. Water based transportation continues to be part of the transportation repertoire to and from villages. Many respondents relied on a system of country boats to reach a facility during labor. In the absence of a boat as a household asset, respondents were dependent on country boat men or neighbors to transport them across water, many of whom were unavailable during night time hours. In such cases the decision to go to a facility was either not made or delayed.

Perception of Time. Time was a significant criterion in the place of birth decision-making process in the bivariate and multivariate analysis, both the perception of not having

enough time to reach a facility and the perception of rapid progression of labor. This makes sense in that for some women, once labor begins, signs and symptoms are recognized, reported, and care seeking initiated, there still may not be enough time to reach a facility depending on when labor onset is recognized and also the rate at which labor progresses. The literature on emergency care seeking in the event of childbirth complications is full of such examples of perceived or actual time constraints in health seeking (Chaudhury & Chowdhury, 2008; A. Chowdhury, Mahbub, & Chowdhury, 2003; Killewo, Anwar, Bashir, Yunus, & Chakraborty, 2007; Muna, Ross, Laston, & Bhuyian, 2002). Yet, the findings from this study show that time is also a critical factor in use of health services in routine or uncomplicated birth when the intention is to deliver in a facility. This is the first known study to identify that the timely recognition of the onset of labor and/or rate of progression is a significant factor in the use of facility-based SBA services among women without complications who intend to deliver in a facility in an area where good quality services are available.

Further exploratory analysis into the factors associated with women's perception of time to reach a facility once in labor showed that the most significant association was with women's perception of rapid progression of labor. Why did a large proportion of women (60.8%) who intended facility birth report rapid progression of labor and end up delivering at home? Although this study was not designed to examine this particular question, some possible explanations as to why women might report a rapid progression of labor are discussed below. These explanations include the actual experience of precipitous labor, difficulty in recognizing or interpreting the signs and symptoms of early labor onset and/or rate of progression, and delay in informing significant others about labor onset and/or the rate of progression. Each explanation is discussed, in turn, below.

Precipitous labor. The population prevalence of precipitous labor, defined as the rapid progression of active labor lasting less than three hours from onset of regular uterine contractions to delivery, is estimated to be 2% in the United States (Ventura, Martin, Curtin, Mathews, &

Park, 2000). Risk factors for precipitous labor include advanced maternal age, history of short or

rapid labor, multiparity, previous vaginal surgery and a small fetus (Mahon, Chazotte, & Cohen,

1994). With respect to place of birth, this study demonstrated significant differences among

women who perceived their labor to progress very rapidly or quickly and those who did have this

perception. Women who perceived rapid progression of labor were on average older (25.44 vs.

23.94), had a higher average parity (2.39 vs. 1.99) and had a significantly higher number of living

children (2.31 vs. 1.88). While these differences are statistically significant, the between group

biological difference is small and does not fit the profile of precipitous labor risk (e.g., advanced

maternal age is considered greater than 35 years and multiparity $\geq$ 4 births). Nonetheless, it is a

possible a small proportion of women reporting rapid progression of labor, may be experiencing

precipitous labor.

   Difficulty recognizing or interpreting the signs and symptoms of early labor and/or the

rate of labor progress. Some women may not recognize the signs of early labor, particularly

women experiencing their first births or those with little previous exposure to childbirth. For

example, some women may interpret ruptured membranes as urinary incontinence or associate

diarrhea with food or water borne illness prevalent in the area. On the other hand, they may

recognize physical changes but be uncertain of how to interpret these changes, leading to delayed

action. Delaying a decision is a known strategy for coping with uncertainty, allowing time to

observe signs and symptoms before determining what actions are warranted, especially when the

single best option is not clear (Lipshitz, Klein, Orasanu, & Salas, 2001; G. W. Ryan, 1998).

Which signs and symptoms women use to demarcate true labor (labor pains that progress and

result in delivery) and to assess labor progress was not the subject of this study. Consultation with

influential others for legitimization of symptoms and approval of action may result in further

delay, especially if there is disagreement in the interpretation of women's condition or lack of

consensus about the action plan. Alternatively, women may not recognize or interpret signs and

symptoms of labor because these do not correspond with their estimated date of delivery

(EDD)—the signs and symptoms are unexpected. Field notes include that some women reported not being prepared to go to a facility because their labor started prior to their EDD. In the study sample, women's actual delivery dates were on average 5.35 days (*SD* 6.9) sooner than their EDD, though within normal biological limits.

Delay in Informing Others. Finally, women may delay informing significant others, including caregivers, about their labor until certain that labor is progressing. In this study, 19% of women reported waiting more than one hour to inform someone of labor pains once they self-identified labor onset. This is consistent with previous findings that expectant women do not announce the start of labor pains until they are sure they have begun, declaring the "time has come" only once her labor pains have peaked. Bhatia in a qualitative study about traditional childbirth practices in Matlab states "generally, she [a pregnant women] continues doing her daily chores until her pain becomes well established" (1981, p. 69). Informing others of labor onset is judged as shameful and in keeping with proper female behavior a "good" women will not express pain, discomfort or disrupt household activity. To do otherwise is considered a social taboo that brings disgrace on the women and her family (Afsana & Rashid, 2001). Women will keep silent about their symptoms to prevent group attention and maintain privacy. A prevailing concern that contributes to a woman's silence during labor onset is the belief that the more people who know about the labor pain, the more prolonged the labor (Darmstadt, Syed, Patel, & Kabir, 2006; ICDDRB, 2005b; Muna, et al., 2002). This finding highlights the need to investigate women's perceptions of the onset and progression of normal labor. Early labor signs and symptoms are critical situational cues that can prompt women with an intention to deliver in facility to act on her intention in the absence of conditional barriers.

Availability of a *Dai*. The availability of a *dai* in or near to a women's *bari* was an important factor in the place of birth decision making. This is not surprising as *dais* are the main alternative to use of an SBA in Matlab. In the present study, the term *dai* refers to both traditional birth attendants (TBAs) who serve multiple families and to family relatives who assist in delivery

within their own extended family (family birth attendant). This research was unable to identify

any studies that examined *dai* availability as an independent variable in place of birth decisions in

Bangladesh. Although, Haider's baseline survey (as cited in (S. Rahman, Parkhurst, & Normand,

2003) provides evidence that the shortage of SBAs coupled with the availability of TBAs are

factors that favor seeking traditional delivery services. Diffusion of innovation models that

examine the time it takes to reach everyone in a social system suggest that at the end of the

diffusion cycle, all people will eventually adopt the innovation, if only because no alternative is

available (Degenne & Forse, 1999). The implication is that a reduction in TBAs and family birth

attendants in Matlab will eventually turn even the late adaptors to SBAs. According to the most

recent ICDDR,B registry figures, updated in 2009, 404 TBAs reside in the Matlab Health Service

Area. Coupled with the family birth attendants, who are not counted in the registry, a viable

alternative to SBA use remains in Matlab, though the trend is towards use of SBAs.

Marital Age. Marital age was a significant determinant of place of birth decisions. The

odds of facility delivery increased with each year increase in respondent's marital age, controlling

for all other variables in the model including education, parity and household wealth. This result

contrasts with the findings from two previous studies in Bangladesh. In a study by N.

Chakraborty et al, women who married at age ≥ 15 years were less likely to use a doctor, nurse or

family welfare visitor in the home or a facility compared with those who married at < 15 years of

age (2003). In the study by Islam et al, marital age did not have a significant association with

place of birth in a multivariate logistic regression model (2006). Differences in the measurement

of marital age and the sample design may be responsible for the conflicting results. In both

previous studies a categorical variable was used to represent marital age (i.e., < 15 years or ≥ 15

years) vs. a continuous variable (i.e., 12-28 years) used in the present study. In the study by Islam

et al, the entire sample of women reported having had complications and less than 3% delivered

in a facility. In the study by Chakraborty et al, the entire sample of women reported having

antepartum complications and 28.3% reported receiving care by a doctor, nurse or trained family

welfare visitor in the home or a facility. In the present study the women who reported having experienced complications were excluded from the sample and 50% delivered in a facility by design. This makes comparisons with these two previous studies difficult.

One explanation for the observed relationship between marital age's influence on health service use is that lower marital age is associated with higher parity, which in turn increases the demands placed on a women's time and financial resources, the latter resulting in a decrease in service use. However, a regression model that controlled for parity demonstrated the independent effect of marital age on health service use. In the demographic literature, age at first marriage is often used as a proxy measure for women's status and increasing age at marriage is thought to be associated with higher status (Balk, 1994). Increased age of marriage is associated with increase in education, urbanization and emergence of new roles for single women (Jejeebhoy, 1995), and decreases in total fertility rates. Although the specific reasons underlying the observed influence of marital age on place of birth decisions cannot be determined from the data in this study, with variation in education, parity and household wealth controlled for in the analysis, it is possible that later marital age reflects the level of woman's participation and influence in household decision-making, an area for future study.

Summary of Findings

This retrospective, cross sectional study employed social network analysis (SNA) and ethnographic decision tree modeling (EDM) to: 1) test the utility of the Network-Episode Model (NEM) in explaining women's health service utilization decisions in uncomplicated pregnancy and childbirth, and 2) examine the predictive power of women's self-identified decision-making criteria on choice of birth attendant in the event of uncomplicated pregnancy and birth in the Matlab Health Service Area of Bangladesh. First, the perceived norms regarding place of birth, an indicator of network content (i.e., SBA endorsement) was more strongly associated with place of birth than a woman's individual attributes alone (i.e., parity, education, asset score). Highlighting the need to look beyond individual factors when assessing the determinants of health service use,

factors most consistently reported in the literature on SBA use. Second, density, kinship homogeneity and strength of ties, indicators of network structure, were not associated with place of birth nor did they modify the relationship between network content and place of birth. Possible explanations, given the existing data, include homogeneity of the structural characteristics, a later stage of diffusion of SBA use in the community, measurement error including the false consensus effect, unobserved community variation and the possibility that structural properties of networks don't matter. With regards to the decision criteria, intention, time, transportation, *dai* availability and marital age were found to be predictors of SBA use among those derived from Ethnographic Decision Modeling techniques. While none of these decision criteria in themselves necessarily produce decreased rates of utilization, their interrelationships impact use as depicted in the second phase "actual-go" hierarchical decision tree model. Additional analysis exploring the mediating effect of intention on the relationship between network content and place of birth showed that network content influenced the outcome both directly and indirectly through intention.

Validity of the Ethnographic Decision Model

The following discussion is in response to common questions raised about the validity of the EDM findings by skeptics of the method. The purpose of the EDM was to tap into the decision-making process itself, an inherent part of the NEM theoretical framework guiding the study. The aim was to capture and predict the decision criteria used by women to select a birth attendant rather than merely the outcome of the decision. As mentioned earlier, the decision is a continuous process that changes over the course of the pregnancy up to the point of labor. Yet, for purposes related to the analytical method, it was necessary to create categorical distinctions between the phases of the decision process and the sequencing of the decision criteria. The result was a two-phased model that attempted to first predict intention during pregnancy and then actual use during delivery. While the second phase of the model adequately predicted actual use of a facility, the data from the first phase failed to significantly predict whether or not women had an intention to go to a facility. In other words, the model accurately predicted behavior from

intention (along with other decision criteria) but did not predict intention from the decision criteria (cost, influence, home birth support availability, beliefs and fears about facilitates, and family support to accompany and attend at a facility) used to derive the first phase of the model.

Formal modeling of choice provides information regarding the nature of health care decisions and typical population patterns of choice, allowing for generalizations beyond what can be derived from individual cases. As a strategy, it does not supplant qualitative methods in explaining health care decisions at the level of the individual and the context in which these decisions are made. In this study, despite a dynamic conceptual model, the NEM, the analytical methods used necessarily present decision criteria and processes as static phenomenon. The actual process by which respondents in the study sample weighed and enacted each of these criteria in decision-making over time is unknown.

Implications for Theory and the Conceptual Framework

A critique of the NEM conceptual framework is provided below. The utility of the NEM to preventive health-seeking behavior was partially supported. Results showed that network variables added significantly to the predictive power of women's individual attributes. However, the hypothesis that structural characteristics of social networks interact with the content of the network to influence the decision was not supported. Instead, social network content (i.e., SBA endorsement) alone was found to significantly influence place of birth decisions, both directly and indirectly. SBA endorsement was directly associated with the final decision and indirectly in that SBA endorsement influenced the final decision through intention. Providing overall support for one of the underlying assumptions of the NEM—interactions of a person with others actors in a system can affect their beliefs and actions (Valente, 1995, Pescosolio, 1991). In other words, norms are understood through social interaction. The emphasis of the social network theory, however, rests on the testable assumption that the social structure of the network itself is largely responsible for determining individual behavior and attitudes by shaping the flow of resources,

such as advice regarding place of birth (Berkman, et al., 2000). Given the existing data and approach to analysis, the results suggest the effect of structure may be overestimated.

The existing data's lack of ability to discriminate between structural network variables and place of birth at first seemed confusing. However, further analysis showed the structural variables to be correlated with the content variable. A more sophisticated analysis, using structural equation modeling or path models, is needed to uncover the specific relationship of structure and content and its influence on place of birth decisions. 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, that the role of structural factors (employed in this study) in influencing the decision to use health services in a setting where dense, strong tie kinship based networks dominate and where the utilization behavior is already widely disseminated may be weak or nonexistent. The recent exclusive focus on structure in the broader social science literature may be unwarranted. Pescosolido suggests that network theory and research take both a social psychological and a structural focus that embraces both qualitative and quantitative approaches (Pescosolido & Rubin, 2000).

The nested strategy of the EDM (i.e., cognitive modeling strategy) within the NEM allowed the conceptual and analytical focus to be on a set of relationships while at the same time continuing to account for individual attributes and decision processes. The result was new insights into the complex phenomenon of health service utilization. For example, use of the EDM, resulted in the discovery that both intention and time perception in labor progress influence place of birth decision, novel findings in this area of research. The identification of intention as a predictive variable also allowed for identification of a positive relationship between intention and the perception of social norms. The EDM concentrated on specifying the criteria that affects the decision making process and indicating their relative influence on the decision rather than the

predictors of the outcome itself. The EDM proved to be valuable method in highlighting the decision criteria implied by the NEM.

It is premature, on the basis of this one study, to try to draw definite conclusions about the sufficiency of the NEM for preventive health seeking. Clearly women's perceptions of network content and certain decision criteria are useful predicators of SBA use but only additional research can determine whether the NEM constructs are sufficient to account for most of the systematic variance in health seeking behavior across various contexts. [Note: only a portion of the full NEM model was tested in this study.] In general, the application of the NEM to a particular health seeking behavior—be it curative or preventative—provides a wealth of information that is useful in any attempt to understand such behavior. Thus it is reasonable to recommend that social network influence be included into theoretical models of health service use and that the application of the NEM be extended to other preventive health seeking behaviors.

Study Limitations and Challenges

Several challenges and limitations were relevant to the conduct of this study. As discussed at length in Chapter 3 these include: lack of previously validated and reliable measures; inherent limitations of a retrospective cross-sectional design; cultural validity of the survey instruments; measurement error; respondent burden; use of self-report and sample size. In addition, certain limitations need to be taken into account as the findings are interpreted. These include the false consensus effect with regard to the significance of network content and the impact of retrospective questioning.

The generalizability of the findings in relation to the representativeness of the sample also needs consideration. Comparisons between the 2007 BHDS national sample and the study sample showed comparability with respect to age, parity, education and household wealth. Despite these similarities and the use of a random sample the generalizability of the current findings is limited by the unique characteristics of the study site, the MHSA. Unlike in the rest of

Bangladesh, in the MHSA, maternal health services are universally available along with health promotion services provided by CHRWs.

Study Strengths

The study had several important strengths. First, this is one of the first known studies to examine SBA use among women without complications. The sample selection excluded women with complications and the focus was specifically on women's decision making in preventive versus emergency childbirth situations. Second, the sample size was large enough to control for a variety of previously identified individual and contextual attributes influential in place of birth decisions. Additionally, the sample was randomly selected from an internationally recognized demographic and health surveillance system, strengthening the study's internal validity. Thirdly, the population of interest had uniform, universal geographic and financial access to relatively good quality SBA services. Therefore, control for access to health services, a major determinant of health service use, was achieved. Fourth, the study adds to the body of studies on SBA use patterns in Matlab. The factors influencing SBA use in this study increase our understanding of how change occurred before, after and during the implementation of a large health service research project entitled: *Comprehensive maternal, neonatal and child health care to reduce mortality: a programmatic approach through a continuum of care to increase facility based delivery in a rural community in Matlab, Bangladesh*. Finally, the type of birth assistance used during delivery directly correlated with place of delivery, a distinction that is often confused in the interpretation of comparable maternal health service utilization studies.

Recommendations

The following recommendations for future research and public health practice are suggested in relation to the major findings of the study.

Major Finding 1: Application of the NEM demonstrated that the explanatory power for network variables was beyond the power of individual attributes within a preventative versus an illness context. Perceived norms regarding place of birth, an indicator of network content (i.e., SBA

endorsement) was more strongly associated with place of birth than a woman's individual attributes alone (i.e., parity, education, asset score).

Future Research:

- The application of the NEM needs to be extended and tested in other preventive health seeking behaviors not only in Bangladesh, but also in the United States.

- Patterns of women's perceived norms regarding place of birth according to the composition of the network need to be explored. For example, the relative influence of SBA endorsement by type of relation and gender composition of the network**.**

Public Health Practice Recommendations:

- Health messages and interventions need to be aimed as much, if not more, toward social networks than individuals.

- Norm-based health campaigns need to be more cognizant of the centrality of kinship networks on women in Matlab and the likelihood of women to heed the advice of social network members with regards to place of birth.

Major Finding 2: The effect of network structure may be overestimated in certain cultural contexts. Application of the NEM demonstrated that indicators of network structure (i.e., density, homogeneity, strength of ties) were not associated with place of birth nor did they modify the relationship between network content and place of birth.

Future Research:

- Network based research needs to take both a social psychological and a structural focus.

- The structural features of a women's global network need to be explored for an association with health care utilization.

Public Health Recommendations:

- Community-based interventions need to be aware that the discussion networks of women in Matlab primarily consist of dense, relatively strong-tie, kinship-based relations. Furthermore, adherence to normative obligations remains despite a growing change in the norm itself (home-based to facility-based delivery), norms that do not vary according to the structure of the women's network.

Major Finding 3: Ethnographic decision tree modeling together with the NEM delineated the decision criteria that were most useful for understanding health-care utilization decisions in addition to the network characteristics. Intention, perception of time, transportation availability, *dai* availability were found to be predictors of SBA use among those derived from ethnographic decision modeling techniques along with marital age. A women's intention about place of delivery during pregnancy and her time perception of the onset and rate of labor progress were novel findings in this area of research.

Future Research:

- The application of the NEM together with the EDM should be extended and tested in other preventive health seeking behaviors not only in Bangladesh, but also in the United States in order to further delineate the factors that influence decision making that results in behavioral changes.

- Explore the patterns of women's intentions to use a facility according to the composition of their networks.

- Determine the effectiveness of birth preparedness and complication readiness plans that specifically indicate when, where and how women will carry out their positive intentions to use facilities for childbirth.

- Investigate the timing and self-diagnoses of labor onset, and the initial actions taken by women in response to perceived onset of labor.

- Determine the extent to which women's perceptions of labor onset and rate of progression are consistent with antenatal care and community health education messages.

Public Health Practice Recommendations:

- Community health worker and antenatal care providers need to be aware that formation of a positive intention, during pregnancy, is necessary but not sufficient in the decision process that results in actual facility use for birth. Practical solutions to overcoming environmental barriers such as transportation and distance are needed.

- Existing birth preparedness and complication readiness interventions should provide sign posts for the sequence, timing and duration of events for the three distinct phases of labor, as well as specific advice about when to report labor signs and symptoms and when to transfer to a facility, for women who chose a facility birth especially in areas where distance and transportation are known barriers.

Chapter Summary

In this final chapter an overview of the major study findings was presented. A discussion of the findings was offered along with potential explanations, considering previous research in the area. Limitations and strengths of the study were presented along with a critique of the ethnographic decision tree model approach and the NEM conceptual model. Recommendations for future analysis and public health practice were included according to the major findings from the study.

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APPENDIX A

Literature Review Table

Table A.1

Description of studies on utilization of skilled birth attendance, medically trained birth attendance or health facilities for childbirth in Bangladesh (N = 29)

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
1	Blanchet, 1984	1984	Meaning and rituals of birth in rural Bangladesh.	1979-1981	Ethnography	Qual	A village 200 kilometers north of Dhaka	The beliefs and birth practices of village women on childbirth are an amalgam of Islamic (purdah), Hindu (concepts pollution) and earlier pre-Hindu beliefs (vengeful spirits). Staying home during pregnancy and childbirth considered protective and rules out need for doctors and use of external medical facilities. Birth is a natural event not requiring medical assistance	
2	Bhatia, S.	1981	Traditional childbirth practices: implications for a rural MCH program.		Ethnography	Qual	Matlab	Belief in evil spirits prevents health seeking	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
3	Hlady WG, Fauveau VA, Khan SA, Chakraborty J, Yunus M.	1992-1993	Utilization of medically trained birth attendants in rural Bangladesh.		Case control	Quant	Matlab	Predictors of use: -ANC care at least one visit -Education mother and spouse education -Distance-women who requested a trained attendant for delivery tended to live closer to a health facility-66% were within 1 mile vs. 40% of controls	Women who used medically trained birth attendants at home and those who did not
4	Goodburn, E, Gazi, A, Chowdhury, M.	1995	Beliefs and practices regarding delivery and postpartum maternal morbidity in rural Bangladesh.	August 1991	Focus group discussions	Qual	Three unions of a rural district in central Bangladesh 90 women in three groups : 1) Young mothers aged 25 years of younger with one to three births 2) Older mothers greater than 25 years with more than four births 3) TBAs, trained and untrained	-All participants agreed TBAs make the best birth attendants -None of the women wanted to go to the hospital for delivery and would only consider doing so if desperately ill -Women and TBAs affirmed that hospital was last resort	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
5	Ahmed, SA, Khanum, PA, Islam, A,	1998	Maternal Mortality in Rural Bangladesh: Where Do Women Go For Care? ICDDRB Working Paper No.145	May 1996-August 1996	Cross-sectional Household Survey	Quant	Chittagong 16,911 households with 2105 women who had a pregnancy outcome during May 1995-June 1996	Reasons for not using facility: -38% did not feel it as necessary -16% had family objections -6% afraid of surgical procedures -6% lack of available medications -6% transportation problems -5% no one to take care of children at home -4% not aware of services -2% concerns about quality of services	Women who reported at least one complication Simple frequencies
6	Nahar, S, Costello, A	1988	The hidden cost of 'free' maternity care in Dhaka, Bangladesh.	July 1995-August 1995	Survey In-depth interviews	Quant and Qual	220 postpartum mothers and their husbands selected from four government maternity facilities in Dhaka	65% of mothers delayed seeking care and 38% of these mothers stated that the main reason for the delay was that money was not available at home. Of the 112 mothers with insufficient funds, most (69%) borrowed from relatives and friends. One-third obtained the money through loans from commercial moneylenders, advanced from employers or selling assets such as livestock or	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
							grain		
7	Rahman, M., Barkat-e-Khuda, & Reza, M.	1999	Determinants of safe-delivery practices in rural Bangladesh: evidence from the Bangladesh Demographic and Health Survey (BDHS) 1996-1997. ICDDRB Working Paper No 123	Nov. 1996 - March 1997	National Household Survey Secondary data analysis of BDHS 1996-1997	Quant	6,160 ever married women age 10-49 who delivered one year before interview	Predictors of Use: **Maternal Age** Ref. < 20 years 25-29 years (OR 1.32) 30-34 years (OR 1.47) **Maternal Education** Ref. no education 1-4 years (OR 1.68) 5 years (OR 3.53) **Religion** Ref. Hindu Muslim (OR 0.52) **TV/Radio Own** Ref. None TV ownership (OR 4.77)	Logistic regression for delivery assistance by medically trained personnel at home or facility Confidence intervals not reported
8	Afsana, K & Rashid, S	2001	The challenges of meeting rural Bangladeshi women's needs in delivery care.	Nov 1998-Jan 1999 3 years after implementation of BRAC birth centers	In-depth interviews Focus group discussions	Qual	Women aged 20-40 who had at least one live birth including one group who had a BRAC health center birth and home birth and one group who had only a home birth	Most women who used health center had complications Constraints to use of health center: -Cost -Fear of hospitals -Stigma of "abnormal" birth Experience of women using health center: -Poor txt of women by	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								health workers -Lack of privacy -Lack of respect for preferred birth position	
9	Paul, BK & Rumsey, DJ	2002	Utilization of health facilities and trained birth attendants for childbirth in rural Bangladesh: an empirical study.	July 1997	Retrospective, cross-sectional Field survey using individual interviews	Quant	Tangail district All 2,334 couples in 39 selected villages that experienced childbirth from July 1, 1995 and June 30, 1997 Convenience Sample	Predictors of use: **Delivery complications** Ref. None Yes (OR 20.79) **Maternal education** Ref. $< 5^{th}$ grade $\geq 5^{th}$ grade (OR 3.78) **Paternal education** Ref. illiterate $> 10^{th}$ grade (OR 1.82) **Prenatal care** Ref. no use Use (OR 1.76)	Logistic regression for use of medically trained birth attendants, either at home or in a hospital Confidence intervals not reported
10	Khanum, Islam, Quaiyum, & Millsap	2002	Use of Obstetric Care Services in Bangladesh, Does Knowledge of Husbands Matter? ICDDRB Working Paper 153	Nov. 1998-June 1999	Cross-sectional Individual interviews using structured questionnaire with closed and open ended questions	Quant	Chittagong 10,216 women with a pregnancy outcome within 5 years preceding survey and 7218 husbands	-75% of husbands were the main decision-makers for their wives' use of services for the mgmt of obstetric complications, in 3% of cases husbands and wives jointly made the decision, 7% of cases the mother or mother-in-law made the decision. Predictors of use: **Husband age** Ref. < 25 years 45 years and above (OR 2.59 $p < 0.05$) **Husband occupation**	Logistic regression for use of trained care for women who had complications Confidence intervals not reported

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								Ref. farmer/agricultural labor Non-agricultural labor (OR 1.51 p < 0.05) **Parity** Ref. 1 4 and above (OR 0.49 p < 0.005) **Husband reads newspaper** Ref. No Yes (OR 1.34 p < 0.05)	
11	Muna, L., Ross, J., Laston, S., & Bhuyian, A.	2002	Failure to Comply? Anthropological Perspectives on Refusal of Emergency Obstetric Care in Rural Bangladesh.	July 1996-Aug. 1996	Case Studies In-depth interviews	Qual	Matlab 20 women who accepted referral 15 women who refused referral 7 community health workers 8 TBAs	-Notion of birth as a natural phenomenon not a medical event -In most cases the decision to seek txt us taken on the basis of group consensus although a particular person by virtue of age, or financial status may have particularly strong influence on the decision -Only those who had supportive decision makers could overcome cultural, economic and logistical barriers to referral to facility -Cost concerns are a barrier	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
12	Chakraborty, Ataharul Islam, Islam Chowdhury, Wasimul Bari, & Hanum Akhter,	2003	Determinants of the use of maternal health services in rural Bangladesh.	Nov. 1992-Dec. 1993	Cross-sectional and prospective National Household Survey Secondary data analysis of prospective component of national survey on Maternal Morbidity in Bangladesh	Quant	993 pregnant women who had at least one antenatal follow-up Multi-stage random sampling	Predictors of use: **Marital age** Ref. ≥ 15 years < 15 years (OR 0.64 95% CI 0.45-0.91) **Maternal education** Ref. some primary secondary or higher (OR 1.84 95% CI 1.12-3.04) **Life threatening conditions** Ref. No Yes (OR 2.2 95% CI 1.51-3.18) **Husband's occupation** Ref. farmer business/service (OR 1.84 CI 1.26-2.69)	Logistic regression Use of doctor, nurse or family welfare visitor
13	Chowdhury AMR., Mahbub A. & Chowdhury AS.	2003	Skilled Attendance at Delivery in Bangladesh: an ethnographic study. Research Monograph Series No 22	Jan. 2001-March 2001	Ethnography -In-depth interviews -Focus group discussions -Free listing, matrix ranking, decision flow chart and problem tree	Qual	Korail slum in Dhaka and rural Chilmari Upazilla Women of reproductive age Influential household members Health care providers from formal and informal sectors	Barriers to use: -Disapprovals by influential persons in the household and the discouraging attitude of neighboring women -Fear of surgery -Shame in delivering in unfamiliar environment or with male doctors -Belief that childbirth is normal and not life-threatening -Indecision and procrastination in seeking EmOC -Distance/transportation	Utilization of formal health care facilities

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								-Unfriendly and irresponsible facility staff -Concern of leaving family behind at home	
14	Afsana, K	2004	The Tremendous Cost of Seeking Hospital Obstetric Care in Bangladesh.	Dec. 2000-Sept. 2001	Ethnography -In-depth interviews -Participant observation -Informal discussion	Qual	Apurbabari village 170 participants among women who had given birth in the previous five years	Cost concerns are one reason women refuse referral from the Thana health complex to the hospital with comprehensive obstetric services	
15	Anwar, I. Killewo, J. Chowdhury, ME, Dasgupta, SK,	2004	Bangladesh: Inequalities in Utilization of Maternal Health Services- Evidence from MATLAB	1994	Surveillance and monitoring Secondary Data Analysis of existing surveillance and monitoring databases in Matlab: -1997-2001 Pictoral Cards -HDSS Birth File -1996 Matlab Census	Quant	Matlab 12,080 births	Predictors of use: **Wealth** Ref. most poor quintile Least poor quintile (OR 3.42 95% CI 2.87-4.04) **Maternal Education** Ref. no formal education >10th grade (OR 1.82 95% CI 1.56-2.13) **Gravida** Ref. first order birth Forth birth order (OR 0.47 95% CI 0.40-.57) **ANC Visits** Ref. no visits Four or more visits (OR 12.94 95% CI 10.24-16.36) **Maternal Age**	Logistic regression from pictorial card data for sociodemographic correlates of SBA at birth

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								Ref. 35+ years 10-19 years (OR 1.64 95% CI 1.27-2.10) **Distance** Ref. $\leq$1km 1.1-2km (OR 0.45 95% CI 0.39-0.51) 2.1-3km (OR 0.50 95% CI 0.43-0.57) **Religion** Ref. Muslim Minority religion Hindu and others (OR 1.76 95% CI 1.54-2.02)	
16	ICDDR,B Centre for Health and Population Research	2005	Posting of trained birthing attendants: a comparison of home- and facility-based obstetric care.	1987-2001	Historical cohort study	Quant and Qual	Matlab 41,419 births recorded through a surveillance system and pregnancy monitoring records between 1987 and 2001.	Differences in use of trained birth attendant by wealth quintile (12% poor vs 29% least poor), mother's education (46% 10+ years education vs 13% no education), father's education (same pattern as mother's education) and distance to the facility (dropped by about half when distance from the home to the health centre was beyond 1km) Acceptable to seek care in the event of complications Barriers to use: -Biomedical delivery	Trained birth attendant either at home or in a facility

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								position -Fears about episiotomies -Misbehavior of midwives -Fear of exposure to evil spirits -Fear that delivery will occur on road -Need to attend household responsibilities including childcare	
17	Hossain, J., & Ross, S. R.	2006	The effect of addressing demand for as well as supply of emergency obstetric care in Dinajpur, Bangladesh.	Oct. 1998-May 1999	Population based survey and exit interviews with women treated at health center Evaluation of Dinajpur Safe Motherhood Initiative-intervention area and control areas	Quanta nd Qual	Dinajpur and Panchagarh	70% of women surveyed indicated need to seek approval from other family decision makers to use hospital services Reasons for not using health center: -Male doctors -Perception that quality of services was poor	Women who had received EmOC treatment
18	Blum, Sharmin, & Ronsmans,	2006	Attending home vs. clinic-based deliveries: perspectives of skilled birth attendants in Matlab, Bangladesh	Sept. 2003-June 2004	Ethnography -Key informant interviews -In-depth interviews	Qual	Matlab 13 SBAs Program manager of facility-based approach	Difficulties associated with attending home births: -Transportation esp. in dry season -Lack of proper environment for delivery -Lack of acceptability of procedures: delivery	From the SBA perspective the health facility environment offered an environment more conducive to effective skilled

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
					-Focus group discussions			position and episiotomies -Lack of necessary supplies and equipment -Family resistance to referrals -Lack of training and supervision -Social pressure to meet family expectations -Inadequate security -Scheduling difficulties	attendance at births
19	Mahabub-Ul-Anwar, Rob, & Talukder,	2006/2007	Inequalities in Maternal Health Care Utilization in Rural Bangladesh.			Quant		Eighty-four percent of women in the lowest wealth group compared to 13% of women in the highest wealth group did not seek treatment for delivery complications due to cost.	Women with delivery complications
20	Parkhurst, Rahman, & Ssengooba,	2006	Overcoming Access Barriers for Facility-based Delivery in Low Income Settings: Insights from Bangladesh and Uganda	Not reported	Comparative Study In-depth interviews	Qual	Jhenaidah district 30 women who had recently delivered at a health facility	-A large number of individuals playing roles in place of birth decisions including non-medical health practioners such as TBAs, village doctors -Decisions are typically made at crisis points when a women's home labor is perceived to be progressing poorly -Bangladeshi women can use health facilities but it	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								may take the idea of a complication to justify its use in a social environment valuing independent home-birth -Lack of pre-planning to overcome barriers such as distance, cost	
21	Chowdhury, ME, Ronsmans, C., Killewo, J., Anwar, I., Gausia, K, Das-Gupta, S Blum, L Dieltans, G Marshall, T Saha,S, Borghi, J,	2006	Equity in use of home-based or facility-based skilled obstetric care in rural Bangladesh: an observational study	1987-2001	Secondary data analysis of 1987-2001 Matlab HDSS birth records	Quant	Matlab 41,419 births	Adjusted risk ratio between the wealthiest and poorest quintiles was 1. 49 (95% CI 1.16-1.91) when midwives were providing services in the home compared to 1.66 (1.41-1.96) at peak of facility based care Predictors of use: **Mother's Education** Ref. none $> 10^{th}$ grade (OR 2.69 95% CI 2.26-3.20) **Father's Education** Ref. none $\geq 10^{th}$ grade (OR 1.32 95% CI 1.13-1.55) **Distance** Use of midwife dropped by more than half for women living 1 KM from health center (OR 0.44 95% CI 0.41-0.48)	Logistic regression and log link regression Presence of a SBA at birth either at home or in a facility

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
22	Islam, M.A. Chowdhury, R.I. Akhter, H.H	2006	Complications During Pregnancy, Delivery, and Postnatal Stages and Place of Delivery in Rural Bangladesh	Jan. 2001-June 2001	Cross-sectional and prospective National Household Survey Secondary data analysis on BIPERHT Bangladesh Maternal Health and Maternal Mortality Survey	Quant	993 pregnant women with at least one ANC follow up	Predictors of use: **Maternal Education** Secondary or higher education (beta estimate 1.52 p < 0.1) **ANC visits** Regular number of ANC visits (beta estimate 1.23 p < 0.1)	Logistic Regression for Delivery at Hospital/Clinic. Odds ratios and confidence intervals not reported
23	Killewo, J. Anwar, I. Bashir, I. Yunus, M. Chakraborty, J.	2007	Perceived delay in healthcare-seeking for episodes of serious illness and its implications for safe motherhood interventions in rural Bangladesh	Dec. 2000-Feb. 2001	Cross-sectional Field based workers administered structured questionnaire	Quant	Matlab 2,177 households	-For pregnancy related morbidities, the most commonly cited reason (45% of respondents) for delay in making a decision to seek care was "inability to judge the graveness of the situation" -Reported time to reach a facility was longest (150 minutes) for pregnancy related conditions	
24	Koenig, M., Jamil, K., Streatfield,	2007	Maternal Health and Care Seeking	Jan. 2001-June 2001	Cross-sectional &	Quant	103,796 ever married women 13-49 years of	-Almost two-thirds currently pregnant women had neither discussed nor	Facility use for treatment seeking in the

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
	P., Saha, T., Al-Sabir, A., El Areifeed, S., et al.,		Behavior in Bangladesh Findings from a National Survey		prospective National Household Survey Secondary data analysis on BIPERHT Bangladesh Maternal Health and Maternal Mortality Survey		age representing 40,657 live births and still births three years preceding the survey	made a decision regarding assistance at delivery, even among those in the third trimester, more than half had not reached a decision. -Reason for not seeking txt for obstetric complication perceived as life threatening-cost (44%) and txt not necessary or condition not serious (39%) -Marked socio-economic disparity 19% of rural women in lowest quintile and 60% of women in highest quintile sought care for a life threatening complication	event of perceived life threatening complication
25	Chowdhury, R. I., Islam, M. A., Gulshan, J., Chakraborty, N., Chowdhury, R. I., Islam, M. A., et al. .	2007	Delivery complications and healthcare-seeking behaviour: the Bangladesh Demographic Health Survey (BDHS), 1999-2000.	1999-2000	Cross-sectional National Household Survey Secondary analysis of BDHS 1999-2000	Quant	1,666 ever-married women age 10-49 who gave birth five years preceding survey and reported a complication	Predictors of use: **Maternal Age** Ref. $\geq$ 35 years Age $\leq$ 24 years (OR 0.58 95% CI 0.34-0.99) **Residence** Ref. urban Rural (OR 0.51 95% CI 0.38-0.69) **Maternal Education** Ref. secondary and higher No education (OR 0.54	Logistic regression for use of doctor/nurse/mid wife among women with reported complications

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								95% CI 0.38-0.77) **Parity** Ref. $\geq$ 5 1 (OR 2.39 95% CI 1.39-3.80) **Assets** Ref. one or more No assets (OR 0.55 95% CI 0.42-0.71) **Antenatal Care** Ref. with doctor No care (OR 0.23 95% CI 0.17-0.32) **Husband Concern Re Complication** Ref. Yes No (OR 0.48 95% CI 0.24-0.96)	
26	Gayen, R. & Raeside, R.	2007	Social Networks, normative influence and health delivery in rural Bangladesh	July 2002-Jan. 2003	Structured questionnaire administered in face-to-face interviews	Quant	694 currently married women who had at least one child from seven villages, one from each six administrative districts	Main reason for not using professional services was the perception that 'service was not needed' (44.4%) followed by 'too expensive' (13.7%).	Any kind of birth attendance other than family and relatives in home or facility
27	Chaudhury, RH. & Chowdhury, Z.	2008	Maternal Mortality in Rural Bangladesh: Lessons Learned from Gonoshasthaya	2002-2005	Case study Death report data collected by field-level health workers	Quant and Qual	86 maternal deaths among women who conceived and delivered between April 15, 2002 and	One-third of maternal deaths during to pregnancy and childbirth complications result from delay in seeking care Factors for delay in	

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
			Kendra Program Villages		reviewed by doctor as part of routine monitoring or program of NGO program		April 14, 2005 in 50 villages Program villages of NGO	seeking care for complications during delivery: -Lack of understanding of seriousness of risk -Non-availability of doctors at government health facilities -Cost concerns -Traditional beliefs and practices -Apathy toward modern allopathic treatment -Lack of negotiating power of women to ask for care owing to their lower social position and dependency on men -Delay in arranging transportation	
28	Banu RS, Ahsan GU, Yasmin N , Hossain MA, Hayder KA, Lahiry S,	2008	Utilization of Emergency Obstetric Care Services among Post-Natal Mothers in the Keranigang Upazilla of Dhaka District	Oct. 2006-Nov. 2006	Descriptive cross-sectional Semi-structured self administered questionnaire	Quant	119 post-natal mothers who received emergency obstetric care from public and private facilities in Dhaka	Decision making for hospitalization was mostly influenced by husband (54%), in-laws (29%), parental relatives (28%) dai (8%) and by the respondent herself (13%) 42% of women tried home delivery before they went to hospital. 60% stayed at home 0-4 hours after the onset of labor	Women who received EmOC

#	Author	Pub. Year	Publication Tile	Data Collection Date	Research Approach	Type of Study	Sample Population and Size	Relevant Results	Comments
								A trial of home labor or delay at home was influenced by: -Mother's education. Less educated mothers tried home delivery compared to more educated mothers -Family income (p < .01)	
29	National Institute of Population Research and Training	2009	Bangladesh, Demographic and Health Survey (BHDS), 2007	March 2007-August 2007	Descriptive, cross-sectional, National Household Survey	Quant	Nationally representative sample of ever married women age 15-49	Delivery in a health facility is substantially higher among women: -who have at least completed secondary education -in the highest wealth quintile -age 20-34 at the time of the birth -having their first child -if they have made at least four ANC visits -living in urban vs. rural areas -living in Kulna vs. Sylhet	Delivery in a health facility

Note: Quant. = Quantitative, Qual. = Qualitative, Ref.= Reference category

Appendix B

Preliminary Study Interview Guide

Preliminary Study Interview Guide

The interview guide consists of six parts:

Part I contains screening questions for eligibility in the study sample

Part II contains questions about place of delivery and type of birth attendant for the respondent's last delivery, social and demographic data, respondent's childbirth history, antenatal care and birth planning for her last delivery.

Part IIl contains guidance for a free-listing exercise on the nature (composition and function) of the respondent's personal social network during pregnancy.

Part IV contains questions about the people named in the free listing exercise in relation to the decision process about where to deliver and who to deliver with.

Part V contains open-ended questions about the decision making process.

Part VI contains process questions about the interview itself.

The majority of Part II can be completed prior to the interview based on the HDSS and existing Matlab community program records.

General Guidelines

All questions and instructions appear in the column headed 'Questions and Instructions'. Pre-coded responses appear in the column headed 'Response Options'. The actual response codes should be placed in the column headed 'Response'.

Please follow the same sequence of questioning for each respondent.

Ask each respondent the questions as written. You may modify a question slightly or clarify a question at the respondent's request.

Clarify any terms, ambiguous words or phrases with the respondent and record the response.

Before Each Interview

Confirm the respondent is eligible for the interview: a women age 18-49 years of age who gave birth in the past 3 months.

Read the oral informed consent to the potential respondent. Then obtain permission to precede with the interview and also to audio record the interview.

Remember to start the audio-recorders at the beginning of the interview

Check to see if the woman is comfortable, is not distracted with other activities, and is ready to begin the interview.

After Each Interview
After the interview and before leaving the respondent, review the completed interview guide for recording errors and missing information. Complete the form, as needed.

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDENT NO.   _____   **CID**_____

Part 1 Screening Questions for Eligibility in Study Sample

(SAY) First I would like to ask you some general questions…			
S 01	I understand that you had a delivery recently. When did your delivery take place?	01 = < 3 Mo. ago 02 = > 3 mo. ago	__ __
S 02	TOTAL RECALL PERIOD TO NEAREST WHOLE MONTH. **COUNT THE NUMBER OF MONTHS BETWEEN THE DATE OF THE DELIVERY AND THE DATE OF THIS INTERVIEW. RECORD THE NUMBER OF MONTHS.** **IF > 3 MONTHS AGO, STOP HERE.**	## (Months) DD=DELIVERY DATE	__ __ __ __
S 03	During your most recent pregnancy did you have any serious health problems? **IF 'YES,' STOP HERE.**	01 = Yes 02 = No	__ __
S 04	Did you have any serious health problems during the birth? **IF 'YES,' STOP HERE.**	01 = Yes 02 = No	__ __

PART II Place of Delivery and Birth Attendant, Demographics, Birth Planning and Antenatal Care

VAR	ITEM	PLACE OF DELIVERY	TYPE OF ATTENDANT
V01 V02 ***	Place of delivery **AND** Type of Attendant **IF TBA, INQUIRE IF TBA IS A RELATIVE OR NEIGHBOR. DOCUMENT RESULT. DOCUMENT TYPE OF RELATIVE**	01 = Marital Home 02 = Natal Home 03 = Nuclear Home 04 = Matlab SC Clinic 05 = Matlab ICDDRB, Hospital 06 = Matlab UHC 07 = District Hospital Chandpur 08 = MCWC Chandpur 09 = Private Clinic Chandpur 10 = Other MCWC 11 = Other Clinic 12 = Other Hospital 88 = Other (Specify)	01 = Mother 02 = Mother-in-law 03 = Sister 04 = Sister-in -law 05 = Aunt 06 = Grandmother 07 = Other female relative 08 = Neighbor 09 = TBA 10 = CHRW (ICDDRB) 11 = FWA (GOB) 12 = FWV (ICDDRB) 13 = HRO/nurse 14 = Village doctor 15 = Paramedic

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO. _____   **CID**_____

			16 = Pharmacist 17 = Big doctor (MBSS) 18 = Midwife (ICDDRB) 19 = Kabiraj/Traditional Healer 20 = None/Self 88 = Other (Specify)
	_____		
V03	If a facility-based delivery, how was the women transported to the facility? **Note all that apply**	01 = By Foot 02 = Bicycle 03 = Rickshaw 04 = Motorcycle or scooter 05 = Motorcar or jeep or babytaxi 06 = Country boat 07 = Motor boat 88 = Other (Specify) 99 = NA	__ __ __ __
V04	Geographic Block Matlab Service Area	01 = A 02 = B 03 = C 04 = D	__ __
V05	Age	## (YEARS)	__ __
V06	Education/Schooling	01= Never attended school 02=Primary, 1-5 years of school 03=Secondary, 6-10 years 04=Higher Secondary, 11-12 years 05=Graduate School or above 06=Other (specify)	__ __
V07	Marital Status	01 = Married 02 = No, Widowed 03 = No. Divorced 04 = No, Separated 05 = No, Never Married	__ __
V08	Religion	01= Muslim 02= Hindu 03= Other	__ __
V09	Do you work outside of the home, if yes what do you do?	01=Yes (Specify) 02=No	__ __
V10	Asset Quintile	1 2 3 4 5	__ __

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

V11	Household Head	01 = Husband 02 = Father-in-Law 03 = Father 04 = Older Brother 05 = Uncle 06 = Grandfather 07 = Other (Specify)	__ __
V12	Household Head Education/Schooling	01= Never attended school 02=Primary, 1-5 years of school 03=Secondary, 6-10 years 04=Secondary 11-12 years 05=Graduate School or above 06=Other (specify)	__ __
V13	Household Size	#	_____
V14	Type of Household	1=Natal Home 2=Marital Home 3=Nuclear Home 4=Other (Specify)	__ __

Birth History Questions			
V15	How many children do you have now who are living?	##	__ __
V16	How many children have you had who were born alive, but later died, if any?	##	__ __
V17	Did you ever have a child who was born dead,,,,who never breathed or cried (after 6 months of pregnancy)?	01=Yes and # 02=No 99=Not applicable	__ __
V18	Did you ever have a pregnancy that ended before 6 months (by itself or with someone's help)?	01=Yes and # 02=No 99=Not applicable	__ __
V19	This means that the total number of times you have ever given birth is _	##	__ __

Other			
V20	How well can you read and write? (Literacy)	01 = Easily 02 = With difficulty 03 = Not at all 99 = Not applicable	__ __
V21	Do you have a micro-credit/NGO membership?	01=Yes 02=No	__ __

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

V22	If you have a micro-credit/NGO membership which one?	01 = BRAC 02 = Grameen Bank 03 = BRDB 04 = ASA 05 = Other (specify) 06 = NA	____
V23	Do you receive weekly news from a television or radio?	01=Yes 02=No	__ __
V24	Do you own a telephone/mobile phone?	01=Yes 02=No	

Antenatal Care Questions

V 25	During your most recent pregnancy, did you receive **care/checkups** to be sure that you and your unborn baby were healthy? **IF 'NO,' SKIP TO VAR 29**	01 = Yes 02 = No		__ __
V 26 **AND** V 27	Who provided you with **care/checkups**? Where did you receive **care/checkups**?	**WHO** ____ ____ 01 = TBA 02 = CHRW (ICDDRB) 03 = FWA (GOB) 04 = FWV (ICDDRB) 05 = HRO/nurse 06 = Village doctor 07 = Paramedic 08 = Pharmacist 09 = Big Doctor (MBSS) 10 = Midwife (ICDDRB) 11 = Kobiraj/Traditional Healer 88 = Other (Specify) 99 = NA	**WHERE** ____ ____ 01 = Marital Home 02 = Natal Home 03 = Nuclear Home 04 = Matlab SC Clinic 05 = Matlab ICDDRB, Hospital 06 = Matlab UHC 07 = District Hospital Chandpur 08 = MCWC Chandpur 09 = Private Clinic Chandpur 10 = Other MCWC 11 = Other Clinic 12 = Other Hospital 88 = Other (Specify) 99 = NA	
V 28	Altogether how many times did you receive antenatal **care/checkups**?	**##**		__ __
V 29	Did you receive a home visit from a CHRW to talk about the danger signs of pregnancy and what to do in the event of complications?	01 = Yes 02 = No		__ __

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

V A R	QUESTIONS AND INSTRUCTIONS	BIRTH ORDER	WHERE DELIVERED (V29a-g)	WHO DELIVERED (V30a-g)
V 3 0	Let's talk about each birth, beginning with the most recent birth. Where was this baby born? **AND**	Birth 1 (most recent) Birth 2 Birth 3 Birth 4 Birth 5 Birth 6 Birth 7	__ __ __ __ __ __ __ __ __ __ __ __ __ __	__ __ __ __ __ __ __ __ __ __ __ __ __ __
V 3 1	Who delivered (caught) the baby and placenta?		01 = Marital Home 02 = Natal Home 03 = Nuclear Home 04 = Matlab SC Clinic 05 = Matlab ICDDRB, Hospital 06 = Matlab UHC 07 = District Hospital Chandpur 08 = MCWC Chandpur 09 = Private Clinic Chandpur 10 = Other MCWC 11 = Other Clinic 12 = Other Hospital 88 = Other (Specify)	01 = Mother 02 = Mother-in-law 03 = Sister 04 = Sister-in -law 05 = Aunt 06 = Grandmother 07 = Other female relative (Specify) 08 = Neighbor 09 = TBA 10 = CHRW (ICDDRB) 11 = FWA (GOB) 12 = FWV (ICDDRB) 13 = HRO/nurse 14 = Village doctor 15 = Paramedic 16 = Pharmacist 17 = Big doctor (MBSS) 18 = Midwife (ICDDRB) 19 = Kabiraj/Traditional Healer 20 = None/Self 88 = Other (Specify)

BIRTH PLANNING AND COMPLICATION READINESS			
V 32	During your most recent pregnancy, before your labor pains began, was there any **arrangements/thinking** for what to do in case a serious problem happened to you or your unborn baby? **IF 'NO,' GO TO PART III.**	01 = Yes 02 = No	__ __
V	Who helped you to make (was	01 = Mother	__ __

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

33	involved in making) these **arrangements**? **RECORD ALL THE PEOPLE THAT THE RESPONDANT NAMES**	02 = Mother-in-law 03 = Sister 04 = Sister-in -law 05 = Aunt 06 = Grandmother 07 = Other female relative 08 = Neighbor 09 = TBA 10 = CHRW (ICDDRB) 11 = FWA (GOB) 12 = FWV (ICDDRB) 13 = HRO/nurse 14 = Village doctor 15 = Paramedic 16 = Pharmacist 17 = Big doctor (MBSS) 18 = Midwife (ICDDRB) 19 = Kabiraj/Traditional Healer 20 = None/Self 21 = Husband 88 = Other (Specify)	__ ___ ___ __
V 34 V 35 ***	In the event of complications, to whom did you / your family first **arrange** to go if you had a problem? In the event of complications, where did you / your family first **arrange** to go? **IF MATLAB SUB CENTER, ASK WHICH BLOCK AND RECORD HERE ___ (A, B, C, D)**	**WHO** 01 = TBA 02 = CHRW (ICDDRB) 03 = FWA (GOB) 04 = FWV (ICDDRB) 05 = HRO/nurse 06 = Village doctor 07 = Paramedic 08 = Pharmacist 09 = Big doctor (MBSS) 10 = Midwife (ICDDRB) 11 = Kobiraj/Traditional Healer 12 = None 88 = Other (Specify) 99 = NA	**WHERE** 01 = Marital Home 02 = Natal Home 03 = Nuclear Home 04 = Matlab SC Clinic 05 = Matlab ICDDRB, Hospital 06 = Matlab UHC 07 = District Hospital Chandpur 08 = MCWC Chandpur 09 = Private Clinic Chandpur 10 = Other MCWC 11 = Other Clinic 12 = Other Hospital 88 = OTHER (SPECIFY) 99 = NA
V 36	How were you to be taken (get) there? **Note all that apply**	01 = By Foot 02 = Bicycle 03 = Rickshaw 04 = Motorcycle or scooter 05 = Motorcar or jeep or babytaxi 06 = Country boat 07 = Motor boat 88 = Other 99 = NA	__ __ __ __ __ __

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

V 37	Did your family save money for your delivery?	01=Yes 02=No 99=NA	— —
V 38	If your family did save money, how much was saved?	#TK Don't Know 99 = NA	— —
V 39	Did you eat any special foods during pregnancy? (more than usual before you were pregnant)	01=Yes 02=No 99=NA	— —

PART III Social Network Composition and Function

THIS SECTION IS COMPOSED OF OPEN-ENDED QUESTIONS FOR EACH TIME PERIOD (E.G, PREGNANCY AND LABOR AND BIRTH). THEY MAY BE USED TO ELICIT THE WOMAN'S RESPONSE. QUESTIONS SHOULD BE ASKED IN A CONVERSATIONAL MANNER. THIS IS VERY IMPORTANT. YOU MAY FOLLOW-UP OR ASK OTHER QUESTIONS, AS NECESSARY, RELATED TO <u>WHO PROVIDED CARE/ASSISTANCE/SUPPORT/INFORMATION</u> AND <u>KINDS OF CARE/ASSISTANCE/SUPPORT/INFORMATION PROVIDED</u>.

> **SAY**…We're interested in all the kinds of help that women get during pregnancy. Thinking back to your most recent pregnancy, please name the people who helped you along the way…
>
> **During Pregnancy (SAY…** Let's start at the beginning, early in your pregnancy…)
>
> How did you find out you were pregnant?
>
> How far along were you?
>
> *Who* did you tell/inform first after you suspected or learned that you were pregnant?
>
> Did you inform *anyone else* about your pregnancy?
>
> Who did you ask for information and advice about your pregnancy and childbirth?
>
> What *kinds of things* did (**NAMED PERSON**) talk with you about?
>
> *Who* else assisted you during your pregnancy, before your labor pains began?
>
> What *kinds of things* did (**NAMED PERSON**) assist you with? When? (**PROBE** Anything else?)
>
> Did *anyone else* care for you during this time?
>
> What *kinds of care* did (**NAMED PERSON**) give?

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO. _____   **CID**_____

<u>Labor and Birth</u>

<u>Who</u> did you tell first when you suspected that you were in labor?

What *<u>kind of things</u>* did (**NAMED PERSON**) do? (**PROBE** Anything else?)

<u>Who</u> else assisted/supported you when you were in labor and during birth itself?

What *<u>kinds of things</u>* did (**NAMED PERSON**) help you with? (**PROBE** Any thing else?)

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

POTENTIAL REPSONSE OPTIONS FOR <u>KINDS OF CARE, ADVICE, ASSISTANCE, TALKING, HELP</u>

01 = Informed about pregnancy

02 = Provided you with information/advice/suggestions
(instructions on proper care, where to go, who to call)

03 = Provided you with practical help/routine activities
(household work like cooking, cleaning, taking care of animals, childcare)

04 = Mental Support
(listen, reassure)

05 = Resources/Material Goods
(Tk, transportation, medicines)

06 = Negotiate
(delivery at natal home, delivery at hospital, avoidance of Chadpour, fees or payment)

07 = Informed about labor pains

08 = Accompanied to facility

09 = Present during labor and delivery of baby and placenta

10 = Assisted during labor and delivery of baby and placenta

11= Other LIST BELOW AND BE SPECIFIC

QUESTIONNAIRE NO. _____   **RID** _____
RESPONDANT NO.   _____   **CID**_____

PART IV Social Influence

SN01 and SN02

Of the people who gave you information and advice about pregnancy and childbirth place them in the circles according to how much <u>you trust the information they gave you about pregnancy and childbirth</u>

NOTE TO INTERVIEWER: Please number the responses according to the order mentioned by the respondent (1,2,3,4,5….etc) and indicate with a **P,** if response follows a specific probe
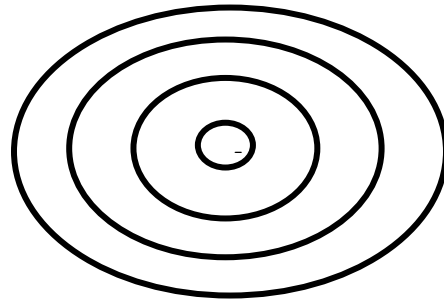
RESPONSE OPTIONS FOR DEGREE OF TRUST BASED ON WHERE PEOPLE ARE PLACED IN THE CIRCLE:

01 = A little (outer circle)
02 = Somewhat (middle circle)
03 = A lot (inner circle)
99 = NA

SN03 and SN04
Of the people in the circle who are kin, family members, neighbors and friends ask the following two questions for EACH person:
Where did ___ think you should have your baby?
Where did ___ deliver most of her babies? If ___ is a male, ask where did your wife deliver her babies?

CODES: NH=Natal Home, MH=Marital Home, H=Nuclear Home, F=Facility

QUESTIONNAIRE NO. _____   **RID** _____
RESPONDANT NO.   _____   **CID**_____

PART V Decision Making Process
Thinking about your most recent birth we would like to understand how you arrived at the decision to use (BIRTH ATTENDANT)

VAR	QUESTIONS
Q01	Was there **any discussion** about where you would deliver? (**IF NO, PROBE** How a decision to use the person was reached?)
Q02	Who initiated the **discussion** of where to give birth? Who else was involved in the discussion?
Q03	What options were considered? (**PROBE**: Did you consider a home birth or a facility birth? Why or why not?)
Q04	What issues or concerns were discussed?
Q05	What disagreements/negotiations were there about what to do, if any? Among who?
Q06	Did the decision change over time? What made it change?
Q07	Who was mainly responsible for the final decision?
Q08	Were you satisfied with the final decision?
Q09	Would you have wanted more involvement in the decision process? Were you able to express your opinions openly in your household?
Q10	If you become pregnant again, where would you prefer to deliver?
Q11	Where would you advise other women to deliver?

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

PART VI Interview Summary

Review the completed interview guide. Check for missing data. Clarify any ambiguous responses. Thank the respondent for participating in the interview. Complete the items listed below.

IS O1	Interview status	01-COMPLETE INTERVEIW 02-PARTIAL INTERVIEW 03-REFUSED INTERVIEW 04-NOT AT HOME 05-NOT ELIGIBLE 06-OTHER	__ __
IS O2	Please specify reason if V01 is 03-REFUSED or 06-OTHER	Specify Reason	
IS03	Date of First Interview Attempt	(DD/MM)	__ __
IS04	Date of Second Interview Attempt	(DD/MM)	
IS05	Interview Start Time Interview End Time	Hour: Minute __ __: __ __ __ __: __ __	__ __ __ __
IS06	Total Duration of Interview	## (MINUTES)	__ __
IS07	Setting of Interview	01-INSIDE HOME 02-OUTSIDE HOME 03-NEIGHBOR HOME 03-OTHER	__ __
IS08	Persons present during /participating in the interview other than the women	01=Yes 02 =No _____ __ 01 = Mother 02 = Mother-in-law 03 = Sister 04 = Sister-in -law 05 = Aunt 06 = Grandmother 07 = Other female relative (Specify) 08 = Neighbor # 09 = Landlady 10 = TBA 11 = CHRW (ICDDRB) 12 = FWA (GOB) 13 = FWV (ICDDRB) 14 = None/Self 88 = Other (Specify)	__ __

QUESTIONNAIRE NO. _____   **RID** _____
RESPONDANT NO.   _____   **CID**_____

			— —
IS09	Describe any distractions or interruptions?	1=None 2=Distraction/Interruption (Specify)	— —
IS10	**Interviewed,** reviewed, edited by	Initials	
IS11	**Transcribed in Bangla**, Date completed (DD/MM)	Initials Date completed (DD/MM)	
IS12	**Translated in English** Date completed (DD/MM)	Initials Date completed (DD/MM)	
IS13	**Data for structured questions entered** Date completed (DD/MM)	Initials Date completed (DD/MM)	
IS14	CID No. Verified	Initials	_____
IS15	RID No Verified	Initials	_____

QUESTIONNAIRE NO. _____   **RID** _____

RESPONDANT NO.   _____   **CID**_____

APPENDIX C

Main Study Phase Interview Guide

ENGLISH VERSION OF INSTRUMENT FOR MAIN STUDY PHASE
Note: Formatting different than original instrument used in the field

Start Time: (__ __: __ __)   Stop Time: (__ __: __ __)

Study ID: _____   MNCH ID (SID): ___ ___ ___ ___ ___ ___

CID (9 digit number):   ___ ___ ___ ___ ___ ___ ___ ___ ___

RID (10 digit number):   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

CHRW code: ___ ___ ___   Bari Code: ____ ____ ____

Interview Date (mm/dd/yy): __ __/__ __/__ __   Block (circle one): A   B   C   D

Education (report | form): ____ | ____   Asset Score: 1   2   3   4   5

Delivery Place (circle one): Home   Facility: SC-B   SC-C   SC- D   Matlab Hospital   Private

Delivery Date: __ __/__ __/__ __   Estimated Date of Delivery :   ___/____/___

Age (report): _____   Religion: M   H   Marital Status: M   D   S   W

PART I SCREENING			
(SAY) First I would like to ask you some general questions about your health…			
S01	I understand that you had a delivery recently. When did your delivery take place? **COUNT THE NUMBER OF MONTHS BETWEEN THE DATE OF THE DELIVERY AND THE DATE OF THIS INTERVIEW. IF > 3 MONTHS AGO, STOP HERE.**	1 = < 3 Mo. Ago 2 = > 3 mo. ago	
S02 a-i	Before or during your pregnancy did a health care provider tell you that you had any of the following major health problems?	**CIRCLE ONE**	**ANSWER OPTIONS**
	Anemia…………………………………………………	1 2 77	1 = Yes
	High Blood Pressure (Hypertension)………………………………	1 2 77	
	Liver Disease (Hepatitis)………………….........................……	1 2 77	2 = No
	Diabetes…………………………………………………	1 2 77	
	Cancer (Tumor)…………………………………………..	1 2 77	77 = Don't know/Don't remember
	Heart Disease…………………………………………….	1 2 77	
	Tuberculosis…………………………………………………	1 2 77	
	Malaria……………………………………………………	1 2 77	
	Epilepsy (Convulsions or Fits)………………………………… →**SKIP TO S04 IF NO TO ALL IN S02**	1 2 77	
S03	**IF "YES" TO AT LEAST ONE OF THE ABOVE HEALTH CONDITIONS <u>AND</u> RESPONDANT DELIVERED IN A FACILITY ASK:** You have just mentioned that you had [LIST ANY MENTIONED IN SO2]. Did you go to a facility for delivery only because you had [LIST ANY MENTIONED IN SO2]? **IF 'YES,' STOP HERE**	1 = Yes (Specify:_____) 2 = No 99 = Not applicable	

S04 a-j	Did you have any of the following signs during pregnancy, at the time of your labor pains and up until the birth of your baby: Any vaginal bleeding during pregnancy…………………… Excessive or unusual amount of vaginal bleeding during your labor and delivery that caused you concern or you felt was life threatening………………………………………….. Headache and blurred vision…………………………… Swollen hands and face………………………………… Severe pallor……………………………………………. Convulsions or fits………………………………………. Reduced movement of the baby inside you…..………… Breaking of the bag of water 18-24 hours before labor pains began………………………………………………… Strong labor pains that began and consistently lasted more than 24 hours before delivery (prolonged labor)………………………………………………………… Labor pains began before 9 full lunar months (premature labor)…………………………………… → **SKIP TO S06 IF "NO" TO ALL IN S04**	**CIRCLE ONE** 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77 1 2 77	**ANSWER OPTIONS** 1 = Yes 2 = No 77 = Don't know/Don't remember
S05	**IF "YES" TO AT LEAST ONE OF THE ABOVE SIGNS AND RESPONSDANT DELIVERED IN A FACILITY ASK:** You have just mentioned that you had [LIST ANY MENTIONED IN SO4]. Did you go to a facility for delivery only because you had [LIST ANY MENTIONED IN SO4] during your pregnancy or delivery? **IF 'YES,' STOP HERE.**	1 = Yes 2 = No 99 = Not applicable	
S06	**IF RESPONSDANT DELIVERED IN A FACILITY ASK:** Did you have any other serious health problems at the time of your pregnancy, labor or delivery **that made you to go to a facility**? **IF 'YES,' STOP HERE.**	1 = Yes (Specify:_____) 2 = No 99 = Not applicable	

PART II

(SAY) First let's talk about each birth, starting with your first birth			

VAR	QUESTIONS AND INSTRUCTIONS	WHERE DELIVERED (Va-g)	WHO DELIVERED (Va-g)
V01 a-g	Where was your [birth number] baby born? AND	First Birth ___ Second Birth ___ Third Birth ___ Forth Birth ___	First Birth ___ Second Birth ___ Third Birth ___ Forth Birth ___ Fifth Birth ___ Sixth Birth ___ Seventh Birth ___
V02 a-g ***	Who delivered (caught) the baby and placenta? **If TBA, inquire if TBA is a relative or neighbor. Document result below according to birth order.** 1. 2. 3. 4. 5. 6. 7.	Fifth Birth ___ Sixth Birth ___ Seventh Birth ___ 1 = Marital Home 2 = Natal Home 3 = Nuclear Home 4 = Matlab SC Clinic 5 = Matlab ICDDR,B Hospital 6 = District Hospital Chandpur 7 = MCWC Chandpur 8 = Private Clinic Chandpur 77 = Don't remember/know 88 = Other (Specify:_____) 99=Not applicable	1 = Mother 2 = Mother-in-law 3 = Sister 4 = Sister-in -law 5 = Aunt 6 = Grandmother 7 = Other female relative **8 = Neighbor** 9 = Trained Provider (MBSS Doctor, Midwife, Nurse, Paramedic) 10 = Village Doctor 11 = Pharmacist 12 = Homeopathic Doctor **13=Traditional Birth Attendant (TBA, Dai) *** ** 14 = Traditional Healer (Spiritual Healer, Kobirij, Hakim) 15 = None/Self 77 = Don't remember/know 88 = Other (Specify: _____) 99 = Not applicable

(SAY) Now, I'd like to ask you some questions about you and your household			

VAR	QUESTION	ANSWER	
V03	How old were you when your marriage started?	# (YEARS) 77 = Don't Know	YEARS ☐☐
V04	Was your marriage a love or arranged marriage?	1 = Love 2 = Arranged	
V05	Did you move into your husband's home within one year after marriage?	1 = Yes 2 = No	
V06	For most of the time until you were 12 years old, did you live in	1 = City 2 = Town	

	a city, in a town, or in the countryside?	3 = Village/Countryside		

V07	How long have you been living in your current residence?
	
	[WRITE "00" IF LESS THAN ONE YEAR]
		# Year
		95 = Always
		77 = Don't know/remember
				YEARS

V08	Can you read and write a letter easily, with difficulty, or not at all?	1 = Easily 2 = With difficulty 3 = Not at all		
V09	Do you receive weekly news from a television or radio?	1 = Yes 2 = No		
V10	Do you own a telephone/mobile phone?	1 = Yes →**SKIP TO V12** 2 = No		
V11	Does someone in your household have a telephone/mobile phone that you can use when you need one?	1 = Yes 2 = No		
V12	What is the highest grade your husband completed?	# (GRADE LEVEL) 77=Don't know	1=Secular 2=Madrasa	GRADE LEVEL
V13	What was the highest grade your father completed?	# (GRADE LEVEL) 77=Don't know		GRADE LEVEL
V14	Who do you consider the head of your household?	1 = Husband 2 = Father-in-Law 3 = Father 4 = Brother (young/old) 5 = Uncle (maternal/paternal)	6 = Grandfather 7 = Husband's Brother or Cousin 8 = Mother-in-law 9 = Respondent 88 = Other (Specify:_____)	
V15	Where was your husband working during your pregnancy?	1 = Abroad 2 = Dhaka 3 = City other than Dhaka 4 = Town in Matlab upazilla 5 = Town outside Matlab upazilla 6 = Village in Matlab upazilla 7 = Village outside Matlab upazilla		
V16	How many months did your husband live in your home during your pregnancy?	1 = 9 months-Entire Pregnancy 2 = 6-8 months 3 = 4-5 months 4 = 1-3 months 5 = < 1 month 6 = 0 months-Never stayed		
V17	How many months did your mother-in-law live in your home **or** in your bari during your pregnancy?	1 = 9 months-Entire Pregnancy 2 = 6-8 months 3 = 4-5 months 4 = 1-3 months 5 = < 1 month 6 = 0 months-Never stayed		

V18	Was any other member of your household or bari living abroad during your pregnancy?	1 = Yes 2 = No →**SKIP TO V20**	
V19 a-k	Which household or bari member was living abroad? (circle all that apply)	1 = Father-in-Law 2 = Father 3 = Older Brother 4 = Uncle 5 = Grandfather	6 = Husband's Brother or Cousin 7 = Mother-in-Law 8 = Other Member of Husband's Family 9 = Other Member of Respondent's Natal Family 88 = Other (Specify:_____) 99 = Not applicable
V20	Where do you currently live?	1 = Natal Home 2 = Marital Home 3 = Nuclear Home 88 = Other (Specify:_____)	
V21	Where did you live most of the time during your pregnancy?	1 = Natal Home 2 = Marital Home 3 = Nuclear Home 88 = Other (Specify:_____)	
V22	How many people lived with you under the same roof during your pregnancy?	# (NUMBER) 77=Don't know/remember	PEOPLE ☐☐
V23	Where were you living at the time of your delivery?	1 = Natal Home 2 = Marital Home 3 = Nuclear Home 88 = Other (Specify:_____)	
V24	Where do most of your **husband's kin** live?	1 = Within your bari 2 = Within your village 3 = Within your Thana 4 = Within your Upazilla 5 = Within your District 88 = Other (Specify:_____)	
V25	Where do most of **your kin** live?	1 = Within your bari 2 = Within your village 3 = Within your Thana 4 = Within your Upazilla 5 = Within your District 88 = Other (Specify:_____)	
V26	Did you spend any time in your natal home during your pregnancy?	1 = Yes 2 = No →**SKIP TO V29**	
V27	How much time did you spend in your natal home during your pregnancy?	(DAYS AND MONTHS)	DAYS ☐☐ MONTHS ☐☐
V28	How much time did it usually take you to travel to your natal home during your pregnancy?	1 = Less than one hour 2 = 1-3 hours 3 = 4-6 hours 4 = Entire day 5 = Two or three days	

		6 = Longer than three days 88 = Other (Specify:_____) 99 = Not applicable

(SAY) Now, I would like to ask your opinion …

V29	If you become pregnant again, where do you want to deliver?	1 = Home 2 = Facility 3 = Facility only if problems 4 = Do not want to be pregnant again
V30	Where would you **advise other women** to deliver?	1 = Home 2 = Facility 3 = Facility only if problems
V31	Do you think that women should have a medical checkup when they are pregnant **even though they are not sick**?	1 = Yes 2 = No 77= Don't know/remember
V32	Do you think that women who have **no problems** should go to a facility for delivery?	1 = Yes 2 = No 77=Don't know/remember
V33	What do you think your risk is of dying in labor and delivery (childbirth)?	1 = Very low 2 = Low 3 = Moderate 4 = High 5 = Very high
V34	Do you know other women, **who are like you**, live in your bari and have delivered in the past two years?	1 = Yes 2 = No →**SKIP TO M01**
V35 a-e	Where did the women who are like you and live in your bari deliver?	a. 1= Home 2 = Facility 77=Don't Know/Remember b. 1= Home 2 = Facility 77=Don't Know/Remember c. 1= Home 2 = Facility 77=Don't Know/Remember d. 1= Home 2 = Facility 77=Don't Know/Remember e. 1= Home 2 = Facility 77=Don't Know/Remember

Mobility and Decision Making Authority Questions		
(SAY) Now I would like to ask some questions about your movement outside the home and your role in decision-making…		
M01	Since your marriage, how frequently do you travel outside your village?	1=Often 2=Sometimes 3=Seldom 4=Never
M02	When you travel outside do you **generally** wear a burka or cover your face?	1=No 2=Sometimes 3=Yes

M03	When you travel outside **generally must you** be accompanied by another adult?	1=Always 2=Sometimes 3=Never	
M04-M08	During your pregnancy **were you permitted** to go outside your bari or village to….	**CIRCLE ONE**	**ANSWER OPTIONS**
	visit your parents (natal home)	1 2 3 4 99	1 = Yes
	visit other relatives or friends	1 2 3 4 99	2 = No
	take a sick child or relative to a health center or hospital	1 2 3 4 99	3 = Rarely
	take yourself to a health center or hospital	1 2 3 4 99	4 = Only in a emergency
	go shopping or to the market	1 2 3 4 99	99 = Not applicable

D01-D08	Who in your life makes the **final decision** or has the **final say** on the following decisions…	**CIRCLE ONE**	**ANSWER OPTIONS**
	To purchase medicine for a sick child		1 = Respondent decided
	To seek health care when you are ill	1 2 3 4 5 6 7 8 77 99	2 = Respondent more then husband
	On how long a child should attend school	1 2 3 4 5 6 7 8 77 99	3 = Husband decided
	To spend money on gifts and jewelry		4 = Husband more than respondent
	To spend money on household purchases for daily needs such as food	1 2 3 4 5 6 7 8 77 99	5 = Respondent and husband had equal influence
	To purchase household assets	1 2 3 4 5 6 7 8 77 99	6 = Mother-in-law decided
	To make visits to family, friends or relatives		7 = Husband and mother-in-law had equal influence
	On what food should be cooked each day	1 2 3 4 5 6 7 8 77 99	
			8 = Mostly other family members
		1 2 3 4 5 6 7 8 77 99	77 = Don't know/Don't remember
		1 2 3 4 5 6 7 8 77 99	99 = Not applicable
		1 2 3 4 5 6 7 8 77 99	
D09-D11	Do you approve or disapprove of **women in this area** deciding to go to a facility for childbirth when she has **no problems** even though her…	**CIRCLE ONE**	**ANSWER OPTIONS**
	Husband opposes (regardless of in-laws opinion)	1 2	1 = Approves
	Husband agrees, but in-laws oppose	1 2	2 = Disapproves
	Husband and in-laws oppose	1 2	
D12	Overall, how much control do you feel you had on the final decision about where you delivered?	1 = No control 2 = Little control 3 = Almost complete control 4 = Complete control	

Part III

Ethnographic Decision Tree Questions		
(SAY) Please answer just "yes" or "no" to the following questions. Answer based on your memory there are no "right" or "wrong" answers.		
(SAY) First, thinking back to events, conversations and thoughts during your pregnancy, prior to when your labor pains started.		
ED01	During your pregnancy did you think delivering at home was less expensive than delivering at a facility?	1=Yes 2=No
ED02	During your pregnancy did you worry that going to a facility would cost too much money?	1=Yes 2=No
ED03	During your pregnancy did your husband or other family members ever refuse to provide money to go to a facility for delivery?	1=Yes 2=No
ED04	During your pregnancy did anyone in your life ever forbid you to go to a facility?	1=Yes 2=No
ED05	During your pregnancy did any influential person in your life (such as a mother-in-law, sister-in-law, or husband) advise you to stay at home for delivery?	1=Yes 2=No
ED06	During your pregnancy, did you think health facilities had poor quality services?	1=Yes 2=No
ED07	During your pregnancy, did you think home services were better than facility services for delivery?	1=Yes 2=No
ED08	During your pregnancy, did you worry about going to facility because of lack of privacy (break purdah)?	1=Yes 2=No
ED09	During your pregnancy, did you worry about going to a facility because of surgical procedures (cutting)?	1=Yes 2=No
ED10	During your pregnancy, was there a dai in your area (household, bari, or close to your bari) to assist with a home delivery?	1=Yes 2=No
ED11	During your pregnancy, was someone available to accompany you to a facility?	1=Yes 2=No
ED12	During your pregnancy, where did **you want** to deliver?	1= Home 2=Facility 3=Facility if problems
(SAY) Now, thinking back on the decision about where to deliver, <u>once your labor pains started</u>.		
ED13	If you wanted to go to a facility, did you have enough time to reach a facility once your labor pains started?	1=Yes 2=No
ED14	Did you labor progress very quickly or rapidly? (delivered <3 hours after labor pains started)	1=Yes 2=No
ED15	Did your labor pains start at night (when the sky was dark)?	1=Yes 2=No
ED16	Was it raining when your labor pains started?	1=Yes 2=No
ED17	Did you wait more than one hour to inform someone about your labor pains once you knew you were in labor?	1=Yes 2=No
ED18	Once your labor pains started, did you have to wait more than one hour for someone to make a final decision about where to deliver?	1=Yes 2=No
ED19	During your labor, did you have a major problem that made you go to a	1=Yes

	facility?	2=No
ED20	During your labor, was transportation available to reach a facility?	1=Yes 2=No
ED21	When you were in labor, did you have someone available to accompany you to a facility?	1=Yes 2=No
ED22	When you were in labor, did you have someone at home to take care of the children?	1=Yes 2=No 99=NA
→**SKIP ED 23-26 if respondent delivered at home**		
ED23	Were you referred or told to go another place for delivery outside of Matlab?	1=Yes 2=No → **SKIP ED25**
ED24	Did you go to the place where you were referred outside of Matlab?	1=Yes 2=No 99=NA
ED25	How much time after your labor started did you leave your home to go to a facility? [WRITE "00" IF LESS THAN ONE HOUR]	HOURS
ED26	How much time did it take to reach the facility from the time you left your home? [WRITE "00" IF LESS THAN ONE HOUR]	HOURS

Part IV and V

Name Generation and Interpretation Documentation Form

No	PROBE	NAME	Age	M/F	Relation	KIN	Reside	Education	Close	Advise	Perceived Beliefs	Delivery Place Last Child	Rank three most influential
1	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
2	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
3	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
4	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
5	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
6	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
7	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
8	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
9	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	

No	PROBE	NAME	Age	M/F	Relation	KIN	Reside	Education	Close	Advise	Perceived Beliefs	Delivery Place Last Child	Rank three most influential
10	S NS SP		1 2 3	M F		Y N	Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
11	S NS SP		1 2 3	M F		Y N	Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
12	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
13	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
14	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
15	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
16	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
17	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
18	S NS SP		1 2 3	M F		Y N	Y N / Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	
19	S NS SP		1 2 3	M F		Y N	Y N / Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	

No	PROBE	NAME	Age	M/F	Relation	KIN	Reside	Education	Close	Advise	Perceived Beliefs	Delivery Place Last Child	Rank three most influential
							Y N						
20	S NS SP		1 2 3	M F		Y N	Y N Y N Y N		1 2 3	H F FC N	1 2 3 4 5	H F 77 99	

Network Grid

Names	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1.															
2.															
3															
4.															
5.															
6.															
7.															
8.															
9.															
10.															
11.															
12.															
13.															
14.															
15.															

PART V Interview Summary   **AUDIO RECORDED: YES   NO**

ISO1	Interview status	01 = Complete interview 02 = Partial interview 03 = Refused interview 04 = Not at home 05 = Not eligible 88 = Other (Specify)_____)	
IS02	Date and Time of First Interview	Start Time Stop Time (MM/DD)	(__ __: __ __) (__ __: __ __) __ __/____
IS03	Date or Time of Second Interview	Start Time Stop Time (MM/DD)	(__ __: __ __) (__ __: __ __) __ __/____
IS04	Was this your first, second or third interview of the day?	1 2 3	
IS05	Did you change the sequence of the interview? If yes, document order according to the interview parts.		
IS06	Setting of Interview	1=Inside home 2=Outside home 3=Inside neighbor home 4=Outside somewhere in bari 88=Other (Specify)	
IS07	Were there persons present during the interview or participating in the interview other than the women?	1=Yes 2 =No →**SKIP TO IS08**	
IS08	Who was present or participating in the interview other than the women? **[Circle all that apply]**	1 = Large crowd of people the entire interview 2 = Initially a large crowd of people that dispersed 3 = Mostly children moving in and out	4 = Husband 5 = Father-in-law 6 = Mother 7 = Mother-in-law 8 = Sisters and Sister-in-Laws 9 = Neighbors 88 = Other
IS09	Were there any major distractions or interruptions during the interview?	1=Yes 2=No → **SKIP IS11**	
IS10	Specify, during what part of the interview did the distractions or interruptions occur?		
IS11	What is your evaluation of the accuracy of respondent's answers?	1 = Excellent 2 = Good 3 = Fair	4 = Not so good 5 = Very bad
IS12	What is your evaluation of the seriousness and attentiveness of the respondent?	1 = Excellent 2 = Good 3 = Fair	4 = Not so good 5 = Very bad
IS13	Interviewer initials and code (Initials: _____)	1 2 3	4 5 6

IS14	Editor/Supervisor initials and code (Initials: _____)	1 2 3	4 5 6
IS15	Data Entry Personnel initials and code (Initials:_____)	1 2 3	4 5 6

INTERVIEWERS COMMENTS AND OBSERVATIONS

RESPONDANT DEBRIEFING

Part IV
Name Generation Questions

[LIST ALL NAMES IN THE ORDER RESONDENT PROVIDES THEM ON THE FOLLOWING PAGES UP TO 20 UNIQUE NOMINATIONS NOTE IF THE NAME WAS REPORTED SPONTANEOUSLY OR AFTER A NON-SPECIFIC OR SPECIFIC PROBE]
[FOLLOW THIS SCRIPT EXACTLY]

"I will ask you to just list the names of people who you might have talked to about where to deliver or who had an opinion about where you could deliver."

"Just list all the names of these people in your life, male and female, young and old, kin or non-kin. People you know by name or recognize by face."

[REPEAT IF NECESSARY]
"Can you list people who you might have talked to about where to deliver or who had an opinion about where you could deliver."

[AT THE POINT WHEN THE WOMEN INTIALLY FINISHES SPONTANEOUSLY LISTING NAMES USE THE FOLLOWING SET OF NON-SPECIFIC PROBES]

"OK, good, what other people did you talk to about where to deliver or who had an opinion about where you could deliver."

[AT THE POINT WHEN THE WOMEN FINISHES LISTING ADDITIONAL NAMES SLOWLY READ BACK THE LIST OF PEOPLE THE WOMEN HAS MENTIONED SO FAR. ACT AS IF YOU ARE CHECKING YOUR DOCUMENTATION FOR ACCURACY. ASK ONCE MORE THE FOLLOWING QUESTION, A NON SPECIFIC PROBE]

"Did I miss anyone, is there anyone else that you talked to, had an opinion about where you could deliver or had an influence on the final decision?"

[NOW USE THE FOLLOWING NON-SPECIFIC PROBE WITH EACH NAME ON YOUR LIST]

"Thinking about [NAME], do you know anyone else like [NAME] who you talked to about where to deliver or who had an opinion about where you could deliver?

[COUNT HOW MANY NAMES THE WOMEN HAS LISTED SO FAR. IF SHE HAS NOT ALREADY LISTED 20 NAMES USE THE FOLLOWING SPECIFIC PROBES]

"Did you ever talk with your CHRW?"
"Did you ever talk with a Village Doctor?"
"Did you ever talk with a Kobiraj?"
"Did you ever talk with a Dai"

"Did you talk with people at the health clinics in this area about where you could deliver? Who?

"Did you talk with people from your natal home village about where you could deliver? Who

"Is there anyone else who may have influenced the final decision about where you delivered? Who?"

PART V Name Interpretation Questions and Codes

VAR	Column Name	Question	Codes	
NI01	Type of Probe	Was the name listed spontaneously or after a non-specific probe or after a specific probe?	S = Spontaneously NS = Non-Specific Probe SP = Specific Probe	
NI02 a-t	Name	Free List of Names	Names	
NI03	Age	Is [name] younger, older or about the same age as you?	1 = younger 2 = older 3 = about the same age	
NI04	Gender (M/F)	Is [name] a male or female?	F = Female M = Male	
NI05	Relation	How is [name] related to you?	Use social relations code list	
NI06	Kinship	Do you consider [name] to be kin?	Y = Yes N = No	
NI07	Residency	Does [name] live in your bari?	Y = Yes → **SKIP NI10** N = No	
NI08		Does [name] live in your village?	Y = Yes → **SKIP NI10** N = No	
NI09		Does [name] live in Matlab upazilla?	Y = Yes N = No	
NI10	Education	What is the highest grade [name] **completed**?	# Year	
NI11	Closeness	How close do you feel to [name]?	1 = Very Close 2 = Somewhat Close 3 = Not Close	
NI12	Advise	Did [name] advise you to deliver in the home or at a health facility?	H = Home F = Facility FC = Facility only if complications N = Did not advise	
NI13	Perceived Beliefs	Does [name] approve or disapprove of pregnant women **without problems** going to a facility for childbirth?	1 = Strongly approve 2 = Approve 3 = Neutral 4 = Disapprove 5 = Strongly Disapprove	
NI14	Place of last delivery	Where did [name] deliver her last child? or Where did [name's wife] deliver her last child?	H = Home F = Facility	77 = DK 99 = NA
NI15	Influence	Of the names you listed, who would you say were the three most influential in the decision making process about your final place of birth.	Rank three most influential names using numbers 1, 2, 3	
Grid	Network Grid	How well does "X" know "Y"?	0 = Don't know each other 1 = Have met from time to time 2 = Know each other well 3 = Are very close/have close contact	

Appendix D

Orientation and Training Schedule

Orientation and Tool Development
Social Networks and Decision Making for
Use of Facilities in Childbirth
Matlab, Bangladesh

Time		Place
9-10:30	Work Together	Sunday and Monday -RHU Conference Room
10:30-11	Tea Break	
11-1	Work Together	Tuesday and Wednesday
1-1:30	Afternoon Break	-Library Conference Room
1:30-2:45	Work Together	
		Thursday -9-11 Library Conference Room -11-2:45 RHU Conference Room

Sunday, September 21, 2008

    I.   Welcome and Introductions

    II.   Team Building Exercise

    III.   Study Organization Overview

    IV.   Roles and Responsibilities

    V.   Overview of Maternal Mortality and Skilled Birth Attendance

    VI.   Overview of Social Networks

    VII.   Study Background and Specific Aims

    VIII. Introduction to the Tool Development Process

Monday, September 22, 2008

    I.   Research Process-"The Data Journey"

    II.   Research Ethics Review

    III.   Begin Review of Draft of Tool-Section by Section

IV.   Interviewing Techniques

    a. Introducing Self
    b. Standardization
    c. Asking Questions
    d. Clarifications
    e. Probing
    f. Giving Feedback
    g. Note Taking
    h. Recording

V.   Data Quality Checks

Tuesday, September 23, 2008

I.   Mock Interviewing

II.   Tool Development

Wednesday, September 24, 2008

I.   Introduction to Field Site-Matlab

II.   Work Plan **Subject to change with notification

III.   Expectations in the Field

IV.   Field Logistics
    a. Supplies
    b. Supervision
    c. Daily Schedules
    d. Working with Porter

V.   Tool Development in the Field

Thursday, September 25, 2008

I.   Mock Interviewing

II.   Tool Development

Appendix E

Informed Consent Form

Ethical Review Committee of the ICDDR,B:
International Centre for Health and Population Research

Verbal Informed Consent
(Interviews)
15 February 2008

Title: Social Networks and Use of Skilled Birth Attendance to Prevent Maternal Mortality

Principal Investigators: Joyce Edmonds, RN, MPH

Study Sponsor: Dr. Lynn Sibley

ICDDR'B Protocol #: 2006-040 (Emory University Protocol # TBD)

Purpose of the Study: Assalamuailikum. My name is [name of interviewer] and I am here to ask you to participate in a research study. I work with the Centre for Health and Population Research, also known as the Cholera Hospital, in Matlab. I am talking to women about their childbirth experiences, choice of birth attendant and involvement of household members in order to try to improve the health of mothers and newborn babies in the area.

Procedure: You have been chosen to participate because of your recent experience with childbirth. Therefore I would like to talk with you. To do this, I will need about 1 hour of your time. The interview will be audio-recorded for backup purposes. Is this a good time for you to talk? [Wait for a moment for an answer "Yes' of 'No'. If 'Yes', continue to read. If 'No', ask the informant if there is a better time and if there is then reschedule the interview]

Risk and Benefits: The risks of participating are minimal, such as your time to complete the interview. There are no known benefits to your participating in the study apart from the important information that will be gained and used to understand women's decision-making during childbirth. This information may save lives.

Privacy: Your answers will be treated in a confidential manner. About 250 women who have experienced childbirth in the last three months will be interviewed. The information you give will be combined with the others to be reported as a whole. Your name or the name of individuals you mention in the interview will not be personally identified in the project report.

Voluntary Participation and Withdrawl: Your participation is completely voluntary and you have the right to refuse to be in this study. You can stop at anytime after giving your consent. This decision will not affect in any way your

current or future medical care or any other benefits to which you are otherwise entitled. You may ask any questions you like, refuse to do the interview or answer any question or end the interview at any time. You may also agree to participate in the interview at a time this is more convenient

Right of the Participant: If you have any questions about your rights as a participant in this study, you may contact Dr. Allyson Moran at the ICDDR'B/Matlab field office. Her contact number is 011-880-2-881-0021. In addition you may contact Dr. Colleen Dilorio, Chair, Institutional Review Board, at Emory University, Atlanta, Georgia, USA. This Board oversees the protection of human research participants. Dr. Dilorio can be reached at 001-404-712-0720. We can assist you to contact both Dr. Moran and/or Dr. Dilorio.

You can have a copy of this consent form for you to keep.

Do you have any questions?

Thank you very much.

If you are willing to volunteer for this research, may be begin? [Wait for the respondent's verbal permission to begin the interview]

_____

Interview No: _____

Respondent No: _____

Name of interviewer/person obtaining consent (please print):

_____

Signature of interviewer/person obtaining consent:

_____
Date: _____Time:_____

Signature of Principal Investigator:

_____
Date:_____Time:_____

Appendix F

Decision Tree Models from Preliminary Study

F.1. Phase I Decision Tree Model, "Plan-to-Go" from Preliminary Study

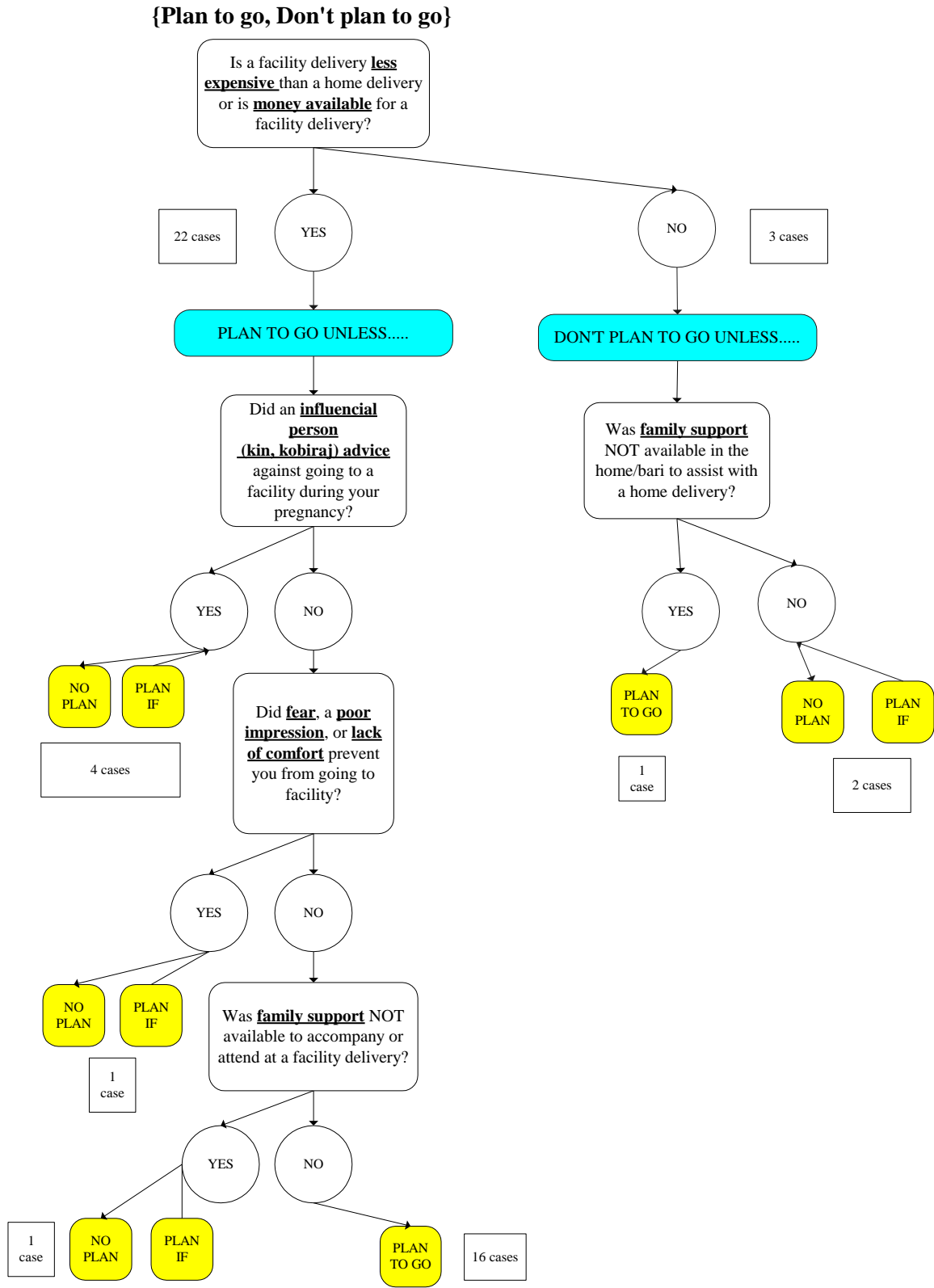F.2. Phase II Decision Tree Model, "Actual-Go" from Preliminary Study

{Plan to go, Don't plan to go}
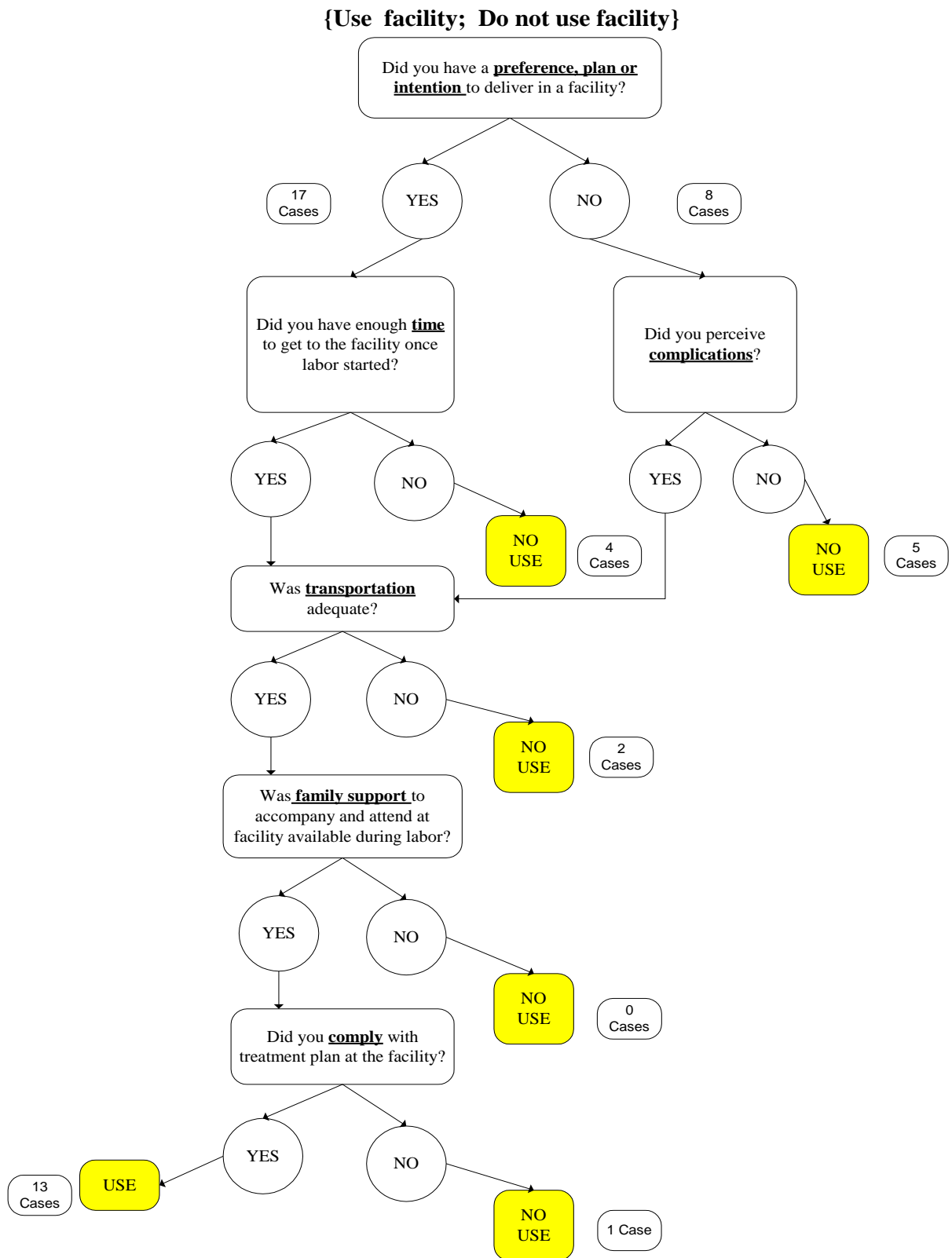

Figure F.1 Phase I Decision Tree Model

{Use facility; Do not use facility}

Figure F.2 Phase II Decision Tree Model