FACTORS INFLUENCING BIRTH SPACING ACROSS DIFFERENT INCOME GROUPS IN PAKISTAN (A MULTILEVEL ANALYSIS)

by

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CERTIFICATE

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I _____ hereby state that my M.Phill thesis titled _____ is my own work and has not been submitted previously by me for taking any degree from Pakistan Institute of Development Economics or anywhere else in the country/world.

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DEDICATION

I dedicate this dissertation to my brother *INAM-ULLAH* who supported me throughout the process both morally and financially. I will always appreciate your support.

I also dedicate my dissertation work to my family. A special feeling of gratitude to my loving parents, *Mahabat.Shah, Meher Bano* and my siblings *Ikram-ullah, Nazish kanwal and Sehrish kanwal* for encouragement.

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Contents

LIST OF ACRONYMS

1.	ICC	Inter Class Correlation
2.	IMR	Infant Mortality Rate
3.	VIF	Variance inflation Factor
4.	MDGs	Millennium Development Goals
5.	MMR	Maternal Mortality Rate
6.	PDHS	Pakistan Demographic and Health Survey
7.	SBI	Short Birth Interval
8.	SDGs	Sustainable Development Goals
9.	UNFPA	United Nations Population Fund
10.	WHO	World Health Organization

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Abstract

Identifying the factors that influence birth spacing among women who belong to different income groups is necessary to improve SBI because SBI is one of the major health challenges under the domain of mother and child health in the context of Pakistan. Several studies have been conducted in Pakistan to identify the underlying reasons that lead to short birth spacing/interval between consecutive births at individual level yet there remains a gap in terms of approaching this subject by involving contextual factors in analysis. The study attempts to bridge the gap by including community level factors along with individual level factors that might be correlated with Short Birth Interval.

To conduct this study data has been taken from the Pakistan demographic health survey 2017-18 with a weighted sample size of 8999 selected from the source and analyzed subsequently to produce desired results. The dependent variable is average birth interval which is dichotomous in nature i.e. Short birth interval and long birth interval. Explanatory variables at individual level are *mother's education level, husband's education level, age, contraceptive use, age at first birth, wealth status* or wealth group of respondents and working status. Community variables comprises of *community female literacy level, community poverty level and place of residence.* For statistical analysis Mixed Effect Logistic Regression is used.

The results of the study indicate that the percentage of long birth interval is 66% and short birth interval is 34% in case of Pakistan. The individual level factors such as *mother's education, husband's education, wealth status, contraceptive use* and age of respondents show statistically significant influence on Short Birth Interval. wealth status has significant influence on short birth interval as women who belongs to middle income quintile are 8% less likely to have SBI as compare to women who falls in low wealth quintile while women who falls in rich income quintile are 21% less likely to have SBI as compared to women who falls in low income quintile. Similarly, at contextual level, community female literacy level reflects significant influence on Odds of short birth interval. The ICC score (6%) calculated in the random effect part of the analysis confirms the influence of contextual factors and allows the application of multilevel analysis techniques.

Women who experience short birth intervals not only depend upon individual level but also depend upon community level context hence public policies should be designed by considering individual as well as community level associates to reduce prevalence of SBI.

Chapter 1

Introduction

Health system is considered as the main pillar for the development of any country. In developed and developing countries health systems are focusing on maternal health and child health. "Maternal health is the health of women during pregnancy, childbirth and postpartum period". It covers different dimensions of maternal health including maternal nutritional status, prenatal, preconception and postnatal care to decrease maternal morbidity and maternal mortality. Family planning plays a vital role in improving maternal health in both developed and underdeveloped countries. Use of family planning services can prevent fertility related high risk birth if the age of mother is less than 18 years or greater than 34 years at the time of birth (Govindasamy, Stewart, Rutstein, Boerma, & Sommerfelt, 1993).

Birth spacing basically provides enough time to heal from lack of nutrition caused by previous pregnancies. For spacing between children different terminologies are used by different researchers in their work, like birth interval, inter pregnancy interval, recuperative interval. These terminologies are used as three main definitions to define the birth interval. these definitions are inter pregnancy interval " the time elapsed between delivery of previous infant and conception of current pregnancy", birth interval " the time elapsed between woman's last delivery and birth of index child" and recuperative interval is " the amount of time the women was neither lactating or pregnant"((Conde- Agudelo, Rosas- Bermudez, Castaño, & Norton, 2012).

As per the recommendation of World health organization a minimum inter birth interval should be at least 33 months between two consecutive live births or it can be 24 months between previous birth and current pregnancy. in order to reduce the risk of adverse maternal and child health

outcomes (Exavery et al., 2012). This definition is preferred by researchers because sometimes pregnancies remain incomplete because of miscarriages and abortion; they left unreported which increases the time interval between conceptions (Gyimah, 2005).

There are two ways mostly used by the researchers to express birth spacing or interval in two periods, short birth interval and long birth interval. Interval is used for live births but mostly this definition ignores abortions; either its induced abortion or spontaneous abortion. It causes the difficulty to understand the association between reproductive failure and intentional pregnancy spacing with increased time intervals between live births (Winikoff, 1983).

If the time interval between two consecutive live births is less than 33 months including nine months of pregnancy is considered a short birth interval while if birth interval greater than four years is considered a long birth interval. Short birth interval is neither good for mother or child. Short birth intervals lead to anemia among mothers and the child is malnourished with low weights (Conde-Agudelo, Rosas-Bermúdez, & Kafury-Goeta, 2006).

Several researchers and demographers have worked on different dimensions to solve these public health issues around the globe. Different policy makers established family planning programs to improve maternal health. Family planning is the practice of controlling children and birth spacing by use of contraceptive and voluntary sterilization (Halli et al., 2019).

Birth spacing has high effects on the health of a child. In the early 1980s there was a huge difference in average child mortality in developed countries and developing countries. Infant mortality was six times greater in developing countries as compared to developed countries around the world. Risk associated with childbearing was high in developing countries (Govindasamy et al., 1993).

Short birth intervals are highly associated with preterm birth, low birth weight. Chances of Neonatal mortality and infant mortality increase after negative outcomes of previous child delivery. Neonatal and infant mortality is high for birth to pregnancy over the period of 18 months. In Bangladesh the level of contraceptive use has increased in the last 30 years which increased the median birth interval from 35 months to 47 months (De Jonge et al., 2014).

For mother's and child's health nutrition's play vital role. Nutrition is related to the birth outcomes. If the nutrition status is poor among mothers, this leads to unfavorable birth outcomes. There is a complicated association between birth outcomes and health of mothers because other socioeconomic factors affect the nutrition status among mothers. The nutrition's which are commonly associated with birth outcomes are proteins, necessary fatty acids, most importantly omega-3 fatty acids, iron, calcium, vitamin C and other multi nutrient supplement (Abu-Saad & Fraser, 2010)

Lactation plays an important role in managing women's fertility and the health of their children. According to Aristotle "while women suckle children menstruation does not occur according to nature, nor do they conceive; if they do conceive the milk dries up". In old ages the lactation period is considered as the time interval between two live births. And this statement is proved by modern researchers. Lactation is considered a natural birth controlling method. The changes in patterns of lactation have increased use of artificial birth controlling methods. Different regions have different lactation patterns; the lactation period is normally short among urban educated women of young age. The less educated women who are living in rural areas have a long lactation period (Thapa, Short, & Potts, 1988).

Short birth intervals between consecutive pregnancies lead to deficiency of nutrition among the mothers. Short space pregnancies do not provide enough time for the mother to have a normal and healthy pregnancy. This nutritional inefficiency leads to adverse implication in the future among women. Females who have spacing interval less than 12 months are at higher risk of having obesity. Mothers who have twin kids after short birth spacing are at high risk for postnatal depression as compared to the women who have a single child (Grundy & Kravdal, 2014).

Incomplete recovery of cesarean section, poor child feeding, low HP level and cross infections between siblings is caused by short birth spacing. Normal birth spacing can prevent the adverse outcomes of maternal health; Short birth spacing leads to adverse effects to the health of newborn children. It has been evaluated that if spacing between pregnancies or birth to new conception is increased up to 3 years it would be possible to prevent around 1.6 million deaths of children below age five every year globally. Malnutrition is one of the reasons which causes child mortality (Justesen & Kunst, 2000).

Short birth spacing is directly related to the poor health outcomes of children. Low weight at the time of birth, preterm births, congenital malformation and early neonatal deaths are considered as adverse child health effects. Deaths of neonatal patients are significantly higher in east jawa and northern central Sulawesi (Titaley, Dibley, Agho, Roberts, & Hall, 2008).

The risk of child mortality under five increases as the birth spacing is less than 24 months. It has been evaluated that still around 25% of births occur at intervals below 2 years or 24 months. 33% of cases of short birth spacing have been noticed in central Asia. While sub-Saharan African countries have 20% cases of short birth spacing. Demographic health survey reports show that most of the sub-Saharan African countries have notable numbers of child births at short spacing.

Uganda as well as in other states of Africa do not show long birth spacing because it is not occurring normally. It has been estimated that in Zimbabwe and Nigeria the short birth interval is 23% and 11%. Tanzania and Kenya shows same short birth interval trends as sub Saharan African countries which is estimated at less than 24 months and the 18% and 19% of short birth spacing cases occurs Short birth spacing is recorded in rural Uganda and the estimated short birth spacing is still considered as 52%. Different socioeconomic factors are linked with short birth spacing, which is the young age of mothers, not using any birth control method and lack of lactation (Aleni, Mbalinda, & Muhindo, 2020). According to world report (2010) of world health organization 13% of deaths caused by unsafe abortions (Pinto, Suwiyoga, Widiana, & Yasa, 2017).

To reduce this issue of maternal mortality and infant child mortality world leaders agreed to MDGs in 2000 they fixed a target to reduce it up to 75% till 2015 later on they established SDGs to reduce the numbers of deaths (Kumar, Kumar, & Vivekadhish, 2016).

WHO selected 40 countries whose MMR was very high which include Chad 1100/100000 and Somalia with 1000/100000 with highest maternal mortality rate, 730 were in Sudan while MMR was 460/100000 live births in Afghanistan (Pinto et al., 2017).

In Pakistan women living in urban areas have mostly short birth intervals between 2 consecutive live births while in rural areas the birth spacing is higher among married women. The contraceptive use among urban women is high as compared to women living in rural communities (Sathar, 1988).

The fertility rate is high and literacy rate is low with poor economic conditions leading to adverse health issues which are mortality and morbidity especially among women and children because they are more vulnerable to the poor health. This era is the era of advanced science and technology but still Pakistan has high morbidity and mortality among children, infants and mothers. The ratio

of women's death during pregnancy in Pakistan is 1/80. The population which has access to health facilities among them 40% of pregnant women suffers from anemia (Safdar, Inam, Omair, & Ahmed, 2002).

Need of Research on Community Context:

There are several theories which show how community level factors affect the decision of a couple for spacing between the births, until recently different studies of birth spacing have focused on the determinants of both individual level and community level. These determinants are residence, female literacy level, community poverty level (McGuire & Stephenson, 2015).

1.2: Background of the Study:

Health is a basic need and right of every human being. Every state is responsible to provide this basic need to all of its citizens. The population of any country is categorized into three main groups' "high income, middle income and low income" group. Income is directly or indirectly associated with heath in two main ways. First one is the effect of income on health by compulsory material conditions which are required for human survival; secondly the effect of income on social participation of an individual and to provide opportunity to control the circumstances of life. Some health opportunities are provided publicly to communities but the individual's income is important for health (Marmot, 2002).

Birth spacing, maternal health, child mortality and nutrition outcomes are concerned issues of the world especially for the poor and developing countries all around the globe. The United Nations started focusing on maternal health and child health in the late nineties because more than half of the population in developing countries was living in poverty. They established millennium

development goals in 2000 for 15 years to target these public health issues. Later on, they targeted these public health issues under sustainable development goals (Organization, 2015).

Birth spacing is directly connected to the health of the child and mother; short birth intervals affect the child's health. Short birth spacing is one of the main reasons for malnutrition among children. There are several individual and community factors which influence the birth spacing (Aychiluhm, Tadesse, Mare, Abdu, & Ketema, 2020)

1.3: Significance of the Study:

Family planning, maternal health or women's reproductive health, child mortality are important components of MDG's and SDG's and these are considered as key indicators of any socio-economic status of any country and birth spacing has high influence on the health outcomes (Perroy, 2015). Despite having a good level of health interventions the state is unable to attain the maximum level of maternal and child health. This study will help the policy makers to improve the family planning programs for the future.

1.4: Research Question:

To examine short birth intervals in Pakistan, the study hypothesizes that individual level and community level factors may play a role. As such the study will address the gap in literature by examining the association between individual, community level and short birth interval. The research questions guiding this study "are individual level and community contextual factors influence short birth interval in Pakistan?"

1.5: Objective of the Study:

The aim of this study is to identify the individual level and community level factors which influence short birth interval among married women across different income groups in Pakistan.

1.6: Hypothesis:

The following hypothesis is tested in this study

- Individual level factors such as; mother's education husband's education, mother's age, contraceptive and wealth influence short birth interval in Pakistan.
- Community poverty level and residence (Urban/Rural) influence short birth interval in Pakistan
- Community contextual attribute like female literacy level influence short birth interval in Pakistan.

Chapter 2:

Literature Review

"Maternal health" and "child health" is one of the longstanding issues and challenges of developing countries and low income countries. Currently, preceding birth interval and maternal health is getting a lot of attention from policy makers and researchers. If the birth spacing interval between the children is shorter than it has adverse effects on both maternal health and the health of the child (Norton, 2005). Children born after interval of 24 months are consider as at high risk of mortality. Almost 1 in four birth occur after an interval of 24 months. The regions with highest percentage of SBI are central Asia 33%, Yemen 42% and Zimbabwe 11% (DHS Report 28).

Access to hospitals during pregnancy and care for prenatal and postnatal care is a challenge for maternal health. This access problem can be caused by several factors like poor roads, poor infrastructure of hospitals, poor income to fulfill required facility in 1980 researchers pointed out that policies are on maternal and child health only focus on child health, breastfeeding, oral rehydration and immunization of children for different diseases but they ignored the maternal health which lead to many maternal mortalities; to cope with this challenge in 1987 the safe motherhood conference took place in Nairobi. World leaders took initiative to reduce the maternal deaths in poor countries globally (Brunson, 2018).

Government initiates different health programs to ensure the health of the female population. Above all these health programs provide health education which is considered as important especially for those women who are in their pregnancy period. Importance of health education of pregnant women is for their behavior towards the utilization of health care facilities properly to

gain possible benefits for healthy pregnancy. Education has a high influence on women's health and it plays a vital role in strengthening the program (Raghupathy, 1996).

Pakistan is one of the developing states of south Asian countries. It is considered the 5th most populous state globally. In 2019 the overall population of Pakistan was 216.6 million. Current yearly "fertility rate" of Pakistan is 3.8. According to this fertility rate every woman has at least 3.6 children in 2017 in Pakistan. In Pakistan around 276 women die per 100,000 during births. A study was conducted in Karachi; according to the study the average age of women who give birth for the first time is 22.8 in Pakistan only 34% of the total population is using different kinds of family planning (Nausheen et al., 2020).

2.1: Family Planning Program:

Rising population is one of the severe concerns of world which is one of the big hurdle for the growth of economies. For the betterment of nation and for worlds better future family planning is considered as very important step. In old ages for spacing between children old method was used and in nineteenth century modern "family planning" method was introduced for population control. The initiative for family planning was taken in 1916 in American capital. They established clinic for birth control (Fischler, 1998). Health professionals introduced two methods to control the births with the help of different organization which provided funds for the advancement of family planning program. The advanced methods were "oral contraceptive and plastic intrauterine". After the mid-century these international aid agencies provided enough funds to establish these family planning centers all around the world. In the early 1990s these family planning centers were established in around 115 countries all around the globe which helped poor and middle income countries to reduce half of their fertility rate (Miller & Babiarz, 2016).

Family planning programs play a vital role in mother's health, newborn and child health by improving the nutrition status in mothers by reducing short birth spacing and promoting long spacing interval between children. The evidence from all around the world shows that Family planning programs have improved the preceding interval between pregnancies which directly improved the health of mother, child and the nutrition level among them. The improvement of nutrition level by family planning program is not the result of one episodic process. It is a regular course of limiting and spacing the birth of children (Rana et al., 2019)

Pregnancies at early age happens to the women who get married at an early age when they are physically not capable of bearing a child. To hold up these pregnancies until women are prepared both mentally and bodily, family planning programs provide guidance. Inadequate spacing due to consecutive pregnancies decreases the level of macro and micro nutrients in women because of the lactation process (Knodel & Hermalin, 1984).

There are two kinds of contraception methods mostly used in Pakistan first "traditional contraception method" second "modern contraception method" where use of modern contraception is higher (Azmat et al., 2016). Around 25% of the total population is using "modern contraception method" while only 9% of the total population is using "traditional methods of contraception". A study has been conducted in Pakistan whose results showed that pregnancy interval is highly influenced by the desire of having a high number of sons. The study revealed that the women who have no son or less than desired sons have spacing less than 18 months or 24 months between pregnancies (Nausheen et al., 2020).

In the late 1970s the experiment was conducted to understand how contraceptive use affects the birth spacing and fertility rate. The experiment was conducted in district Matalab of Bangladesh.

Around 141 areas have been selected within the district for experimental purpose. They used lady health workers to give awareness about reproductive health and give awareness about the required supplements during pregnancy. It was mandatory for health awareness providers to visit the women who belong to the reproductive age group. The provision of cost-free contraceptive, prenatal and postnatal care awareness was part of this experiment. There was a sharp decline in fertility rate in the first two years of the experiment. Different reports showed there was a 25% decrease in "fertility growth rate". It remained decreased for the next whole decade. It decreased the "number of ever born children" from 1 to 1.5 kids. The results also revealed that the provision of these services also showed a positive effect on spacing time. It increased from 8 to 13 months between children (Miller & Babiarz, 2016).

During the era of Islamic revolution, the people of Iran were not allowed to use any family planning procedure of any artificial contraceptive to avoid child bearing. Later on in late 1980 the government of Iran allowed it's already existing reproductive health workers to provide awareness to people to use family planning. The study on the family planning program was conducted in Iran whose results showed the sharp decrease in fertility rate in late 1980s and early 1990s. The results showed that the number of children decreased from 7 to 2. As a result of the family planning program the decline in fertility rate occurred was 4 to 20 percent (Salehi- Isfahani, Abbasi-Shavazi, & Hosseini- Chavoshi, 2010). Pakistani society is a male dominating society where crucial decisions were made by the head of the family. And the decision of conception of the child is also the decision of male partner. The behavior of men towards contraceptive use affects fertility rate. In the late 1970s the "fertility rate" in Pakistan was very high; it was 6.3 and it dropped to 4.3 in 2000. The level of contraceptive use in the 1970s was 14 percent and later in 2000 the use of contraceptive increased up to 28 percent (Kiani, 2003).

2.2: Short Birth Spacing and Maternal Health

Poor birth spacing has adverse maternal health outcomes, Complications in pregnancy are one of the leading causes of maternal deaths in the world. 529000 mothers die every year all around the world (Mumtaz, Salway, Shanner, Zaman, & Laing, 2012).

According to world report (2010) of world health organization 1/4 portion of total maternal mortalities is caused by bleeding during child birth and after child birth, and around 12% of maternal mortalities all around the globe are caused by unsafe abortions (Organization, 2010)

The risk of dying from pregnancy was high among poor nations. Around 500000 women die around the world and half of the deaths occur in SSA countries due to complications in pregnancies (Alvarez, Gil, Hernández, & Gil, 2009).). In 1990s there was appreciable improvement in demography of Pakistan. In early 19980 the fertility rate of Pakistan was around 6.the average of children number was around 6 later on it was reduced to 4.1. According to the report of NIPS 2001 average children per woman decreased to 4.1 because of the improvement in health in the 1990s. Other factors also played an important role in decrease of fertility rate in Pakistan these factors are "rise in age of women at the time of marriage", increase in use of "contraceptive", "ending of unwanted pregnancies". According to the report of NIPS 2003 around 28 percent of all the pregnancies are unwanted pregnancies. According to this report around 890000 abortions took place in 2002.every year around 29 out of 1000 women of age group 15 to 49 do abortions (Arif, 2004).

A cohort study has been conducted in Latin America which compared the women who conceived after 18-23 month of previous childbirth with women who conceived after 6 months of child birth.

The comparison showed that the women who conceived after 6 months of previous pregnancy are at high risk of death (Conde-Agudelo, Rosas-Bermúdez, & Kafury-Goeta, 2007).

Maternal health is highly influenced by poor spacing between pregnancies which also causes the nutrition depletion among mothers. The risk of maternal mortality rises 150% if the spacing between two consecutive pregnancies is 6 months. Mothers who have pregnancy intervals shorter than or equal to two years are two times at high risk to suffer from "anemia" for the upcoming pregnancies. It can also cause iron store depletion among mothers. In poor income countries women who have short spaced pregnancies do not visit hospitals for antenatal care. It is freely provided by the government. It is very difficult to monitor the pregnancy and its complications for those women who don't visit hospitals (Nausheen et al., 2020).

Family planning programs are introduced to improve the birth spacing issues all around the globe. To quantify the relation between health and birth spacing, very little work has been done. The time period between pregnancies either they are short time intervals or long time intervals they have high risk or increase risk of perinatal outcomes such as premature child birth, low birth weight, small gestational age, perinatal death (Whitworth & Stephenson, 2002)

Birth spacing is considered as the preventive measure for these adverse outcomes mostly in developing countries. If the interval between pregnancies is 6 months or is less than 6 months is considered as highly risky and if the interval between pregnancies is 50 months or greater than 50 months is also considered as highly associated with high risk of adverse perinatal outcomes (Chungkham, Sahoo, & Marbaniang, 2020).

To reduce maternal deaths during pregnancy WHO recommends at least four visits to hospital before child birth. Globally only 64% of pregnant women receive antenatal health care.52% in sub Saharan African countries and 46% in south Asian countries (Bhattarai, 2019).

Short birth intervals lead to nutrition depletion. If the nutrition status is poor among mothers, this leads to unfavorable birth outcomes. There is a complicated association between birth outcomes and health of mothers because other socioeconomic factors affect the nutrition status among mothers. The nutrition's which are commonly associated with birth outcomes are proteins, necessary fatty acids, most importantly omega-3 fatty acids, iron, calcium, vitamin C and other multi nutrient supplement (Abu-Saad & Fraser, 2010).

The study was conducted in India in 2016 for the last decade. The results of the study showed the consequences of short birth intervals between pregnancies on the health of the mother. According to the estimated results, the women who have a short birth interval between pregnancies suffer from underweight and anemic issues. According to WHO, 35% to 75% pregnant women in poor countries suffer from anemia. And the prevalence of anima is higher among south Asian women as compared to other regions (Suryanarayana, Santhuram, Chandrappa, Shivajirao, & Rangappa, 2016)

Maternal mortality is one of the adverse outcomes of short birth spacing. To reduce this issue world leaders agree to MDG's in 2000 they fixed target to reduce it up to 75% till 2015 later on they established SDG,s to reduce the numbers of deaths (Koblinsky, Anwar, Mridha, Chowdhury, & Botlero, 2008).

2.3: Birth Spacing and Child Health Outcomes:

The health of a child is directly or associated with a mother's wellbeing. If the mother is healthy it means, there is low risk of poor outcomes of child health. Risk associated with childbearing is high in developing countries. Spacing helps to avoid maternal deaths related to abortion complications (Kozuki & Walker, 2013).

In the last twenty years there was huge progress in two important areas in Pakistan. They are social and demographic improvements. These two socioeconomic and demographic improvements are in "poverty" and "fertility transitions". In the 1980s there was a boost in the agriculture sector which reduced the rate of poverty. The reason for the decline in poverty rate is international remittances. Later on in the 1990s the inconsistency in the production side of the agriculture sector again increased the poverty and policy makers failed to establish any policy to safeguard the "real income" of the most vulnerable group of people to the prices of basic necessity goods. There has been a sluggish decline in fertility rate in Pakistan for the last two decades. Because of this decline there is reduction in child mortality in Pakistan. According to the World Bank there is improvement in prevalence of nutrition status among children in Pakistan (Arif, 2004).

For child health, a mother's nutrition's level play vital role. Nutrition is related to birth outcomes. If the nutrition status is poor among mothers, this leads to unfavorable birth outcomes. There is a complicated association between birth outcomes and health of mothers because other socioeconomic factors affect the nutrition status among mothers. The nutrition's which are commonly associated with birth outcomes are proteins, necessary fatty acids, most importantly omega-3 fatty acids, iron, calcium, vitamin C and other multi nutrient supplement (Abu-Saad & Fraser, 2010)

In developing countries low birth weight among infants leads to high infant and child mortality. Low birth weight has been defined as a birth weight of an infant less than 2500 gram by the World health organization. World health organization categorized low birth weight in to further categories low1500gms-2500gms, very low1000gms-1500gms and extremely low <1000gms birth weights (Sharma & Mishra, 2014)

The countries with high population rate and high level of poverty face adverse consequences of poor spacing on the health of children. In India short birth spacing is considered a major health issue. Because of short birth spacing there is adverse effect on the health of the child. According to the study conducted in India around 35% of children are underweight while 38% children suffer from stunting and remaining 58% of children are anemic. The child who is premature at the time of birth has higher risk of death as compared to the child who is a full term infant (Rana et al., 2019).

The adverse outcome of short birth spacing between children is child malnourishment. Malnourishment is also caused by poor intake of required food. Children who belong to poor families who have very low income and cannot afford enough food are at higher risk for malnutrition. According to the report of the World Bank in Pakistan there is a positive relation between poverty and child malnutrition (Arif, 2004).

The attitude of the family and the couple towards the pregnancies highly affect the health of the child. High fertility rate and small birth interval are considered as the most influencing reasons for infant mortality and child mortality. in poor and middle income countries. In poor and middle income countries around 35% of children below die while in high income countries only 1 percent of children below five die. Half of the children die in the first month of their birth in poor and

developing countries. In 2000 around 27% of children died in the first month of their birth in India. Households with many kids have a strong relation with short birth spacing and its consequences. The conception of the next child depends upon the survival of the preceding infant. If the child dies, then the couple won't take a long time to conceive their next pregnancy. Conception of a child to replace the previous dead child provides a short time period for the mother to heal from a previous pregnancy. There is another reason that mothers stop lactating their previous child to conceive sooner. This can increase the risk of mortality for the succeeding child. So the households which are more exposed to this problem get trapped in a death trap. It creates a high risk of death within the household (Bhalotra & Van Soest, 2008).

The intensity of the relationship between "child mortality" and "short birth spacing" is caused by the different factors. The survival chances of the child and the birth interval between two consecutive and successive live births is reduced by the birth of a premature child. When there is no presence of statistical control for this type of premature births, this shows that there is direct association between the short "preceding birth interval" and Childs prematurity with child casualty (Manda, 1999).

2.4: Factors Influencing Birth Spacing:

According to a study conducted in India; there are several factors which influence birth spacing directly or indirectly. According to the study, maternal education has a higher influence on the interval of birth spacing. Mothers with secondary education have a high birth interval between two successive and consecutive live births as compared to the mothers whose education is less than matriculation. Infant mortality and the gender of the previous child also has a high influence on birth spacing because after a short time period of the infant's death another pregnancy starts so it

increases the time interval. If the previous child is male then the interval between the births is higher as compared to the previous child female (Gyimah, 2005).

There is a high influence of the age of women on birth spacing. Several studies found that women of younger age have shorter birth intervals between consecutive live births as compared to the women who are older. According to the report of Ethiopia demographic health survey 2005, with increase in maternal age the median month interval also increases. With the increase in the age of women the proportion of women who prefer short birth spacing and the proportion of women who prefer long birth spacing rises. The reason for young women to have short birth spacing may be due to several reasons like early building a family process. Women of older age are more interested in achieving "desired family size". Women of older age are more likely to be less fertile which leads to higher birth spacing between pregnancies (Yohannes, Wondafrash, Abera, & Girma, 2011).

Breastfeeding highly influences the spacing between the pregnancies. It is also considered a natural contraception method to avoid child bearing. Mothers who don't breastfeed their child are at high risk of having short birth spacing between pregnancies. Sometimes due to illness of a child or mother they avoid breastfeeding. The babies who never breastfeed are at high risk of mortality before reaching age of 5 the biases caused by the prematurity is ignored because it is considered rare. Sometimes the spacing between pregnancies becomes shorter because parents intentionally want to conceive a new child to replace the dead one. The children who have a short time period of breastfeeding are considered as more vulnerable to the different diseases caused by contaminated water. Several studies have shown a positive relation of child survival, better preceding birth interval and breastfeeding (Manda, 1999).

The study has been conducted in Ethiopia among all respondents; only 762 women heard about having optimal birth spacing between births. Only 31% of the women have awareness of spacing between live births and showed the highest level of birth spacing which was 36 months between live births. The age of the mother is considered as one of the most influencing factors for birth spacing among Ethiopian women. According to the study 57% of the women in African countries who belong to the reproductive age have birth spacing shorter than 33 months. Education level of women plays a vital role in the improvement of birth spacing. It influences different factors of social life. According to the report of demographic health surveys, un-educated women in 38 out of 51 countries have less than 33 months of birth spacing between live births as compared to the educated women. Sometimes women who are highly educated have a short time interval between pregnancies to be part of non-child bearing activities (Yohannes et al., 2011).

In Zimbabwe and Uganda women have high birth spacing who are living in communities with high mean maternal age, age at the time of marriage and mean parity while the communities where the level of contraceptive is high and the communities where the low level of unmet contraceptive need have short birth intervals. The behavior of people has high influence on the different variables of community variables like fertility, gender norms, and family planning behavior which influence the birth spacing outcomes. Income of the individual or the women of wealthier communities prefer to use modern contraceptive as compared to traditional methods (McGuire & Stephenson, 2015).

There are huge differences between urban women and rural women. As compared to urban women, there is less probability for rural women to have a birth spacing greater than five years. According to the reports of demographic health surveys in 51 out of 55 states, women who were living in rural areas have shorter birth spacing between pregnancies than three years as compared to the

women who were living in urban areas. According to the study conducted in Ethiopia the women who were living in rural areas had 2.66 times more chances to have a short birth interval which is less than 3 years between pregnancies as compared to the women who were living in urban areas. The median birth interval for women living in urban areas is 4 months greater than rural areas. Women living in urban areas have better access to health facilities; they have better social services, better access to information, education and other better living opportunities. These opportunities create variation between women living in urban and rural areas (Yohannes et al., 2011).

According to the study conducted in Iran, the rural areas showed two major relations between birth spacing interval and socio demographic variables. First, the risk for child death rises as the interval between two live births is shorter than the recommended spacing time interval. Second, the death of a child automatically decreases the spacing time period. The Latin American center for perinatology and human development observed millions of pregnancies in over 19 different states. The researchers observed women who had a birth interval greater than 2 years. They observed the pregnancy interval of 27-30 months has a positive association with "toxemia, anemia and trimester bleeding". The results also showed that the women who have spacing of 27-30 months are at lower death risk as compared to the women who have spacing of 9 to 14 months between pregnancies (Fallahzadeh, Farajpour, & Emam, 2013).

Pakistan is a developing country with a high population and poor economic conditions where the ratio of women's death during pregnancy in Pakistan is 1/80 while in the developing countries it is 1/61. In industrialized countries it is 1 out of 4085. Among four provinces Sindh is the second most populous province in Pakistan where the women living in backward areas have less access to health care and family planning facilities. In this province about 40 % of pregnant women suffer from anemia (Midhet, Becker, & Berendes, 1998).

Several studies showed that early marriages increase the time period of conception because it provides less time for schooling and other job facilities. The median interval for birth spacing is 1 month shorter for the women whose age was equal to 18 are above 18 at the time of marriage; as compared to the women whose age is less than 18 at the time of marriage. The reason behind the difference could be the access of these women to the information and the knowledge of family planning for birth spacing between pregnancies (Yohannes et al., 2011).

Two third of Bengali women who are married at the age of 18 had their first delivery at the age of 18 and the birth interval of these young women was just 27 months. Huge differences were noticed between different socioeconomic groups. Women living in poor communities with low income and less education were more likely to have short birth intervals. The birth interval is highly associated with the survival of the previous child. According to a DHS report of 2011 the median birth interval was 15 months shorter for those children whose previous sibling died as compared to those whose previous sibling is alive (De Jonge et al., 2014).

The study was conducted in 1988 in Pakistan, according to the study women living in urban areas have shorter birth intervals as compared to the women living in rural areas, while the educated women have shorter birth intervals between the children than those of uneducated. Those who use the contraceptive have a longer birth interval than those who never used any contraceptive (Sathar, 1988)

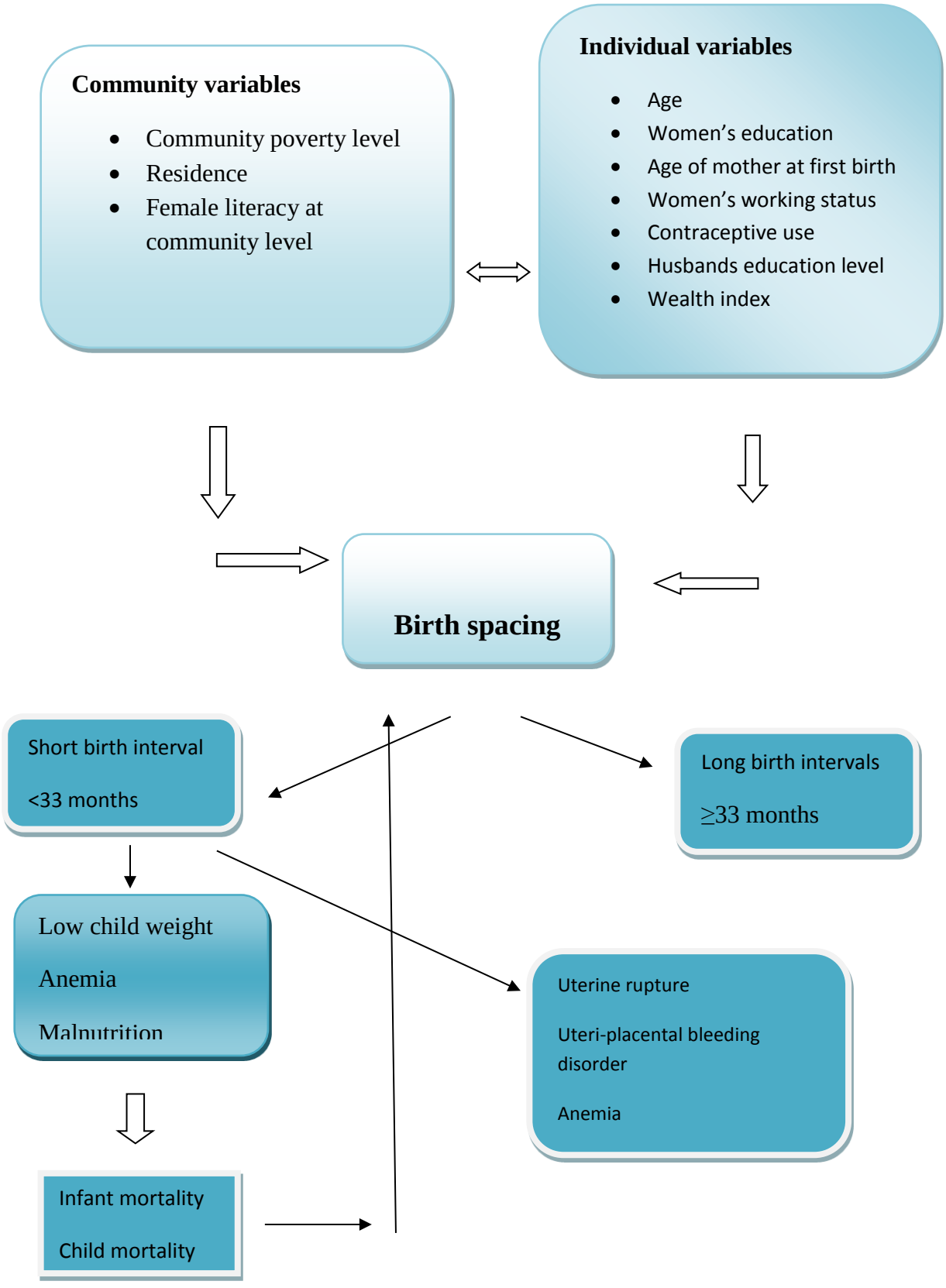
There is a huge difference between the living style between poor and rich communities. Women who belong to rich communities are more flexible towards the long birth spacing between children as compared to the women of poor communities because women who belong to the rich community can afford the higher education and they have more exposure to the knowledge of birth

spacing and knows the benefits of having small family size. According to the 2002 report of Bangladesh, women from urban areas have higher birth spacing as compared to the women of rural areas. The reason for long births among urban women is their access to better education(Khan, Bari, & Latif, 2016).

2.5: The Framework of the Study:

The theoretical framework of the study presented in fig 1.1 shows the path ways of cause of birth intervals. This study will try to understand the path through which birth spacing cause at different levels

Fig1.1: Theoretical Framework, The Path Way of Birth Spacing and its Consequences



2.6: Research Gap:

It is understood fact that the short birth interval has adverse impact on child health and maternal health. The researchers have given the importance to the association between birth spacing and child health outcomes but some have looked at the community factors influencing birth spacing. None of the study is conducted on National level PDHS data to determine the factors which influence birth spacing. A multilevel analysis makes this study unique by identifying Community level factors which influence Short Birth Spacing.

Chapter 3:

Data and methodology

3.1: Data:

The study uses the secondary data from Pakistan demographic health survey 2017-2018 conducted by national institute of population studies under ministry of national health services in collaboration of United States agency for international development, department for international development and united nation population fund. This is forth survey conducted by the Pakistan demographic health survey and followed survey by 1990-1991, 2006-2007, 2012-2013. It includes 580 clusters and each cluster has 28 households. By using equal probability systematic selection process is used for sample selection. A sample size of 16240 was selected but due to some problems the data has been collected from 15661. It covers almost all the health indicators of SDG's.

3.2: Population Characteristics:

The PDHS data for 2017-2018 has selected total number of 77818 populations as sample size. There were 51% of female and 49% male while 30% of the population was less 15 age. For this analysis the women of age group of 15-49 are interviewed. More than 60% of the population was from ruler areas. There were 49% ever married women who were educated while 25% were ever married educated male.

3.3: Study Population:

The sample population for this study includes all women who had at least 2 children with in five years before conducting survey. Women in sample are nested in 580 clusters across the country.

Total This study population excludes those who are from AJK and Gilgit Baltistan and female respondents who has no birth or only one birth in five years before survey. Thus the current analysis base on female respondents with non-first births with five years preceding the survey with a complete set data.

3.4: Methodology:

This study has well established methodology for achieving the objectives of the research and will help to explore the different factors which are associated with the outcome variable. To determine the association between community level variables and outcome variable a multilevel analysis is required because community variables are constructed by aggregating the individual level variables for each PSU which cannot be analyzed by using simple logistic regression. A multilevel analysis methodology will be used after calculating ICC for null model.

3.4.1: Multilevel Analysis:

Multilevel analysis is used to examine relation between the variables measured at different levels of multilevel data structure. The fundamental principal for the qualification of multilevel analysis in research is the value of ICC score. ICC is calculated prior to fitting a multilevel model and if the ICC score is positive different from 0 then a multilevel is appropriate method. The ICC score in this study is 6% and thus the using multilevel becomes necessary to gauge the impact of contextual factors affecting our variable of interest.

That multilevel data is complex at different levels. Unit of analysis is the lowest level of hierarchy. Which is nested in different upper levels like household and communities. For example, members in household, students in class, staff in office. Nested and complex data is used to understand the fact that each level of nesting data is related to the variability which has different explanation.

Multi-level analysis refers to differences within the groups and between the different groups. This approach gives the differences between the individual level effects and aggregate effects at higher levels of nested data (Snijders & Bosker, 2011).

3.3.2: Unit of Analysis

The unit of analysis is woman, age 15 to 49. Selecting this age group for this study is because for women of this age group is consider as reproductive age group and women of this age are more vulnerable to pregnancies and its outcomes.

3.3.3: Multilevel Analysis to determine the Influence of Community Factors on Birth Spacing.

Multilevel analysis is also called hierarchical linear modeling or linear mixed modeling. Multilevel techniques are established to avoid errors by using different inappropriate models by analysts. Multilevel analysis identifies the factors that influence the outcome variable at different levels for the purpose of multilevel analysis logistic model will be used because the dependent variable is a binary variable. For data analysis the inter birth intervals will be analyzing descriptively to understand their distributional features (Rice & Jones, 1997).

In order to determine the influence of independent variables on binary outcome variable the multilevel logistic model will be used. The data is in nested form; STATA will be used for the procedure.

3.3.4: Variables:

For this study we will categorize the independent variables in to two groups, individual level groups which will show only individual level characteristics while community level variables will show the characteristics of different communities in which an individual is living.

Dependent Variable:

This study will examine preceding birth intervals as dependent variable at individual level and community level. Preceding birth interval is defined as "the time interval between two live births"(Shifti, Chojenta, G. Holliday, & Loxton, 2020). The dependent variable is further categorized in to two groups by using WHO recommendations

1) <33 months which is considered as short birth spacing

2) ≥33 is considered as appropriate birth spacing or long birth spacing.

Birth spacing or birth interval is binary outcome variable because it is divided in to two groups according to world health organization. The recommended categories are as following

"Short birth interval (1) = if the inter birth interval is <33 months"

"Long birth interval (0) = if the inter birth interval is ≥33 months"

Independent Variables

The independent variables are defined from literature

Community Level Variables:

Many different contextual associates have been huddle together to analyses the socioeconomic and demographic characteristics that influence short birth interval in a given community. The community indicators were generated by taking aggregate at PSU level. The process of combining

individual level data to generate group variables is an established practice to generate high level variables. (Yohannes et al., 2011)

Community Poverty Level:

The DHS community indicators were generated by aggregating individual level survey responses to PSU. The behavior of an individual is effected by the common characteristic of the community. studies show that the communities where there is high concentration of wealthier household shows positively effect on short birth interval. Likewise, the communities where there is high concentration of poor household show negative impact.

For this research community poverty level is generate by the aggregating the individual respondent data at PSU level and then categorized it in to "low" "medium" and "higher" level of poverty in community (Ayane, Desta, Demissie, Assefa, & Woldemariam, 2019).

Residence:

Residence of an individual highly influences the birth spacing between pregnancies. The women who live in rural residence have less knowledge of family planning programs because the women who live in urban areas have better access to the job opportunities and they have better exposure to the information about the family planning programs. The variable is selected at PSU level and categorized in to urban and rural residence(McGuire & Stephenson, 2015).

Community Female Literacy Level

This variable offers comprehensive information about female literacy at community level. This variable has been generated by aggregating the selected attributes at cluster level and then divided in to appropriate categories. In case of female literacy, respondents "who can read and write a

sentence" has been selected at PSU level and then categorized in to "low" "moderate" and "high" proportion of literacy in a community. (Khan et al., 2016)

Individual Level Variables:

Maternal Education Level:

The education level of women has strong association with birth spacing. The women who have high education can easily communicate their desire of spacing with their partner. This variable has been constructed from DHS questionnaire. This variable has 4 categories coded as 1 "no education" 2 "primary education" 3 "secondary education" 4 "higher education" (Kaggwa, Diop, & Storey, 2008).

Maternal Age at First Birth:

Age of mother at the time of first birth is strong determinant of birth spacing interval. Because the women whose age is less than 18 have less knowledge of family planning programs. this variable has been constructed from DHS questionnaire. It has been coded as 1 "age below 18" 2 "age equal and above 18" (Yohannes et al., 2011).

Respondent Working Status:

Working status is closely associated with the birth spacing. The women who are working utilize the family planning programs to continue their jobs and they have better knowledge of family planning program. They want to utilize the family planning services to avail the better job opportunities in coming future. This variable has been constructed from DHS questionnaire. it is coded as 1 "working" 2 "not working" (Antai, 2009).

Respondents Age Level:

Age of the respondent plays vital role in association with birth spacing. It is the self-reported age of the respondent at the time of the survey. It has been constructed from DHS survey questionnaire. It is categorized in to three years' age group. 1 "lower age group" 2 "middle age group" 3 "upper age group(Antai, 2009)

Contraceptive Use:

The use of contraceptive strongly influences the birth interval. this variable has been constructed from DHS questionnaire. 1 is coded for "yes" and 0 is coded for no contraceptive use (Aychiluhm et al., 2020).

Husband's Education Level:

Education level of male partner has significance association with family planning program and birth spacing. Husband education level has positive impact on birth spacing; better education makes them better to understanding the need of family planning when they have better exposure of knowledge and small family size. This variable has been constructed from DHS questionnaire. It has 4 categories coded as 1 "no education" 2 "primary education" 3 "secondary education" 4 "higher education"(Sobhan, Hasan, & Hossain, 2018)

Wealth Index:

Basically wealth index has five wealth quintiles. Poorer, poor, middle, rich and richest. wealth is very important socio economic indicator of living status of population. For this research This variable is generated wealth index with three wealth quintiles at household level. The quintiles are Poor, middle and rich; combined poorer and poor category and named it as "poor" while combined richest and rich category and named it as "rich" (Khan et al., 2016).

3.3.5: Estimation techniques:

To estimate the outcome variable at two levels individual level and community level we will use multilevel logistic regression model because the outcome variable is categorical variable with 0 and 1, it will be 1 if the inter birth interval is <33 months and will be 0 if inter birth interval is ≥33 months.

For multilevel logistic regression model following steps will be used

3.3.6: Null model:

The very first step of any estimation is to establish the null model which has only intercept with no predictors

a. if there is no predictor at individual level

$$logit(Y_{ij}) = \left[\frac{\tau_{ij}}{1-\tau_{ij}}\right] = \beta_{0j} + r_{ij} \text{ ..... (1)}$$

b. if there is no predictor at community level

$$\beta_{oj} = \gamma_{00} + u_{0j} \text{ ..... (2)}$$

Substitute equation (2) in equation (1)

$$logit(Y_{ij}) = \gamma_{00} + u_{0j} + r_{ij} \text{ ..... (3)}$$

τ_{ij} = probability of having short birth interval

Y_{ij} = dependent variable (short birth spacing which is less than 33 months = 1)

β_{0j} = mean outcome for community j

r_{ij} = level 1 random error; assumed to be normally distributed

γ_{00} = grand mean

u_{0j} = is the random effect associated with community j; normally distributed.

This model is used to check if the grouping variable at level 2 significantly affects the intercept of the dependent variable at level 1.

Equation 3 doesn't explain the variance in variable y for this purpose we will use interclass correlation

$$ICC_{logit} = \rho = \pi_{00}/(\pi_{00} + \frac{\pi^2}{3}) \text{ ..... (4)}$$

If inter Class Correlation is close to "0" then ICC is insignificant, hence no multilevel modelling is needed.

3.3.7: Individual level model (Level 1)

$$logit(Y_{ij}) = \left[\frac{\tau_{ij}}{1-\tau_{ij}}\right] = \beta_{0j} + \beta_{1j}X_{ij} + r_{ij} \text{ ..... (5)}$$

Y_{ij} = dependent variable for ith level-1 unit within the jth level-2 unit

X_{ij}= value on the level-1 predictor in j community

β_{0j}= intercept for the jth level-2 unit,

β_{1j}= regression coefficient associated withX_{ij} for the jth level-2 unit

r_{ij}= random error with the ith level-1 unit within the jth level-2 unit.

3.3.8: Community level model (Level 2)

$$\beta_{0j} = \gamma_{00} + \gamma_{01}w_j + U_{0j} \text{ ..... (6)}$$

If $\beta_{0j} = \gamma_{00}$ than

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + U_{1j} \text{ ..... (7)}$$

β_{0j} = intercept for jth community

β_{1j} = slope for jth community

W_j = Level 2 predictor in jth community

γ_{00} = Over all mean intercept adjusted for W

γ_{10} = Over all mean intercept adjusted for W

γ_{01} = Regression coefficient of W in relative to level 1 intercept

γ_{01}= Regression coefficient of W relative to level 1 slope

U_{0j} And U_{1j} are random effects of jth level 2 unit adjusted forX_{ij}.

3.3.9: Combined model (individual and community model):

$$logit(Y_{ij}) = \left[\frac{\tau_{ij}}{1-\tau_{ij}}\right] = \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}W_j + \gamma_{11}W_jX_{ij} + U_{1j}X_{ij} + U_{0j} + r_{ij} \text{ ..... (8)}$$

By substituting equation 6 and 7 in equation 5 we get combined models. This model includes all the level 1 and level 2 predictors (X_{ij} and W_j) cross level terms (W_jX_{ij}) and combined error term($U_{1j}X_{ij} + U_{0j} + r_{ij}$). This model is mix model as it is composed of fixed and random effects.

Equation 8 shows only one variable for each level, however, this model will be extended by including all the variables of interest while performing data analysis in the STATA 15.0

Variance inflation Factor (VIF) is run to check Multicollinearity in the model. If the mean VIF score is <5 the variables are presumed having no multicollinearity, however if the VIF is between 5-10 multicollinearity exists, and the model needs readjustments, to similarly to verify if the fitted models have statistically significance this study employs Wald X^2 test. If the $p<0.05$ models are considered to have statistically significant and if the $p>0.05$ the models are not significant.

The comparison of odd ratios will be used for this analysis in three models Model 1, Model 2, and Model 3, reference categories are used. The first category is selected as reference category in STATA and by default this category are naturally omitted by software. The odd ratios of reference category is assigned value 1 as base level and based on this value rest of the categories are analysed

and discussed. Odd ratio is drawn by the percentage increase and decrease in the categories of the variables.

Given the base level as 1, odd ratio is converted to percentage increase or decrease using relationship:

$$(OR-1)\ x100 \ldots\ldots\ldots\ldots\ldots\ldots\ (A)$$

Where, OR=odd ratio,

1= is base level value of the reference category

If OR>1; = there is percentage increase and

If OR<1; = there is a percentage decrease.

Chapter 4

Descriptive Analysis

Descriptive analysis of the data will help to describe and summarize the data. It will show the patterns might emerge from the data. The purpose of descriptive analysis is for two main reasons; first, this basic analysis will provide some basic information about the variables in the data set while second purpose of descriptive analysis is to show the relationship between the variables.

4.1: Summary Statistics of Dependent Variable.

The table of summary statistics of the dependent variable has two groups. “long birth interval” and “short birth interval”, long birth interval is a group of women whose average birth interval is greater than 33 months. while “short birth spacing” is a group of women whose average birth interval is less than 33 months. Total weighted (n=8999) women gave birth to at least two or more than two children preceding survey. The results of the findings show that 65.54% of the women have short birth interval while 36.46 percent of the sample population has long birth interval.

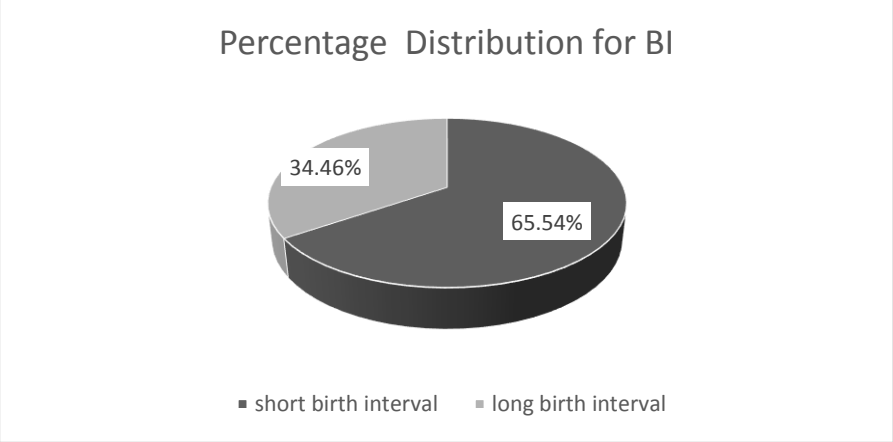


Fig 4.1: Percentage distribution for population sample for BI

4.2: ***Table 1 Univariate Analysis of Individual level factors and Community level factors***

Characteristics	Number of women(n=8999)	Percentage
Mothers Education		
None	4744	52.71
Primary	1,494	16.61
Secondary	1756	19.52
Higher	1004	11.16
Respondents working status		
Currently working	1,665	18.51
Not working	7334	81.49
Husbands education level		
None	3,060	34.01
Primary	1,402	15.59
Secondary	2,928	32.54
Higher	1607	17.87
Respondents age level		
Lower age level	797.62	8.86
Middle age level	3756	41.74
Upper age level	4445	49.39
Respondents age at first birth		
Age below 18	1704	18.93
Age above 18	7295	91.07

Characteristics	Number of women	Percentage
Wealth status		
Poor	3545	39.40
Middle	1861	20.68
Rich	3592	39.92
Contraceptive use		
No	5157	57.31
Yes	3842	42.69
Community Poverty		
Low	4330	48.12
Medium	1664	18.49
High	3005	33.39
Community Literacy		
Low	2456	27.30
Moderate	2974	33.05
High	3,568	39.65
Place of Residence		
Urban	4,356	48.23
Rural	4,633	51.77

4.2: Results of the Association between some important Individual Level Variable, Community Level Variables and Dependent Variables

To check the association between variables and to see clear picture of data distribution. If the variables are independent from each other than chi square test will run for to compare how well the observed distribution of data fits with expected distribution of data. This study will use chi-square test to check the hypothesis about the distribution of frequencies with in different variables and categories.

4.2.1: Table 2: *Chi-square Results for Individual and Community Level Variables*

	Long Birth Interval %	Short Birth interval%	p-value
Mothers Education			0.000
None	33.21%	66.79%	
Primary	35.69%	64.31%	
Secondary	40.80%	59.20%	
Higher	44.07%	55.93%	
Contraceptive use			0.007
Yes	37.24%	62.76 %	
No	34.46%	65.54%	
Husbands education level			0.000
None	33.27%	66.73%	
Primary	29.24%	70.76%	
Secondary	38.66%	61.34%	
Higher	41.34%	63.875%	
Wealth index			0.000
Poor	31.60%	68.40 %	
Middle	33.49%	66.51%	
Rich	41.86%	58.14 %	
Residence			0.000
Urban	39.40%	60.60%	
Rural	32.91%	67.09%	

	Long Birth Interval %	Short Birth interval%	p-value
Community poverty level			0.000
Low	40.29%	59.71%	
Middle	31.00%	69.00%	
High	32.13%	67.71%	
Community literacy level			0.000
Low	31.32%	68.68 %	
Medium	34.45%	65.55%	
High	42.81%	57.19%	

Table 2 presents the bivariate relationship between birth interval, mothers education, contraceptive use, husbands education, wealth, residence of respondent, community literacy level and community poverty level. Chi-square is used to test the distribution of variables differ from each other. Chi-square test results show that p-value for each variable id less than 0.05 which reveal that there is association between birth spacing, mother's education, contraceptive use, husband's education, wealth, poverty and community literacy level. The chi-square results support hypothesis that individual and community level variables have influence on SBI.. SBI decreases as maternal education level increases from no education level to primary, secondary and higher education level respectively. LBI increases with increase of education. These findings shows same outcomes as other studies showed a strong correlation between SBI and maternal education level (Khan et al., 2016). There is no association between BI and contraceptive use. The prevalence of SBI is higher

for those who are using contraceptive as compare to non-users. The finding is in confirmatory with other previous studies that show that there is no association between SBI and contraceptive use (Sobhan et al., 2018). that there is strong association between BI and household wealth. SBI decreases from poor to middle and higher wealth household respectively. The finding is in confirmatory with other previous studies that show that there is strong association between SBI and household wealth.

Chapter 5

Results of the Research Analysis

Bivariate and Multivariate Analysis of SBI for individual and community level associates.

This chapter will discuss the results of both bivariate and multivariate prospective. This chapter is divided in to two sections. In first section will discuss the bivariate analysis results while second section will discuss the multivariate analysis. It includes the application of multilevel modeling which employs multilevel logistic regression for this purpose.

5.1 Bivariate Analysis

Unadjusted logistic regression is run in the first section, and it allows us to analyse association between the outcome variable and a single exposure variable. In this study this technique is used to check the relation between SBI and each individual dependent variable. SBI has been constructed as binary variable. For birth interval less than 33 months is considered as 1 while birth interval more than 33 months is considered as 0. The coefficients measure the strength of each categorical variable in relation to the percentage of SBI. Signs of the coefficient reflect positive or inverse relationship of each variable with SBI. Moreover, the bivariate outcomes are related with the univariate results which attests to the consistency of the result in univariate and bivariate analyses.

Table 5.1 Proportion of short birth interval (SBI) and unadjusted binary logistic regression coefficients showing bivariate relationships

Proportion of short birth interval (SBI) and unadjusted binary logistic regression coefficients showing bivariate relationships			
Characteristics	**P-value**	**Coefficient**	**Confidence Interval (CI) 95%**
Mothers Education			
• None[RC]		-	-
• Primary	0.27	-.109	-.308 .089
• Secondary	0.000	-.315 ***	-.480 -.149
• Higher	0.000	-.439***	-.644 -.233
Respondents working status			
• Currently working[RC]		-	-
• Not working	0.54	-.047	-.199 .105
Husbands education level			
• None[RC]		-	-
• Primary	0.03	.206**	.0167 .395
• Secondary	0.000	-.310 ***	-.455 -.165
• Higher	0.000	-.398***	-.583 -.213
Respondents age level			
• Lower age level[RC]		-	-
• Middle age level	0.000	-.782***	-1.048 -.515
• Upper age level	0.000	-1.34***	-1.59 -1.089
Respondents age at first birth			
• Age below 18[RC]		-	-
• Age above 18	0.41	.058	-.080 .196

(Continued)-Table. 5.1: Proportion of short birth interval (SBI) and unadjusted binary logistic regression coefficients showing bivariate relationships			
Characteristics	**SBI %**	**Coefficient**	**Confidence Interval (CI) 95%**
Wealth status			
• Poor[RC]		-	-
• Middle	0.22	-.100	-.262 .062
• Rich	0.000	-.481***	-.622 -.339
Contraceptive use			
• No[RC]		-	-
• Yes	0.000	.274***	.147 .401
Community Poverty			
• Low[RC]		-	-
• Medium	0.000	.416***	.219 .613
• High	0.000	.358***	.207 .509
Community Literacy			
• Low[RC]		-	-
• Moderate	0.67	- .034	-.196 .127
• High	0.000	-.395***	-.557 .232
Place of Residence			
• Urban[RC]		-	-
• Rural	0.000	.431***	.289 .573

1. *RC: Reference Category*
2. **** p<.01, ** p<.05, * p<0.1*

Table 5.1 shows the proportions of SBI and bivariate relationships between the research variables. Maternal education and SBI have significant relations. With high education level there is improvement in SBI (OR -.439 CI -.644 -.233).

The respondent's upper age level has significant relationship with short birth interval with (OR -1.34 CI -1.59 -1.089). Female respondents' working status and respondents' age at the time of birth have no significant relationship with short birth intervals.

The Respondent's husband's higher education level and short birth interval has significant relationship with (OR -.39 CI -1.59 -1.089) Residence of the respondent is positive and significantly associated with short birth interval (OR .431, CI .289 .573).

The SBI and medium female literacy level are negatively associated with insignificant relationship (OR-.034 CI -.196 - .127) while female respondents who have high literacy level have significant relationship with short birth interval with (OR -.39 CI -.577 -.257)

The association between SBI and community poverty level has a positive and significant relationship with for respondents living in communities with high poverty levels (OR .358 CI .207 .509).

5.2 Multi-Level Logistic Regression Analysis.

Variance Inflation Factor (VIF)

VIF test is run before fitting multilevel logistic model. VIF is calculated to check the existence of multicollinearity among independent variables in regression model. The VIF is mandatory to check whether the independent variables are qualified to include in multilevel analysis. The score of VIF is between 1-10. If the VIF less than 5, the variables qualify to part of regression equation. In this study VIF score is 3.04 which shows that there is no multicollinearity between independent variables.

The results of multilevel logistic regression have two phase. first is fixed effect and second is random effect. three models were constructed to capture the effect of 7 individual and 3 community variables.

Null Model

The multilevel null model is also known as unconditional mean model. This model is used in two level models to find if the variables of higher level or at level 2 affects the mean or intercept of outcome variable significantly at lower level or level 1. Measurements of variations is calculated by using interclass correlation (ICC). ICC is calculated by using community level variance. The ICC value for null model is 0.0645. it recommends that the variation in short birth interval may be blameable for other unobserved higher level characteristics. Hence the value of ICC is positively different from zero this will lead for multilevel modelling instead of any other usual regression (Nkoka, Mphande, Kanje, & Milanzi, 2020).

Fixed Effect

The fixed effect describes results of “binary logistic regression” exbihit fixed effect on SBI

Table 5.2 ***Odd Ratios of Adjusted Binary Logistic Regression Showing Fixed Effect on likelihood Ratio of SBI***

Characteristics predicting Short birth interval (SBI)	Model 1 (Wald X^2 =249.93; P<0.01		Model 2 (Wald X^2 =66.85; P<0.01		Model 3 (Wald X^2 =259.14; P<0.01	
	OR	95% CI	OR	95% CI	OR	95% CI
Mothers' Education						
• None[RC]	-	-	-	-	-	-
• Primary	.895*	.767 1.043			.929	.795 1.087
• Secondary	.764***	.654 .891			.819***	.698 .961
• Higher	.743***	.613 .901			.815**	.668 .995
Respondents working status						
• C. working[RC]	-	-	-	-	-	-
• Not working	.948	.828 1.08			.944	.823 1.082
Husbands education level						
• None[RC]	-	-	-	-	-	-
• Primary	1.174**	.999 1.381			1.182 **	1.005 1.39
• Secondary	.835***	.734 .951			.834**	.733 .950
• Higher	.855**	.731 1.002			.844*	.721 .984
Respondents age level						
• lower age[RC]						
• Middle age	.471***	.385 .576			.474***	.388 .580
• Upper age	280***	.227 .345			.285***	.232 .352
Respondents age at first birth						
• Below 18[RC]	-	-	-	-	-	-
• Above 18	1.419***	1.257 1.602			1.423***	1.26 1.60

Table 5.2 ***Continued Odd Ratios of Adjusted Binary Logistic Regression Showing Fixed Effect on likelihood Ratio of SBI***

Characteristics predicting Short birth interval (SBI)	Model 1 (Wald X^2 =249.93; P<0.01		Model 2 (Wald X^2 =66.85; P<0.01		Model 3 Wald X^2 =259.14; P<0.01	
	OR	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Wealth status						
• Poor[RC]	-	-	-	-	-	-
• Middle	.928	.802 1.074			.965	.824 1.131
• Rich	.744***	.641 .864			.829**	.694 .989
Contraceptive use						
• No[RC]						
• Yes	1.36***	1.230 1.512			1.377***	1.241 1.528
Community poverty level						
• low[RC]			-	-	-	-
• Middle			1.275	1.044 1.55	1.156	.948 1.408
• Rich			1.048	.857 1.281	.930	.755 1.145
Community female literacy						
• Low[RC]			-	-	-	
• Moderate			.893	.752 1.035	.923	.777 1.097
• High			.066***	.509 .742	.748***	.603 .927
Residence						
• Urban[RC]			-	-	-	-
• Rural			1.146*	.984 1.334	1.087	.935 1.263

1. **** p<.01, ** p<.05, * p<0.1*
2. *RC = Reference Category*
3. *RC is omitted naturally by STATA.*

Model 1

The table above shows the results of the bivariate logistic model for different determinants at individual level.in model 1 (Wald $\chi 2 = 249.93$; $P<0.01$) the Wald chi-square test confirms that the model 1 is statistically significant.

There are seven variables at individual level to determine the influence on average short birth spacing First determinant is respondent's education level. No education is a referral category. For instance, women who have a primary education level are 11% less likely to have short birth intervals as compared to the respondents who have no education with (OR .895, CI .767 1.043) and it shows the significance impact level at 10% confidence interval. Respondents who have secondary education are 24% less likely to have short birth intervals as compared to those with no education with (OR .764, CI .654 .891) with probability 0.000. which shows that it is statistically significant. While respondents with higher education level are 26% less likely to have short birth intervals with (OR .743, CI.613 .901) with a predicted probability of 0.001 it shows the significant impact level at less than 1% confidence interval. Beta values are positive which means with increase in each education level there is an increase in average spacing between children.

Literature shows that women's age plays a vital role in birth spacing. the results show that there is significant relation between respondent age level and outcome variable lower age in the referral category for this variable. For instance, the respondents of middle age are 53% less likely to have short birth intervals as compared to lower age with (OR .471, CI .385 .576) and a predicted probability of 0.000. While for the respondents in the upper age they are 72% less likely to have short birth spacing between children with (OR .280, CI .227 .345) and probability of 0.000. The

beta values are positive which means that with increase in age level there is an increase in spacing between children and decrease in short birth interval with increase in age.

Literature shows that Women working status is another variable which influences the birth interval. Women working status is categorized into two groups: currently working and not working while the working category is the referral category for this variable. For instance, the respondents who are currently working are 6% less likely to have short birth interval as compared to respondents who are not working with (OR .948, CI .828 1.08) and it shows significant impact above 10% confidence interval which means it is insignificant.

Respondents' age at first birth has influence on birth interval. It is divided into further two categories. Group one includes all those women whose age is less than 18 at their first birth and second group includes all those women whose age is above 18 at the time of first birth. respondents age below 18 is the referral category for this variable. For instance, the respondents whose age is above 18 at the time of first birth are 41% more likely to have a short birth interval as compared to those respondents whose age is below 18 with (OR 1.419, CI 1.257 1.602). and predicted a probability of 0.000.

According to literature respondents, the husband's education level is one of the important factors to determine the influence on a short birth interval. This variable is categorized into further four levels, "No education, primary education, secondary education and higher education". No education is considered as a referral category for this variable. For instance, the respondents whose husbands have primary education are 17% more likely to have short birth intervals as compared to respondents with husbands with no education (OR 1.174, CI .999 1.38). It shows the significant impact level is at less than 2% confidence interval. Respondents whose husbands have secondary

level education are 17% less likely to have short birth intervals as compared to those respondents whose husbands have no education (OR .858, CI.734 .951). It is significant at less than 1 percent confidence interval. While respondents whose husbands have higher education are 15% less likely to have short birth intervals as compared to husbands with no education level (OR .882, CI .731 1.001). This level is significant at 8% confidence interval.

Literature shows that there is strong association between contraceptive use and birth interval. Contraceptive use is further divided into two categories using contraceptive and not using contraceptive. Not using contraceptive is referral category for this variable. For instance, the respondents who use contraception are 36% more likely to have short birth interval as compared to the respondents who don't use contraception (OR 1.360, CI 1.23 1.512). the p-value (0.000) shows that this variable is 100 % significant.

Among many determinants, the wealth index is considered as a major determinant to understand the status of the respondent. And shows the clear picture about the living status of the respondent. Wealth index is categorized into three groups. Poor category, middle and rich class category. Poor category is the referral category for this variable. Respondents who belong to the middle wealth category are 8% less likely to have short birth intervals between children as compared to respondents who belong to the poor wealth category (OR .928, CI .802 1.074). the p-value above the 10 % confidence interval. While respondents who belong to the rich wealth category are 21.8% less likely to have short birth intervals as compared to respondents of the poor wealth category (OR .782, CI 641 .864). the predicted probability for this category shows that it is statistically significant.

Model 2

Model 2 shows the proportions of short birth spacing and bivariate relationship between the research variables at community level and outcome variable.in model 2 (Wald $\chi 2 = 66.85$; $P<0.01$) the Wald chi-square test confirms that the model 2 is statistically significant.

There are three community level variables. Community poverty level, female respondent's literacy at community level and residence of the respondent.

Community poverty level is generated from the mean wealth index for the poorest wealth group.it is further divided into three categories of "poor level, medium and higher" . Poor level is the referral category for this variable. Female respondents in the "communities with a medium proportion of women" in the poorest wealth group are 27% more likely to have short birth intervals as compared to the female respondents who live in "communities with a low proportion of poorest wealth" group (OR 1.275, CI 1.044 1.557). While female respondents in the communities with a high proportion of women in communities with the poorest wealth are 4% less likely to have short birth intervals as compared to the women in communities with a low proportion of women in the poorest wealth group (OR 1.04, CI .857 1.281).

Female literacy at community level is one of the important determinants of short birth intervals at community level. It has been divided into three main categories. Poor (low proportion of women who can read a complete sentence), moderate (medium proportion of women who can read a complete sentence) and high (high proportion of women who can read a complete sentence). Poor category is the referral category for this variable. Female respondents who live in the communities with "medium proportion of women" who can read a complete sentence are 11% less likely to have

short birth interval as compare to the women in "communities with low proportion of women" who can read a complete sentence (OR .893, CI .752 1.061) while women who lives in communities with "high proportion of women" who can read a complete sentence are 36% less likely to have short birth interval as compare to the women in "communities with low proportion of women" who cannot read or write at all (OR .643, CI .525 .787).

Literature shows that the residence of the respondent is an important determinant of short birth intervals. Residence is further categorized into groups urban residence and rural residence. Urban residence is the referral category for this variable. The respondents who live in rural areas are 14% more likely to have short birth interval as compared to the respondents who live in urban areas (OR 1.146, CI .984 2.41).

Model 3

The model 3 is the combination of model 1(individual level variables) and model 2(community level variables). For model 3 (Wald $\chi 2 = 259.14$; $P<0.01$) the Wald chi-square test confirms that the model 3 is statistically significant.

The first variable is the respondent's education level. No education is a referral category. For instance, women who have a primary education level are 8% less likely to have short birth interval as compared to the respondents who have no education with (OR .929 CI .795 1.087). Respondents who have secondary education are 19% less likely to have short birth interval as compared to no education with (OR .819 CI .698 .961). probability shows that it is statistically significant. While for respondents with higher education level are 19% less likely to have short birth interval with (OR .815 CI .668 .995) with predicted probability of 0.001 it shows that it is

statistically significant. Beta values are positive which means with increase in each education level there is an increase in average spacing between children.

For variable respondents age level, lower age is considered as a referral category. For instance, the respondents of middle age are 53% less likely to have short birth interval as compared to lower age with (OR .474, CI .388 .580) and predicted probability of 0.000 which shows that it is statistically significant. The respondents in the upper age range are 72% less likely to have short birth spacing between children with (OR .285 CI .232 .352) and probability of 0.000. which shows that this category is statistically significant. The beta values are positive which means that with increase in age level there is an increase in spacing between children and decrease in short birth interval with increase in age.

For variable respondents, working status "working" is the referral category for this variable. For instance, the respondents who are currently working are 6% less likely to have short birth interval as compared to respondents who are not working with (OR .944 CI .823 1.082) and it shows significant impact at above 10% confidence interval which means it is insignificant.

For variable respondents' age at first birth, the respondents' age below 18 is the referral category. For instance, the respondents whose age is above 18 at the time of first birth are 42% more likely to have short birth intervals as compared to those respondents whose age is below 18 with (OR 1.423 CI 1.260 1.606). and predicted probability 0.000 shows that it is statistically significant.

No education is considered a referral category for this variable. For instance, the respondents whose husbands have primary education are 18% more likely to have short birth intervals as compared to respondents with husbands with no education (OR 1.182 CI 1.005 1.39). For respondents whose husbands have secondary level education are 17% less likely to have short birth

interval as compared to those respondents whose husbands have no education with (OR .834 CI .733 .950). While respondents whose husbands have higher education have 16% less likely to have short birth interval as compared to husbands with no education level with (OR .844. CI .721 .989).

Contraceptive use is an important determinant. for this variable using contraceptive is the referral category for this variable. For instance, the respondents who use contraceptive are 37% more likely to have short birth interval as compared to the respondents who don't use contraceptive with (OR 1.377 CI 1.24 1.52).

For the individual level wealth index, the Poor wealth category is the referral category. Respondents who belong to the middle wealth category are 4% less likely to have short birth interval between children as compared to respondents who belong to the poor wealth category (OR .965, CI .824 1.131). While respondents who belong to the rich wealth category are 18% less likely to have short birth interval as compared to respondents of the poor wealth category with (OR .829 CI .694 .989).

Community poverty level is generated from the wealth index. Poor wealth category (high proportion of women in communities with poorest wealth) is the referral category for this variable. "Communities with a medium proportion of women in the poorest wealth group" are 15% more likely to have SBI as compared to the poor (OR 1.156, CI .946 1.408). while the "communities with low proportion of women with poorest wealth groups" are 7% less likely to have short birth interval as compared to poor wealth group (OR .930 CI .755 1.145).

Female literacy at community level is one of the important determinants of short birth interval at community level. It has been divided into three main categories. Poor (low proportion of women

who can read a complete sentence), moderate (medium proportion of women who can read a complete sentence) and high (high proportion of women who can read a complete sentence). poor is the referral category for this variable. Women who live in communities with medium proportion of women who can read a complete sentence are 8% less likely to have short birth interval as compare to the women in communities with low proportion of women who can read a complete sentence (OR .923 CI.777 1.097) while women who lives in communities with high proportion of women who can read a complete sentence are 26% less likely to have short birth interval as compare to the women in communities with low proportion of women who cannot read or write at all (OR.748 CI .603 .927).

Literature shows that the residence of the respondent is an important determinant of short birth intervals. Residence is further categorized into groups urban residence and rural residence. Urban residence is the referral category for this variable. The respondents who live in rural areas are 8% more likely to have short interval as compared to the respondents who live in urban areas (OR 1.08, CI 3.320 6.29).

5.3 Random Effect

Random effect derived from multilevel logistic regression. This analysis shows the impact of community level variables on short birth interval and results are given below in table 5.3

The LR test shows that all the models reflect a good fit with highly significant LR test (P<0.001).

The ICC results corresponding to Null model is (6%) where community level variables and individual level variables are excluded.6% of the total variability in uptake of short birth interval is attributed to contextual phenomena. Or we can say that the prevalence of SBI is similar among community women. For model 1 individual level variables are added to the equation the ICC drops

to 0.043 thus reflect the fact that the increase level of variation in short birth interval is induced by the contextual factors. For model 2 shows that 4% of variation in SBI is caused by community factors (ICC .047). in model 3 which is full model of individual and community level variables, 4% of variation in short birth interval is caused by community level predictors. (ICC 0.041)

5.3 Random effect showing influence of community characteristics on SBI

Parameter	Empty Model	Model 1	Model 2	Model 3
Community level variance (SE)	0.2243	0.1493	0.1635	0.1411
Log likelihood	-5897.68	-5725.31	-5863.04	-5717.09
LR test	$\chi2 = 113.52$; P<0.01	$\chi2 = 249.93$; P<0.01	$\chi2 = 66.85$; P<0.01	$\chi2 = 259.14$; P<0.01
ICC	0.064	0.043	0.047	0.041

Chapter 6

Discussion

Short birth interval is considered as one of the major public health issues which affects mothers and child's health. By increasing spacing between children, complications during pregnancy can be reduced and improve the health of both mother and child. Outcome of the current study reflects a short birth interval i.e.66.54% with sample size (n=8999) which include all the female respondents who had at least 2 live births in the last 5 years before conducting the survey. It also excludes AJK and Gilgit Baltistan.

Literature is abundant in evidence that SBI is influenced by both the individual and community level factors. To corroborate this assertion in case of Pakistan, several important background attributes at community level and individual level are selected i.e.: mother's education, employment status, husband's education level, contraceptive use, wealth status, community poverty level, literacy level, age at the time of first birth and residence of the respondent. Referring to the result of the present study, a mother's education is positively correlated with the prevalence of SBI. The participation of women in education is one of the favorable measures to decrease the short birth interval. With increase in education level the decrease in SBI is 66%, 64% 59% 55% for no education, primary education, secondary education and higher education. (Khan et al., 2016).

According to the results of the study the women of the higher age are less likely to have short birth interval as compare to the women to lower age. It could be due to the ability of producing off

springs. Younger age increases the ability of producing offspring higher as compared to older women. The result is compatible to the study of (Regasa, chakilu Tilahun, & Mesfin, 2020).

Respondent age at first birth is a significant determinant of short birth interval and the use of contraceptive has negative association with the birth interval. Those people who use contraceptives are more likely to have short birth intervals as compared to those who don't use any contraceptive with a rate of 65% and 62%. The reason may be due to a couple starting to use contraceptives after having their desired children. The results for respondent's husband's education level; with increase in education level from no education to primary is 66% to 70% and for secondary education SBI is 61% and 58% is for higher education level (Sobhan et al., 2018).

The results further reveal that women who are currently not working are less likely to have short birth interval as compared to the women who are currently working; the results are similar to the study conducted in Iran. The study results reveal that Women who belongs to the rich income /wealth quintile are less likely to have short birth interval as compare to the women who belongs to the poor income/wealth quintile and middle income/wealth quintile with rate of 68%, 66%, 58% for poor, middle and rich income quintile. It is due to the women who belong to the rich families were able to utilize better health facilities, more access to health care information and are more educated as compared to poor respondents. The findings are the same as the previous study of (Fallahzadeh et al., 2013).

Residence of the respondent has a significant influence on the short birth interval. Respondents who belongs to the rural areas are more likely to have short birth interval as compare to the respondents who belongs to the urban areas because the women who live in urban areas have

access to better education and other opportunities as compare to rural respondents which is similar to the previous studies (Khan et al., 2016).

Results of unadjusted logistic regression indicate that individual and community level factors have statistically significant association with prevalence of short birth interval. Women's education, women's age, husband's education level, women who are living in rich income quintile are less likely to have short birth interval (Khan et al., 2016). There is no significant association between women working status, contraceptive use and short birth interval as women who are currently working are more likely to have short birth interval as compared to those who are not working. Women who are using contraceptive are more likely to have short birth interval (i.e. 65%) as compared to those who are not using contraceptive (62%) (Sobhan et al., 2018).

The outcome of the multivariate analysis of individual level and community level variables substantiate the results obtained at the univariate and bivariate stages of the study. Mothers' education, age, husband's education level, contraceptive use shows significant association with SBI. Likewise, at community level, female literacy shows significant association with SBI. Women with high literacy levels are less likely to have short birth interval as compared to illiterate women or women with low literacy level. it may be due to their access to health information and awareness of family planning (Shifti et al., 2020). While community poverty level and residence shows no significant association with SBI (Table 5.2) which is similar to the previous study (Khan et al., 2016).

6.1 Review of Hypothesis:

- Individual level factors such as; *mother's education husband's education, mother's age, contraceptive and wealth* influence short birth interval in Pakistan-------***ACCEPTED***
- *Community poverty level and residence* (Urban/Rural) influence short birth interval in Pakistan------***REJECTED***
- Community contextual attribute like *female literacy level* influence short birth interval in Pakistan------***ACCEPTED***

Chapter 7

Conclusion and Recommendations

7.1 Conclusion

The study is first study of its kind to examine the influence of individual level and community level variables on birth spacing in Pakistan. Few studies have been conducted internationally. The study exhibit that more that 60% of women experience birth interval less than 33 months. The women experience is not only determined by the individual level characteristics but also determined by the community level variables. The variables at individual level are respondent education level, respondent age level, respondents husband education level, contraceptive use, working status, age at first birth, wealth index. Similarly, community level characteristics are community poverty level, female literacy at community level, residence of residence. For individual level; respondent's education level, respondents age level, husband's education level age at first birth and wealth index were found significantly associated to short birth interval. While contraceptive use showed that those couples who use contraceptive are more likely have short birth interval. The reason may be due to the couple started using contraceptive after have desired number of children.

the female literacy at community level found significant associated with short birth interval. The high proportion of respondents in communities who can read complete sentence are less likely to have short birth interval as compare to the low proportion or respondents in communities who can read. This shows that the communities where female literacy is high are less likely to have short birth interval. the residence of respondent found significant associated with short birth interval. The women who are living in rural areas are more likely to have short birth interval the reason

may be that the high percent of the population is living in rural areas of Pakistan. Where they don't have better access to health literacy. They have no better opportunities to explore as compare to the women who are living in urban areas. while community poverty and residence showed insignificant association with short birth interval. the communities where high proportion of respondents belongs to poor wealth are less likely to have short birth interval. The reason may be the family planning program started by the government in early 1990 to focus on poor communities by providing door to door services to increase the family planning information among poor people to reduce short birth spacing and high fertility.

The analysis of random effect results show that community level random effect is significant after controlling community and individual level variables which reveals that women who experience short birth interval not only depends upon individual level but also depends upon community level context. for this purpose, a multifaceted intervention approach is needed to prevent the short birth interval.

7.2 Policy Recommendations to Improve SBI

The core stone of the study to approach public health challenges with an appropriate method. A multilevel analysis is used for a large nested survey data. This research offers inclusive methodology to understand individual and community context that's impact the short birth interval in Pakistan. The evidence generated in study suggest that alongside the individual characteristics, community factors such as *female literacy at community level* has appreciable influence on reducing short birth interval. Despite have many family health policies SBI is above 60% in Pakistan.to improve SBI the following recommendations are being put forward.

- Short birth interval leads to poor maternal health and child health. The government should set a specific target of (45%) and reduce the magnitude of short birth interval which is currently 66% in defined time period.
- WHO has recommended a specific message for short birth interval and the government should incorporate this message to "antenatal care, postnatal care and immunization services" to increase the awareness among mothers for better quality life.
- Education of women plays vital role in improving birth interval between children so ministry of health should collaborate with education ministry to further improve the literacy of female at community level. Because the respondents living communities with higher female literacy has positive impact short birth interval.
- The prevalence of short birth interval in urban areas is higher as compare to rural areas so government should focus on community base health care delivery in urban areas. Government should add male members with lady health workers to address the husbands in every household because the male partners more influence the decision of having children.
- Policy makers should focus on alleviating poverty at household level to improve birth interval.

7.3 Strengths and Limitations of the Study

The strength of the study is that it has two level multilevel logistic regression which express the effects of individual level as well as community level that influences short birth interval. Multilevel is appropriate and accurate when it comes to the nested data.

The limitation of the study is that the nature of DHS data is cross-sectional which does not allow researchers to establish a cause and effect between dependent and independent variables.

References:

Abu-Saad, K., & Fraser, D. (2010). Maternal nutrition and birth outcomes. *Epidemiologic reviews, 32*(1), 5-25.

Aleni, M., Mbalinda, S., & Muhindo, R. (2020). Birth intervals and associated factors among women attending young child clinic in Yumbe Hospital, Uganda. *International journal of reproductive medicine, 2020*.

Alvarez, J. L., Gil, R., Hernández, V., & Gil, A. (2009). Factors associated with maternal mortality in Sub-Saharan Africa: an ecological study. *BMC public health, 9*(1), 1-8.

Antai, D. (2009). Inequitable childhood immunization uptake in Nigeria: a multilevel analysis of individual and contextual determinants. *BMC Infectious Diseases, 9*, 181.

Arif, G. M. (2004). Child health and poverty in Pakistan. *The Pakistan Development Review*, 211-238.

Ayane, G. B., Desta, K. W., Demissie, B. W., Assefa, N. A., & Woldemariam, E. B. (2019). Suboptimal child spacing practice and its associated factors among women of child bearing age in Serbo town, JIMMA zone, Southwest Ethiopia. *Contraception and reproductive medicine, 4*(1), 4.

Aychiluhm, S. B., Tadesse, A. W., Mare, K. U., Abdu, M., & Ketema, A. (2020). A multilevel analysis of short birth interval and its determinants among reproductive age women in developing regions of Ethiopia. *Plos one, 15*(8), e0237602.

Azmat, S. K., Hameed, W., Hamza, H. B., Mustafa, G., Ishaque, M., Abbas, G., . . . Ali, S. (2016). Engaging with community-based public and private mid-level providers for promoting the use of modern contraceptive methods in rural Pakistan: results from two innovative birth spacing interventions. *Reproductive health, 13*(1), 1-15.

Bhalotra, S., & Van Soest, A. (2008). Birth-spacing, fertility and neonatal mortality in India: Dynamics, frailty, and fecundity. *Journal of Econometrics, 143*(2), 274-290.

Bhattarai, P. (2019). Factors Associated with Use of Maternal Health Services in Nepal: Analysis of the 2016 Nepal Demographic and Health Survey. *Journal of Nepal Health Research Council, 17*(3), 301-307.

Brunson, J. (2018). Maternal health in Nepal and other low-income countries: Causes, contexts, and future directions. In *International Handbook on Gender and Demographic Processes* (pp. 141-152): Springer.

Chungkham, H. S., Sahoo, H., & Marbaniang, S. P. (2020). Birth interval and childhood undernutrition: Evidence from a large scale survey in India. *Clinical Epidemiology and Global Health, 8*(4), 1189-1194.

Conde-Agudelo, A., Rosas-Bermúdez, A., & Kafury-Goeta, A. C. (2006). Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. *Jama, 295*(15), 1809-1823.

Conde-Agudelo, A., Rosas-Bermúdez, A., & Kafury-Goeta, A. C. (2007). Effects of birth spacing on maternal health: a systematic review. *American journal of obstetrics and gynecology, 196*(4), 297-308.

Conde- Agudelo, A., Rosas- Bermudez, A., Castaño, F., & Norton, M. H. (2012). Effects of birth spacing on maternal, perinatal, infant, and child health: a systematic review of causal mechanisms. *Studies in family planning, 43*(2), 93-114.

De Jonge, H. C., Azad, K., Seward, N., Kuddus, A., Shaha, S., Beard, J., . . . Fottrell, E. (2014). Determinants and consequences of short birth interval in rural Bangladesh: a cross-sectional study. *BMC pregnancy and childbirth, 14*(1), 1-7.

Exavery, A., Mrema, S., Shamte, A., Bietsch, K., Mosha, D., Mbaruku, G., & Masanja, H. (2012). Levels and correlates of non-adherence to WHO recommended inter-birth intervals in Rufiji, Tanzania. *BMC pregnancy and childbirth, 12*(1), 1-8.

Fallahzadeh, H., Farajpour, Z., & Emam, Z. (2013). Duration and determinants of birth interval in Yazd, Iran: a population study. *Iranian journal of reproductive medicine, 11*(5), 379.

Fischler, R. (1998). The metropolitan dimension of early zoning: Revisiting the 1916 New York City ordinance. *Journal of the American Planning Association, 64*(2), 170-188.

Govindasamy, P., Stewart, M., Rutstein, S., Boerma, T., & Sommerfelt, A. (1993). High-Risk Births and Maternity Care. Demographic and Health Surveys Comparative Studies No 8. *Columbia Maryland: Macro International Incorporated*.

Grundy, E., & Kravdal, Ø. (2014). Do short birth intervals have long-term implications for parental health? Results from analyses of complete cohort Norwegian register data. *J Epidemiol Community Health, 68*(10), 958-964.

Gyimah, S. O. (2005). The Dynamics of Timing and Spacing of Births in Ghana. *Journal of Comparative Family Studies, 36*(1), 41-60. Retrieved from http://www.jstor.org/stable/41603979

Halli, S. S., Ashwini, D., Dehury, B., Isac, S., Joseph, A., Anand, P., . . . Blanchard, J. (2019). Fertility and family planning in Uttar Pradesh, India: major progress and persistent gaps. *Reproductive health, 16*(1), 1-12.

Justesen, A., & Kunst, A. (2000). Postneonatal and child mortality among twins in Southern and Eastern Africa. *International journal of epidemiology, 29*(4), 678-683.

Kaggwa, E. B., Diop, N., & Storey, J. D. (2008). The role of individual and community normative factors: a multilevel analysis of contraceptive use among women in union in Mali. *International family planning perspectives*, 79-88.

Khan, J. R., Bari, W., & Latif, A. M. (2016). Trend of determinants of birth interval dynamics in Bangladesh. *BMC public health, 16*(1), 1-11.

Kiani, M. F. K. (2003). Motivation and involvement of men in family planning in Pakistan. *The Pakistan Development Review*, 197-217.

Knodel, J., & Hermalin, A. I. (1984). Effects of birth rank, maternal age, birth interval, and sibship size on infant and child mortality: evidence from 18th and 19th century reproductive histories. *American Journal of Public Health, 74*(10), 1098-1106.

Koblinsky, M., Anwar, I., Mridha, M. K., Chowdhury, M. E., & Botlero, R. (2008). Reducing maternal mortality and improving maternal health: Bangladesh and MDG 5. *Journal of health, population, and nutrition, 26*(3), 280.

Kozuki, N., & Walker, N. (2013). Exploring the association between short/long preceding birth intervals and child mortality: using reference birth interval children of the same mother as comparison. *BMC public health, 13*(3), 1-10.

Kumar, S., Kumar, N., & Vivekadhish, S. (2016). Millennium development goals (MDGS) to sustainable development goals (SDGS): Addressing unfinished agenda and strengthening sustainable development and partnership. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine, 41*(1), 1.

Manda, S. O. (1999). Birth intervals, breastfeeding and determinants of childhood mortality in Malawi. *Social science & medicine, 48*(3), 301-312.

Marmot, M. (2002). The influence of income on health: views of an epidemiologist. *Health affairs, 21*(2), 31-46.

McGuire, C., & Stephenson, R. (2015). Community factors influencing birth spacing among married women in Uganda and Zimbabwe. *African journal of reproductive health, 19*(1), 14-24.

Midhet, F., Becker, S., & Berendes, H. W. (1998). Contextual determinants of maternal mortality in rural Pakistan. *Social science & medicine, 46*(12), 1587-1598.

Miller, G., & Babiarz, K. S. (2016). Family Planning Program Effects: Evidence from Microdata. *Population and Development Review, 42*(1), 7-26.

Mumtaz, Z., Salway, S., Shanner, L., Zaman, S., & Laing, L. (2012). Addressing disparities in maternal health care in Pakistan: gender, class and exclusion. *BMC pregnancy and childbirth, 12*(1), 1-10.

Nausheen, S., Bhura, M., Hackett, K., Hussain, I., Shaikh, Z., Rizvi, A., . . . Soofi, S. B. (2020). Determinants of Short Birth Intervals among married women in Karachi, Pakistan. *medRxiv*.

Norton, M. (2005). New evidence on birth spacing: promising findings for improving newborn, infant, child, and maternal health. In: Wiley Online Library.

Organization, W. H. (2010). *World health statistics 2010*: World Health Organization.

Organization, W. H. (2015). *Trends in maternal mortality: 1990-2015: estimates from WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division*: World Health Organization.

Perroy, R. (2015). Demographic and health survey key indicators. *Statew Agric L Use Baseline, 1*, 55.

Pinto, F., Suwiyoga, I. K., Widiana, I. G. R., & Yasa, I. W. P. S. (2017). Factors Cause of Maternal Death in Timor-Leste. *International Research Journal of Engineering, IT and Scientific Research, 3*(2), 34-40.

Raghupathy, S. (1996). Education and the use of maternal health care in Thailand. *Social science & medicine, 43*(4), 459-471.

Rana, M., Gautam, A., Goli, S., Reja, T., Nanda, P., Datta, N., & Verma, R. (2019). Planning of births and maternal, child health, and nutritional outcomes: recent evidence from India. *public health, 169*, 14-25.

Regasa, Z., chakilu Tilahun, B., & Mesfin, A. (2020). Spatial Distribution And Determinant Factors Of Birth Interval Among Reproductive Age Group Women, Based On Edhs 2016, Ethiopia, 2019.

Rice, N., & Jones, A. (1997). Multilevel models and health economics. *Health economics, 6*(6), 561-575.

Safdar, S., Inam, S., Omair, A., & Ahmed, S. (2002). Maternal health care in a rural area of Pakistan. *J Pak Med Assoc, 52*(7), 308-311.

Salehi- Isfahani, D., Abbasi- Shavazi, M. J., & Hosseini- Chavoshi, M. (2010). Family planning and fertility decline in rural Iran: the impact of rural health clinics. *Health economics, 19*(S1), 159-180.

Sathar, Z. (1988). Birth spacing in Pakistan. *Journal of biosocial science, 20*(2), 175-194.

Sharma, M., & Mishra, S. (2014). Effects of maternal health and nutrition on birth weight of infant. *International Journal of Science and Research, 3*(6), 855-858.

Shifti, D. M., Chojenta, C., G. Holliday, E., & Loxton, D. (2020). Individual and community level determinants of short birth interval in Ethiopia: A multilevel analysis. *Plos one, 15*(1), e0227798.

Snijders, T. A., & Bosker, R. J. (2011). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*: sage.

Sobhan, M. A., Hasan, M. F., & Hossain, M. M. (2018). Socio-Economic and Demographic Determinants of Birth Intervals among Married Women in Bangladesh. *researchgate.net*.

Suryanarayana, R., Santhuram, A. N., Chandrappa, M., Shivajirao, P., & Rangappa, S. S. (2016). Prevalence of anemia among pregnant women in rural population of Kolar district. *Int J Med Sci Public Health, 5*(3), 454-458.

Thapa, S., Short, R. V., & Potts, M. (1988). Breast feeding, birth spacing and their effects on child survival. *Nature, 335*(6192), 679-682.

Titaley, C. R., Dibley, M. J., Agho, K., Roberts, C. L., & Hall, J. (2008). Determinants of neonatal mortality in Indonesia. *BMC public health, 8*(1), 1-15.

Whitworth, A., & Stephenson, R. (2002). Birth spacing, sibling rivalry and child mortality in India. *Social science & medicine, 55*(12), 2107-2119.

Winikoff, B. (1983). The effects of birth spacing on child and maternal health. *Studies in family planning*, 231-245.

Yohannes, S., Wondafrash, M., Abera, M., & Girma, E. (2011). Duration and determinants of birth interval among women of child bearing age in Southern Ethiopia. *BMC pregnancy and childbirth, 11*(1), 1-6.

Appendix-A

a (VIF for multicollinearity)

Variable	VIF	1/VIF
educationl~l		
2	1.48	0.677001
3	2.00	0.499021
4	2.11	0.473884
respondent~l		
2	4.20	0.238033
3	4.89	0.204622
2.womencur~g	5.39	0.185484
2.fage_1bi~h	4.76	0.210191
husbandsed~l		
2	1.43	0.697135
3	2.28	0.439195
4	2.34	0.427795
1.contrace~e	1.80	0.555051
v190_windx		
2	1.89	0.529813
3	4.92	0.203115
compov		
2	1.69	0.590041
3	3.48	0.287579
comflt1		
2	2.54	0.394230
3	4.25	0.235539
1.przd	3.21	0.311212

```
    Mean VIF |      3.04
```

b) formula for calculating ICC

This formula will be used to find the ICC value for models

$$\text{ICC} = \rho/(\rho + \left(\frac{\pi^2}{3}\right), \qquad \rho \text{ is community level variance.}$$

C) ICC for Null model

```
------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+------------------------------------------------
v001: Identity               |
                  var(_cons) |   .2243544   .0365254      .1630637    .3086825
-----------------------------+------------------------------------------------
v002: Identity               |
                  var(_cons) |   .2598845   .1645128      .0751537    .8986909
```

ICC = 0.064

d) ICC for individual level

```
------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+------------------------------------------------
v001: Identity               |
                  var(_cons) |   .1493813   .0294239      .1015392    .2197653
-----------------------------+------------------------------------------------
```

```
v002: Identity               |
                  var(_cons) |   .2347536   .1656753      .0588687    .9361388
------------------------------------------------------------------------------
LR test vs. logistic model: chi2(2) = 59.98               Prob > chi2 = 0.0000
```

ICC 0.043

e) ICC for community level

```
------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+------------------------------------------------
v001: Identity               |
                  var(_cons) |   .1635697   .0306646      .1132732    .2361991
-----------------------------+------------------------------------------------
v002: Identity               |
                  var(_cons) |   .2937259   .1671988      .0962519    .8963447
------------------------------------------------------------------------------
LR test vs. logistic model: chi2(2) = 71.57               Prob > chi2 = 0.0000
```

ICC 0.047

f) ICC for combine model

```
------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.     [95% Conf. Interval]
-----------------------------+------------------------------------------------
v001: Identity               |
                  var(_cons) |   .1411261   .0285907      .0948774    .2099192
-----------------------------+------------------------------------------------
```

```
v002: Identity               |
                  var(_cons) |   .2418521   .1663016      .0628419    .9307872
-----------------------------------------------------------------------------
```

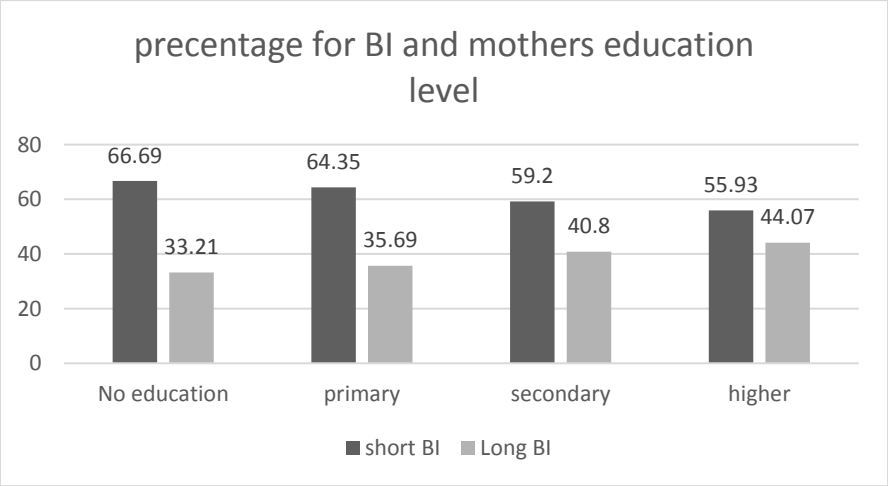
LR test vs. logistic model: chi2(2) = 55.25 Prob > chi2 = 0.0000

ICC 0.041

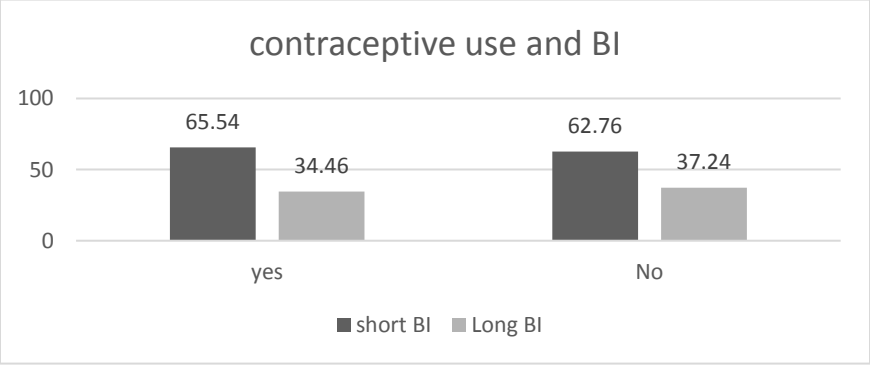
Appendix-B

Graphs for chi-square

Mothers education and BI



Contraceptive use and BI



Community literacy level and BI

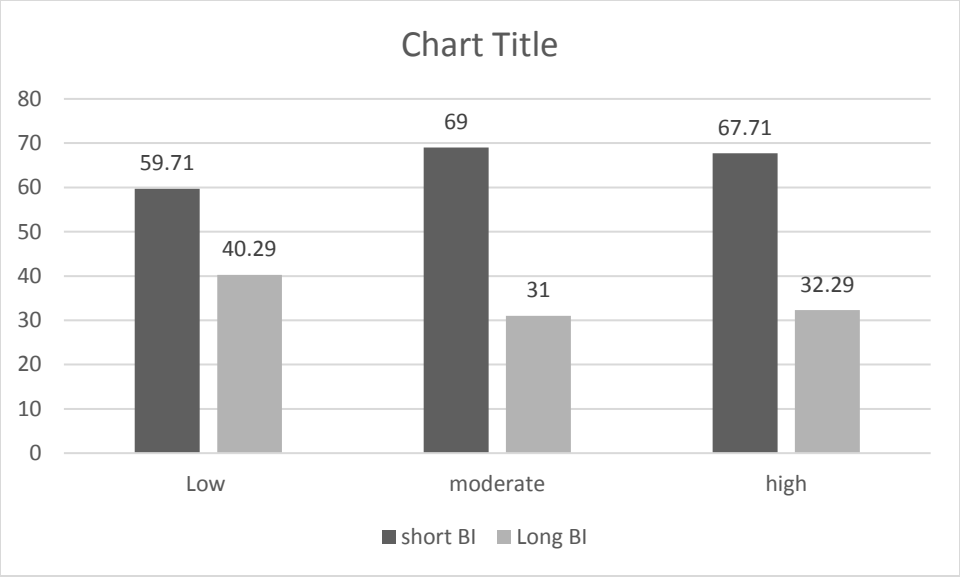


Chart Title
80
70
60
50
40
30
20
10
0
59.71
40.29
69
31
67.71
32.29
Low
moderate
high
short BI
Long BI