

ABSTRACT

Title of Dissertation: DOMESTIC VIOLENCE EXPOSURE,
MATERNAL EDUCATION, AND MATERNAL
AUTONOMY AS PREDICTORS OF INDIAN
WOMEN'S USE OF MATERNAL HEALTH
SERVICES AND INFANT LOW BIRTH
WEIGHT

Mili Duggal, Doctor of Philosophy, 2015

Dissertation directed by: Professor Sally A. Koblinsky
Department of Family Science

India contributes disproportionately to the world's maternal mortality ratio and rate of infant low birth weight. Securing adequate antenatal care and delivery in a hospital or health facility are key strategies aimed at improving India's maternal and infant health outcomes. This study utilized the National Family Health Survey-3 (NFHS-3) to investigate predictors of Indian women's use of maternal health care services and delivery of a low birth weight infant. The ecological model of health was used to examine how the individual level factor of maternal education and the relationship level factors of women's domestic violence exposure and maternal autonomy were related to maternal and infant outcomes. Specifically, the study examined the role of physical violence, psychological violence, sexual violence, maternal education, and maternal autonomy in predicting women's receipt of adequate antenatal care, institutional delivery, and likelihood of delivering a low birth weight child.

The study utilized NFHS-3 data from 2005-06 with a sample of 4,983 Indian women who gave birth in the previous year. This survey was the first to include a module

addressing three different types of domestic violence exposure within the marital relationship. Findings revealed that 19% of women reported experiencing physical violence, 10% reported psychological violence, and 8% reported sexual violence in the previous year. Multivariate logistic regression analyses examined the association between the targeted maternal variables and women's use of maternity health services and infant low birth weight. Domestic violence emerged as a risk factor, with physical violence predicting less adequate antenatal care and higher likelihood of low infant birth weight. Psychological violence predicted lower likelihood of adequate antenatal care and institutional delivery, and sexual violence was associated with a lower likelihood of institutional delivery. In contrast, both maternal education and maternal autonomy emerged as protective factors. Maternal education was predictive of adequate antenatal care, institutional delivery, and lower likelihood of infant low birth weight, while maternal autonomy predicted institutional delivery and lower likelihood of delivering a low birth weight infant. Implications of the findings for policy makers, public health practitioners, and educators seeking to improve maternal and infant outcomes in India are discussed.

DOMESTIC VIOLENCE EXPOSURE, MATERNAL EDUCATION, AND
MATERNAL AUTONOMY AS PREDICTORS OF INDIAN WOMEN'S USE OF
MATERNAL HEALTH SERVICES AND INFANT LOW BIRTH WEIGHT

by

Mili Duggal

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Advisory Committee:

Professor Sally A. Koblinsky, Chair
Research Assistant Professor Elisabeth Maring
Assistant Professor Marian Moser Jones
Assistant Professor Xin He
Associate Professor Donna E. Howard

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To my father

who never stopped believing in me.

Thank you for being the greatest father

and for teaching me how to live life.

Acknowledgements

I started this journey five years ago while I was still apprehensive about what it would unfold for me. At the last milestone of my dissertation, as I look back, I have to say it has been a truly exceptional journey of learning. I have been fortunate to have wonderful co-travelers who at times pushed and prodded, sometimes they just walked silently alongside, and at times where the climb was steep, they held out their hands and pulled me up. I know all my words will not adequately express my gratitude towards all the individuals who helped me get to this milestone.

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List of Abbreviations

ANC	Antenatal Care
ASHA	Accredited Social Health Activist
CI	Confidence Interval
DLHS	District Level Household Survey
IFA	Iron Folic Acid
IRCR	International Center for Research on Women
JSY	Janani Suraksha Yojana
LBW	Low Birth Weight
MASVAW	Men's Action To Stop Violence Against Women
MCH	Maternal Child Health
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
NFHS	National Family Health Survey
NGO	Non Governmental Organization
OR	Odds Ratio
PPS	Probability Proportional to Size
PSU	Primary Sampling Unit
RCH	Reproductive Child Health
SAS	Statistical Analytic Software
SDGs	Sustainable Development Goals
SHG	Self Help Group
STI	Sexually Transmitted Infection
TBA	Traditional Birth Attendant
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
VIF	Variance Inflation Factor
WHO	World Health Organization

Chapter 1: Introduction

Maternal health has been linked to numerous economic, social, and political benefits. Increasing women's use of maternal health services, including antenatal care and timely use of institutional delivery care, may improve outcomes for women and children throughout their lifetimes.¹ Adequate utilization of antenatal care, in particular, has been associated with higher infant birth weight.² Delivery in a health care facility ensures that immediate medical care will be available to the mother and her baby, and is especially valuable in cases of high-risk pregnancy.³

The importance of strengthening maternal health services is reflected in two of the eight Millennium Development Goals (MDGs) established by the United Nations in 2001 to improve health, social, and economic conditions in the world's poorest nations.⁴ MDG 5 aims to reduce the maternal mortality rate by 75% between 1990 and 2015.⁵ MDG 4 aims to reduce the mortality rate in children less than five years of age by two-thirds during the same time period. Reducing low birth weight is critical to achieving MDG 4 since low birth weight is an important indirect cause of neonatal deaths.⁶ The World Health Organization (WHO) defines low birth weight (LBW) as weight at birth of less than 2500 grams (5.5 pounds). About 14% of infants are born at low birth weight every year worldwide; however, they account for 60 to 80% of neonatal deaths.⁶ Efforts to improve women's use of maternal health services in developing nations may reduce the incidence of maternal deaths and babies born at low birth weight, as well as reduce the burden of costly interventions.

Currently, global estimates of maternal mortality indicate that Sub-Saharan Africa and Southeast Asia account for approximately 86% of the world's maternal deaths.⁷ India has the largest number of births of any nation in the world, estimated at 27 million annually,⁸ and its rate of low birth weight is approximately 22%.⁹ Despite India's recent economic progress, the country continues to experience high levels of maternal mortality. WHO reports that India is the highest contributor to maternal deaths in the world, with 57,000 recorded maternal deaths in 2010.⁷ The country's current maternal mortality rate (MMR) is 212 deaths per 100,000 live births, suggesting that India will miss its MDG 5 goal of 109 deaths per 100,000 births by 2015.¹⁰ The country's under five mortality rate in 2011 was 68 per 1000, whereas the target goal is 38 deaths per 1000 live births by 2015.¹¹ The United Nations also predicts that India will fail to reach MDG 4. It should be noted that the MDG goals will expire in 2015 and transition to Sustainable Development Goals (SDGs). Key to achieving both MDG and SDG goals will be improvements in Indian women's utilization of maternal and child health services.

Domestic Violence

Although pregnancy is generally a joyful time for Indian parents and families, it can also be a vulnerable time for Indian women, especially those in socially disadvantaged groups. Literature suggests that domestic violence is a risk factor that can compromise women's ability to secure the support and resources necessary for optimal utilization of maternal health services.^{12,13} Pregnant women benefit from instrumental and social support from their spouses and families. Domestic violence and lack of support within their families may reduce women's access to and use of maternal health services.

Various cultural and household factors in India have the potential to jeopardize women's participation in antenatal care and their use of institutional delivery. Specifically, India is a patrilineal society with a patriarchal household structure.¹⁴ Strong patriarchal family structures favor male over female control of family resources and decision-making. The differential balance in male-female power also increases women's susceptibility to stressors such as domestic violence. A review of literature suggested that domestic violence can be attributed, in part, to a system of gender relations in which men are considered superior to women. Domestic violence has been viewed as an extension of beliefs that grant men the right to control women's behavior.¹⁵

Domestic violence is reported to be widespread in India, with one multi-site, household survey revealing that 50% of Indian women experienced some form of domestic violence in their married life.¹⁶ Another study conducted in northern India estimated that the prevalence of violence during pregnancy was 18%.¹⁷ Research also reveals that most Indian women who are victims of violence are hesitant to report or prosecute such crimes, often believing that they have provoked the abuse.¹⁸ Given this hesitancy, the existing data is likely to underestimate the actual prevalence of domestic violence in married Indian households.

Researchers have reported three types of domestic violence that may be committed against women: physical violence, psychological violence, and sexual violence. Physical violence has been defined as behaviors that have the potential to produce bodily harm, such as, slapping, pulling hair, punching with a fist, kicking, choking and threatening to attack with knife, gun, or any other weapon. Definitions of psychological violence include saying or doing something to humiliate a person in front

of others, threatening to hurt or harm an individual, and insulting or making a person feel badly. Sexual violence has been defined as forcing an individual to have sexual intercourse against her/his will or to perform unwanted sexual acts.⁹ Each of these types of domestic violence may contribute to biological and psychological stress for pregnant women, and can have a negative impact on their use of maternal health services and their obstetric outcomes.¹⁹⁻²¹ Specifically, pregnant women who are abused may delay initiation of antenatal care or refrain from delivering in a hospital/primary care center because they fear husbands who do not support use of these services, or are ashamed of the physical evidence of their abuse (e.g., bruises, black eyes).²² Exposure to domestic violence during pregnancy has also been linked to adverse outcomes such as low birth weight, preterm birth, fetal injury, and fetal death.²²⁻²⁶

Maternal Education and Autonomy

The maternal and child health literature emphasizes the importance of identifying factors that may increase women's optimal use of maternal health services and contribute to positive birth outcomes.^{13,27} Women may draw on individual resources to cope with adversity and decrease their vulnerability to adverse maternal and child health outcomes.²⁸ Two potential factors that may facilitate Indian women's use of antenatal care and institutional delivery, as well as reduce their risk of having a low birth weight baby, are women's education and women's autonomy.

Maternal education, or the number of years of schooling a woman has completed, has been found to be a salient predictor of maternal health services utilization and birth outcomes in developing and developed countries.²⁹ Education can increase women's

understanding of the importance of early and adequate antenatal care and institutional delivery. Several studies in different Indian states have investigated relationships between maternal education and pregnant women's use of maternal health services. Findings revealed that more educated women are more likely to obtain adequate antenatal care and to deliver in government health facilities than less educated women.³⁰⁻³²

A second factor that may increase women's use of maternal health services is maternal autonomy. Autonomy has been defined as the capacity to control resources and information in order to make decisions about personal concerns or concerns of close family members.³³ Three important elements of women's autonomy are their decision-making power, control over finances, and freedom of movement. India's patriarchal family structures often limit women's agency and role in personal and family decision-making, including decisions about reproduction and use of health services.^{34,35} There are relatively few studies examining the relationship between maternal autonomy and women's health services utilization in India. However, one previous small study in northern India found a significant relationship between women's autonomy and their use of antenatal services and having a skilled birth attendant at the delivery of their children.³⁵

Purpose of Study

The purpose of the current study is to examine factors that may predict Indian women's use of maternal health services and help to reduce their likelihood of delivering a low birth weight infant. Drawing from the ecological model of health, the study will examine the role of three types of domestic violence--- physical, psychological and

sexual violence---often linked to India's patriarchal society, in predicting Indian women's use of maternal health services and their likelihood of giving birth to a low birth weight infant. Using this same theoretical framework, the study will also explore how maternal education and maternal autonomy, factors that fall at the individual and relationship level respectively, predict these same maternal health care and birth outcomes.

The current study is unique in exploring the relationship between domestic violence and maternal health care and birth outcomes in a large, population-based sample representative of the entire Indian nation. Most prior studies of domestic violence in India have focused on small samples in one city, one state, or very limited geographic regions. Although previous research has examined the relationship between health care system factors (e.g., skilled birth attendants, hygienic environment) and Indian women's use of maternity services and birth outcomes, there has been less study of how women's individual and familial experiences predict their utilization of maternal health services and their birth outcomes, such as infant low birth weight. National data on three types of domestic violence in Indian families has only been available for six years,⁹ and this study is one of the first to investigate how three distinct types of violence are associated with Indian women's use of antenatal care, delivery in a hospital or health facility, and likelihood of having a low birth weight infant.

Although the individual level factor of maternal education has been frequently studied in relation to women's health care, this research also expands existing literature by exploring how maternal autonomy, a relationship level factor, is related to Indian women's use of maternal health services and their likelihood of having a low birth weight infant. The study examines the extent to which maternal autonomy, a construct that

includes women's ability to participate in decision-making and take action in the areas of health decisions, financial control, and freedom of movement, are related to maternal and infant outcomes. This relationship is examined in a representative sample of Indian women who gave birth to a child within the previous year.

The present study used data from the National Family Health Survey (NFHS-3) conducted in 2005-06, the third in the series of NHFS surveys. Previous surveys were NFHS-1 conducted in 1992-93 and NFHS-2 completed in 1998-99. NFHS-2 asked only one question regarding domestic violence: whether a woman had been beaten or mistreated physically in the last twelve months.³⁶ NFHS-3 was the first survey to include a module addressing three different types of domestic violence exposure, including physical, psychological, and sexual violence. The current study represents a first attempt to identify relationships between the identified ecological factors and maternal health services utilization and infant birth weight in a nationally representative sample of Indian mothers. Findings may have important implications for developing policies and programs that strengthen Indian women's use of maternal and child health services, and that facilitate the country's achievement of MDGs 4 and 5.

Chapter 2: Theoretical Framework

A theoretical framework is key for developing hypotheses and research questions. The current study will utilize the ecological model to explore the relationships between domestic violence, maternal education, and maternal autonomy, and three maternal and child health outcomes: use of antenatal care, childbirth in an institutional facility (e.g., hospital, primary care center), and delivery of a low birth weight child.

The ecological model of health originated in the field of psychology and human development in the works of Lewin,³⁷ Barker,³⁸ and Bronfenbrenner.³⁹ It then evolved in public health fields such as health promotion, health psychology, and maternal and child health, focusing on individuals' interactions with their environments.⁴⁰ The ecological model is now an integral part of public health and has been used to guide research and interventions both nationally and internationally.

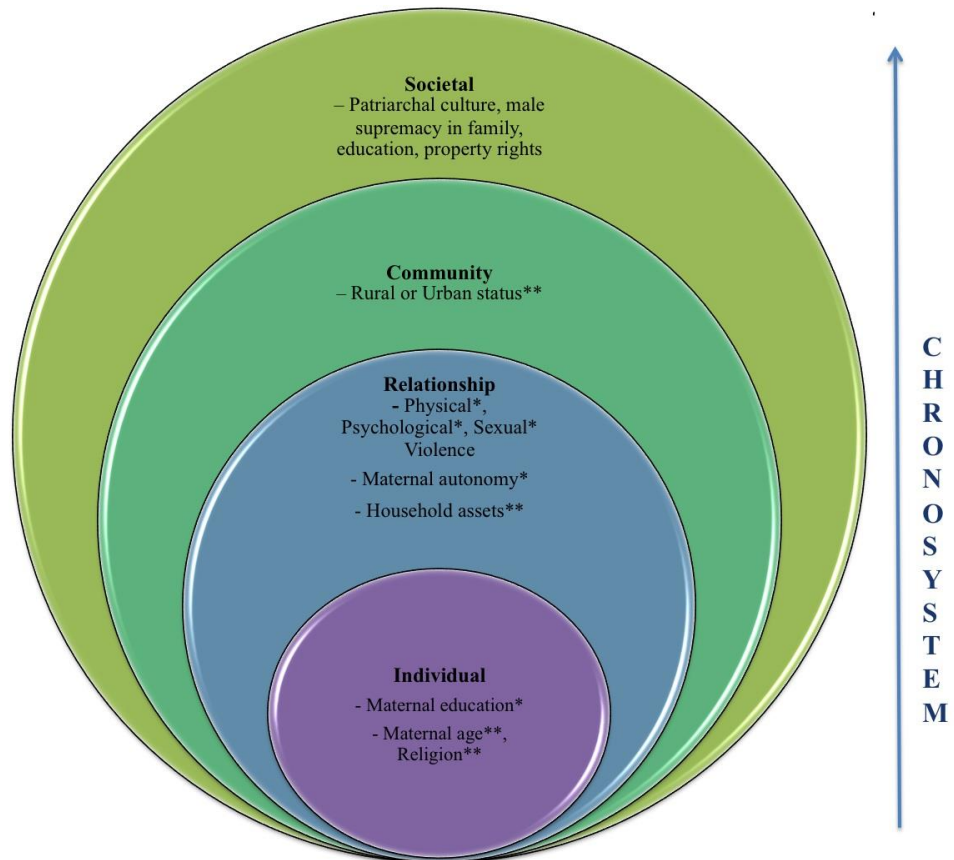
The Institute of Medicine defines an ecological model as “a model of health that emphasizes the linkages and relationships among multiple factors (or determinants) affecting health.”^{41(pp5)} The ecological model has been used to identify and examine health determinants and to propose interventions in Healthy People 2020,⁴² the World Health Organization's strategy for diet, physical activity, and obesity,⁴³ and WHO's convention on tobacco control.⁴⁴ With respect to women and violence, the ecological model has been used to better understand all types of violence,⁴⁵ as well as determinants and outcomes of domestic violence.⁴⁶ The ecological model addresses the interplay of individual, relationship, community, and societal factors. At each of these levels are risk and protective factors that have the potential to influence maternal and child health outcomes. Risk factors increase the likelihood of experiencing negative outcomes, and

protective factors can serve as a buffer against risks and contribute to positive outcomes.⁴⁷

The ecological model operates on four important principles:⁴⁸

1. There are multiple influences on health outcomes, including factors at each of the levels.
2. Determinants influencing health outcomes interact across the different levels.
3. The model should consider potential determinants at each level in the model.
4. Multi-level interventions should be effective in influencing health outcomes.

This study will adopt an ecological model of health to examine factors that may influence a woman's likelihood of obtaining adequate antenatal care and an institutional delivery, as well as her likelihood of having a low birth weight infant. The ecological model has four levels that may impact these health outcomes and are described below. A graphic of the ecological model of health, emphasizing the multiple and dynamic influences between the risk factors and between its different levels is presented in Figure 1. The figure includes variables that were investigated in the current study.



*Independent Variables
 **Control Variables

Figure 1: Ecological Model of Health for the Study

1. Individual Level

The first or individual level of the ecological model identifies personal factors that may affect health outcomes. In the current study, educational status of the woman is an individual level factor predicted to be associated with all three outcomes: adequate antenatal care, institutional delivery, and infant low birth weight. Studies in developing countries show strong empirical evidence of a relationship between a woman's educational status and her use of maternal health care services.⁴⁹ Lack of education can prevent women from recognizing the "need to seek risk-appropriate care".^{49(p2)} Educated women are more likely than uneducated women to have knowledge of optimal antenatal care, the benefits of institutional delivery, and healthy eating habits that can have an indirect impact on the birth weight of their infants. Educated mothers are more likely to use health care services and to use them more competently than their uneducated peers.³¹ Education may also impart feelings of self-worth and increase a woman's confidence in her ability to take action to improve her personal health and the health of her children. In addition to examining the variable maternal education, the study will also control for two other individual level factors, the woman's age and her religion.

2. Relationship Level

The relationship level is the second level in the ecological model, consisting of family characteristics, social support, and relationships such as those with family, friends, and marital partners. This level explores how these relationships can increase the risk of adverse health outcomes or serve in a protective manner for a pregnant woman. In the current study, domestic violence is a risk factor likely to contribute to negative health

outcomes. Specifically, all three types of domestic violence – physical, psychological, and sexual – are relationship level factors hypothesized to restrict a woman’s ability to secure adequate antenatal care and institutional delivery, as well as contribute to infant low birth weight. Domestic violence in a woman’s relationship with her husband can directly and/or indirectly impact the health outcomes of a pregnant woman, affecting her eating habits, timely initiation of antenatal care, smoking, and substance abuse.⁵⁰ Victims of domestic violence may lack social support from husbands or family members during the vulnerable period of pregnancy. Husbands who control their wives through violence may restrict women’s antenatal care visits to health care facilities, where physical abuse may be detected.

Women who experience physical or sexual violence may also avoid accessing antenatal care out of fear that healthcare workers will see the marks or bruises that result from intimate partner violence. In this situation, women may be ashamed to discuss their abuse with health care workers, fearing that it will bring dishonor to the family. Women experiencing psychological violence during pregnancy may be at greater risk for depression.⁵¹ Consequently, psychological violence can interfere with compliance to antenatal regimens such as taking daily doses of vitamins and folic acid. Finally, women’s feelings of shame and diminished self-worth related to domestic violence or husbands’ desire to keep the abuse private may prevent women from securing an institutional birth. Overall, domestic violence may create barriers to obtaining antenatal care and an institutional delivery, as well as contribute to the low birth weight of the infant.

Another factor at the relationship level of the model is maternal autonomy. Maternal autonomy is defined as having some control of decision-making in the household including health care decisions for self, access to financial resources, and mobility. Maternal autonomy can be a key factor facilitating a woman's ability to obtain adequate health care. Specifically, limited decision-making power in the household including decision-making about health and restricted economic resources can impede women's ability to obtain adequate maternity services.⁴⁹

Maternal autonomy in India is a relationship level factor. While it requires individual initiative, it would be challenging to achieve maternal autonomy in Indian culture without the support of a woman's husband.³⁵ Autonomy in the household includes making decisions independently or in consultation with one's husband about daily and large household purchases, women's health care, and visits to family and relatives. Greater autonomy may allow a woman to gain control of resources like food that can affect her dietary intake during pregnancy. Financial autonomy may also allow a pregnant woman to negotiate and access more favorable health services, including those related to maternal and child health. Lastly, having control over one's mobility and freedom of movement may help a woman to navigate the health care system, instead of waiting for someone from her household to accompany her on a visit to a health care facility. Similarly, having the freedom to go to the market unescorted reduces a woman's need to depend on someone else to buy food, medicine, or other things she might need.

In addition to examining the variables of domestic violence and maternal autonomy, the study will also control for one additional relationship level factor, the woman's socioeconomic status. In the proposed study, socioeconomic status is defined as

the household assets of the woman's immediate family or her husband's family (if the couple resides with the husband's family).

3. Community Level

Community level factors in the ecological model explore the community contexts in which individuals reside and social relationships occur, such as schools, workplaces, and neighborhoods. This level attempts to identify characteristics of these settings that increase or mitigate the risk of particular health behaviors or outcomes. One example of a community level factor is a woman's residence in a rural or urban setting. In India, a woman who lives in a rural village may lack easy access to primary health care facilities that deliver antenatal care. Approximately 40% of Indian villages lack all weather roads to health facilities and about 3 million kilometers of rural roads are in poor condition; additionally, approximately one third of rural villages are often cut off from major health services by monsoon flooding.^{52,53} If maternal and child health care services are not easily accessible, pregnant women are likely to have difficulty traveling to health facilities to obtain adequate antenatal care and an institutional delivery. Thus, this study will control for a woman's rural or urban status.

4. Societal Level

The societal level of the ecological model is the last level in the model and includes broad societal factors that infuse and inform the other three layers of the ecological model. Social and cultural norms and policies including health policies are important factors to be considered at this level. In India, cultural and social norms are believed to influence maternal and child health outcomes. For example, male supremacy

influences the distribution of power in society and affects decision-making authority in marital relationships and community organizations.³⁵ The status accorded to women by society contributes to a climate in which violence is accepted or inhibited. Historically and traditionally, India has favored male over female children, such that male children receive more education, better food in the household, and greater property and religious rights.⁵⁴ In contrast, female children in India are taught to “make personal sacrifices, to be obedient, tolerant and virtuous.”^{55(p15)} Thus, it is not surprising that when Indian children reach adulthood, men are accorded far greater economic and social mobility than women.

Cultural norms of male superiority have likewise contributed to men’s domination over women, enhancing gender-based violence.⁵⁶ Indeed, many Indian women believe that husbands are justified in beating their wives if the wives have been disobedient.^{14,57} Male domination appears likely to influence a woman’s ability to secure health care services, including adequate antenatal care and/or a hospital birth. Patriarchal norms also pervade the community level. For example, males traditionally head village governing organizations, such as the “Panchayat,” which traditionally settle disputes between husbands and wives. Resolution of these disputes generally favors the husband. Thus, Indian cultural norms provide a context affecting all levels of the ecological model, influencing maternal health care as well as infant health outcomes.

Chronosystem

Bronfenbrenner’s ecological model also includes the chronosystem, which refers to the dimension of time and includes events and transitions over the life course.⁵⁸ The chronosystem includes normative and non-normative events. Normative events, such as

marriage and birth, are bound within social contexts at specific points in time and often have shared meanings relevant to family identity and traditions. Non-normative events, such as divorce and losing employment, appear unexpectedly and often at times when families are unprepared to deal with them. Both events occur to those born in different generations, which are characterized by different social, economic, and political events that may influence individual development, health, and well-being.

Although time and women's experience of historical events are not measured in the current study, India has been a changing society. Major historical events over the past seven decades have included gaining independence from British rule in 1947 and the transition to a modern society and economic superpower. Changes in the health care sector have resulted in a gradual shift from home-based deliveries assisted by TBAs to current policies that incentivize hospital-based deliveries.⁵⁹ The current study addresses women who were experiencing the normative event of birth within a specific historical time period; all were surveyed within a two year period (2005-2006) and had given birth within the year preceding the survey's administration. Although not measured in the current study, the construct of chronosystem provides a context for understanding societal and environmental forces that may influence women's health outcomes.

Summary

Taking guidance from the ecological model, it is hypothesized that individual level factor of maternal education will predict women's greater likelihood of obtaining adequate antenatal care and an institutional delivery, and lower likelihood of having a low birth weight infant. Relationship level factors of physical, psychological, and sexual violence will predict women's lower likelihood of obtaining adequate antenatal care,

lesser likelihood of a hospital or health facility delivery, and greater likelihood of giving birth to a low birth weight child. As in the case of maternal education, the relationship factor of maternal autonomy is expected to predict women's greater likelihood of obtaining adequate antenatal care and an institutional delivery, and lower likelihood of having a low birth weight infant.

Chapter 3: Review of Literature

Current literature indicates that individual and relationship level factors may be predictors of maternal health services utilization and infant low birth weight in developing countries such as India.^{30,60} The following section provides an overview of maternal health care services in India as well as information about the challenge of reducing India's incidence of low birth weight babies. The review of literature then summarizes previous research on the predictors being examined in this study: maternal exposure to physical, psychological, and sexual violence in the marital relationship; maternal education; and maternal autonomy.

Antenatal Care

Adequate antenatal care is a critical component of reproductive health care that can help to reduce maternal mortality and offer women other valuable health services. Antenatal care visits provide women with pregnancy-related services such as information about dietary needs and the importance of taking folic acid tablets; danger signs in a pregnancy; and other guidance about antenatal care.⁶¹ UNICEF, WHO, and country-based surveys have examined Indian women's use of antenatal care services.⁶² Data collected by NFHS-3 found that 25% percent of Indian mothers had one to two antenatal care visits and 52% had three or more antenatal care visits.⁹ These figures may be increasing since UNICEF data from 2007 to 2012 found that 74% of Indian women had at least one antenatal care visit during their pregnancy. However, UNICEF data also revealed that only 37% of pregnant women had at least four visits during the course of their pregnancy, UNICEF's recommended number of visits for women in developing

countries.⁶²

The Indian Reproductive and Child Health Program (RCH) aims for pregnant Indian women to obtain a minimum of three antenatal care visits.⁶³ Visits should be made either at home by a community health worker or in an antenatal care facility by a nurse or doctor, including one in each trimester. It is also recommended that a pregnant woman have a checkup in her first trimester and intake of at least hundred iron folic acid (IFA) tablets during the pregnancy. Iron folic acid supplementation is considered an important component of safe motherhood services offered as a part of the Indian RCH program since iron deficiency anemia is regarded as one of the most commonly found micronutrient deficiencies in the world.^{64,65} Consistent with the recommendation of the Indian RCH program, previous studies have used a range of one to four antenatal care visits for the purpose of measurement.^{31,66,67} Adequate antenatal care in the current study is defined as having a minimum of at least three antenatal care visits, one visit within the first trimester, and a minimum intake of 100 folic acid tablets during the pregnancy.

Institutional Delivery

Presence of a skilled birth attendant during delivery is a key indicator for measuring the progress of MDG 5.⁶⁸ Unskilled birth attendants conduct more than half of the infant deliveries in India despite some improvements in use of skilled birth attendance, which has increased from 33% in NFHS-1 to 48% in NFHS-3.^{9,69} Skilled attendance “requires a skilled attendant AND an enabling environment which includes adequate supplies, equipment, and infrastructure, as well as efficient and effective systems of communication and referral”.^{70(p100)} One of the top strategies for reducing

maternal mortality is the provision of facility-based health delivery care for pregnant women.³

The Government of India pledged to increase and improve institutional delivery to improve maternal survival as part of its national policy in 2002.⁷¹ Institutional delivery was defined as the delivery of an infant in a government or accredited private health care facility. In 2005, the Ministry of Health and Family Welfare, Government of India launched a safe motherhood intervention called Janani Suraksha Yojana (JSY).⁶⁴ The objective of JSY, translated as “scheme for long life,” is to improve neonatal and maternal mortality by promoting institutional deliveries. The scheme provides cash assistance as an incentive for delivery care. JSY was launched in all Indian states; eligibility was extended to all pregnant women in low-performing states (low institutional delivery rates) and pregnant women below the poverty line women in high-performance states (high institutional delivery rates). However, it required some time to roll out JSY so implementation was not complete in most States until 2007, after the period of data collection in the current study. Researchers have recently begun to evaluate the impact of JSY on institutional deliveries and other maternal and child health outcomes.^{59,72-74}

Low Birth Weight

WHO defines low birth weight as weight at birth less than 2500 grams.⁷⁵ Low birth weight is an important indicator to measure a country’s progress in achieving MDG 4, which aims to reduce child mortality. Low birth weight can be a result of preterm birth or restricted intrauterine growth.⁷⁶ It is closely associated with neonatal mortality and morbidity, hindered child growth and cognitive development, and chronic diseases later

in life.⁷⁷ According to the global databases of UNICEF in 2012, India is one of the countries with the highest incidence of low birth weight babies. Approximately 8 million low birth weight babies are born in the country annually.⁷⁸ According to the NFHS-3 data, low birth weight babies account for 22% of all births in India.⁹

Potential Predictors of Maternal Health Services Utilization and Infant Low Birth Weight

Domestic Violence

One potential factor that may influence an Indian woman's use of maternal health services and her likelihood of delivering a low birth weight infant is domestic violence. Domestic violence refers to any behavior by one partner towards another within a domestic relationship that brings physical, psychological, or sexual harm.⁷⁹ Although domestic violence may be perpetrated by, and on, both men and women, most victims in India are women.⁸⁰

In the violence literature, the terms “domestic violence” and “intimate partner violence” are often used interchangeably. In the United States, “domestic violence” refers to violence occurring in a family setting or home and can include abuse towards children and the elderly. In contrast, “intimate partner violence” refers to physical, psychological, and sexual abuse by someone who is, was, or wishes to be involved in an intimate or dating relationship with an adult or adolescent.⁸¹ Indian researchers and practitioners prefer the term “domestic violence” to “intimate partner violence” for several reasons. India developed legal provisions for addressing this social problem with “The Protection of Women from Domestic Violence Act” in 2005.⁸⁰ Historically, the institution of

marriage has been sacred in India. However, the scope of the Domestic Violence Act not only includes married women, but also female live-in partners and other members of the household such as mothers and sisters.⁸⁰ Although recent years have seen a rise in cohabitating relationships, they are primarily confined to the metropolitan cities and definitely not the norm. Indian social scientists have followed Indian law in favoring the term “domestic violence” over other terminology.

The proposed study uses the term “domestic violence” to refer to abuse perpetrated by husbands on their wives. Domestic violence is a sensitive issue; ethical considerations and differences in measurement make it difficult to compare the prevalence of domestic violence in a developing country like India with an industrialized nation like the United States. However, several reports have provided a brief global overview of the magnitude of domestic violence in developing and industrialized nations. One report that summarized forty-eight population-based studies found that between 10% and 69% of women reported being physically assaulted by an intimate partner during their lifetime.⁸²

One of the most widely-cited studies by WHO collected data on domestic violence against women from ten countries: Bangladesh, Brazil, Japan, Namibia, Peru, Samoa, Thailand, Tanzania, Ethiopia, New Zealand, Serbia, Montenegro, Chile, China, Indonesia, and Viet Nam. Findings revealed that, among women who had been in intimate partnerships, 13 to 61% had experienced physical violence and 4 to 49% women had experienced severe physical violence; 6 to 59% of women reported sexual violence by a partner at some point in their lives, and 20 to 75% reported experiencing one or more emotionally abusive act from a partner.⁴⁶ In comparison, The National Intimate

Partner and Sexual Violence Survey conducted in the United States in 2010 found that 33% of women had lifetime prevalence of physical violence by an intimate partner, 26% of women experienced sexual violence including rape in their lifetime, and nearly 48% of women experienced at least one psychologically aggressive behavior by an intimate partner during their lifetime.⁸³ It is evident from the numbers above that gender-based violence is a global public health problem.

National level estimates of domestic violence were largely lacking for India until implementation of the NFHS-3, a cross-sectional national survey. One study using data from this survey estimated that over Indian women's lifetimes, 10% suffer from severe physical violence, 31% experience less severe physical violence, 14% experience psychological violence, and 8% are victims of sexual violence.⁸⁴ In comparison to studies in other nations, Indian rates of reported physical violence were relatively high, whereas reports of psychological and sexual violence were relatively low. Notably, this study did not report rates of domestic violence during pregnancy.

Domestic violence during pregnancy can result in a number of negative consequences for the woman, her pregnancy outcome, and her infant's health.⁸⁵ One of the multi-site household surveys conducted in India found that about 41% of women reported experiencing some form of physical violence in their married life, and 13% of women reported experiencing moderate to severe violence (hit, kicked, or beaten) during pregnancy.¹⁶ Another study conducted in antenatal clinics in one Indian city found that 22% women reported experiencing physical abuse during pregnancy.⁸⁶ Yet another study conducted in the Mumbai slums found that 15% women experienced some form of domestic violence during pregnancy.⁹³

Domestic violence and Maternal Health Services Utilization

Existing research suggests that domestic violence may influence women's use of two maternal health services: antenatal care and delivery in an institutional facility (e.g., a government or accredited private hospital). For example, studies conducted outside of India have found that pregnant women who experience domestic violence may delay the initiation of antenatal care.⁸⁷⁻⁹⁰ Abusive partners may deliberately prevent pregnant women from obtaining antenatal care services, especially early in their pregnancies. Women who have been physically or sexually abused by their husbands may experience shame and embarrassment, and thus be reluctant to share signs of the abuse, such as marks or bruises.⁸⁸ Some women may fear that exposing their abuse will put their husband in legal jeopardy, threatening the economic survival of their families. Additionally, psychological abuse may contribute to low self-worth and self-esteem.^{91,92} Feelings of low self-esteem and self-worth can result in a woman feeling unworthy of optimal maternal health services or unlikely to pursue obtaining quality antenatal and delivery care.

There is limited research examining the effects of domestic violence on pregnant women in Southeast Asia, especially with respect to maternal health services utilization. However, one Indian study focused on four states using data from the NFHS-2, conducted in 1998-99, with a sample size of 2,877 women.⁶⁷ The study focused on four different outcomes related to maternal health-seeking behaviors: 1) receipt of any antenatal care evidenced by at least one antenatal checkup during pregnancy; 2) receipt of a home visit from a health worker for an antenatal checkup; (3) receipt of three or more antenatal care visits during the course of the most recent pregnancy, as recommended;

and (4) receipt of antenatal care in the first trimester. Findings revealed that women who experienced physical violence during their most recent pregnancy were significantly less likely than peers who had not been physically abused to have obtained: any measure of antenatal care (Odds Ratio [OR] 0.80; 95% Confidence Interval [CI] 0.68- 0.95); a home-based antenatal checkup from a trained health worker (OR 0.43; 95% CI 0.33-0.56); and three or more antenatal care visits (OR 0.66; 95% CI 0.52- 0.84). Women who were victims of one or more violent episodes during their most recent pregnancy were also more likely than non-victimized women to have received their first antenatal care visit during the third trimester of pregnancy, rather than during their first trimester (relative risk ratio 1.62; 95% CI 1.08-2.45). This study provides some evidence that domestic violence decreases Indian women's likelihood of receiving adequate antenatal care. However, it should be noted that the research involved only four of the twenty-eight Indian states and only examined physical violence. Women's exposure to psychological and sexual violence was not investigated. Notably, the latter study was the only one cited in a literature review examining the impact of domestic violence on Indian women's health outcomes between 2000 and 2011.⁸⁵

Another smaller study conducted in India sought to examine the association between maternal exposure to domestic violence, antenatal care, delivery care, and mortality of the mothers' children.¹⁷ The study was conducted in Uttar Pradesh, the largest Indian state, and focused only on physical violence. Husband and wife data were matched from two surveys conducted between 1995 and 1996: the PERFORM System of Indicators Survey of women and the Male Reproductive Health Survey. Eligible men for this study were currently married men residing with their wives, between the age of 15

and 59. Data from wives and husbands were matched. The final sample consisted of 2,199 women who had given birth during the three-year period before the woman's survey. About 18% women from the final sample were classified as having experienced physical violence. Unfortunately, no precise definition of adequate antenatal care and delivery care was provided in this investigation. Adjusting for socio-demographic variables, findings revealed that abused pregnant women were significantly less likely than their non-abused peers to have received adequate antenatal care (OR 0.68; 95% CI 0.5-0.93). No significant relationship was found between maternal domestic violence exposure and institutional delivery. In addition to the lack of an operational definition of adequate antenatal care, the study assessed domestic violence exposure by interviewing the husband rather than his wife. This approach may have contributed to inaccurate or underreporting of the prevalence of domestic violence.

Recently, a group of researchers conducted a cross-sectional study in the slums of Mumbai in the Indian state of Maharashtra to explore the relationship between maternal exposure to domestic violence before, during, and after pregnancy and the health of their newborns.⁹³ A total of 2,139 married women were interviewed six weeks after the delivery of their children. Mothers were questioned about their exposure to physical, psychological, and sexual violence in their relationship with their husbands during the preceding twelve months, using questions adapted from the WHO multi-country study on domestic violence.⁹⁴ They were also interviewed about their receipt of any antenatal care and whether or not they had a home-based or institutional delivery. Women receiving any antenatal care and giving birth in a health care facility formed the reference groups for antenatal care and place of delivery, respectively. Results revealed no differences in

maternal use of antenatal care as a function of women's exposure to any form of domestic violence. However, it should be noted that the researchers did not provide a definition of antenatal care and termed "any antenatal care received" as the receipt of antenatal care. In this study, the definition of antenatal care set a very low bar. Findings further revealed that the association between domestic violence and place of delivery was non-significant.

Still another study utilizing a mixed methods approach examined the magnitude of domestic violence in the Indian state of Maharashtra.⁹⁵ However, this study was confined to women in five rural villages of the state. Five hundred women were questioned about their experiences of past and current physical and psychological violence. The women were asked about domestic violence during pregnancy, and almost half of the participants (44%) reported having been kicked during pregnancy by their husband. Although this study did not examine the association between domestic violence and maternal health services utilization and findings may have been limited by the long period of recall (for lifetime data), it was one of the first to investigate the prevalence of domestic violence during pregnancy among Indian women in rural villages.

Finally, a study conducted in a city in central India randomly selected 600 pregnant women in their third trimester from a public antenatal clinic to examine their exposure to domestic violence during pregnancy.⁸⁶ This study used the Abuse Assessment Screen, which asked whether physical violence had been inflicted on the participants in the twelve months preceding the survey and since their pregnancy. Approximately 22% of the screened participants reported abuse during the current pregnancy and 8% reported escalated abuse after they became pregnant. Logistic

regression analysis showed that physically abused women were more likely to begin antenatal care after 32 weeks of gestation as compared to non-abused women (OR 2.5; 95% CI 1.1-5.6). Notably, the participants were recruited from a public antenatal clinic, which is frequented largely by women of lower socioeconomic status. Thus, there is a limitation in generalizing the results to the larger population of pregnant Indian women. However, the findings provide strong evidence that poor, urban Indian women who are abused during pregnancy are likely to experience delayed antenatal care.

Overall, little research has been conducted in India examining maternal use of health services among women who have experienced domestic violence during pregnancy. Several studies described above found significant associations between domestic violence and use of antenatal care, but did not find any significant association between domestic violence during pregnancy and institutional delivery. Research done in other parts of the world and a limited body of work done in Southeast Asia have also found that domestic violence during pregnancy is associated with potentially detrimental health outcomes, such as late entry into antenatal care and lower use of antenatal services.^{90,96} To date, the vast majority of studies on domestic violence during pregnancy in India have been conducted with relatively small samples in a limited number of states. Moreover, most of the research has been limited to examining physical violence and antenatal care was often loosely defined. Additional research is needed to explore the relationship between different types of domestic violence and maternal health services utilization among a sample of Indian women from diverse socioeconomic groups and geographic regions.

Domestic Violence and Infant Low Birth Weight

Research has also explored the relationship between women's exposure to domestic violence and the birth weight of their infants. However, the evidence from individual studies has been contradictory. A meta-analysis of fourteen published studies from North America and Europe showed a weak but significant association between domestic violence during pregnancy and infant low birth weight, (OR 1.4; 95% CI 1.1–1.8).²⁶ The authors speculated that low birth weight might stem from preterm delivery, which could be the result of domestic violence during pregnancy, or could occur in full term infants as a result of complex, causal physiological pathways.

Very few studies have investigated maternal exposure to domestic violence as a risk factor for infant low birth weight in developing countries. A review of the literature from 1996 to 2001 focusing on domestic violence among pregnant women in developing nations found only three studies that examined the relationships between domestic violence during pregnancy and infant health outcomes.⁹⁷ One of the studies conducted in Nicaragua used a case-control design and found a significant association between physical violence during pregnancy and infant low birth weight. Specifically, women who were victims of physical violence during their pregnancy were more likely than non-victimized women to have a low birth weight infant (OR 3.98; 95% CI 1.7 - 9.31).⁹⁸ Another study conducted in India explored the relationship between domestic violence during pregnancy and fetal and infant mortality.¹⁴ This investigation drew data from a community-based survey conducted in two districts in each of two states: Uttar Pradesh and Tamil Nadu. Participants were Hindu and Muslim women (N=894) between the ages of 15 and 39 who had one or more pregnancies and were married ten years or less.

Domestic violence items included questions about whether or not the woman had been beaten by her husband. Findings revealed that, in comparison to women who had not experienced physical violence during pregnancy, women who had been beaten were more likely to report a fetal mortality (OR=1.47) and also more likely to report an infant mortality (OR=2.02); no CIs were provided.

A more recent Indian study conducted in Uttar Pradesh explored the relationship between physical violence during pregnancy and perinatal and early childhood mortality.¹⁷ The sample included women who had given birth during the three-year period before the administration of the PERFORM survey (N=2,199). The study sample primarily consisted of young women (mean age 27) and about 18% of sample women were found to have experienced domestic violence. Again, results revealed that women who reported physical violence during pregnancy were at greater risk of experiencing a perinatal mortality (OR 2.6; 95% CI 1.35 - 4.95) and a neonatal mortality (OR 2.4; 95% CI 1.21 - 4.62) than women who had not suffered from physical violence during this time period.

Still another case-control study of urban Indian women conducted in a New Delhi hospital included 168 cases and 632 controls (N=800).⁹⁹ Cases were defined as women who reported abuse; the remaining women formed the control group. Thirty-one low birth weight babies were born to the cases, and twenty-four low birth weight babies were born to the control group. Findings revealed a strong and significant association between maternal domestic violence exposure and infant low birth weight (OR 16.29; 95% CI 7.25 - 37.04). However, it should be noted that the instrument used to screen for domestic violence did not assess type or severity of violence. Additionally, the researchers claimed

that results were statistically inconclusive owing to low sample size and failure to adjust for confounding variables, such as age, religion, socioeconomic status, and education of both husband and wife.

Maternal Education

In an effort to improve utilization of maternal health services, researchers have also focused on identifying protective factors. Maternal education is one potential protective factor that may influence both maternal and child health outcomes. In the current study, maternal education is defined as the level of education a woman has acquired (categorized by years of schooling), including uneducated (zero years of formal schooling), one to five years of education, six to nine years of education, and ten or more years of education. According to the NFHS-3 data collected in India, approximately 39% of currently married Indian females ages 15 to 49 have never attended school, 15% have 1 to 5 years of education, 22% have 6 to 9 years of education, and 24% have ten or more years of education.⁹ In a systematic review of literature of peer-reviewed articles from 1990 to 2006 about factors determining antenatal care utilization in developing countries, maternal education was found to be a consistent factor influencing utilization of antenatal care services.¹⁰⁰

Maternal Education and Maternal Health Services Utilization

A NFHS-1 report using 1992-93 data explored the association between maternal education and utilization of maternal and child health care in eight Indian states, four each from the northern and southern parts of the country.²⁹ Participants were divided into three groups based on their education: illiterate, literate but not completed middle school

(Grade 1 through 7 of school), and completed middle school and above (Grade 8 and above in school). Maternal health services utilization constituted of five indicators: antenatal care, tetanus toxoid immunization, receipt of iron/folic acid tablets, place of delivery, and delivery care. Significant associations were found between maternal education and all the dependent variables; overall, women who had completed middle school or more schooling were eight times as likely to have received antenatal care, seven times as likely to have tetanus immunization, five times as likely to have received iron/folic acid tablets, eight times as likely to have delivered in a health care facility, and seven times as likely to have their delivery assisted by a health professional compared to illiterate women. Education remained a significant predictor of maternal health care utilization when northern and southern states were considered separately.

Another study used data from the NFHS-2 (1996-98) to determine predictors of institutional delivery using a representative sample of Indian women living in rural areas across the nation (N=21,911).¹⁰¹ Findings indicated that approximately 59% of the sample had no education, 16% had primary education (1 to 5 years), 20% had secondary education (6 to 12 years), and 4% had higher education (more than 12 years of education). Results further revealed that maternal education was a strong predictor of having an institutional delivery. Specifically, women with primary education were more likely to give birth in a hospital (OR 1.60; 95% CI 1.43 - 1.79) compared to women with no education. Similarly, women with a secondary education were more likely (OR 2.60; 95% CI 2.33 - 2.91), and women who had obtained higher education were also more likely to have an institutional birth (OR 4.79; 95% CI 3.90 - 5.87) compared to uneducated women.

Maternal education has been found to be a consistent predictor of utilization of maternal and child health services, including use of antenatal care and institutional delivery. Results have been consistent across studies, including those with a small sample size,³⁵ those conducted in rural areas of northern India,^{67,102,66} studies conducted with nationally representative samples from rural areas across India,²⁹ and northern and southern states,¹⁰¹ research in southern India,¹⁰³ and studies with married adolescents.³¹ However, no published studies were found examining the relationship between maternal education and maternal health services utilization using data from NFHS-3, which is the latest cross-sectional survey with a representative sample of Indian women.

Maternal Education and Low Birth Weight

A review of factors that might reduce the likelihood of low infant birth weight revealed maternal education as a potential protective factor.¹⁰⁴ The review included studies from the United States¹⁰⁵⁻¹⁰⁷ that suggested a decreased risk of low birth weight associated with increasing education of the mother.

A few Indian studies have explored the relationship between maternal education and delivery of a low birth weight infant. A WHO-funded, community-based, prospective cohort study followed currently pregnant women from forty-five villages in the Indian state of Maharashtra. Eligible couples and currently pregnant women were followed for the eighteen-month study period and information was collected during the pregnancy about maternal weight gain, antenatal care, and delivery setting, among other health factors. Data were analyzed for 1,922 women who had a live birth and where birth weight information was available for the infant.¹⁰⁸ Birth weight was recorded to the nearest 25

grams using a Salter-type spring balance. The cumulative incidence of low birth weight in the cohort was found to be 29%. Regarding education levels, 8.8% of mothers who had a low birth weight baby had eight to ten years of education compared to 11.6% of mothers with less education. Results found that the adjusted odds for having a low birth weight baby decreased significantly with increased educational status of the mother (OR 0.87; 95% CI 0.78 - 0.97). Although the study was limited to rural villages in one state, it did establish the importance of maternal education as a potential protective factor for low infant birth weight. However the higher level of education for village women in this study was set very high (eight to ten years); the vast majority of rural village women in India have less education.

Another study explored socio-demographic and maternal determinants of low birth weight infants in rural areas of the southern Indian state of Karnataka.¹⁰⁹ Data from 2,919 singleton mother-child dyads were obtained from a larger community-based sample. The incidence of low birth weight was 14.2% among literate mothers compared to 16.8% among illiterate mothers. This difference was not statistically significant and so was not included in the final model of predictors of low birth weight. The study's findings may be attributed, at least in part, to the definition of maternal education used by the researchers. Women who could neither read nor write comprised the "illiterate" group and women who had formal education, or could read and write but had no formal education, were termed "literate." Combining women who could only read and write their name with those who had formal education, especially at the secondary level or above, appears likely to have influenced study outcomes.

Another recent Indian study using NFHS-3 data to explore links between maternal

autonomy and infant low birth weight used maternal education as a covariate in the study.¹¹⁰ This study measured low birth weight in two ways: by using information from the health card (birth weight of the child) and by taking into account the mother's perception of the size of her child. In both groups, maternal education was found to be a significant predictor of infant low birth weight. Health card data revealed that women who had secondary education, defined as education between 6 to 12 years (OR 0.78; 95% CI 0.67 - 0.92), and women with higher education defined as more than 12 years of education (OR 0.48; 95% CI 0.37 - 0.64), were significantly less likely than women with no education to have a low birth weight baby. Among the group of women whose perception of the size of their child was measured, only women with higher education were significantly less likely to give birth to a low birth weight child (OR 0.68; 95% CI 0.55 - 0.85) compared to women with no education. In a discussion of their findings, the researchers suggested that less educated women may be more likely than their more educated peers to practice unsuitable health behaviors and to experience poor economic conditions during pregnancy that may influence fetal growth.¹¹⁰

Maternal education has been posited to have an indirect impact on infant low birth weight, influencing mother's adoption of healthy habits during pregnancy, such as eating a nutritious diet and obtaining adequate antenatal care.²⁹ One would expect there to be a large number of Indian studies exploring the relationship between maternal education and infant low birth weight. However, with the exception of the study summarized above,¹¹⁰ there is very little published Indian research examining maternal education as a predictor of infant low birth weight that: 1) uses a representative sample of rural and urban Indian women across the nation, and 2) defines maternal education in terms of the number of

completed years of schooling. Thus, additional investigation of the relationship between maternal education and infant low birth weight may have valuable implications for future interventions aimed at reducing India's incidence of low birth weight babies.

Maternal Autonomy

Maternal autonomy is a second potential protective factor that may influence Indian women's utilization of maternal health care services. The World Bank has defined maternal autonomy as the "the expansion of freedom of choice and action to shape one's life,"^{111(p14)} noting that the impact of autonomy lies in its "ability to formulate strategic choices and to control resources and decisions that affect important life outcomes".^{112(p73)} A systematic review of major factors affecting women's utilization of antenatal care in developing countries between 1990 and 2006 listed maternal autonomy among these factors.¹⁰⁰ However, results from some previously conducted studies around the world show that decision-making solely by women may actually increase their probability of experiencing negative outcomes, such as domestic violence.¹¹³⁻¹¹⁵ These studies suggest that measures of maternal autonomy include egalitarian decisions, or those that are made jointly by the woman and her partner.

In the current study, the construct of maternal autonomy included women's ability to make decisions or take action, independently or in consultation with one's husband, about health care, financial matters, and personal mobility. Examples of autonomous behaviors included engaging in health-related decision making, having control of some financial resources through ownership of a bank account or being able to put money aside for personal use, and being able to visit a health facility or relatives alone.

Maternal Autonomy and Maternal Health Services Utilization

Several small studies have explored maternal autonomy and women's use of maternal health services. For example, one investigation in the northern state of Uttar Pradesh examined women's autonomy and their utilization of maternal health services and safe delivery care.³⁵ The study sample was composed of urban women of poor to middle class socioeconomic status (N=300). The researchers measured maternal autonomy in three different areas: decision-making autonomy, control over finances, and freedom of movement. Unlike the current study, decision-making autonomy did not include decisions about health; it included making small and large decisions in the household and permission to go out of the house. Financial autonomy included unrestricted access to money and being able to use the money without consulting anyone. Freedom of movement constituted of going alone to the market, going alone to the doctor and taking the child to the doctor, and visiting parents as desired. Researchers divided the indices into two groups, high vs low autonomy.

In the latter study, antenatal care was measured as a continuous variable consisting of several components (e.g., taking blood pressure, tetanus toxoid injection, prescription of folic acid tablets, and frequency of antenatal visits), with a final score ranging from 0 to 100%. Women with scores in the 0 to 25% range were placed in the category of low antenatal care, the middle 50% were classified as receiving moderate antenatal care, and the top 25% were classified as recipients of high antenatal care. The study also examined the relationship between three elements of autonomy and level of antenatal care. Findings revealed that only freedom of movement had a significant relationship with antenatal care; a one-point increase in the freedom of movement index

increased the predicted antenatal score by five percentage points. While this study shows that at least one component of autonomy may predict antenatal care, it was limited by a very small sample size of urban women in one Indian state. Additionally, this study examined various dimensions of maternal autonomy independently and did not include decisions about health care.

The latter study in Uttar Pradesh also investigated the association between maternal autonomy and safe delivery care.³⁵ Safe delivery care was defined as a delivery attended by a trained birth attendant, including deliveries at home and in a health care facility. Researchers defined a trained birth attendant as one with medical training and did not include traditional birth attendants. Findings revealed that out of the three indices of autonomy, only freedom of movement was significantly associated with safe delivery. The estimated odds of using a trained birth attendant were higher for women with high freedom of movement scores compared to those with low freedom of movement scores (OR 1.32; 95% CI 1.01 - 1.73). However, again it should be noted that the study failed to differentiate between deliveries at home and those in an institutional setting, and assessed the three domains of autonomy separately.

A larger study explored the association between maternal autonomy and antenatal health care utilization in rural areas of four of the most underdeveloped Indian states, namely Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh (N=11,369).¹⁰² In this study, which employed NFHS data from 1998-99, antenatal care was divided into two components: antenatal visits and antenatal services. Antenatal visits referred to visits to an antenatal care facility or home visits by a health worker. Antenatal services were defined as services actually obtained, such as blood pressure measurement, urine test,

blood test, and tetanus toxoid injection. Institutional delivery was not measured in this study as an outcome of interest. To measure maternal autonomy, researchers obtained a total score based on seven questions that addressed decision-making in cooking, health care, and household purchases; ability to visit friends and family members; and freedom to keep money aside. Each of the 7 items was assigned a score of 1 or 2: 1 where a woman was not a decision maker and 2 where a woman was the decision-maker. Consequently, the score for each participant ranged from 7 to 14. However, the researchers of this study did not specify whether categorizing woman as the decision-maker included decision-making in consultation with her husband. Researchers used scores from 7 to 10 to indicate low autonomy score and scores of from 11 to 14 to indicate high autonomy. They then analyzed data using two models, the first focusing on antenatal care visits made through a health facility and second included both facility and home visits.

Findings of the latter study revealed that only 37% of women in the four states had received at least one antenatal checkup during pregnancy, including 26% who visited a health care facility, 7% who had home visits, and 4% of respondents who had both. Overall, maternal autonomy was significantly associated with use of antenatal care in two of the four states, Madhya Pradesh and Uttar Pradesh. Women with high autonomy were more likely to use antenatal care compared to women with low autonomy in these two states. Moreover, significant findings were limited to those women who received antenatal care in a health care facility and were not found for those who had facility and/or home visits. This study documented a significant relationship between maternal autonomy and antenatal care in half of the states under investigation, but was limited by

its focus on women in India's poorest states who resided in rural areas.

A study carried out by researchers using NFHS-2 data from 1998 to 1999 attempted to explore whether health decision-making autonomy, financial autonomy, and freedom of movement were related to use of antenatal care and institutional delivery among rural Indian women (N=11,648).⁶⁶ Decision-making autonomy included decisions about healthcare, purchasing jewelry or other major household items, and visiting parents. Women were asked about whether they made independent decisions about these matters, decided them jointly with their husbands, jointly with others in the household, or were not involved in decision-making at all. Based on their responses, an autonomy index was created ranging from 0 to 3. Financial autonomy was measured by asking if the respondents set aside some money that they could use as they wished. Freedom of movement was measured by asking if the participants needed permission to go to the market or for visiting family and friends. Adequate antenatal care was defined on the basis of two factors: adequate number of antenatal care visits and timing of first antenatal care visit. Using WHO guidelines, at least three antenatal visits were deemed adequate in this study, and adequate timing of first antenatal care visit was defined as a visit between the first and fourth months of pregnancy. Institutional deliveries were defined as those occurring in a medical setting such as a government or private hospital or dispensary, non-governmental or trust hospital or clinic, community health center, or sub-center.

Findings from the latter study revealed that only 28% of the rural Indian women reported adequate antenatal care. Measurement of autonomy revealed that 20% of women were independent decision makers about own health care, 24% women made decisions about their health care in consultation with husband or a family member, and 56% were

not involved in decision-making at all. Additionally, 20% were able to visit the market without permission, and 51% of women could keep money aside for self-use. However, it was not clear how higher and lower levels of autonomy were defined, and whether there were differences in outcome measures when women made decisions independently versus when they made collaborative decisions with their husbands.

Findings from the latter study revealed that out of the three indices of maternal autonomy, decision-making autonomy (OR 1.08; 95% CI 1.04 - 1.13) and freedom of movement (OR 1.11; 95% CI 1.04 - 1.19) were significantly associated with adequate antenatal care utilization. Women with more decision-making power and mobility were more likely than their peers with no autonomy in these areas to obtain antenatal care. With respect to institutional delivery, freedom of movement (OR 1.13; CI 1.05 - 1.21) and financial autonomy (OR 1.30; 95% CI 1.15 - 1.47) were found to be significantly associated with women's delivery in an institutional setting. Women with financial independence and mobility were more likely than those with no autonomy in these areas to have an institutional delivery. It is interesting to note that freedom of movement predicted use of both antenatal care and institutional delivery, whereas decision-making power was linked to antenatal care, and financial independence was associated with institutional delivery. Although this study was limited to rural areas, it did cover the entire country and had a large sample size as compared to much of the previous research. However, the study did not include permission to go to a health care facility in its measurement of freedom of movement, and did not inquire about bank account to measure financial autonomy. Additionally, decision-making in this study did not include decisions about daily household purchases.

One of the most recent studies found in the literature used the same data set as the present study, NFHS-3, to examine predictors of maternal health care among adolescent women in rural areas.³¹ Participants were married Indian women between the ages of 15 and 19 (N=3,599). As in the previous study,⁶⁶ the researchers focused on the relationship between autonomy and three outcome variables: antenatal care, safe delivery care, and postnatal care. Researchers created an autonomy index using information that addressed the ability to participate in decisions about going to a health facility, involvement in major and daily household purchases, decisions to visit family or relatives, decisions to spend the husband's money, and being allowed to make visits to the market and outside the village/community. Financial autonomy was calculated using two indicators; access to money for own use and bank account. The autonomy index had two categories, high and low. Women who were involved in decision-making, did not require permission to go out, and had economic security were placed in the high autonomy category. In this study, adequate antenatal care was defined as having minimum of three antenatal care visits, at least two tetanus toxoid injections during the pregnancy and at least one in the three years preceding the pregnancy, and iron folic acid tablets for ninety days or more. Safe delivery care was defined as delivery in a government facility or delivery in a home with a trained birth attendant (e.g., doctor, nurse, trained midwife). Results revealed that only 23% of respondents had high autonomy. Among the high autonomy group, 18% reported adequate antenatal care and 55% reported safe delivery care. Findings revealed no significant associations between autonomy and adequate antenatal care or between autonomy and safe delivery. Findings may have been influenced by the young age of the participants and their overall low autonomy scores. Additionally, the researchers did not

examine institutional delivery as separate from their broader measure of safe delivery care.

Another study conducted in rural and urban areas of the state Karnataka in southern India (N=3,595) also examined the relationship between women's autonomy and their delivery in an institutional health care setting.¹⁰³ Maternal autonomy was defined as self-reported health decision-making power and freedom of movement. Approximately 45% of respondents fell into the low autonomy category, 34% in the medium autonomy category, and 21% in the high autonomy category. Approximately 38% of respondents in the study delivered in a hospital, including 57% of urban women and 29% of rural women. With regard to home deliveries in both rural and urban areas, untrained traditional birth attendants conducted 77% of the deliveries. In this study, women's autonomy was not found to be a significant predictor of institutional delivery. This study was interesting because southern India has better health indicators than other regions of the nation, as well as less patrilineal structures in its social fabric. However, the study did find that maternal autonomy was significantly associated with deliveries in private health care facilities. It can be argued that women with higher autonomy are better able to exercise their right to use private and more expensive health care than their peers with lower autonomy.

A more recent study using NFHS-3 data was conducted to examine maternal autonomy and its association with maternal and child health care services including antenatal care and institutional delivery.¹¹⁶ Adequate antenatal care was defined as having at least three antenatal care visits, one hundred IFA tablets, and two tetanus toxoid injections. Birth in a hospital setting was defined as institutional delivery. Maternal

autonomy was assessed by the mother's ability to make decisions in five areas: large household purchases, daily household purchases, mobility, control over spending, and personal health care. The study examined the influence of decisions made by the woman alone, jointly with her husband, or by others when she had no involvement. Findings revealed that women who independently made decisions about daily household purchases were more likely to obtain adequate antenatal care. Moreover, women who made large and daily household purchases decisions jointly with their husbands were more likely to have an institutional delivery.

In summary, the existing literature reveals that several Indian studies have examined the relationship between maternal autonomy and adequate antenatal care. However, these studies have employed various measures of the adequacy of such care, some more stringent than others. One study found that only one index of maternal autonomy, freedom of movement, predicted more adequate antenatal care,³⁵ but another found two of the indices, health decision-making autonomy and freedom of movement, significantly predicted more adequate antenatal care.⁶⁶ A third study found a weak association ($P<0.10$) between maternal autonomy and safe delivery care, which included hospital and home births by trained birth attendants.³¹ Yet another study found a significant association between making independent decisions about daily household purchases and securing antenatal care.¹¹⁶

The literature review revealed relatively few studies investigating the relationship between maternal autonomy and institutional deliveries in India, despite evidence of maternal and child health benefits of institutional delivery care^{3,116,117} and recent Indian policies incentivizing institutional deliveries.⁶⁴ Again, findings from existing studies have

been mixed, and are likely influenced by methodological and measurement differences. Moreover, most of the studies have focused on India's rural populations, poorer states, or specific regions of the country, with one study limited to mothers under the age of twenty. Given India's policy initiatives to increase institutional births, it is important to explore factors that may predict Indian women's use of institutional facilities for childbirth.

Maternal Autonomy and Infant Low Birth Weight

The high prevalence of low birth weight in India has been clearly established in the literature.⁷⁸ Maternal autonomy may influence infant low birth weight through a woman's health-seeking behavior. Women with high autonomy may actively make decisions to obtain antenatal care and purchase nutritious foods, reducing the likelihood that they will deliver a low birth weight baby.¹¹⁸ Currently, most of the research exploring relationships between maternal autonomy and child development has focused on outcomes other than infant low birth weight. For example, researchers have attempted to explore the association between maternal autonomy and such child outcomes as child stunting in India,¹¹⁹ infant growth in India,¹²⁰ and infant mortality in Nepal.¹²¹

One of the Indian studies used NFHS-2 data from rural and urban women in the state of Andhra Pradesh to examine the relationship between maternal autonomy and child stunting.¹¹⁹ The sample consisted of 821 mother-child dyads and included anthropometric data for children less than three years of age. Four measures of autonomy were used: decision-making power of women in various household activities, including health care related decisions; women's freedom of movement; women's financial

resources; and women's attitudes towards domestic violence, including whether or not women felt wife beating was justified. Only freedom of movement and having financial resources were correlated with child stunting and included in the subsequent multivariate regression analysis. Women with higher financial autonomy were less likely (OR 0.73; 95% CI 0.55 - 0.98) and women with greater freedom of movement were less likely (OR 0.59; 95% CI 0.38 - 0.93) than their peers with less autonomy in these areas to have a stunted child.

Another study involving 600 mother-infant pairs from sixty villages in the Indian state of Andhra Pradesh examined maternal autonomy as a predictor of exclusive breastfeeding and infant growth.¹²⁰ Maternal autonomy was measured with a self-report questionnaire that assessed household decision-making, child-related decision-making, financial independence, and mobility. Infant growth measures included length for age, weight for age, and weight for length. The study found that mothers with higher financial autonomy were more likely to breastfeed 3 to 5 month old infants compared to women with lower financial autonomy, and mothers with higher participation in household decision-making had infants who were less underweight and less wasted compared to mothers with lower involvement in decision-making.

A third study using data from the Nepal Demographic and Health Survey, 2005-06, utilized a nationally representative sample of 5,545 women to examine maternal autonomy as a predictor of infant mortality.¹²¹ Autonomy measures included mothers' educational status (literate vs. illiterate) and their household decision-making related to health care, daily and large household purchases, and visiting family or relatives. Only autonomy related to making health care related decisions was found to be significantly

associated with infant mortality. Infants of Nepalese mothers who were involved in decision-making independently, or jointly in consultation with husbands or other family members regarding their own health care, had lower odds of death (OR 0.75; 95% CI 0.57 - 0.98) than infants whose mothers were not involved in health care decisions.

There is very little literature exploring the relationship between maternal autonomy and infant low birth weight in developing nations. Only one study conducted in India was found to have examined maternal autonomy as a predictor of low birth weight.¹¹⁰ Researchers conducted a secondary analysis using the NFHS-3 dataset, first comparing regional differences between low birth weight deliveries in rural and urban areas of five regions: north, east, north-east, south, and central west. The sample included non-pregnant women who had a child less than five years old. Maternal autonomy was defined on the basis of women's decision-making ability in four areas: decisions about health care, making purchases to address daily needs, making large household purchases, and decisions about visiting family or relatives. An autonomy score was created based on participants' responding about whether they made a decision independently, jointly with their husband, jointly with another family member, or husband or someone else made the decision. Each of these six responses was given scores from 1 to 6 and consequently the total autonomy score came to be 24. Women with autonomy scores in the range of 4 to 7 were categorized as having high autonomy, those with scores between 8 and 15 were considered to have medium autonomy, and low autonomy was defined as having scores between 16 and 24.

The latter study ran two separate models to examine the relationship between autonomy and the outcome variable of low birth weight: information from the health

cards for infants who were weighed at birth (n=14,407), and information from mother's perception of birth size (n=33,881), defined as her subjective assessment of whether the infant was born small or average/large. According to NFHS-3, approximately 60% of deliveries in the five years preceding the survey took place at home.⁹ Since a significant portion of Indian births occur at home where infants are not weighed at birth, mothers' perception of birth size has been reported to be a reliable indicator.¹²²

Findings from the latter study revealed that, among the sample using infant birth weight information from the health cards, approximately 20% of mothers constituted the high autonomy group, 54% comprised the medium autonomy group, and 25% were in the low autonomy group. Women with low autonomy scores were more likely to give birth to a low birth weight infant compared to women in the high autonomy group (OR 1.28; 95% CI 1.07 - 1.53). Medium autonomy was not significantly associated with the likelihood of delivering a low birth weight infant when mothers with medium autonomy scores were compared to women with high autonomy. In the sample using perceived birth size as the definition for low birth weight, approximately 17% comprised the high autonomy group, 53% fell in the medium autonomy group, and 29% had low autonomy scores. The odds ratio and confidence intervals for this sample using mother's perceptions of birth size were similar to those obtained with the health cards: women with low autonomy scores were more likely to give birth to an infant of a smaller size compared to women in the high autonomy group (OR 1.28; 95% CI 1.07 - 1.53). Additionally, a moderate association was found between place of residence and low birth weight; women from rural areas were more likely to have a low birth weight baby compared to women in urban areas (OR 1.14; 95% CI 1.01 - 1.28) in the sample using infant birth weight cards.

Similar results were not found for the sample using mothers' perception of infant birth size.

Researchers who conducted the latter study emphasized that their data were representative of the larger Indian population, contributing to the generalizability of their findings. It should be noted that the measure of autonomy in this study addressed health related decision-making, ability to make daily and big household purchases, and ability to visit family and friends. With respect to freedom of movement, it did not assess the woman's ability to make an independent visit to a health care facility, and the measure of financial autonomy did not examine women's control of money through a bank account. The current study will include both these items in its measure of autonomy.

A unique contribution of the latter study was the use of mothers' perception of birth size as the definition for low birth weight. The current study used the same criteria for defining low birth weight. In developing countries, reliable data on low birth weight remains limited, primarily because 60% of children are born at home and are rarely weighed. For example, a study based on the NFHS-2 revealed that 70% of babies were not weighed within two days of birth in India.¹²³ Even when children are weighed, their weight is not always measured accurately, or recorded, reported and tabulated correctly.¹²² Since many developing countries do not have birth weight data from a health facility, alternative methods have been developed. UNICEF's report on low birth weight recommends mothers' subjective assessment of the infant's size at birth (i.e., very large, larger than average, average, smaller than average, very small) as one of the alternative methods.¹²² In a country such as India, researchers interested in low birth weight have therefore used mother's subjective assessment of birth weight as the best available proxy

measure when no data from health facilities is available.

Control Variables

The control variables in the current study were maternal age, socioeconomic status, religion, and location of the mother (rural/urban). The control variables represent those variables that have been found to have strong associations with both independent and dependent variables in previous research.

Maternal Age

Many studies have controlled for maternal age because it has been found to be a significant predictor of domestic violence, maternal autonomy, and health outcomes. Specifically, older women have been found to be less likely to experience violence compared to younger women.^{124,125} Age is also positively associated with maternal autonomy; older women tend to have more autonomy in the household compared to younger women.¹²⁶ With respect to the study's dependent variable, antenatal care, research has found utilization of antenatal care to be higher among older women (women in their 30s) compared to younger women.^{100,102} Additionally, studies have found that very young (15 to 19 year old) mothers and older mothers (over 35 years of age) are more likely than those 20 to 35 to have a low birth weight infant.⁷⁶ The current study includes women in their reproductive years, between 15 and 49 years of age.

Socioeconomic status

Socioeconomic status has previously been linked to domestic violence.¹²⁵ Among the explanations are that men experiencing economic problems are more likely to express their anger and frustration by abusing their partners. Socioeconomic status is also highly

correlated with antenatal care. The literature indicates that women of higher socioeconomic status are more likely to receive adequate and timely antenatal care than those of lower socioeconomic status.^{100,102} Hence, it was important that socioeconomic status be controlled for in the current study.

Religion

India is predominantly a Hindu country. Some previous research has found religion to be linked to some of the key variables in this study. The 2005-06 NFHS found that Muslim women in India were more likely than Hindu women to experience physical violence.¹²⁵ Research also suggests that Muslim women are more likely to seek antenatal care than Hindu women.¹⁰² Thus, it was important to control for the potential confounding effect of religion in this study.

Urban Versus Rural Location

Geographic location has been associated with maternal and child health services utilization in countries such as India.¹²⁷ As a result of poor roads, rugged terrain, and monsoon flooding, women in rural villages often have poor access to primary care facilities that provide antenatal care and hospitals/institutional facilities for child birth.^{128,129} Research has found that women in urban areas use more antenatal care than those in rural areas.¹⁰⁰ Data related to domestic violence is mixed; some studies suggest women in urban areas are more abused than women in rural areas,¹²⁴ while others have found that rural women experience more domestic violence than their urban peers.¹²⁵ Taken together, this research suggested the need to control for geographic location (urban versus rural status) in the proposed study.

Summary and Contributions of Proposed Study

The literature presented in this chapter summarizes research conducted in India that examines predictors of maternal health services utilization and infant low birth weight. Specifically, the study examines how three types of domestic violence, maternal education, and maternal autonomy may be related to women's use of antenatal services, institutional delivery, and delivery of a low birth weight child. Adopting an ecological framework, domestic violence is a potential risk factor at the relationship level. Maternal education is a potential protective factor at the individual level, and maternal autonomy is a potential protective factor at the relationship level of the ecological model. Not surprisingly, previous studies examining the relationships between these ecological factors and maternal and child health outcomes have produced mixed results. Research has been conducted in different parts of India, with rural and urban populations, and with mothers from different socioeconomic and age groups. Equally important, there have been differences in methodological and measurement approaches. The current study is unique in a number of ways and will add to the existing literature on maternal and child health in India.

The current study draws on the ecological model of health to explore the association between selected maternal factors and women's use of health services and their likelihood of delivering a low birth weight child. The study adds to the scant literature by examining how different types of domestic violence exposure during pregnancy are related to Indian women's health behaviors and infant outcomes. The proposed research employed the latest national data on domestic violence before birth of a child, and will expand existing literature by examining three types of domestic

violence: physical, psychological, and sexual. It will be one of the first studies in India to examine the relationship between domestic violence and antenatal care, institutional delivery, and infant low birth weight using a nationally representative sample. In particular, it will add to the literature on the relationship between different types of domestic violence and infant outcomes, which has previously focused on perinatal and neonatal mortality.^{14,17}

Maternal education has been found to be a consistent predictor of maternal health services utilization in existing literature from developed and developing countries. However, there are no published studies examining how maternal education is related to maternal health services utilization in the NFHS-3 dataset.

This study further expands current knowledge of role of maternal autonomy in maternal health services utilization and infant low birth weight in India. It utilizes a composite measure of a woman's autonomy and compares women's ability to make decisions alone or in conjunction with her husband about health, mobility, and finances versus having to rely on permission from others. Moreover, most of the existing studies on maternal autonomy have been conducted in a limited number of states and focus largely on rural populations. The present study used a representative sample from the entire country, and controlled for rural and urban location and socioeconomic status.

The present study also extends the literature by adopting a definition of adequate antenatal care that is consistent with JSY program and District Level Household Survey (DLHS) definitions, including a minimum of three antenatal care visits, an antenatal visit in the first trimester, and mother's intake of at least hundred IFA tablets.^{64,130} Many of the previous studies did not have all three requirements for adequate antenatal care. The

proposed investigation further provides valuable data on predictors of institutional delivery, especially important because the government of India has made increasing institutional deliveries a major strategy to reduce maternal and infant mortality.⁶⁴ Thus, findings from the current study may help India to achieve MDGs 4 and 5.

As noted above, many of the variables in the proposed study have not been examined in a nationally representative Indian sample. The proposed study is at the forefront of research in examining the role of domestic violence and maternal autonomy in women's use of maternity services and their birth outcomes. It is important to first identify significant relationships between the selected ecological factors and maternal and child health outcomes throughout the nation before initiating more complex analyses testing moderation and mediation.

Research Objective, Questions, and Hypotheses

Objective

The specific objective of this study was to explore the role of three types of domestic violence exposure during pregnancy, maternal education, and maternal autonomy as predictors of Indian women's obtaining adequate antenatal care, having an institutional delivery, and delivering a low birth weight baby. The study was conducted with Indian women who gave birth within the year preceding data collection.

Research Questions and Hypotheses

The study asked three major research questions. Each question is followed by hypotheses based on theory and existing research.

Question 1. Are exposure to domestic violence, maternal education, and maternal

autonomy significant predictors of women's use of adequate antenatal care?

Hypotheses:

1A. Women who experienced physical violence within the year prior to childbirth are less likely to obtain adequate antenatal care than women who did not experience physical violence during that same time period.

1B. Women who experienced psychological violence within the year prior to childbirth are less likely to obtain adequate antenatal care than women who did not experience psychological violence during that same time period.

1C. Women who experienced sexual violence within the year prior to childbirth are less likely to obtain adequate antenatal care than women who did not experience sexual violence during the same time period.

1D. Women with more education are more likely to obtain adequate antenatal care than women with less education.

1E. Women with higher autonomy are more likely to obtain adequate antenatal care than women with lower autonomy.

Question 2. Are exposure to domestic violence, maternal education, and maternal autonomy significant predictors of having an institutional delivery?

Hypotheses:

2A. Women who experienced physical violence within the year prior to childbirth are less likely to have an institutional delivery than women who did not experience physical violence during the same time period.

2B. Women who experienced psychological violence within the year prior to childbirth are less likely to have an institutional delivery than women who did not experience

psychological violence during the same time period.

2C. Women who experienced sexual violence within the year prior to childbirth are less likely to have an institutional delivery than women who did not experience sexual violence during the same time period.

2D. Women with more education are more likely to have an institutional delivery than women with less education.

2E. Women with higher autonomy are more likely to obtain an institutional delivery than women with lower autonomy.

Question 3. Are exposure to domestic violence, maternal education, and maternal autonomy significant predictors of having a low birth weight baby?

Hypotheses:

3A. Women who experienced physical violence within the year prior to childbirth are more likely to deliver a low birth weight infant than women who did not experience physical violence during the same time period.

3B. Women who experienced psychological violence within the year prior to childbirth are more likely to deliver a low birth weight infant than women who did not experience psychological violence during the same time period.

3C. Women who experienced sexual violence within the year prior to childbirth are more likely to deliver a low birth weight infant than women who did not experience sexual violence during the same time period.

3D. Women with more education are less likely to deliver a low birth weight infant than women with less education.

3E. Women with higher autonomy are less likely to deliver a low birth weight baby than

women with lower autonomy.

For ease of reference, all the above-described hypotheses are summarized in Table 1.

Table 1: Independent Variables, Dependent Variables, and Hypotheses

Independent Variables	Dependent Variables		
	Adequate Antenatal Care (ANC)	Institutional Delivery	Infant Low Birth Weight (LBW)
Physical Violence	1A. Negative association	2A. Negative association	3A. Positive association
Psychological Violence	1B. Negative association	2B. Negative association	3B. Positive association
Sexual Violence	1C. Negative association	2C. Negative association	3C. Positive association
Maternal Education	1D. Positive association	2D. Positive association	3D. Negative association
Maternal Autonomy	1E. Positive association	2E. Positive association	3E. Negative association
Control Variables: <i>Maternal age, maternal religion, household socioeconomic status, and location (rural vs. urban)</i>			

Chapter 4: Methodology

Sample

The current study utilized data from the National Family Health Survey-3 (NFHS-3) conducted in 2005-06. NFHS-3 is a nationally representative, cross-sectional survey that employed a systematic, two-stage, cluster sample of households. NFHS-3 is the third in a series of national surveys, preceded by NFHS-1 and NFHS-2 that were conducted in 1992-93 and 1998-99, respectively. The NFHS series of surveys were designed to provide estimates of key indicators of maternal and child health, family welfare, and nutrition. Additionally, NFHS-3 provides information on several new and emerging issues, including detailed information on domestic violence, maternal autonomy, family life education, perinatal mortality, adolescent reproductive health, high-risk sexual behavior, tuberculosis, malaria, and HIV testing in the adult population. NFHS-3 was conducted under the leadership of the Ministry of Health and Family Welfare, Government of India with the International Institute for Population Sciences carrying out the survey. The national survey covered all twenty-nine states in India. Further details on sampling and basic descriptive statistics can be obtained in the final report of the NFHS-3 survey.⁹

Technical assistance for the NFHS-3 was provided by Macro International, Maryland, which oversees the Demographic Health Surveys (DHS). India's NFHS-3 is one of the surveys developed by DHS that are carried out in more than fifty countries across the world. The question assessing mothers' perception of the size of her infant as a measure of LBW is used in all countries where birth weight is not available from hospital

records due to the large number of home-based births. The Domestic Violence module used in the NFHS-3 has now been used to collect data about physical, psychological, and sexual violence in more than 25 countries. Questions from the Conflict Tactics Scale were used to develop the domestic violence measures in these countries.¹³¹

NFHS-3 interviewed ever-married women and never married women aged from 15 through 49 years. Overall, data was collected from 124,385 women in 109,041 households. The domestic violence module was included in the Women's Questionnaire. Only one woman from each sample household was chosen to complete the domestic violence module. In households with more than one eligible woman, a random selection procedure was used to choose the eligible woman who completed this component of the survey. Overall, 83,703 women, or 67% of the entire NFHS-3 sample, were interviewed about their domestic violence experiences. Out of these 13,999 were never married women and 69,704 were ever-married women.

The study sample consisted of women ages 15 to 49 who gave birth to a child during the twelve months preceding administration of the Women's Questionnaire (including the domestic violence module). Only currently married women were retained in the final sample. It should be noted that the domestic violence module asked women about experiencing three types of domestic violence during the last 12 months. It did not specifically ask women about domestic violence during pregnancy. However, since the sample was restricted to women who had given birth within the last 12 months, and the violence questions also addressed the same period, it is likely that there was substantial overlap between the pregnancy and the woman's experience of domestic violence.

Measures

NFHS-3 used three types of questionnaires: the Household Questionnaire, the Women's Questionnaire (ever-married and never-married women age 15 to 49), and the Men's Questionnaire (not utilized in the current study). Questionnaires were administered in both English and the local language. The Household Questionnaire collected information on all members of the household including each member's age, sex, marital status, relationship to the head of the household, and education. The Household Questionnaire assessed the household's socioeconomic characteristics, household assets, source of drinking water, and use of fortified salt.

The Women's Questionnaire was the most comprehensive of all the three questionnaires. Topics included: demographic characteristics, including maternal education, marriage and cohabitation, domestic violence, antenatal delivery, quality of care and contacts with health personnel, infant birth weight, postnatal care, and maternal autonomy, among others.

Data for all of the independent and dependent variables were obtained from the Women's Questionnaire. Data for the control variables of maternal age, religion, and rural or urban location came from the Women's Questionnaire. The control variable of socioeconomic status, which included five wealth quintiles, was obtained from the Household Questionnaire. Following is a summary of the study variables that will be used to test the hypotheses.

Independent Variables

Domestic Violence: Data on three types of domestic violence were collected from the domestic violence module within the Women's Questionnaire. Domestic

violence questions were adapted from the shortened and modified Conflict Tactics Scale (CTS).¹³¹ Women were asked about their experiences of domestic violence during the last twelve months. Physical, psychological, and sexual violence were measured using a series of items to which the women had to answer 'yes' or 'no'. Consistent with the scoring of the NFHS-3,⁹ a 'yes' response to one or more items for each type of violence was considered evidence of the woman's experiencing that type of violence.

1. Physical violence: Experience of at least one act of spousal physical violence in the year preceding administration of the Women's Questionnaire. The seven items in this measure included behaviors that have the potential to produce bodily harm: pushing, shaking, or throwing something at the woman; slapping her; twisting her arm or pulling her hair; punching her with a fist or something causing harm; kicking, dragging, or beating her up; choking or burning her intentionally; and threatening to attack her with a knife, gun, or any other weapon. Physical violence was a binary variable; a yes response to any of the items was categorized as physical violence.

2. Psychological violence: Experience of at least one act of spousal psychological violence in the year preceding administration of the Women's questionnaire. The three items in this measure addressed saying or doing something to humiliate a person in front of others, threatening to hurt or harm an individual, and insulting or making a person feel badly. Psychological violence was a binary variable; a yes response to any of the items was categorized as psychological violence.

3. Sexual violence: Experience of at least one act of spousal sexual violence in the year preceding administration of the Women's Questionnaire. The two items included forcing an individual to have sexual intercourse against her will or to perform unwanted sexual

acts. Sexual violence was a binary variable; a yes response to any of the items was categorized as sexual violence.

4. Maternal education: Mother's level of education based on total years of schooling completed. Four categories were used: uneducated (no years of formal schooling), one to five years of education, six to nine years of education, and ten or more years of education.

5. Maternal autonomy: Maternal ability to participate in decision-making and take action, alone or in consultation with her husband, in areas of health and household decisions, financial control, and freedom of movement. Four items addressed decision-making, two items addressed financial autonomy, and three items addressed freedom of movement. Sample items included being able to make health and household related decisions, have a bank account, and hold some money aside for personal use, visit the market unescorted, and visit a health facility unescorted (see Appendix 1 for all items). Total scores for the nine items ranged from 0 to 9. Based on frequency data, scores were divided into three categories: low, medium, and high maternal autonomy. Scores in the range 0 to 2 constituted low autonomy, scores from 3 to 4 were classified as medium autonomy, and scores from 5 to 9 were considered as high autonomy.

Control Variables

1. Maternal Age: Age of the mother in years. Women in the age range of 15 to 49 were divided into 5 categories; 15-19; 20-24; 25-29; 30-34; 35 plus.

2. Religion: For the present study, religion was divided into two categories, Hindu and non- Hindu.

3. Rural or urban location: Information from the latest Census held in 2001 was used to

determine the urban or rural status of the respondent. The Census lists every village and city in the country. Location was a binary variable.

4. Socioeconomic status: Using the household wealth index, mothers were placed into one of five quintiles: lowest; second; third; fourth; or highest.

Dependent Variables

1. Adequate antenatal care: Mothers having an antenatal visit in the first trimester, at least three antenatal visits, and intake of hundred or more IFA tablets were considered to have received adequate antenatal care. All of these conditions had to be satisfied for a ‘yes’ to receiving adequate antenatal care. Adequate antenatal care was treated as a binary variable.

2. Institutional delivery: Mothers having a delivery in a government facility, in an accredited private facility, or in facility run by a Non Governmental Organization (NGO)/Trust. Institutional delivery was a binary variable.

3. Infant low birth weight: Mother’s perception of the size of her infant at birth, on a scale that includes “very large,” “larger than average,” “average,” “smaller than average,” and “very small.” A ‘yes’ response to “smaller than average” and “very small” constituted infant low birth weight. Infant low birth weight was a binary variable.

Sampling Procedure

The proposed study used the NFHS-3 data from women who were administered the domestic violence module questionnaire and who gave birth in the year preceding data collection. NFHS-3 used a two-stage stratified random sampling procedure in rural areas and a three-stage stratified sampling procedure in urban areas of each state. The

sample frame for selecting Primary Sampling Units (PSUs) was the information from the 2001 Census of India. In rural areas, the first level of stratification was geographic. Villages were then stratified using selected variables such as the size of the village, female literacy, and other factors. Households were listed in each sample area selection at the second stage. Large sample villages (more than 500 households) were segmented and two segments were selected randomly using the Probability Proportional to Size (PPS) method. The procedure for selection for the urban areas was the same as it was for the rural areas. Using the 2001 Census, wards were arranged using a list of variables. A sample of wards was systematically selected using the PPS method. Using the PPS method, one block of 150 to 200 households was selected from each ward.

The NFHS-3 survey was approved by the IIPS ethical review board in India and institutional review boards of the funding and the technical assistance agencies.⁹ All women selected in the sample were asked to provide voluntary informed consent. Interviewers were required to administer the domestic violence module to women in complete privacy. When a private setting was unavailable, the domestic violence questions were not asked. The NFHS-3 data set is available publicly from the DHS website and can be accessed after sending a brief request to DHS. Confidentiality of the participants has been maintained; case numbers were assigned to each participant to avoiding any possibility of personal identification.⁹

Data Analyses

First, a power analysis was conducted to confirm the sample size was adequate to test hypothesized relationships. Descriptive statistics were then calculated and are

presented for all study variables, including: 1) maternal demographics, 2) the independent variables of domestic violence, maternal education, and of maternal autonomy, 3) control variables of maternal age, religion, household socioeconomic status and rural/urban location, and 4) dependent variables of adequate antenatal care, institutional delivery, and infant low birth weight. Bivariate analyses using binary logistic regression were carried out to examine the relationships among all independent and dependent variables.

A valid concern in the proposed study was the correlation between the three independent variables: physical violence, emotional violence, and sexual violence. The VIF collinearity test was conducted to measure the correlations between these three variables. If the correlations were too high, then one or more variables would need to have been removed from the analyses.

In order to test the proposed hypotheses, multivariate logistic regression analyses were used to determine the degree to which the independent variables are predictors of the three dependent variables: adequate antenatal care, institutional delivery, and infant low birth weight. Control variables included maternal age, religion, household socioeconomic status, and rural/urban location. Three independent logistic regression analyses were conducted with data from the study sample, one for each dependent variable. Strength of association between the independent and control variables and the three dependent variables was estimated by calculating the ORs with 95% CIs; a *P* value less than or equal to 0.05 was considered as statistically significant in all analyses.

Statistical Analysis Software (SAS) version 9.3 was used to carry out all statistical analyses. The study sample included women from all over India; hence all analyses were carried out using the primary sampling units and national weights for

women, as determined by NFHS-3. The basic objective of weighting sample data is to maximize the representativeness of the sample in terms of size, distribution, and characteristics of the study population.⁹ Additionally, sampling weights for the domestic violence module generated by NFHS-3 were applied in the data analyses.

Chapter 5: Results

This chapter begins with results of the power analysis and a summary of descriptive statistics for the analytic sample. Next, the bivariate analyses present information about the relationships between each independent and dependent variable. A final set of tables presents results of the multiple logistic regression analyses, which were used to test the proposed hypotheses. All analyses reflect the sampling weights for the domestic violence module that were generated by NFHS-3.

Power Analysis

A power analysis was conducted for logistic regression with a single binary covariate. Values of all three independent variables of domestic violence, namely physical violence, psychological violence, and sexual violence were used to conduct power analysis. Using an alpha level of 0.05, power set at 0.80, proportion of physical violence cases at 0.2, and detectable OR at 0.6, the required sample size was found to be 760. Using an alpha level of 0.05, power set at 0.80, proportion of psychological violence cases at 0.1, and detectable OR at 0.7, the required sample size was found to be 3,802. Finally, using an alpha level of 0.05, power set at 0.80, proportion of sexual violence cases at 0.08, and detectable OR at 0.3, the required sample size was found to be 1,080. NFHS-3 is a large data set, and as a result, the analytic sample of 4,983 more than meets the requirements of the minimum sample size.

Descriptive Statistics

A total of 69,704 ever-married women completed the domestic violence questionnaire. The analytic sample consisted of 4,983 women between the ages of 15 to

49 who were currently married and had given birth within the year before the participants were administered the domestic violence survey. The analytic sample included all of the participants who had complete data for each survey item.

Table 2 presents demographic characteristics of the analytic sample as well as data on women's domestic violence experiences, maternal education, maternal autonomy, antenatal care utilization, institutional delivery, and infant low birth weight. As the table indicates, the majority of women in the sample (72%) were between the ages of 20 and 29. Approximately, 15% of women were 19 years of age or less, and approximately 12% were age 30 or older. Approximately 80% of sample women were Hindu, members of the largest religious group in India. Approximately 70% of the women surveyed resided in rural areas in India. The socioeconomic status of the sample is presented in five quintiles. NFHS-3 constructed a wealth index using household asset data and housing characteristics. Approximately 37% of the women belonged to the poorest two quintiles, 20% were in the middle quintile, and a total of 43% were in the two most affluent quintiles.

Table 2: Descriptive Statistics for Mothers in Analytic Sample (N=4,983)

Characteristic	n	Weighted %
Age		
15-19	713	14.69
20-24	2170	44.70
25-29	1354	27.89
30-34	478	9.86
35 or above	138	2.85
Religion		
Hindu	3883	80.01
Non Hindu	970	19.99
Location		
Rural	3397	70.01
Urban	1456	29.99
Socioeconomic status (Divided in quintiles)		
Lowest	880	18.13
Second	909	18.74
Middle	958	19.74
Fourth	1122	23.11
Highest	984	20.28

Table 3 provides data on the independent variables, including three types of domestic violence, maternal education, and maternal autonomy. Approximately 19% of women reported physical violence, 10% reported psychological violence, and 8% women reported experiencing sexual violence during the year previous to the survey administration. Women's education was grouped into three categories: uneducated, 1 to 5 years, 6 to 9 years, and 10 or more years of education. Approximately 33% of the women had no education, 14% had 1 to 5 years of education, 25% had 6 to 9 years of education, and 27% had 10 or more years of education. The study focused on maternal autonomy by creating a composite score using nine items. It included decisions made independently or in consultation with husband about health care, large and small household purchases, holding money aside for personal use, bank accounts, and visiting health care facilities and family/relatives. Approximately 39% of respondents fell into the low autonomy category, 25% women had medium autonomy, and 36% women had high autonomy.

Finally, Table 3 summarizes data on maternal health care utilization and infant birth weight. Approximately 18% of the women reported obtaining adequate antenatal care, which required meeting three criteria: having an antenatal care visit in the first trimester, at least three total antenatal visits, and intake of hundred or more IFA tablets. In this study, 60% of mothers met the criteria of receiving antenatal care in the first trimester and 70% had a minimum of three antenatal visits, but only 25% reported consuming 100 or more IFA tablets. Institutional delivery was defined as giving birth to a child in a health care facility. Slightly more than half of the sample, or 55%, reported giving birth in a health care facility. With respect to infant birth weight, 20% of the analytic sample reported giving birth to a low birth weight infant.

Table 3: Descriptive Statistics for Independent and Dependent Variables in Analytic Sample (N=4,983)

Physical violence	n	Weighted %
Experienced physical violence	926	19.08
Did not experience physical violence	3927	80.92
Psychological violence		
Experienced psychological violence	491	10.11
Did not experience psychological violence	4362	89.89
Sexual violence		
Experienced sexual violence	388	7.99
Did not experience sexual violence	4466	92.01
Maternal Education		
Uneducated	1616	33.31
1-5 years	700	14.42
6-9 years	1237	25.49
10 years or more	1300	26.79
Maternal Autonomy		
Low	1893	39.01
Medium	1207	24.88
High	1753	36.12
Antenatal Care		
Adequate antenatal care	858	17.68
Inadequate antenatal care	3995	82.32
Institutional Delivery		
Yes	2674	55.09
No	2179	44.91
Birth weight of the infant		
Low birth weight	986	20.31
Normal birth weight	3867	79.69

Bivariate Analyses

Bivariate analyses were conducted to examine relationships between the independent variables and the three dependent variables and to select variables to use as predictors in the multivariate analyses. All variables that had a moderately significant relationship ($P < 0.10$) with at least one of the three dependent variables were included in the regression models for multivariate analyses. Table 4 presents the results of the bivariate analyses.

Results revealed that physical violence was significantly negatively associated with adequate antenatal care and institutional delivery, and positively related to infant low birth weight ($P < 0.001$). Psychological violence was significantly negatively related to adequate antenatal care and institutional delivery ($P < 0.001$), but this type of violence was not significantly related to infant low birth weight ($P = 0.25$). Sexual violence was significantly negatively related to adequate antenatal care and institutional delivery ($P < 0.001$), and was significantly positively related to infant low birth weight ($P = 0.06$). With respect to the variable of maternal education, 1 to 5 years of education was significantly positively associated with adequate antenatal care ($P < 0.001$) and institutional delivery ($P < 0.001$), but not with infant low birth weight ($P = 0.37$). Additionally, 6 to 9 years of education was significantly positively related to adequate antenatal care and institutional delivery ($P < 0.001$) and was not related to infant low birth weight ($P = 0.63$). The last category of education, 10 or more years of education, was found to be significantly positively related to adequate antenatal care and institutional delivery ($P < 0.001$) and was significantly negatively related to infant low birth weight ($P < 0.001$). For the variable of maternal autonomy, there were no

Table 4: Bivariate Analyses for Analytic Sample (Weighted)

	Adequate antenatal care		Institutional delivery		Infant low birth weight	
Independent variables	Unadjusted OR	<i>P</i> value	Unadjusted OR	<i>P</i> value	Unadjusted OR	<i>P</i> value
Physical violence	0.32	<.001	0.47	<.001	1.44	<.001
Psychological violence	0.34	<.001	0.45	<.001	1.14	0.243
Sexual violence	0.37	<.001	0.37	<.001	1.27	0.057
Maternal education						
Uneducated	Ref					
1-5 years	2.01	<.001	2.21	<.001	0.91	0.373
6-9 years	3.91	<.001	4.61	<.001	0.96	0.627
10 years or more	8.17	<.001	14.27	<.001	0.61	<.001
Maternal Autonomy						
Low	Ref					
Medium	1.16	0.140	1.14	0.084	0.99	0.869
High	1.64	<.001	1.90	<.001	0.72	0.001

significant relationships between medium level of maternal autonomy and adequate antenatal care ($P = 0.14$) and infant low birth weight ($P = 0.87$). Medium autonomy was significantly positively related to institutional delivery ($P = 0.08$). High autonomy was significantly positively related to adequate antenatal care and institutional delivery ($P < 0.0001$). Moreover, high autonomy was significantly negatively related to infant low birth weight ($P = 0.001$). In summary, all of the independent variables were significantly related to at least one maternal health care utilization variable or birth outcome variable. Collinearity statistics were also performed to assess the relationship between each independent and dependent variable. Tolerance values of less than 0.10 indicate a high correlation with other variables, suggesting multicollinearity. VIF (Variance inflation factor) is the inverse of Tolerance, with VIF values above 10 indicating multicollinearity. Table 5 presents tolerance values and VIF. All independent variables had acceptable tolerance values and were thus retained in the final regression models.

Multivariate Analyses

The main objective of the current study was to examine predictors of maternal health care utilization and infant birth outcome for Indian women who had given birth in the twelve months preceding their participation in the NFHS-3 survey. Logistic regression was used to conduct the multivariate analyses. Three logistic regression models examined the associations between all of the independent variables and a binary dependent variable. Adjusted odds ratios and 95% confidence intervals have also been provided for all of the independent variables in the model. All of the associations with P values less than 0.05 were considered significant.

Table 5: Collinearity Statistics for Independent Variables

	Adequate Antenatal Care		Institutional Delivery		Infant Low Birth Weight	
Variable	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
Physical Violence	0.735	1.36	0.735	1.36	0.736	1.36
Psychological violence	0.764	1.31	0.764	1.31	0.764	1.31
Sexual violence	0.862	1.16	0.862	1.16	0.864	1.16
Maternal education	0.618	1.62	0.618	1.62	0.618	1.62
Maternal Autonomy	0.898	1.11	0.898	1.01	0.908	1.10

Multivariate Analyses for Adequate Antenatal Care

Table 6 presents results of the multivariate analyses for adequate antenatal care. Of the three types of domestic violence, physical violence and psychological violence were found to be significant predictors of adequate antenatal care. Women who experienced physical violence in the last year were less likely to have received adequate antenatal care as compared to women who did not experience such violence (OR 0.62; 95% CI 0.46 - 0.83). Women who were exposed to psychological violence in the last year were less likely to have received adequate antenatal care as compared to women who did not experience psychological violence (OR 0.67; 95% CI 0.45 - 1.00). Sexual violence was not a significant predictor of a woman's obtaining adequate antenatal care.

Maternal education was also found to be a significant predictor of adequate antenatal care. Specifically, women with 1-5 years of education were more likely (OR 1.69; 95% CI 1.22 – 2.33), women with 6-9 years of education were more likely (OR 2.47; 95% CI 1.88 – 3.24), and women with 10 or more years of education were also more likely to obtain adequate antenatal care than uneducated women (OR 3.15; 95% CI 2.37 – 4.19). Maternal autonomy was not found to be a significant predictor of adequate antenatal care.

Table 6: Multivariate Analyses for Adequate Antenatal Care (Weighted)

Independent Variable	Adjusted Odds Ratio	95% CI	P value
Physical violence	0.62	0.46 - 0.83	0.001
Psychological violence	0.67	0.45 - 1.00	0.048
Sexual violence	0.78	0.52 - 1.19	0.252
Maternal education			
Uneducated	Ref		
1-5 years	1.69	1.22 - 2.33	0.002
6-9 years	2.47	1.88 - 3.24	<.001
10 years or more	3.15	2.37 - 4.19	<.001
Maternal Autonomy			
Low	Ref		
Medium	0.94	0.76 - 1.16	0.541
High	1.02	0.84 - 1.24	0.843
Age			
15-19	Ref		
20-24	0.91	0.69 - 1.19	0.480
25-29	1.25	0.94 - 1.66	0.134
30-34	1.24	0.87 - 1.76	0.242
35 or above	0.74	0.39 - 1.40	0.354
Religion - Hindu	1.18	0.96 - 1.45	0.107
Location – Rural	0.75	0.62 - 0.89	0.002
SES			
Lowest	Ref		
Second	0.82	0.54 - 1.23	0.328
Third	1.60	1.11 - 2.29	0.011
Fourth	2.55	1.79 - 3.63	<.001
Highest	3.33	2.26 - 4.90	<.001

Multivariate Analyses for Institutional Delivery

Table 7 presents the results of the multivariate analyses for institutional delivery. Of the three types of domestic violence, psychological and sexual violence were found to be significant predictors of institutional birth. Women who had experienced psychological violence were less likely (OR 0.74; 95% CI 0.58 – 0.96), and women who reported sexual violence were also less likely (OR 0.58; 95% CI 0.45 – 0.75) to have an institutional delivery compared to women who did not experience psychological and sexual violence respectively. Physical violence failed to be a significant predictor of institutional delivery.

Findings further revealed that maternal education was a significant predictor of institutional delivery. Women who had 1 to 5 years of education were more likely (OR 1.78; 95% CI 1.45 - 2.15), women with 6 to 9 years of education were more likely (OR 2.80; 95% CI 2.34 - 3.34), and women with 10 or more years of education were also more likely (OR 5.15; 95% CI 4.12 - 6.43) to have an institutional delivery compared to uneducated women. With respect to maternal autonomy, women who had high autonomy were more likely to have an institutional delivery compared to women with low autonomy (OR 1.31; 95% CI 1.11 - 1.54).

Table 7: Multivariate Analyses for Use of Institutional Delivery (Weighted)

Independent Variable	Adjusted Odds Ratio	95% CI	P value
Physical violence	0.97	0.80 - 1.17	0.725
Psychological violence	0.74	0.58 - 0.96	0.021
Sexual violence	0.58	0.45 - 0.75	<.001
Maternal education			
Uneducated	Ref		
1-5 years	1.78	1.45 - 2.15	<.001
6-9 years	2.80	2.34 - 3.34	<.001
10 years or more	5.15	4.12 - 6.43	<.001
Maternal Autonomy			
Low	Ref		
Medium	0.95	0.80 - 1.13	0.537
High	1.31	1.11 - 1.54	0.001
Age			
15-19	Ref		
20-24	0.76	0.62 - 0.92	0.006
25-29	0.76	0.61 - 0.94	0.012
30-34	0.64	0.48 - 0.85	0.002
35 or above	0.76	0.48 - 1.20	0.235
Religion – Hindu	1.08	0.91 - 1.28	0.406
Location – Rural	0.42	0.35 - 0.50	<.001
SES			
Lowest	Ref		
Second	1.68	1.34 - 2.09	<.001
Third	2.58	2.07 - 3.23	<.001
Fourth	3.08	2.44 - 3.89	<.001
Highest	6.24	4.58 - 8.48	<.001

Multivariate Analyses for Infant Low Birth Weight

The final logistic regression model presented in Table 8, tested associations between independent variables and infant low birth weight. Results revealed that women who experienced physical violence were more likely to give birth to a low birth weight infant compared to women who did not experience this form of violence (OR 1.38; 95% CI 1.13 - 1.68). In contrast, psychological and sexual violence were not found to be significant predictors of infant low birth weight.

Only one level of maternal education was found to be a significant predictor of infant low birth weight in the analytic sample. Specifically, women who had 10 or more years of education were less likely to have a low birth weight infant compared to uneducated women (OR 0.73; 95% CI 0.57 - 0.94).

With respect to maternal autonomy, the multivariate analyses revealed that women who had high autonomy were less likely to give birth to a low birth weight infant compared to women having low autonomy (OR 0.82; 95% CI 0.69 - 0.97).

Table 8: Multivariate Analyses for Infant Low Birth Weight (Weighted)

Independent Variable	Adjusted Odds Ratio	95% CI	P value
Physical violence	1.38	1.13 - 1.68	0.001
Psychological violence	0.86	0.67 - 1.12	0.269
Sexual violence	1.05	0.81 - 1.37	0.703
Maternal education			
Uneducated	Ref		
1-5 years	0.90	0.72 - 1.12	0.337
6-9 years	1.02	0.84 - 1.25	0.809
10 years or more	0.73	0.57 - 0.94	0.012
Autonomy			
Low	Ref		
Medium	1.05	0.88 - 1.26	0.591
High	0.82	0.69 - 0.97	0.022
Age			
15-19	Ref		
20-24	0.87	0.71 - 1.06	0.171
25-29	0.78	0.62 - 0.98	0.036
30-34	0.70	0.52 - 0.95	0.023
35 or above	0.55	0.33 - 0.91	0.021
Religion – Hindu	1.04	0.87 - 1.24	0.703
Location – Rural	0.79	0.66 - 0.95	0.012
SES			
Lowest	Ref		
Second	1.18	0.94 - 1.47	0.155
Third	1.01	0.80 - 1.28	0.922
Fourth	0.71	0.55 - 0.92	0.010
Highest	0.88	0.64 - 1.20	0.403

Summary of Hypotheses and Results

Table 9 presents a summary of all hypotheses and the results of the multivariate analyses, organized by the independent variables and three dependent variables of adequate antenatal care, institutional delivery, and infant low birth weight.

Table 9: Summary of Hypotheses and Findings

Independent Variables	Dependent Variables		
	Adequate Antenatal Care (ANC)	Institutional Delivery	Infant Low Birth Weight (LBW)
Physical Violence	1A. Negative association Supported	2A. Negative association Not Supported	3A. Positive association Supported
Psychological Violence	1B. Negative association Supported	2B. Negative association between Supported	3B. Positive association Not Supported
Sexual Violence	1C. Negative association Not Supported	2C. Negative association Supported	3C. Positive association Not Supported
Maternal Education	1D. Positive association Supported for all three levels of education versus uneducated	2D. Positive association Supported for all three levels of education versus uneducated	3D. Negative association Supported for 10 or more years of education versus uneducated
Maternal Autonomy	1E. Positive association Not Supported	2E. Positive association Supported for high versus low autonomy	3E. Negative association Supported for high versus low autonomy

Chapter 6: Discussion

Increasing the use of maternal health care services in India is pivotal to attaining MDGs 4 and 5.^{4,132} Previous research has found that services such as antenatal care and institutional delivery are often associated with improvements in maternal and child health outcomes, including infant birth weight.^{1,2} The current study addressed this issue by examining factors that predicted Indian women's use of maternity services, as well as their incidence of having a low birth weight infant. The study adopted an ecological framework to investigate how domestic violence, maternal education, and maternal autonomy were related to women's use of antenatal services, institutional delivery, and delivery of a low birth weight child. Use of the NFHS-3 dataset with its new domestic violence module made it possible for the first time to examine how three different types of domestic violence were related to study outcomes. Specifically, this study examined the role of physical, psychological, and sexual violence in predicting use of maternal health services and infant low birth weight in a nationally representative sample of Indian women who gave birth within the previous year. The study also added to existing literature by assessing the role of maternal education and maternal autonomy in predicting antenatal care, institutional delivery, and infant low birth weight in this large national sample of Indian women. Findings are of particular significance given the Indian government's recent national scheme, Janani Suraksha Yojana, to reduce maternal and neonatal deaths by promoting the institutional delivery of infants.⁶⁴

Characteristics of the Study Sample

It is important to consider demographic and other characteristics of the study

sample, including women's exposure to domestic violence during the year in which their last child was born. Three types of domestic violence, all relationship level variables, were examined. Findings revealed that 19% of the sample reported experiencing at least one incident of physical violence in the twelve months preceding the survey administration, a period likely overlapping with the women's pregnancies (since all had given birth within the year before taking the survey). Approximately 10% of the sample reported experiencing psychological violence and 8% reported experiencing sexual violence during the same time period. According to NFHS-3 data, 35% of all ever-married women reported experiencing any incident of physical violence, 15% of women experienced any form of psychological violence, and 10% of women reported experiencing sexual violence during their lifetimes.⁹ Although rates of all types of domestic violence during the year of women's pregnancies are lower than lifetime rates, it is clear that pregnancy does not protect substantial numbers of Indian women from physical, psychological, and sexual violence.

Current findings are generally consistent with previous research investigating domestic violence in India during a woman's pregnancy. One study conducted in Uttar Pradesh, India's most populous state, found an 18% rate of physical violence among the study sample. Although the researchers did not directly ask about violence during pregnancy, they did match timing of the violence to the latest pregnancy.¹⁷ Another study conducted in seven different Indian states reported that approximately 50% of women experienced one or more types of domestic violence at least once in their married life. Additionally, 13% of women reported experiencing severe physical violence during pregnancy, such as hitting, kicking, or beating.¹⁶ The latter items are similar to those on

the current study's physical violence measure, which found that one in five Indian women likely experienced physical violence during the period of her pregnancy. However, the current study includes seven (versus three) different types of physical violence in the year prior to the woman's last birth, which may explain why there was a higher percentage of women reporting physical violence than in the previous research. In still another study conducted in antenatal clinics in one Indian city, 22% of women reported physically being abused during their pregnancy.⁸⁶ Researchers used the Abuse Assessment Screen in the latter study, which asks women about violence experiences at the hands of husbands and other family members, such as the mother-in-law, father-in-law, and brother-in-law. The current study was limited to domestic violence committed by the woman's husband, but the overall rate of physical violence (19%) was very similar that in the previous study (22%) which included other family members as potential perpetrators.

Notably, all except one of the previous studies that interviewed women about domestic violence during pregnancy limited their focus to physical violence. The current study revealed that Indian women also experienced other types of violence during the year of their pregnancy and birth. Specifically, about 10% of women experienced psychological violence and 8% experienced sexual violence. Another study which focused only on the slums of Mumbai found that 12% of women reported physical violence, 8% reported psychological violence, and 2% reported sexual violence during the year of their last pregnancy.⁹³ The latter rates of violence exposure are lower than in some previous studies,^{16,86} a finding the researchers attributed to the lack of privacy in the settings where data were collected.

It is interesting to note that women in India have been more likely to report physical than psychological violence, which is contrary to trends in the United States. In one national study in the United States, 33% of the women reported physical violence by an intimate partner, 9% reported rape, 17% reported other sexual violence such as coercion and unwanted sexual contact, and 48% reported any psychological aggression by an intimate partner during their lifetimes.¹³³ One likely reason for this difference in findings is India's greater social and cultural acceptance of psychological violence as a normal phenomenon in marital relationships as compared to its lesser acceptance in more developed countries.⁴⁶ Thus, Indian women may not consider or report threats and insults as a form of psychological violence.

Sexual violence was the least frequent form of lifetime domestic violence reported by Indian women in this national study. One in twelve women reported being physically forced by their husbands to engage in unwanted sexual intercourse or other sexual acts during the year of their pregnancies. The United States National Intimate Partner and Sexual Violence Survey does not collect data on intimate partner violence during pregnancy and population-based studies of intimate partner violence during pregnancy have largely focused on physical versus sexual violence.¹³³ However, a very recent study conducted in University-affiliated clinics in the United States found that 12% of women experienced at least one instance of sexual violence during the first eighteen weeks of pregnancy.¹³⁴

Although most of the previous research interviewed Indian women, studies of Indian men confirm high levels of domestic violence within their marriages. One recent study by the United Nations Population Fund (UNFPA) and the Washington-based

International Center for Research on Women (ICRW) polled over 9,000 Indian men across seven Indian states (Uttar Pradesh, Rajasthan, Punjab, Haryana, Odisha, Madhya Pradesh and Maharashtra) about their engagement in partner violence.¹³⁵ While this study did not focus on the year of their wives' pregnancy, findings revealed that six out of ten men admitted to having perpetrated violence against their wives or partners. Psychological violence was the most commonly reported (41%), followed by physical violence (33%), and sexual violence (31%), respectively.

The high rate of violence perpetrated by Indian men in the latter study was attributed, in part, to gendered roles and the expectation that men should exert control over their female partners. Interestingly, only 52% of Indian women interviewed for this study admitted to experiencing some form of violence, with 38% reporting that they were victims of physical violence. The researchers speculated that the lower rate of victimization reported by women (compared to men) was due to women's shame or fear of social stigma, as well as beliefs that violent acts were normal in a marital relationship.¹³⁵ NFHS-3 sample data revealed that 56% of Indian women felt a husband was justified in hitting or beating his wife if she argued with him, did not cook properly, showed disrespect for in-laws, neglected the house, or left the house without informing him.⁹

Another factor thought to influence maternal and child outcomes in this study was the individual level variable of maternal education. In the current study sample it was found that 33% respondents were uneducated, 14% had 1 to 5 years of education, 25% had 6 to 9 years of education, and 27% had 10 or more years of education. NFHS-3 reported similar results; 39% of the NFHS-3 sample was uneducated, 15% of women had

1 to 5 years of education, 22% had 6 to 9 years of education, and 24% of the sample had 10 or more years of education. The current sample includes younger women than the larger NFHS-3 sample, which likely explains the slightly higher level of education.

The current study also explored the role of the relationship variable, maternal autonomy, in predicting women's use of maternity health services and infant low birth weight. The study employed a comprehensive measure of maternal autonomy that was based on nine questions focusing on three domains of autonomy: decision-making autonomy, financial autonomy, and freedom of movement. Women were asked about their ability to perform these nine behaviors within their marriage. Findings revealed that 39% of women had low autonomy (had engaged in 0-2 autonomous behaviors), 25% women had medium autonomy (3-4 autonomous behaviors), and 36% had high autonomy (5-9 behaviors). Women in the sample engaged in an average of 3.2 behaviors on the study measure, which would place them in the medium group for autonomy. While women in many western cultures would be expected to have engaged in almost all of the study behaviors associated with autonomy (e.g., participate in decision making about household purchases, make independent visits to relatives, travel to a market or health care facility alone), the Indian findings reflect women's lower social status relative to men.³⁵ Historically, India has favored males over females, awarding males more education, more autonomy, greater inheritance/property rights, and more economic opportunity.⁵⁴

Use of Maternal Health Services

Of central interest in this study was Indian women's use of maternity health

services. Findings revealed that 18% of the women in the study sample received adequate antenatal care, defined as having an antenatal visit in the first trimester, at least three antenatal visits, and intake of 100 or more iron folic acid tablets. The current study adopted definitions of adequate antenatal care established by the Indian government's JSY program and the DLHS. Data collected by DLHS after 2005-06 revealed that 50% of pregnant Indian women had at least three visits during the course of their pregnancy, 45% had their first antenatal visit in the first trimester, and 47% consumed at least 100 IFA tablets.¹³⁰ The lower percentage of women reported to have received adequate antenatal care in the current study is due to the comprehensive definition of this variable. Less than a quarter of study women consumed the recommended number of folic acid tablets, and a portion of this group did not meet at least one of the other required conditions for adequate antenatal care (at least three visits and one in the first trimester). These data suggest that there is considerable room for improvement in providing the larger population of Indian women with adequate antenatal care.

With respect to institutional delivery, current findings revealed that 55% of Indian women in the current study reported their last birth as an institutional delivery. These women delivered their infants in either a public or private hospital or health facility. Institutional deliveries have been consistently increasing in India. When NFHS surveys investigated institutional deliveries for three years prior to the survey, the rates increased from 26% in NFHS-1 to 34% in NFHS-2 and 41% in NFHS-3.⁹ As noted, India now has a conditional cash transfer scheme, JSY, which incentivizes women to give birth in health facilities in an effort to decrease the number of maternal and neonatal deaths.⁶⁴ Although JSY was first introduced in mid-2005 during the period of the current study,

implementation of the scheme within Indian states remained highly variable as late as 2008, when less than 5% to 44% of women giving birth in institutional facilities received cash payments from JSY.⁹

The third outcome variable in the current study was infant low birth weight. Findings revealed that 20% of infants born to study mothers were low birth weight. As noted earlier, the current study used mothers' subjective assessment to categorize low birth weight given the very low percentage of Indian infants who are weighed within two days of their birth.¹²³ NFHS-3 recorded birth weight information in two ways: for institutional deliveries, information was taken from the health card and for home births, information was gathered from mother's perception of the size of her infant.⁹ It is interesting to note that the larger sample of mothers in NFHS-3 reported results comparable to those in the current study. Approximately, 22% of infants were born low birth weight according to the information collected on the health card, and 21% of infants were born low birth weight according to the mothers' perception of their child's birth size.

The rate of low infant birth weight in the current sample, 20%, reveals that India continues to have a high percentage of low birth weight infants. India has approximately 40% of the low birth weight babies in developing nations and more than half of those born in Asia.¹³⁶ A study based on NFHS-2 data found that of those infants weighed within two days of birth, 22.6% were below 2500 grams when born in India in 1999.¹²³ The current NFHS-3 data suggest only a small amount of improvement in infant low birth weight in India during the six-year period between the two surveys.

Predictors of Maternal Health Services Utilization and Infant Birth Outcome

The major goal of this study was to use the ecological model of health to examine how selected factors at the individual and relationship levels predicted Indian women's use of adequate antenatal care, institutional delivery, and infant low birth weight. Additional variables at the individual, relationship, and community levels were also controlled in the analytic model. Based on previous research, it was hypothesized that all three types of violence would be risk factors predicting negative maternal and infant outcomes, and that maternal education and maternal autonomy would serve in a protective role and be associated with positive outcomes for both mothers and infants. The following sections discuss the study's findings, and compare them to previous research.

Adequate Antenatal Care

There is broad agreement that antenatal care services are instrumental in improving maternal health, as well as the health and survival of infants.¹³⁷ Adequate antenatal care is especially important in developing countries where the maternal morbidity and mortality levels are high and the antenatal period provides opportunities to present pregnant women with information that is beneficial to their health.¹³⁷ It was hypothesized that three types of domestic violence, maternal education, and maternal autonomy would be significant predictors of Indian women's use of adequate antenatal care, with all three violence factors predicting negative outcomes and maternal education and maternal autonomy predicting positive outcomes.

The current findings revealed that physical and psychological violence, which

were relationship level variables in the ecological model, were significant predictors of adequate antenatal care. Indian women who reported physical violence and psychological violence during the year of their last birth were significantly less likely to obtain adequate antenatal care than those who had not experienced these two types of violence.

Specifically, women who reported physical violence were 38% less likely and women who reported psychological violence were 33% less likely to obtain adequate antenatal care when compared to women who did not experience these types of violence within their marriages. The relationship level variable of sexual violence was not found to be a significant predictor of Indian women's receipt of adequate antenatal care.

Current findings were consistent with two studies conducted in India, including one that focused on four Indian states.^{67,86} These studies also revealed that exposure to physical violence during pregnancy was associated with a lower likelihood of Indian women obtaining adequate antenatal care. Findings suggest that Indian husbands' use of physical violence is part of an abusive pattern of behavior that includes controlling women's health care choices and/or devaluing the importance of her health care during the period of her pregnancy. Women may also feel shame or fear of social stigma by seeking antenatal care when they are showing signs of physical abuse such as bruises and black eyes.^{22,67} The current study extends existing research in very limited geographic regions of India by demonstrating that physical violence is predictive of women's failure to obtain adequate antenatal care in a large representative sample of mothers throughout the nation.

With respect to psychological violence, women who experienced psychological violence were 33% less likely to obtain antenatal care as compared to those who did not

report psychological violence. At present, there is only one published study in India that examined the relationship between psychological violence and antenatal care. A small investigation conducted in the slums of metropolitan Mumbai collected information on psychological violence and discovered that instances of this type of violence were fairly uncommon, which the researchers attributed to likely underreporting.⁹³ Additionally, the researchers did not find any type of violence (physical, psychological, or sexual) to significantly predict women's receipt of adequate antenatal care.

The association between psychological violence exposure and antenatal care in the current study may be due to several factors. Psychological violence has been associated with low self-worth and depression,^{91,92} which likely reduce women's sense of agency and their motivation to engage in positive health behaviors. Thus, women who are psychologically abused by their husbands may be less likely to pursue maternal and child health care services that contribute to the delivery of a healthy infant. Additionally, a woman's fear of her husband, perpetrated by statements threatening to harm her or someone close to her, may reduce her willingness to seek health care. Such fear may also prevent her from confiding in her mother, family members, and friends about her health, isolating her from those who might advise her to seek antenatal care during her pregnancy.¹³⁸

The third type of domestic violence, sexual violence was not found to be a significant predictor of adequate antenatal care in the current study. Approximately 8% of Indian women in the study reported being forced to have unwanted sexual intercourse or engage in unwanted sexual acts with their husbands during the year of their last birth. Within the social structure of India, there is little awareness of the concept of unwanted

sex and coercion of sexual acts within the marital relationship.¹³⁹ Women believe that it is a part of their marital duty to engage in sexual relations with their husbands, and most appear likely to be unaware of their right to say no to unwanted sex. Thus, sexual violence may not affect Indian women's likelihood of seeking adequate antenatal care.

As hypothesized, maternal education, an individual level variable in the ecological model, played a protective role with respect to antenatal care. Women with 1 to 5 years of education were 1.7 times more likely, women with 6 to 9 years of education were 2.5 times more likely, and women with ten or more years of education were 3.2 times more likely to receive adequate antenatal care when compared to uneducated women. Findings supported a linear relationship between maternal education and antenatal care; as the number of years of maternal education increased, the odds of women obtaining adequate antenatal care improved. Previous studies in India and other developing countries have also found a strong association between maternal education and women's receipt of adequate antenatal care.^{29-31,35,49,66,100,102} Educated women are more likely than their uneducated peers to understand the potential benefits of early and adequate antenatal care, and to have the confidence to take action to improve their own and their infant's health. Although the role of maternal education as a strong predictor of antenatal care has previously been established, the current study is the first to demonstrate this relationship with the nationally representative sample of married Indian women in the NFHS-3 survey.

Contrary to expectations, the relationship variable of maternal autonomy in the ecological model was not found to be a significant predictor of Indian women's receipt of adequate antenatal care. Previous studies examining the relationship between maternal

autonomy and utilization of antenatal care have found mixed results.^{35,66,102} One study in a small Indian city found that only one of the indices of maternal autonomy, freedom of movement, predicted women's use of adequate antenatal care.³⁵ Another study in Indian rural villages found that two of the indices, health decision-making autonomy and freedom of movement, predicted more adequate antenatal care.⁶⁶ In a third study, maternal autonomy was found to be a significant predictor of antenatal care in two of the four Indian states under investigation.¹⁰² A final study, also conducted with NFHS-3 data, found that decision-making about large and daily household purchases, but not other measures of autonomy, predicted women's receipt of adequate antenatal care.¹¹⁶

Notably, there were differences in the methodologies in each of the four previous studies and the current study. The current study employed a comprehensive measure of maternal autonomy with a nationally representative sample of Indian women in an effort to examine autonomy as a multi-dimensional construct.¹⁴⁰ It has been argued, for example, that while women may be able to participate in health decision-making, this will have little impact if they have no financial resources or freedom of movement. Additionally, a measure such as freedom of movement may play a more salient role in predicting use of antenatal care in a rural village than in an urban area. The current study contributes to the current literature as one of the first to examine whether or not a comprehensive measure of maternal autonomy predicts Indian women's receipt of adequate antenatal care. Given the lack of significant findings when controlling for important demographic factors, future investigations should examine how various dimensions of autonomy (e.g., financial resources, freedom of movement) are related to women's obtaining adequate antenatal care in areas of the nation that differ with respect

to region (rural versus urban; northern versus southern), gender attitudes, family customs, economic opportunity, and legal rights (inheritance/property).¹⁴¹

Institutional Delivery

Institutional delivery care for pregnant women is considered to be India's most important strategy for reducing maternal mortality.³ As a result, institutional delivery rates have been a key indicator of the progress of MDG 5.⁶⁸ In this study, both individual and relationship level variables were found to be significant predictors of institutional delivery among Indian women who had a birth in the twelve months preceding administration of the NFHS-3 survey.

It was hypothesized that all three violence variables at the relationship level of the ecological model would be negatively associated with institutional delivery. Findings revealed that psychological violence and sexual violence were significant predictors of institutional delivery, but physical violence failed to predict this outcome. Women who experienced psychological violence in their marriages were 26% less likely to obtain an institutional birth compared to women who did not report this type of violence. Additionally, women who experienced marital sexual violence were 43% less likely to give birth in a hospital or health facility than women who did not report sexual violence.

Although only 10% of Indian women in the current study reported that their husbands had psychologically abused them during the year of their pregnancy, psychological violence emerged as a significant predictor of women's lower likelihood of delivering in a health facility. Another study conducted with abused women in south India found that 90% of husbands had verbally abused or physically humiliated them and 82% had been threatened with not being able to interact with their children or parents.¹⁴⁴

Although this research was limited to abused women, it is notable that large numbers of women reported that psychological violence hurt them even more than physical violence. As noted earlier, psychological abuse has been associated with maternal depression, low self-esteem, and a reduced sense of personal agency,^{91,92} likely reducing pregnant women's belief that she is deserving of a hospital birth and reducing her motivation to seek an institutional delivery.

Still another Indian study found that psychological violence during pregnancy included taunts and pressure related to giving birth to more valued male children, especially if the child from the previous pregnancy was a female.¹⁴² Although the government of India has banned sex determination during pregnancy, some families have found ways to circumvent legalities to find out the sex of their unborn child.¹⁴³ A study in northern India where son-preference is more prevalent found that women were 16% more likely to deliver in a hospital or health facility if pregnant with a son.¹⁴⁴ Thus, one could speculate that husbands who determined that their wives were pregnant with a daughter were more likely to engage in psychological abuse and less likely to provide financial and moral support for an institutional delivery. Although the current study failed to assess husbands' attitudes about son-preference or sex-selective health investments, the relationship between these factors, psychological violence, and institutional delivery are worthy of future investigation.

As noted, the current study also revealed that a woman's experience of sexual violence during the year of her pregnancy predicted a lower likelihood of having an institutional delivery. Currently, there is dearth of studies that have examined the relationship between marital sexual violence and institutional delivery in India. However,

it appears possible that husbands who use their power to force sexual relations on their pregnant wives also exert control over their wives' reproductive choices and behaviors, including the decision about whether their wife should deliver in a hospital or health facility. A study conducted with married women in Uttar Pradesh found that women who experienced any of the three types of domestic violence were more likely than their non-abused peers to report symptoms of Sexually Transmitted Infections (STIs) and less likely to seek care for them.¹⁴⁵ As in the case of psychological violence, women who are victims of sexual violence in their marriages may experience shame, humiliation, diminished self-confidence, and low self-esteem. It can be argued that experiences such as sexual violence likely reduce Indian women's motivation and initiative to seek appropriate health care, which in this case, would involve negotiating with her husband to obtain an institutional delivery.

Contrary to expectations, women's experience of physical violence was not predictive of their lower likelihood of delivering in a hospital or health facility. The failure to find a relationship between marital physical violence and institutional birth was also found in a previous study conducted in Uttar Pradesh, the most populous state in India.¹⁷ However, the latter study queried husbands, rather than wives, about domestic violence during pregnancy. Another study conducted in the Mumbai slums with women who had given birth six weeks before their interviews also failed to find a relationship between domestic violence and institutional delivery.⁹³ Notably, the latter study used a global measure of domestic violence, rather than separating physical, psychological, and sexual violence as in the current investigation.

This study's failure to find the predicted relationship between physical violence

and institutional delivery was unexpected; especially in view of the finding that greater physical violence was predictive of women's likelihood of obtaining adequate antenatal care. Several factors may have contributed to this outcome. As noted earlier, Indian husbands' willingness to report a high level of physical violence in their marriages and their wives' beliefs that violent acts were normal in a marital relationship⁹³ may have reduced the salience of physical violence as a predictor of delivery in a health facility. Existing sociocultural beliefs about husband's rights to control their wives' behavior, combined with a majority of Indian women believing that hitting or beating was justified for arguing, disrespecting in-laws, or poor cooking, suggests that many women would accept the use of physical punishment in their marriages. Other, less common types of marital violence, including psychological and sexual violence, may play a more important role in predicting Indian women's institutional deliveries. It can also be argued that obtaining adequate antenatal care involves a much longer time period than the event of delivering in a hospital or health facility. If women fail to obtain one antenatal visit in the first trimester, or miss a later visit due to shame or fear of the implications of physical signs of abuse, then they will not meet the criteria for adequate antenatal care. Thus, exposure to physical violence may be more salient in predicting this outcome. Decisions about whether wives should deliver in a hospital or health facility may be made near the end of pregnancy when other factors, such as the family's financial resources and the sex of the unborn child, may play a more important role than the marital physical violence in predicting whether or not a woman has an institutional delivery.

The individual level variable of maternal education in the ecological model was hypothesized to play a protective role with respect to institutional delivery. Current

findings revealed that maternal education was a positive predictor of having a delivery in a hospital or health facility. In comparison to uneducated women, Indian women with 1 to 5 years of education were 1.8 times more likely, those with 6 to 9 years of education were 2.8 times more likely, and those with 10 or more years of education were 5.2 times more likely to obtain an institutional delivery. As with the outcome variable of adequate antenatal care, maternal education was found to have a linear relationship with institutional delivery. As women's level of education rose, so did the proportion of those who delivered in a hospital or health facility. These findings were consistent with those of other Indian studies that identified a positive relationship between maternal education and institutional delivery.^{30,66,101} Higher levels of maternal education have been associated with women's greater knowledge of the benefits of institutional delivery, including access to emergency obstetrical care if needed. Moreover, more educated women have been found to seek "modern" delivery methods rather than relying on traditional home-based deliveries.²⁹

As predicted, maternal autonomy, a relationship level variable in the ecological model, was also found to be a significant predictor of institutional delivery. Women who had high autonomy were 1.3 times more likely to give birth in a hospital or health facility compared to women with low autonomy. Previous research that examined the relationship between maternal autonomy and institutional delivery in India found mixed results. One study conducted with rural Indian women found two elements of maternal autonomy, financial autonomy and freedom of mobility, to be significantly associated with institutional delivery.⁶⁶ Another study conducted in rural and urban areas of the southern Indian state of Karnataka found maternal autonomy to be a significant predictor

of deliveries in private institutions, but not all institutional deliveries (private and public).¹⁰³ Still another study, also conducted using NFHS-3 data, found significant associations between different components of the maternal autonomy construct and institutional delivery.¹¹⁶ The current study differed from the previous NFHS-3 study in using a comprehensive measure of autonomy, rather than focusing on individual components. Women with highest level of autonomy were significantly more likely than those with low levels of autonomy to deliver in a hospital or health facility. Women with high autonomy were more likely than those with low autonomy to have some power in making health-related decisions, financial resources to help pay for the delivery, and freedom of movement to navigate the health care system. Current findings also suggest that women's autonomy may play a more important role in institutional delivery decisions than in their receipt of antenatal care, since maternal autonomy was not a significant predictor of adequate antenatal care. Again, a couple's decisions to have the pregnant wife deliver in a hospital or health facility may have far more implications for the family than her receipt of antenatal care, since institutional deliveries often require substantial out-of-pocket expenses to cover transportation to hospitals/health facilities, the cost of the delivery itself,¹⁴⁶ and indirect costs such as losing the woman from household duties and other labor.¹⁴⁷

Infant Low Birth Weight

Research has found that low infant birth weight is a major risk factor and indirect cause of newborn death.¹⁴⁸ Low birth weight (less than 2500 grams) has been associated with both neonatal mortality and morbidity, impeded child growth and cognitive development, and chronic diseases later in life.⁷⁷ India's efforts to reduce low birth

weight are critical to achieving MDG 5. Thus, the current study examined domestic violence, maternal education, and maternal autonomy as potential predictors of low infant birth weight.

As hypothesized, the relationship variable of physical violence in the ecological model was found to be a significant predictor of infant low birth weight. Indian women who experienced physical violence were 1.4 times more likely to give birth to a low birth weight infant compared to women who did not experience this form of violence. Contrary to expectations, neither psychological violence nor sexual violence significantly predicted low birth weight.

There is a paucity of previous studies examining the relationship between domestic violence and infant low birth weight in India. The majority of existing research has focused on relationships between wife-beating and fetal and infant mortality,¹⁴ physical violence and perinatal and early childhood mortality,¹⁷ domestic violence and stillbirth and miscarriage,¹⁴² and lifetime experience of domestic violence and terminated pregnancies.¹⁴⁹ The one published Indian study that examined how domestic violence was related to infant birth weight was a case-control study conducted in a hospital in Delhi.⁹⁹ Although the findings revealed a strong and significant association between maternal exposure to domestic violence and infant low birth weight (OR 16.29; 95% CI 7.25 - 37.04), the researchers did not describe the type of severity of violence experienced by the mothers. Additionally, the study failed to account for demographic covariates so the researchers concluded that results were “statistically inconclusive.”

The current study appears to be the first to examine how three types of domestic violence experienced by Indian women during the year of their last pregnancy were

related to infant birth low weight. Interestingly, only physical violence was related to infant low birth weight. It can be speculated that low birth weight (which may also be linked to premature birth) was the result of blunt physical trauma to the mother since the physical violence indicators included kicking, beating, punching with fists, and dragging. Elevated stress levels associated with physical assaults could likewise be a contributor to infant low birth weight.^{54,150} It is also possible that mothers responded to physical violence with negative coping behaviors, such as eating poorly, failing to obtain antenatal care, smoking, and drinking alcohol. One previous Indian study found that women who experienced physical violence during their pregnancy were likely to begin antenatal care after 32 weeks of gestation.⁸⁶ However, these health behaviors (with the exception of antenatal care) were not measured or investigated in the current study.

Contrary to other hypotheses, neither psychological nor sexual violence predicted infant low birth weight in this study. Again, no prior studies have been conducted in India to examine the relationship between these types of domestic violence and infant low birth weight. A review of literature conducted outside of India between 2002 and 2008 found that psychological violence exposure during pregnancy was associated with greater maternal depression,¹⁵¹ but the research did not explore how depression was related to infant outcomes. Sexual violence may not have been related to infant low birth weight because some of the behaviors (e.g., oral sex) did not involve severe physical trauma.

As hypothesized, maternal education, an individual level factor in the ecological model, had a protective role in predicting infant low birth weight. However, the relationship was only significant in the comparison of mothers with the highest and lowest levels of education. Specifically, women who had 10 or more years of education

were 27% less likely to have a low birth weight infant compared to uneducated women. Previous Indian studies examining the relationship between maternal education and low birth weight have supported this finding. For example, a prospective cohort study conducted in rural villages found that higher levels of maternal education (8 to 10 years) significantly decreased the risk of infant low birth weight.¹⁰⁸ Another study using NFHS-3 data with slightly different educational groupings also found that women with higher levels of education (12 years or more) were 32% less likely to deliver a low birth weight infant.¹¹⁰

It can be speculated that maternal education had an indirect impact on infant low birth weight in the current study, influencing women's health behaviors. Highly educated Indian women were more likely to understand messages about the importance of nutrition in pregnancy, to eat a nutritious diet, and to obtain adequate antenatal care.²⁹ Indian messages about antenatal care do not address issues such as refraining from smoking and drinking, which highly educated women would likely encounter in their reading. Current findings indicated that a threshold of higher education had to be reached before a relationship between maternal education and infant low birth weight was detected. It is also possible that Indian women with less education do not have the financial resources to purchase and eat as many nutritious foods as more educated and wealthier women.

Finally, the relationship level variable of maternal autonomy in the ecological model significantly predicted infant low birth weight. Findings revealed that women who had high autonomy were approximately 18% less likely to deliver a low birth weight infant compared to women with low autonomy. To date, research conducted on maternal autonomy in India has focused on infant outcomes such as child stunting,¹¹⁹ infant

growth,¹²⁰ and infant mortality.¹²¹ The only study that examined the relationship between maternal autonomy and infant low birth weight also used the NFHS-3 dataset.¹¹⁰ The latter study differed from the current one in using a comprehensive measure of autonomy that included only four behaviors focused on decision-making; moreover, it placed a higher value on woman's independent decisions than those made jointly with her husband. Despite these differences in measurement, both studies revealed that women with high autonomy were less likely to deliver a low birth weight infant than those with low autonomy.

Taken together, these findings with a representative sample of Indian women suggest that pregnant women with high autonomy were able to engage in more health-seeking behaviors, such as eating nutritious foods, supplementing their diets with folic acid, and attending antenatal visits. Their higher autonomy, reflected in items such as having an independent bank account, putting money aside for personal use, and making decisions about routine household purchases, presumably gave them the ability to purchase nutritious food items that reduced the likelihood of low infant birth weight.¹⁵² Women with high autonomy likely made decisions to purchase and consume nutritious foods, reducing the likelihood that they would deliver a low birth weight baby.¹¹⁸ It can also be speculated that Indian women with high autonomy were more likely to secure equitable distribution of food within their families. As noted earlier, gender biases in India often result in men receiving more and better food than women.⁵⁴ Having the ability to visit their families may have also increased pregnant women's access to nutritious food in their household of birth. Thus, it was not surprising that higher maternal autonomy was predictive of having a child of normal birth weight.

In summary, all five variables in the ecological model adopted for this study predicted at least one outcome of Indian women's use of maternal health services or their likelihood of having a low birth weight baby. The study illustrated the influence of individual and relationship level factors on maternal and infant health, suggesting the potential benefits of intervention at multiple levels.

Limitations

This study explored how selected individual and relationship factors within a broader ecological context predicted utilization of maternal health services and infant birth outcomes in India. Although the study expands existing literature, it has several limitations. First, there is the possibility of recall bias. Women may not correctly recall how many IFA tablets they took during their last pregnancy or how many times they visited an antenatal care provider. Similarly, they may not have accurately remembered their experiences of domestic violence. Second, the potential for participant reactivity to the study setting presents another methodological limitation. Although the interviews were conducted privately and women were told that their answers would be confidential, participants may have given socially desirable responses to the interviewer. In particular, they may have failed to report their experiences with the various types of domestic violence during the previous year. A third limitation concerns the measure used to assess domestic violence exposure. It is not possible to be certain that the violence occurred during the woman's pregnancy since the measure assessed violence exposure during the past year. There was very likely an overlap between the woman's experience of domestic violence and her pregnancy but the study did not question women about when each type

of violence began and/or ended. Lastly, the study was cross-sectional in nature and thus it is not possible to draw any causal relationships from observed relationships. Longitudinal studies are needed to explore causal associations.

Implications

Despite these limitations, the current study has important implications for policy makers, public health practitioners, and educators interested in improving the use of maternal health care services and infant birth outcomes in India. In particular, findings contribute to the limited literature on domestic violence and autonomy in the nation, as well as their relationship to women's antenatal care, institutional deliveries, and infant low birth weight.

The current study confirmed that each type of domestic violence was related to at least one negative outcome. Physical violence predicted a lower likelihood of antenatal care and a higher likelihood of low infant birth weight, psychological violence predicted a lower likelihood of both adequate antenatal care and institutional delivery, and sexual violence predicted a lower likelihood of institutional delivery. Given India's high rate of infant low birth weight, and its association with neonatal mortality and morbidity, child health and developmental problems, and chronic diseases in adulthood,⁷⁷ efforts should be made to ensure that policymakers are aware of the potential negative impacts of domestic violence on infant outcomes. The relatively high rates of domestic violence within the population have both health and financial consequences for the nation. Local, state, and central governments should collaborate with Non-Governmental Organizations (NGOs) to design campaigns and other interventions to reduce the incidence of all three types of domestic violence.

India's central government has supported three antenatal check-ups for pregnant women as part of the RCH program.⁶² Additionally, the JSY program has made free institutional deliveries available to all pregnant women in India's low-performing states and to pregnant women below the poverty line in the nation's high-performing states.⁷³ However, this study suggests that domestic violence exposure may prevent some Indian women from using these services, negatively affecting their own and their infants' well-being. New policies that promote screening for all types of domestic violence early in women's pregnancies may inform health care providers of the need to monitor the pregnancies of violence-exposed women to ensure that they receive adequate maternity care.

Efforts should also be made to design and implement community-based interventions to identify and reduce women's exposure to domestic violence. Accredited Social Health Activists (ASHAs), who are charged with ensuring that women receive adequate antenatal care and institutional delivery, should be trained to identify the obvious physical injuries associated with physical violence and to probe for psychological and sexual violence. Women should be assured that their reporting of violent incidents will be kept confidential if they fear repercussions. Health service agencies should ensure that women feel safe, are treated with respect, and are not stigmatized for reporting. Existing women's Self Help Groups (SHGs) should provide women with support and information about treatment for abuse, particularly in rural areas.

Finally, culturally-sensitive educational campaigns and programs should tackle the issue of domestic violence and its negative impacts on Indian families.

Comprehensive interventions should target husbands, mothers-in-law, fathers-in-law and other family members, as well as women of childbearing age. For example, initiatives such as Men's Action for Stopping Violence Against Women (MASVAW) in Varanasi should be a model for other programs seeking to engage men in the fight against domestic violence.¹³⁵ Campaigns that make the connection between domestic violence and future financial losses to families as a result of poor maternal and infant/child health may be especially important in outreach to Indian men.

The current study also revealed that maternal education predicted all study outcomes. Mothers with at least one year of education or more were more likely than their uneducated peers to obtain adequate antenatal care and to deliver their infants in a hospital or health care facility. However, it was only the most educated group, women with 10 years or more of education, who were less likely than uneducated women to deliver a low birth weight infant. Overall, these findings support the important contribution of education to more optimal maternal and child health.

The Government of India has identified free primary education (up to 8 years) as a fundamental right of its citizens.¹⁵⁴ Investments in female education will likely increase women's awareness of the benefits of adequate antenatal care and institutional delivery. Both policy-makers and practitioners should work to ensure that all Indian girls, and particularly those who are poor and living in rural areas, have access to education. Promoting schooling beyond the primary grades may expose young women to curricula and external resources addressing healthy pregnancy and childbearing. More advanced education should also increase women's confidence in making health-related decisions. Findings suggest that investments in literacy will be an important component of

initiatives that improve women's use of maternity services in India.

Finally, findings revealed that higher maternal autonomy predicted greater likelihood of having an institutional delivery among Indian mothers, as well as lower likelihood of infant low birth weight. As in the case of education, policy makers and practitioners should support empowerment programs aimed at increasing maternal autonomy. These programs should focus on multiple aspects of autonomy, including improving women's financial independence, decision-making power, mobility, and gender equality. Increasing women's autonomy in India will be enhanced by teaching both girls and boys about women's rights at very early ages, including the importance of respect between marital partners. Changing cultural norms related to Indian women's autonomy will require long-term commitment and collaboration of the nation's political, educational, health, economic and religious sectors, as well as India's popular media.

The current study's findings indicate that prevention strategies at multiple levels of the ecological model are likely to be more effective than those targeting a single level. For example, it may not only be important to target the individual level factor of education, enhancing a woman's knowledge of the importance of antenatal care, but also to increase her autonomy within the family at the relationship level. Reduction of domestic violence at the relationship level may remove multiple barriers to obtaining maternal health care services. Community and societal level factors may be more resistant to intervention, but public health initiatives such as behavior change communication campaigns may contribute to a community climate that facilitates greater and optimal use of maternal health services.

Recommendations for Future Research

The current study extends existing literature that addresses relationships between women's domestic violence exposure, education, and autonomy and their use of maternity services and birth outcomes. However, there is a clear need for additional research, including longitudinal studies, to understand the observed associations. Qualitative studies, including those involving focus groups, may be a valuable first step. Holding focus groups with women may shed light on why particular types of domestic violence lessen their likelihood of obtaining adequate antenatal care or delivering in a hospital or health facility. Focus groups with men may explore motives behind their violent behaviors, including those that may be related to their wives' pregnancies. Such studies may identify important variables for future investigation in quantitative studies that explore relationships between domestic violence exposure and women's use of maternity services and birth outcomes.

In the current study, violence was examined as a binary variable. Although a number of questions were asked about each type of violence, consent to any one of the questions was considered as the presence of violence. It is recommended that future research examine how the severity of different types of violence relates to women's use of maternal health services and infant low birth weight. The study also revealed that psychological violence was a significant predictor of both adequate antenatal care and institutional delivery. However, this type of violence has received very little attention in the Indian literature to date. Future research should continue to investigate the nature and incidence of psychological violence among Indian married couples, as well as its relationship to maternal and child outcomes. To increase awareness of psychological

violence as a public health problem, future studies should also attempt to explore the differential impact of psychological and physical violence on maternal and child health.

Study findings further suggest a need for more research on the association between maternal autonomy and women's use of maternal health services. In particular, studies might examine whether maternal autonomy predicts women's use of traditional birth attendants for antenatal care, especially in the rural areas. TBAs are not formally recognized by Indian health systems, but are known for their empathy, cultural competence and social support.¹⁵³ Future research might also explore how both maternal autonomy and education are related to Indian women's use of Cesarean Section delivery. Such research would be especially timely given the recent rise of Cesarean Section deliveries in the larger Indian states, including those that are medically unnecessary.¹⁵⁴ Studies might also examine how maternal education and autonomy predict Indian women's deliveries in private versus public hospitals/health facilities.

In the current study, maternal autonomy was measured as a comprehensive variable using nine different individual items. Future research might explore how different dimensions of autonomy are related to women's use of maternal health services. For example, studies might explore the unique influences of financial, health decision-making, and movement autonomy.

This study was one of the first to use a nationally representative sample of Indian women to examine associations between domestic violence and maternal and child health outcomes. Future research should include a more accurate measure of women's exposure to domestic violence, asking woman specifically about violence experiences during their pregnancy versus during the previous year. Studies should also explore the role of other

ecological variables as predictors of maternity service use and infant outcomes, including community level (e.g., rural/urban) and health system level (e.g., availability of skilled birth attendants, JSY financial incentives) variables. Finally, future studies should conduct more complex analyses to examine potential relationships between Indian women's domestic violence exposure and their use of maternity health services and birth outcomes. Specifically, studies should explore moderators of the relationship between different types of violence and health outcomes. For example, research might explore whether or not maternal education or maternal autonomy moderates the relationship between physical violence exposure and women's receipt of antenatal care.

Conclusions

The current study utilized a nationally representative sample of married Indian women to examine the roles of domestic violence, maternal education, and maternal autonomy in predicting women's adequate antenatal care, institutional delivery, and infant low birth weight. Overall, findings were consistent with an ecological framework in revealing that individual and relationship level factors predicted women's use of maternity services and infant outcomes. Domestic violence was found to be risk factor, with physical violence predicting less adequate antenatal care and higher likelihood of low infant birth weight. Psychological violence predicted lower likelihood of adequate antenatal care and institutional delivery, and sexual violence was also related to lower likelihood of institutional delivery. In contrast, both maternal education and maternal autonomy emerged as protective factors. Maternal education was predictive of adequate antenatal care, institutional delivery, and lower likelihood of infant low birth weight. Maternal autonomy predicted institutional delivery and lower likelihood of delivering a

low birth weight infant.

Current findings underscore the need for policy makers, public health practitioners, and educators to develop interventions that emphasize the protective value of maternal education and autonomy, and that reduce the risks associated with physical, psychological, and sexual violence within Indian marriages. This will not be an easy task. India's patriarchal traditions and long history of gender discrimination have meant that domestic violence is often ignored and that many wives are accepting of their husband's violent behaviors, even during pregnancy. As recommended by the ecological model, effective responses to domestic violence should be multi-level. Interventions should focus on changing societal and community level norms, but also on implementing change at the individual and relationship levels. Initiatives aimed at increasing women's education and autonomy, and reducing all types of marital violence, may play an important role in decreasing the incidence of violent behavior in future generations. Children will benefit from observing mothers and sisters who are educated, self-confident, and share family decision-making with their husbands. Comprehensive, multi-level interventions to reduce domestic violence and increase gender equality can play an important role in empowering Indian women and improving maternal and child health outcomes.

Appendix A: Survey Questions

Demographic Background

NFHS-3 collected information on maternal age, maternal education, geographic location, and religion in the Women's Questionnaire. Maternal age is recorded as complete years. Education is recorded in number of years of schooling. Location as rural or urban is recorded based on the sampling and census data. Religion is recorded using the categories described below. Socioeconomic status is recorded using the wealth index calculated by NFHS as described below.

Independent Variables

- 1. Physical Violence:** Women were asked seven questions regarding physical violence. "During the last 12 months, does/did your husband ever do any of the following things to you: Slap you? Twist your arm or pull your hair? Push you, shake you, or throw something at you? Punch you with his fist or with something that could hurt you? Kick you, drag you or beat you up? Try to choke you or burn you on purpose? Threaten or attack you with a knife, gun, or any other weapon?" The response to all these questions was "yes" or "no". "Yes" response was coded as "1" and the "no" response was coded as "0". For the present study, "yes" response to any one of the items was coded as "yes" to physical violence.
- 2. Psychological Violence:** Women were asked three questions regarding psychological violence. "During the last 12 months, does/did your husband ever do any of the following things to you: Say or do something to humiliate you in front of others? Threaten or hurt or harm you so someone close to you? Insult you

or make you feel bad about yourself?” The response to all these questions was “yes” or “no”. “Yes” response was coded as “1” and the “no” response was coded as “0”. For the present study, “yes” response to any one of the items was coded as “yes” to emotional violence.

- 3. Sexual Violence:** Sexual violence was assessed by asking the following questions to the women: “During the last 12 months, does/did your husband ever do any of the following things to you: Physically force you to have sexual intercourse with him even when you did not want to? Force you to perform any sexual acts you did not want to? The response to all these questions was “yes” or “no”. “Yes” response was coded as “1” and the “no” response was coded as “0”. For the present study, “yes” response to any one of the items was coded as “yes” to sexual violence.

- 4. Maternal Education:** The respondent was asked, “Have you ever attended a school?” The response was recorded as “yes” or “no”. If the answer was “yes”, then she was asked, “What was/is the highest standard you have passed?” Response was recorded in numbers. Four categories were used: uneducated (no years of formal schooling), 1 to 5 years of education, 6 to 9 years of education, and 10 or more years of education.

- 5. Maternal Autonomy:** Nine items were used to measure maternal autonomy. Four items asked the respondent about decision-making, “Who usually makes the decisions about health care for yourself, about large household purchases, about small household purchases, and about visiting family and relatives?” Responses to the above questions were recorded as 1) respondent alone, 2) respondent and

husband, 3) husband alone, 4) someone else, and 5) others. Each of these items was recoded as a binary variable: “yes” if the respondent chose option 1 or 2 and “no” if the respondent chose any other option. For financial autonomy, the respondent was asked two questions: “Do you have a bank or savings account?” and “Can you put money aside for personal use?” The responses to both these questions were scored as yes or no. For freedom of movement, the respondent was asked three questions: “Are you usually allowed to go to the health facility, to the market, and to the village/city or outside the village/city either alone, only with someone else, or not at all?” There were three response options: “1) alone,” 2) with someone else only,” and “3) not at all.” Each of these items was recoded as a binary variable: “yes” if the respondent chose option 1 and “no” if the respondent chose option 2 or 3. The maternal autonomy scale had a total score of 9 based on the above-mentioned nine items. Based on frequency data for total scores in this study, scores from 0-2 were classified as low autonomy, 3-4 were classified as medium autonomy, and scores of 5 or higher were classified as high autonomy.

Control Variables

- 1. Maternal Age:** The respondent was asked, “In what month and year were you born?” and the response was recorded as age in years. It was further divided into seven categories; 15-19; 20-24; 25-29; 30-34; 35 plus.
- 2. Religion:** The respondent was asked, “What is your religion?” Hindu was coded as 01, Muslim as 02, Christian as 03, Sikh as 04, Buddhist or neo-Buddhist as 05, Jain as 06, Jewish as 07, Parsi or Zoroastrian as 08, no religion as 09 and others

as 96. For the present study, religion was divided into two categories: Hindu (code-01) and non-Hindu (code more than 01).

- 3. Location:** Location had into six response options. Mega city was coded as 1, large city as 2, small city as 3, large town as 4, small town as 5, and rural as 6. For the purpose of the current study, location was divided in two categories: Urban (code from 1 to 5) and Rural (code-6).
- 4. Socioeconomic Status:** Socioeconomic status was based on the wealth quintiles as devised by NFHS based on household assets. There were five quintiles: lowest; second; third; fourth; and highest.

Dependent Variables:

- 1. Adequate Antenatal Care:** The respondent was asked, “How many months pregnant were you when you first received antenatal care for this pregnancy?” and the response was recorded in number of months. She was further asked, “How many times did you receive antenatal care during this pregnancy?” and the response was recorded in number of visits. The respondent was asked, “During the whole pregnancy, for how many days did you take the iron folic acid tablets or syrup?” and the response was recorded in number of days. For the current study, adequate antenatal care was defined as first visit in the first trimester, at least three antenatal care visits, and 100 or more IFA tablets. All the conditions needed to be satisfied for a “yes” response to adequate antenatal care.
- 2. Institutional Delivery:** The respondent was asked, “Where did you give birth?” and the responses were recorded. Home was coded from 11 to 13 and included the respondent’s home, her parents’ home, and other home. Government facilities

were coded from 21 to 26 and included Government/Municipal hospital, Government dispensary, primary and community health care centers, Government sub-centers, and other public sector health facility. NGO or a Trust hospital/clinic was coded as 31. Private facilities were coded as 41 and 42 and included private hospitals, maternity homes/clinics, and other private sector facility. Other facilities were coded as 96. For the purpose of the current study, all codes from 21 to 26, 31, 41, and 42 were considered institutional deliveries.

- 3. Infant Low Birth Weight:** The respondent was asked about the perceptions of the size of the infant with the question, “When your child was born, was he/she very large, larger than average, average, smaller than average, or very small?” For the present study, “smaller than average” and “very small” were considered as low birth weight infants.

References

1. World Health Organization. *Investing in Maternal, Newborn and Child Health: The Case for Asia and the Pacific*. Geneva, Switzerland: World Health Organization; 2009.
2. Kogan MD, Alexander GR, Kotelchuek M, Nagey DA. Relation of the content of prenatal care to the risk of low birth weight: maternal reports of health behavior advice and initial prenatal care procedures. *Obstet Gynecol Surv*. 1994;49(10):667-668.
3. Campbell OM, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. *Lancet*. 2006;368(9543):1284-1299.
4. Goodburn E, Campbell O. Reducing maternal mortality in the developing world: sector-wide approaches may be the key. *BMJ*. 2001;322(7291):917.
5. UNICEF. *State of the World's Children 2009: Maternal and Newborn Health*. New York, NY: UNICEF; 2008.
6. Lawn JE, Cousens S, Zupan J. 4 million neonatal deaths: when? Where? Why? *Lancet*. 2005;365(9462):891-900.
7. World Health Organization. *Trends in Maternal Mortality: 1990 to 2008. Estimates Developed by WHO, UNICEF, UNFPA, and The World Bank*. Geneva, Switzerland: World Health Organization; 2010.
8. Ronsmans C, Graham WJ. Maternal mortality: who, when, where, and why. *Lancet*. 2006;368(9542):1189-1200.
9. International Institute for Population Sciences. *National Family Health Survey 2005-06*. Vol 1. Mumbai, India: International Institute for Population Sciences; 2007.
10. Dhar A. U.N.: India likely to miss MDG on maternal health. July 12, 2012; <http://www.thehindu.com/sci-tech/health/policy-and-issues/un-india-likely-to-miss-mdg-on-maternal-health/article3595095.ece>. Accessed November 22, 2013.
11. UNICEF. *Levels and Trends in Child Mortality Report 2012 Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation*. New York, NY: UNICEF; 2012.
12. Contrada RJ, Baum A. *The Handbook of Stress Science: Biology, Psychology, and Health*. New York, NY: Springer Publishing Company; 2010.

13. Fraser MW, Galinsky MJ, Richman JM. Risk, protection, and resilience: Toward a conceptual framework for social work practice. *Soc Work Res.* 1999;23(3):131-143.
14. Jejeebhoy SJ. Associations between wife-beating and fetal and infant death: impressions from a survey in rural India. *Stud Fam Plann.* 1998;29(3):300-308.
15. Heise L, Pitanguy J, Germain A. Violence against women: the hidden health burden. . *World Health Stat Q.* 1993;46(1):78-85.
16. International Center for Research on Women and The Center for Development and Population Activities. *Domestic Violence in India 3: A Summary Report of a Multi-Site Household Survey.* Washington DC: International Center for Research on Women and The Center for Development and Population Activities;2000.
17. Ahmed S, Koenig MA, Stephenson R. Effects of domestic violence on perinatal and early-childhood mortality: evidence from north India. *Am J Public Health.* 2006;96(8):1423-1428.
18. Fernandez M. Domestic violence by extended family members in India interplay of gender and generation. *J Interpers Violence.* 1997;12(3):433-455.
19. Dole N, Savitz DA, Hertz-Picciotto I, Siega-Riz AM, McMahon MJ, Buekens P. Maternal stress and preterm birth. *Am J Epidemiol.* 2003;157(1):14-24.
20. Pritchard CW, Teo Mfphm PYK. Preterm birth, low birthweight and the stressfulness of the household role for pregnant women. *Soc Sci Med.* 1994;38(1):89-96.
21. Rondo PHC, Ferreira RF, Nogueira F, Ribeiro MCN, Lobert H, Artes R. Maternal psychological stress and distress as predictors of low birth weight, prematurity and intrauterine growth retardation. *Eur J Clin Nutr.* 2003;57(2):266-272.
22. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *Lancet.* 2002;360(9339):1083-1088.
23. Heise L. Violence against women: the hidden health burden. *World Health Stat Q.* 1993;46(1):78.
24. Shumway J, O'Campo P, Gielen A, Witter FR, Khouzami AN, Blakemore KJ. Preterm labor, placental abruption, and premature rupture of membranes in

- relation to maternal violence or verbal abuse. *J Matern Fetal Neonatal Med*. 1999;8(3):76-80.
25. Neggers Y, Goldenberg R, Cliver S, Hauth J. Effects of domestic violence on preterm birth and low birth weight. *Acta Obstet Gynecol Scand*. 2004;83(5):455-460.
 26. Murphy CC, Schei B, Myhr TL, Mont JD. Abuse: A risk factor for low birth weight? A systematic review and meta-analysis. *Can Med Assoc J*. 2001;164(11):1567-1572.
 27. Rutter M. Resilience, competence, and coping. *Child Abuse Negl*. 2007;31(3):205-209.
 28. Wakeel F, Wisk L, Gee R, Chao S, Witt W. The balance between stress and personal capital during pregnancy and the relationship with adverse obstetric outcomes: findings from the 2007 Los Angeles Mommy and Baby (LAMB) study. *Arch Womens Ment Health*. 2013;16(6):1-17.
 29. Govindasamy P, Ramesh B. *Maternal Education and the Utilization of Maternal and Child Health Services in India*. Mumbai, India: International Institute of Population Sciences; 1997.
 30. Navaneetham K, Dharmalingam A. Utilization of maternal health care services in southern India. *Soc Sci Med*. 2002;55(10):1849-1869.
 31. Singh PK, Rai RK, Alagarajan M, Singh L. Determinants of maternity care services utilization among married adolescents in rural India. *PLoS One*. 2012;7(2):e31666.
 32. Singh L, Rai RK, Singh PK. Assessing the utilization of maternal and child health care among married adolescent women: evidence from India. *J Biosoc Sci*. 2012;44(1):1-26.
 33. Basu AM. *Culture, the Status of Women, and Demographic Behaviour: Illustrated With the Case of India*. Oxford, UK: Clarendon Press; 1992.
 34. Desai S, Johnson K. Women's decisionmaking and child health: familial and social hierarchies. In: Kishor S, ed. *A Focus on Gender: Collected Papers on Gender Using DHS Data*. Calverton, MD: ORC Macro; 2005:55-68.
 35. Bloom SS, Wypij D, Gupta Md. Dimensions of women's autonomy and the influence on maternal health care utilization in a north Indian city. *Demography*. 2001;38(1):67-78.

36. International Institute for Population Sciences. *India National Family Health Survey NFHS-2 1998-99*. Mumbai, India: International Institute of Population Sciences; 2000.
37. Lewin K. Field theory in social science: selected theoretical papers (Edited by Dorwin Cartwright.). 1951.
38. Barker RG. *Ecological psychology*. Stanford University Press; 1968.
39. Bronfenbrenner U. *The Ecology of Human Development*. Cambridge, MA: Harvard University Press; 1979.
40. Stokols D. Establishing and maintaining healthy environments: toward a social ecology of health promotion. *Am Psychol*. 1992;47(1):6.
41. Institute of Medicine. *Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century*. Washington DC: The National Academies Press; 2003.
42. Office of Disease Prevention and Health Promotion. *Healthy People 2020*. Washington D.C: US Department of Health and Human Services; 2012.
43. World Health Organization. *World Health Organization: Process for a Global Strategy on Diet, Physical Activity and Health*. Geneva, Switzerland: World Health Organization; 2003.
44. World Health Organization. *WHO Framework Convention on Tobacco Control*. Geneva, Switzerland: World Health Organization; 2007.
45. World Health Organization. *World Report on Violence and Health*. Geneva, Switzerland: World Health Organization; 2006.
46. World Health Organization. *WHO Multi-country Study on Women's Health and Domestic Violence Against Women: Summary Report: Initial Results on Prevalence, Health Outcomes and Women's Responses*. Geneva, Switzerland: World Health Organization; 2005.
47. World Health Organization, London School of Hygiene and Tropical Medicine. *Preventing Intimate Partner and Sexual Violence Against Women: Taking Action and Generating Evidence*. Geneva, Switzerland: World Health Organization; 2010.
48. Sallis J, Owen N, Fisher E. Ecological models of health behavior. In: Glanz K, Rimer B, Viswanath K, eds. *Health Behavior and Health Education: Theory*,

Research, and Practice. 4th ed. San Francisco, CA: John Wiley & Sons, Inc.; 2008:465-485.

49. Ahmed S, Creanga AA, Gillespie DG, Tsui AO. Economic status, education and empowerment: implications for maternal health service utilization in developing countries. *PLoS One*. 2010;5(6):1-6.
50. Bacchus L, Bewley S, Mezey G. Domestic violence in pregnancy. *Fetal Matern Med Rev*. 2001;12(04):249-271.
51. Martin SL, Beaumont JL, Kupper LL. Substance use before and during pregnancy: links to intimate partner violence. *Am J Drug Alcohol Abuse*. 2003;29(3):599-617.
52. Lalmalsawmzauva K, Nayak D. Maternal health care utilization in India: role of surface road networks. Paper presented at: XXVI, IUSSP International Population Conference, Morocco, 2009.
53. Ministry of Road Transport and Highways. 2014; <http://www.allgov.com/india/departments/?detailsDepartmentID=646>. Accessed 10.11.14, 2014.
54. Pande RP, Astone NM. Explaining son preference in rural India: the independent role of structural versus individual factors. *Popul Res Policy Rev*. 2007;26(1):1-29.
55. Bhattacharya R. *Behind closed doors: Domestic violence in India*. Sage Publications India; 2009.
56. Martin SL, Moracco KE, Garro J, et al. Domestic violence across generations: findings from northern India. *Int J Epidemiol*. 2002;31(3):560-572.
57. Narayana G. Family violence, sex and reproductive health behaviour among men in Uttar Pradesh, India. Paper presented at: Annual meeting of the National Council on International Health 1996; Arlington, VA.
58. Bronfenbrenner U. Toward an experimental ecology of human development. *Am Psychol*. 1977;32(7):513-531.
59. Gupta SK, Pal DK, Tiwari R, et al. Impact of Janani Suraksha Yojana on institutional delivery rate and maternal morbidity and mortality: an observational study in India. *J Health Popul Nutr* 2012;30(4):464.
60. Nayar KR. Social exclusion, caste & health: a review based on the social determinants framework. *Indian J Med Res*. 2007;126(4):355-363.

61. Jani YK, Shukla AA, Bala D. Practices Related to pregnancy and child birth: a cross sectional study among women of Ahmedabad district. *Parity*. 2013;30(7):10.
62. UNICEF. India Statistics. 2013; http://www.unicef.org/infobycountry/india_statistics.html. Accessed February 6, 2014.
63. Ministry of Health and Family Welfare Government of India. *My Safe Motherhood Booklet for Expecting Mothers*. New Delhi, India: Ministry of Health and Family Welfare; 2005.
64. Ministry of Health and Family Welfare Government of India. *Janani Suraksha Yojana JSY Features and Frequently Asked Questions*. New Delhi, India: Ministry of Health and Family Welfare; 2006.
65. Kassebaum NJ, Jasrasaria R, Naghavi M, et al. A systematic analysis of global anemia burden from 1990 to 2010. *Blood*. 2014;123(5).
66. Mistry R, Galal O, Lu M. Women's autonomy and pregnancy care in rural India: a contextual analysis. *Soc Sci Med*. 2009;69(6):926-933.
67. Koski AD, Stephenson R, Koenig MA. Physical violence by partner during pregnancy and use of prenatal care in rural India. *J Health Popul Nutr*. 2011;29(3).
68. Group UD. *Indicators for monitoring the Millennium Development Goals: definitions, rationale, concepts and sources*. Vol 95: United Nations Publications; 2003.
69. Vora KS, Mavalankar DV, Ramani K, et al. Maternal health situation in India: a case study. *J Health Popul Nutr* 2009;27(2):184-201.
70. Graham WJ, Bell JS, Bullough CH, De Brouwere V, Van Lerberghe W. Can skilled attendance at delivery reduce maternal mortality in developing countries. *Safe Motherhood Strategies: A Review of the Evidence*. 2001;17:97-130.
71. Ministry of Health and Family Welfare Government of India. *National Health Policy of 2002*. New Delhi, India: Ministry of Health and Family Welfare; 2002.
72. Khan M, Hazra A, Bhatnagar I, et al. Impact of Janani Suraksha Yojana on selected family health behaviors in rural Uttar Pradesh. *J Fam Welf*. 2013;56(5):9-22.

73. Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *Lancet*. 2010;375(9730):2009-2023.
74. Guin G, Sahu B, Khare S, Kavishwar A. Trends in maternal mortality and impact of Janani Suraksha Yojana (JSY) on maternal mortality ratio in a tertiary referral hospital. *J Obstet Gynecol India*. 2012;62(3):307-311.
75. World Health Organization. *ICD-10: International Statistical Classification of Diseases and Related Health Problems: Tenth Revision*. Geneva, Switzerland: World Health Organization; 1989.
76. Kramer MS. Determinants of low birth weight: methodological assessment and meta-analysis. *Bull World Health Organ*. 1987;65(5):663.
77. Barker DJP. Fetal and infant origins of adult disease. *BMJ*. 1990;301(6761):1111.
78. UNICEF. Low birth weight status and trends. 2013; http://www.childinfo.org/low_birthweight_status_trends.html. Accessed February 6, 2014.
79. Capaldi DM, Knoble NB, Shortt JW, Kim HK. A systematic review of risk factors for intimate partner violence. *Partner Abuse*. 2012;3(2):231-280.
80. Kaur R, Garg S. Addressing domestic violence against women: an unfinished agenda. *Indian J Comm Med*. 2008;33(2):73.
81. Bloom S. Domestic Violence. In: O'Brien J, ed. *Encyclopedia of gender and society*. Thousand Oaks, CA: Sage Publications; 2009:216-221.
82. Heise L, Ellsberg M, Gottemoeller M. Ending violence against women. *Popul Rep L*. 1999(11):1-43.
83. Brieding M, Chen J, Black M. *Intimate Partner Violence in the United States 2010*. Atlanta, GA: National Center for Injury Prevention and Control Centers for Disease Control and Prevention; 2014.
84. Dalal K, Lindqvist K. A national study of the prevalence and correlates of domestic violence among women in India. *Asia Pac J Public Health*. 2012;24(2):265-277.

85. Sarkar NN. The cause and consequence of domestic violence on pregnant women in India. *J Obstet Gynaecol*. 2013;33(3):250-253.
86. Purwar MB, Jeyaseelan L, Varhadpande U, Motghare V, Pimplakute S. Survey of physical abuse during pregnancy GMCH, Nagpur, India. *J Obstet Gynaecol Res*. 1999;25(3):165-171.
87. Bailey B, Daugherty R. Intimate partner violence during pregnancy: incidence and associated health behaviors in a rural population. *Matern Child Health J*. 2007;11(5):495-503.
88. Taggart L, Mattson S. Delay in prenatal care as a result of battering in pregnancy: cross - cultural implications. *Health Care Women Int*. 1996;17(1):25-34.
89. Dietz PM, Gazmararian JA, Goodwin MM, Bruce FC, Johnson CH, Rochat RW. Delayed entry into prenatal care: effect of physical violence. *Obstet Gynecol*. 1997;90(2):221-224.
90. McCloskey L, Williams C, Lichter E, Gerber M, Ganz M, Sege R. Abused women disclose partner interference with health care: an unrecognized form of battering. *J Gen Int Med*. 2007;22(8):1067-1072.
91. Aguilar RJ, Nightingale NN. The impact of specific battering experiences on the self-esteem of abused women. *J Fam Violence*. 1994;9(1):35-45.
92. Mckinnon L. *Hurting without hitting: Non-physical contact forms of abuse*. Australian Domestic and Family Violence Clearinghouse, UNSW; 2008.
93. Das S, Bapat U, Shah More N, et al. Intimate partner violence against women during and after pregnancy: a cross-sectional study in Mumbai slums. *BMC Public Health*. 2013;13(1):817.
94. García-Moreno C, Jansen HA, Ellsberg M, Heise L, Watts C. *WHO Multi-Country Study on Women's Health and Domestic Violence Against Women: Initial Results on Prevalence, Health Outcomes and Women's Responses*. Geneva, Switzerland: World Health Organization; 2005.
95. Jain D, Sanon S, Sadowski L, Hunter W. Violence against women in India: evidence from rural Maharashtra, India. *Rural Remote Health*. 2004;4(4):304.
96. Miller E, Decker MR, Raj A, Reed E, Marable D, Silverman JG. Intimate partner violence and health care-seeking patterns among female users of urban adolescent clinics. *Matern Child Health J*. 2010;14(6):910-917.

97. Nasir K, Hyder AA. Violence against pregnant women in developing countries review of evidence. *Eur J Public Health*. 2003;13(2):105-107.
98. Valladares E, Ellsberg M, Peña R, Högberg U, Persson LÅ. Physical partner abuse during pregnancy: a risk factor for low birth weight in Nicaragua. *Obstet Gynecol*. 2002;100(4):700-705.
99. Muthal-Rathore A, Tripathi R, Arora R. Domestic violence against pregnant women interviewed at a hospital in New Delhi. *Int J Gynecol Obstet*. 2002;76(1):83-85.
100. Simkhada B, Teijlingen ERv, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *J Adv Nurs*. 2008;61(3):244-260.
101. Kesterton AJ, Cleland J, Sloggett A, Ronsmans C. Institutional delivery in rural India: the relative importance of accessibility and economic status. *BMC Pregnancy Childbirth*. 2010;10(1):30.
102. Pallikadavath S, Foss M, Stones RW. Antenatal care: provision and inequality in rural north India. *Soc Sci Med*. 2004;59(6):1147-1158.
103. Bhatia JC, Cleland J. Determinants of maternal care in a region of South India. *Health Transit Rev*. 1995;5(2):127-142.
104. Valero de Bernabé J, Soriano T, Albaladejo R, et al. Risk factors for low birth weight: a review. *Eur J Obstet Gynecol Reprod Biol*. 2004;116(1):3-15.
105. Millar W, Chen J. Maternal education and risk factors for small-for-gestational-age births. *Health Rep*. 1998;10(2):43-51.
106. Campbell J, Torres S, Ryan J, et al. Physical and nonphysical partner abuse and other risk factors for low birth weight among full term and preterm babies: a multiethnic case-control study. *Am J Epidemiol*. 1999;150(7):714-726.
107. Longo DR, Kruse RL, LeFevre ML, Schramm WF, Stockbauer JW, Howell V. An investigation of social and class differences in very-low birth weight outcomes: a continuing public health concern. *J Health Care Finance*. 1998;25(3):75-89.
108. Hirve SS, Ganatra BR. Determinants of low birth weight: a community based prospective cohort study. *Indian Pediatr*. 1994;31(10):1221-1225.

109. Nair NS, Rao RSP, Chandrashekar S, Acharya D, Bhat HV. Socio-demographic and maternal determinants of low birth weight : a multivariate approach. *Indian J Pediatr.* 2000;67(1):9-14.
110. Chakraborty P, Anderson AK. Maternal autonomy and low birth weight in India. *J Womens Health.* 2011;20(9):1373-1382.
111. Narayan-Parker D. *Empowerment and Poverty Reduction: A Sourcebook.* Washington DC: World Bank Publications; 2002.
112. Malhotra A, Schuler SR. Women's empowerment as a variable in international development. In: Narayan D, ed. *Measuring empowerment: Cross-disciplinary perspectives.* Washington DC: World Bank; 2005:71-88.
113. Friedemann-Sánchez G, Lovatón R. Intimate partner violence in Colombia: who is at risk? *Soc Forces.* 2012.
114. Flake DF, Forste R. Fighting families: family characteristics associated with domestic violence in five Latin American countries. *J Fam Violence.* 2006;21(1):19-29.
115. Hindin MJ, Adair LS. Who's at risk? Factors associated with intimate partner violence in the Philippines. *Soc Sci Med.* 2002;55(8):1385-1399.
116. Mahapatro SR. Utilization of maternal and child health care services in India: Does women's autonomy matter? *J Fam Welf.* 2012;58(1):22-33.
117. Anderson T. How can child and maternal mortality be cut? *BMJ.* 2010;340(c431).
118. Woldemicael G, Tenkorang EY. Women's autonomy and maternal health-seeking behavior in Ethiopia. *Matern Child Health J.* 2010;14(6):988-998.
119. Shroff M, Griffiths P, Adair L, Suchindran C, Bentley M. Maternal autonomy is inversely related to child stunting in Andhra Pradesh, India. *Matern Child Nutr.* 2009;5(1):64-74.
120. Shroff MR, Griffiths PL, Suchindran C, Nagalla B, Vazir S, Bentley ME. Does maternal autonomy influence feeding practices and infant growth in rural India? *Soc Sci Med.* 2011;73(3):447-455.
121. Adhikari R, Sawangdee Y. Influence of women's autonomy on infant mortality in Nepal. *Reprod Health.* 2011;8(7):1-8.

122. UNICEF. *Low Birthweight: Country, Regional and Global Estimates*. New York, NY: UNICEF; 2004.
123. Blanc AK, Wardlaw T. Monitoring low birth weight: an evaluation of international estimates and an updated estimation procedure. *Bull World Health Organ*. 2005;83(3):178-185d.
124. Jeyaseelan L, Kumar S, Neelakantan N, Peedicayil A, Pillai R, Duvvury N. Physical spousal violence against women in India: some risk factors *J Biosoc Sci*. 2007;39(05):657-670.
125. Kimuna SR, Djamba YK, Ciciurkaite G, Cherukuri S. Domestic Violence in India: Insights From the 2005-2006 National Family Health Survey. *J Interpers Violence*. March 1, 2013 2013;28(4):773-807.
126. Jejeebhoy SJ. Women's autonomy in rural India: its dimensions, determinants, and the influence of context. In: Presser HB, Sen G, eds. *Female Empowerment and Demographic Processes: Moving Beyond Cairo*. Oxford, UK: Oxford University Press; 2000.
127. Say L, Raine R. A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bull World Health Organ*. 2007;85(10):812-819.
128. Thind A, Mohani A, Banerjee K, Hagigi F. Where to deliver? Analysis of choice of delivery location from a national survey in India. *BMC Public Health*. 2008;8(1):29.
129. Madhavan S, Bishai D, Stanton C, Harding A. *Engaging the private sector in maternal and neonatal health in low and middle income countries*. Future health systems (FHS); 2010.
130. International Institute for Population Sciences. *District Level Household Survey DLHS-2, 2002-04*. Mumbai, India: IIPS; 2006.
131. Straus MA, Hamby SL, Boney-McCoy S, Sugarman DB. The revised conflict tactics scales (CTS2) development and preliminary psychometric data. *J Fam Issues*. 1996;17(3):283-316.
132. Kumar C, Singh PK, Rai RK. Coverage gap in maternal and child health services in India: assessing trends and regional deprivation during 1992–2006. *J Public Health*. 2013;35(4):598-606.

133. Black MC, Basile KC, Breiding MJ, et al. National intimate partner and sexual violence survey. *Atlanta, GA: Centers for Disease Control and Prevention*. 2011.
134. Flanagan JC, Jaquier V, Gordon KC, Moore TM, Stuart GL. Examining the prevalence, bidirectionality, and co-occurrence of sexual intimate partner violence among women during pregnancy and postpartum. *Partner Abuse*. 2014;5(4):407-419.
135. Nanda P, Gautam A, Verma R, et al. *Study on Masculinity, Intimate Partner Violence and Son Preference in India*. New Delhi, India: International Center for Research on Women; 2014.
136. Chellan R, Lopamudra P, P.M. K. Incidence of low birth weight in India regional variations and socio-economic disparities. *Journal of Health and Development*. 2007(Jan-July).
137. WHO, UNICEF. *Antenatal Care in Developing Countries. Promises, Achievements and Missed Opportunities. An Analysis of Trends, Levels and Differentials, 1990–2001*. Geneva, Switzerland 2003.
138. Panchanadeswaran S, Koverola C. The voices of battered women in India. *Violence Against Women*. 2005;11(6):736-758.
139. Das D. Marital rape: The assassination of a woman's dignity. *Indian Police Journal*. 2010;LVII(62).
140. Kabeer N. *The conditions and consequences of choice: Reflections on the measurement of women's empowerment*. Vol 108. Geneva, Switzerland: United Nations Research Institute for Social Development; 1999.
141. Jejeebhoy SJ. Wife-beating in rural India: a husband's right? Evidence from survey data. *Econ Polit Wkly*. 1998;33(15):855-862.
142. Mahapatro M, Gupta R, Gupta V, Kundu A. Domestic violence during pregnancy in India. *J Interpers Violence*. 2011:0886260510390948.
143. Bhalotra S, Cochrane T. Where have all the young girls gone? On the rising trend in sex selection in India. *University of Bristol Working Paper*. 2010.
144. Bharadwaj P, Lakdawala LK. Discrimination begins in the womb: evidence of sex-selective prenatal investments. *J Hum Resour*. 2013;48(1):71-113.
145. Sudha S, Morrison S. Marital violence and women's reproductive health care in Uttar Pradesh, India. *Womens Health Issues*. May-Jun 2011;21(3):214-221.

146. Mohanty SK, Srivastava A. Out-of-pocket expenditure on institutional delivery in India. *Health Policy Plan*. 2012;czs057.
147. Griffiths P, Stephenson R. Understanding user's perspectives of barriers to maternal health care use in Maharashtra, India. *J Biosoc Sci*. 2001;33(03):339-359.
148. World Health Organization, Unicef. *Countdown to 2015 Decade Report (2000-2010) with Country Profiles: Taking Stock of Maternal, Newborn and Child Survival*. Geneva, Switzerland: World Health Organization; 2010.
149. Yoshikawa K, Agrawal NR, Poudel KC, Jimba M. A lifetime experience of violence and adverse reproductive outcomes: findings from population surveys in India. *Biosci Trends*. Jun 2012;6(3):115-121.
150. Alhusen JL, Ray E, Sharps P, Bullock L. Intimate partner violence during pregnancy: maternal and neonatal outcomes. *J Womens Health*. 2014.
151. Sarkar NN. The impact of intimate partner violence on women's reproductive health and pregnancy outcome. *J Obstet Gynaecol*. 2008;28(3):266-271.
152. Sharma A, Kader M. Effect of Women's Decision-Making Autonomy on Infant's Birth Weight in Rural Bangladesh. *ISRN pediatrics*. 2013;2013.
153. Bergström S, Goodburn E. The role of traditional birth attendants in the reduction of maternal mortality. *Safe motherhood strategies: A review of the evidence*. 2000.
154. World Health Organization. *Born Too Soon: The Global Action Report on Preterm Birth* Geneva, Switzerland: WHO; 2012.