Factors Affecting Stillbirth in Ever-Pregnant Women in Nepal

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

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Thesis Title Factors Affecting Stillbirth in Ever-Pregnant Women in Nepal

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ชื่อวิทยานิพนธ์ ปัจจัยที่มีผลต่อทารกตายคลอดในผู้หญิงที่เคยตั้งครรภ์ประเทศเนปาล

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บทคัดย่อ

ทารกตายคลอดเป็นผลจากการตั้งครรภ์ที่ผิดปกติซึ่งมีผลกระทบต่อสภาพจิตใจและเกิดภาวะซึมเศร้าในหญิงตั้งครรภ์และคู่ครองปัญหาสุขภาพของมารดาเป็นปัญหาที่ควรต้องได้รับแก้ไขอย่างจริงจัง ซึ่งปัญหานี้ถูกละเลยในประเทศที่กำลังพัฒนาอย่างเช่นเนปาลดังนั้นวัตถุประสงค์ของการศึกษานี้ คือ เพื่อวิเคราะห์ปัจจัยต่าง ๆ ที่มีผลต่อภาวะทารกตายคลอดในผู้หญิงที่เคยตั้งครรภ์ประเทศเนปาล

การศึกษานี้ใช้ข้อมูลทุติยภูมิจากหน่วยงานการสำรวจสุขภาพและข้อมูลพื้นฐานประเทศเนปาล (Nepal Demographic and Health Survey: NDHS) โดยสำรวจกลุ่มตัวอย่างในประเทศเนปาล ปี ค.ศ. 2011 เป็นการศึกษาแบบภาคตัดขวางมีหน่วยตัวอย่างที่ถูกสัมภาษณ์ทั้งหมดจำนวน10,826 บ้านเรือน เป็นหญิงที่มีอายุอยู่ในช่วง 15-49 ปี จำนวน 12,674 คน และมีผู้ตอบแบบสอบถามร้อยละ 95.3ตัวแปรตามของการศึกษานี้ คือ หญิงที่มีอายุอยู่ในช่วง 15-49 ปี และเคยมีภาวะทารกตายคลอดอย่างน้อยหนึ่งครั้ง สถิติที่ใช้ในการวิเคราะห์ ได้แก่ การทดสอบไคสแควร์ (Chi-squared test)และการวิเคราะห์การถดถอยโลจิสติก(Logistic regression)

ผลจากการศึกษา พบว่า หญิงที่เคยตั้งครรภ์และมีอายุอยู่ในช่วง 15-49 ปี จำนวน 8,918 คน เป็นหญิงที่เคยมีภาวะทารกตายคลอดอย่างน้อยหนึ่งครั้งจำนวน 488 คน คิดเป็นร้อยละ 5.47 หลังจากปรับตัวแปรกวนของแต่ละปัจจัยแล้ว พบว่า อายุของมารดา การศึกษาของมารดา ภูมิลำเนา และภูมิภาคต่าง ๆ มีความสัมพันธ์กับผู้หญิงที่มีภาวะทารกตายคลอดอย่างมีนัยสำคัญทางสถิติ ความเสี่ยงของภาวะทารกตายคลอดเพิ่มสูงขึ้นตามอายุของมารดา มารดาที่อาศัยอยู่ในพื้นที่ชนบทมีร้อยละของภาวะทารกตายคลอดสูงกว่ามารดาที่อาศัยอยู่ในพื้นที่เขตเมือง ในขณะที่มารดาที่มีการศึกษาสูงโอกาสมีภาวะทารกตายคลอดค่อนข้างต่ำ สำหรับภูมิภาคต่าง ๆ ทั้งหมด 13 ภูมิภาค ภูมิภาคภูเขาส่วนกลาง (central mountain) ภูมิภาคภูเขาฝั่งตะวันตก (western mountain) และเนินเขาทางด้านตะวันตกไกลออกไป (far-western hill) มีร้อยละของภาวะทารกตายคลอด

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สูงกว่าค่าเฉลี่ยรวมอย่างมีนัยสำคัญทางสถิติ ในขณะที่เนินเขาส่วนกลาง (central hill) และธีรายส่วนกลาง (central terai)มีร้อยละของภาวะทารกตายคลอดต่ำกว่าค่าเฉลี่ยรวมอย่างมีนัยสำคัญทางสถิติ

ภาวะทารกตายคลอดยังคงเป็นปัญหาสำคัญในกลุ่มมารดาที่มีอายุสูงขึ้น ไม่รู้หนังสือ และอาศัยอยู่ในชนบท เพื่อลดภาวะทารกตายคลอดในประเทศเนปาล การวางแผนและวางนโยบายจึงเป็นสิ่งสำคัญในกลุ่มมารดาที่มีการศึกษาน้อย และอาศัยอยู่ในพื้นที่ชนบท โดยเฉพาะอย่างยิ่งมารดาที่อยู่ในภูมิภาคภูเขาฝั่งตะวันตกและเนินเขาทางด้านตะวันตกไกลออกไป

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ABSTRACT

Stillbirth is a common adverse pregnancy outcome which is a distressing and traumatic event for women and their partners. This is a serious and neglected maternal health problem in developing countries like Nepal. The aim of the study is to identify factors affecting stillbirth in ever-pregnant women in Nepal.

This study utilized individual women's data set from Nepal Demographic and Health Survey (NDHS), which is a nationally representative cross sectional survey conducted in 2011. This survey interviewed 10,826 households. In selected households, 12,674 women aged 15-49 years. The response rate was 95.3%. The outcome was whether or not women who had at-least one stillbirth during their lifetime. The association between determinants with women having stillbirth was analyzed using the chi-squared test. These determinants, which were significant in the univariate analysis, were consequently included in the logistic regression model to identify the strength of association between these determinants and the outcome.

Among 8,918 ever-pregnant mothers aged 15-49 years, 488 mothers had experienced at least one stillbirth during their life time representing a 5.47% of the total. After adjusting each factor for the confounding effects of other factors, maternal age, maternal education, place of residence and subregion were significantly associated

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with women having stillbirth. The risk of stillbirth increased as the mother's age; Mother's residing in rural areas had a higher adjusted percentage of stillbirths than those residing in urban areas. Higher educated mothers had a lower chance of having a stillbirth. Out of 13 sub-regions, central mountain, western mountain and far-western hill had significantly higher and central hill and central terai had significantly lower percent of women who had at least one stillbirth compared to the overall mean percentage.

Stillbirth continuous to be a major problem among women across higher maternal age, illiterate mothers and geographical region. To minimize the stillbirth in Nepal, plans and policies should be focused on low education mothers living in rural area with special focus on women who reside in western mountain and far-western hill regions.

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Mahesh Prasad Bhusal

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Lists of Acronyms

ASEAN	Association of Southeast Asian Nations
DHS	Deomographic and Health Survey
EAs	Enumeration Area
HH	Households
ICD-10	International Classification of Diseases and Related Health Problem 10th Revision
ICR	Intelligent Character Recognition
LPG	Liquefied Petroleum Gas
MOHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
UN	United Nations
US	United States
VDCs	Village Development Committees
WHO	World Health Organization

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Chapter 1

Introduction

1.1 Background and rationale

Stillbirth is a main component of perinatal mortality. Perinatal mortality is one of the most sensitive indices of maternal and child health which reflect the socioeconomic, cultural and environmental condition of the community. The World Health Organization (WHO) defines perinatal mortality as the "number of stillbirths and deaths in the first week of life per a 1000 live births, the perinatal period commences at 22 completed weeks (154 days) of gestation and seven completed days after birth". Globally stillbirth accounts for two thirds of all perinatal deaths and most of them are preventable (Di Mario *et al.,* 2007).

Stillbirth is a responsive signal of the quality of health care services in any country. It is mainly categorized as ante-partum (macerated) and intra-partum (fresh). In ante-partum stillbirths, death of babies may occur more than 12 hours before delivery and in intra-partum death occurring less than 12 hours before delivery. Rates of intra-partum stillbirth are assumed to reflect the quality of intra-partum care (such as caesarean section); whereas rates of ante-partum stillbirths show the maternal health condition and quality of antenatal care (ANC). Intra-partum stillbirths represent 10-60%, with the highest proportion where stillbirth is more common. Globally, it is estimated that intra-partum account for 15-40% while ante-partum account for 40-60% stillbirth (Lawn *et al.,* 2011;

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Goldenberg *et al.,* 2011; Vogel *et al.,* 2013). However, intra-partum stillbirth is drastically reducing in developed countries; associated with good health facilities for delivery, better intra-partum care and enlarged use of cesarean section when indicated; which makes most of these stillbirths preventable (Goldenberg *et al.,* 2016). Moreover, stillbirth is closely related to the quality of ANC and obstetric management during labor and childbirth, as well as quality of general health care, quality of life, and health-seeking behavior of the women (Froen *et al.,* 2011).

Stillbirth is a common adverse outcome of pregnancy that contributes considerably to poor maternal health vice versa. Globally, each year, 2.65 million babies (birth weight ≥1000 grams or ≥28 weeks of gestation) are born dead, with more than 8,200 deaths a day (WHO, 2009; Cousens *et al.,* 2011). It is found that 98% of these deaths occur in developing countries, primarily in low-resource setting. There is large difference between high-income countries like Finland with stillbirth 2.0 per a 1000 total births; and low-income countries like Nigeria and Pakistan which have more than 40 stillbirths per a 1000 total births. Worldwide, from 1995 to 2009, stillbirth rate declined by 14%, representing a 1.1% decrease per year, although improvement occurred only in developed countries and not in developing countries (Cousens *et al.,* 2011; McClure *et al.,* 2011). In most developing countries, birth occurred without skilled health professionals. Cultural taboos and social stigma influence the reporting as well as there is inconsistency between the definitions of stillbirths, so these numbers are probably an underestimate of the true burden of the problem. It is estimated that more than 2 million stillbirths are still lack of reported, so these numbers are probably an underestimate of the true burden of the

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problem (Lawn *et al.*, 2011). Despite the higher number of stillbirths reported in Southeast Asian countries, data on this topic from this area have been scarce.

In Nepal, stillbirth is a major concern among pregnant women. Every year women die and suffer from many complications due to stillbirths. The rate of stillbirth has been declining in recent decades in Nepal. It is reported that stillbirth rate is 21 per a 1000 total births nationally (Cousens *et al.*, 2011). There exist pronounced spatial variations of stillbirth in Nepal. Stillbirth rate is as high as 35.4 per a 1000 births in Sarlahi, a rural district of Nepal, where most of the birth occurred at home without the assistance of a health professional (Lee *et al.*, 2011). However, the results from the Nepal Demographic and Health Survey (NDHS) 2011 showed that, 1% of pregnancies were stillbirth.

Stillbirth is a devastating and traumatic event for women and their partners. Most stillbirths are potential life loss and can be viewed as tragic. Furthermore, many parents faced psychological effects, including anxiety and depression, post traumatic stress disorder and stigmatizations (Turton *et al.*, 2009). In addition, women who have experienced stillbirth are more likely to experience this again in later pregnancies (Lamont *et al.*, 2015). Also, stillbirth is strongly correlated with maternal mortality and a recent research shows that 28 countries that reported the highest stillbirth rates also had the highest maternal mortality rate worldwide (Lawn *et al.*, 2011).

Controlling and preventing stillbirth is of great importance to the achievement of the target of 12 or fewer stillbirths per a 1000 total births in every country by 2035 as proposed by Global Every Newborn Action Plan by the 67th WHO Assembly (WHO,

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2014). Even so, stillbirths were not mentioned in the UN millennium development goals, almost invisible to policy makers, bilateral as well as multilateral organizations and also at the national level (Frogen *et al*., 2011). Stillbirth is not included in the newly formulated United Nations Sustainable Development Goals, which sets global targets for 2015-2030, even though neonatal, under 5 years mortality rates and maternal mortality ratio are included (UN, 2015).

Knowledge of the relative importance of the different risk factors of stillbirth in developing countries like Nepal is still lacking. To the best of our knowledge, very few studies are conducted based on data from some districts and few hospitals but no study has been conducted based on a national level on stillbirth in Nepal (Lee *et al.*, 2011; Ashish *et al.*, 2015). There is a need for study on stillbirths and its associated risk factors as a basis for developing preventive measures in developing countries (Lawn *et al.*, 2011). The basic idea about factors affecting the women having stillbirth will facilitate the development of a better public health intervention to reduce the preventable deaths and contribute in children as well as maternal health in Nepal. Our study aims to explore the factors associated with stillbirth in ever-pregnant women in Nepal.

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1.2 Objectives

The objectives of the study are as follows:

1. To investigate the distribution of stillbirth in ever-pregnant women in Nepal
2. To identify the factors affecting stillbirth in ever-pregnant women in Nepal

1.3 Expected advantages of this study

The information from this study can be used to create guidelines for making of health plans and policies for preventing and controlling stillbirth. Moreover, it will also provide information on various factors associated with stillbirths in Nepal.

1.4 Scope of the study

In this study, we investigate the distribution of stillbirth in ever-pregnant women in Nepal. The appropriate statistical method was used to estimate the adjusted percentage of women who have had at least one stillbirth during their life time period and identify the factors affecting stillbirth in Nepal.

1.5 Definition of term

Ever-pregnant women are those women who have had at least one pregnancy outcome before the survey.

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1.6 Conceptual framework

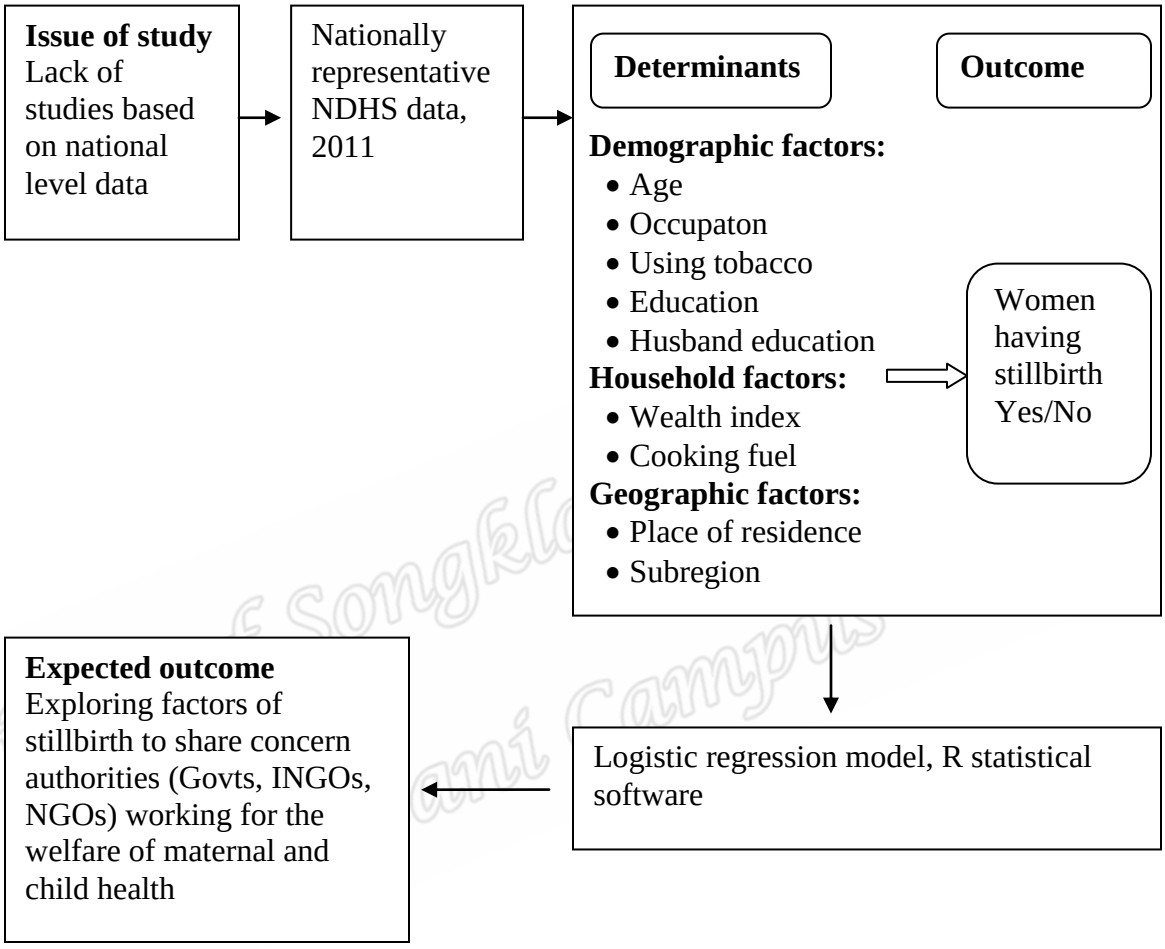

Figure 1.1: Conceptual framework of the study

1.7 Literature review

1.7.1 Definition of stillbirth

Identification of stillbirths, as a social health concern is hindered by uncertainty and conflicting use of terminology has contributed to confusion about stillbirths (Smith *et al.*, 2004). There is no clear guideline as well as changing terminology over time and there is

a much different between countries with high inconsistency in developed countries than developing countries. Most of the developed countries use lower gestational age cutoff for the birth of 20th weeks. However, Sweden is one of the very few developed countries use a lower cutoff of 28th weeks as a lower gestational age. Most of the developing countries use lower cutoffs of 28th weeks or 1000 grams (McClure *et al.,* 2015; Waldenstrom *et al.,* 2015; Marufu *et al.,* 2015).

The international classification of diseases, 10th revision (ICD-10) defines a fetal death not stillbirths. "Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles" without specification of the duration of pregnancy.

Early fetal death: according to the ICD-10, an early fetal death is death to a fetus weighing at least 500 grams (or, if the birth weight is unavailable, after 22 completed weeks gestation, or with a crown-heel length of 25 centimeters or more), who died before or during labor and birth.

For international comparability, WHO promotes the definition of stillbirth (or late fetal death) "as a death occurring at least 28th weeks of gestation or at least 1000 grams birth weight, or at least 35 centimeters (cm) body length" (WHO, 1996; 2004).

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In this analysis, Demographic Health Survey 2011 defined stillbirth is fetal death in pregnancies lasting seven or more months.

1.7.2 Common risk factors for stillbirth

1.7.2.1 Advanced maternal age

Globally, advance maternal age is common determinant for stillbirth. In rural Sarlahi district, Nepal, those mothers ages above of 35 years had a higher risk of occurrence of stillbirth compared to those aged 20-24 years (Lee *et al.,* 2011). The study conducted in Zimbabwe found that higher maternal age was significantly associated with stillbirth (Stringer *et al.,* 2011). A similar result has been seen in the US, where increased chance of occurrence of stillbirth for women aged 35-39 years and above 40 years (Bahtiyar *et al.,* 2006). However, both low and high maternal age has been closely related to an increasing risk of stillbirth (McClure *et al.,* 2007).

1.7.2.2 Cooking fuel

Worldwide, 41% of households, mainly in low income countries in Asia and sub-Saharan Africa use solid fuel like coal and biomass for cooking (Bonjour *et al.,* 2015). The study conducted in India reported that the risk of stillbirths was considerably higher among women who used firewood for cooking as compared to those who use liquefied petroleum gas (LPG) (Lakshmi *et al.,* 2013). The result of the study agrees with a study conducted by Mishra *et al.* (2005) which showed a significant association between household cooking fuel and stillbirths. Similarly, Pop *et al.* (2010) conducted a

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systematic review with meta analysis in developing countries found that internal air pollution was closely related to increased risk of stillbirth.

1.7.2.3 Using tobacco

Smoking during pregnancy is a major health problem in the high income countries. The WHO predicted that smoking will reach higher proportions in low income countries in very soon (WHO, 2013). Another study conducted by Marufu *et al.* (2015) investigated that smoking had a positive relationship with the happening of stillbirth in developed countries and it is rapidly growing in the developing world. The study conducted in high-income countries using a systematic review and meta-analysis supported the same result that maternal smoking in early pregnancy is associated with stillbirth (Flenady *et al.*, 2011). Similarly, the study conducted in India found that women who smoke during pregnancy were at a higher risk of stillbirths (Mishra *et al.,* 2005).

1.7.2.4 Maternal education

Globally, maternal education is common determinant for stillbirth. The study conducted in Canada found that there was a significant association between stillbirths and maternal education at all gestational ages (Auger *et al.*, 2012). The study conducted in the rural Southern part of Nepal, supported the same result that maternal education had significantly associated with stillbirth (Katz *et al.*, 2008). A prospective, population-based observational study conducted in low and middle income countries reported that

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the illiterate women were more likely to have stillbirths, compared to educated women (McClure *et al.,* 2015).

1.7.2.5 Paternal education

According to the study conducted in the eastern part of Nepal, paternal education had an influence on the rates of stillbirth (Lee *et al.,* 2011). Similarly, the study conducted in North East Tanzania showed that low paternal education was highly associated with higher perinatal mortality (Habib *et al.,* 2008). However, the study conducted in Norway found that paternal education was more important in predicting stillbirth, whereas maternal education was more significant in predicting post-neonatal death (Arntzen *et al.,* 1996).

1.7.2.6 Place of residence (Urban and Rural)

The study conducted in India found that the risk of stillbirths was considerably raised among those who resided in rural areas (Lakshmi *et al.,* 2013). The study conducted in Zimbabwe supported that residence in a rural area had a positive and significant association of stillbirth rates (Feresu *et al.,* 2004). Similarly, a study conducted in North East Tanzania, confirmed that rural and semi urban living as risk factors for perinatal mortality (Habib *et al.,* 2008).

1.7.3 Factors for stillbirth in developing and developed countries

Factors and causes of stillbirths differ between developing and developed countries (McClure *et al.,* 2007). Maternal factors like as nutritional status, previous stillbirth, lack

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of education, higher age, smoking, alcoholism and drug use are common factors of stillbirth. However, lack of ANC, hypertensive diseases of pregnancy as well as obstructed or prolonged labor and those delivered without a skilled birth attendant are factors of stillbirth in developing countries. Stillbirths in developing countries are preventable because more than two-thirds are non-macerated (Di Mario *et al.,* 2007; McClure *et al.,* 2015). In developed countries, higher maternal age, pre-existing diabetes, hypertension, primiparity, ante-partum hemorrhage, parity, ethnicity and the past of psychological health problems and fetal growth restriction are common factors of stillbirth. In addition, maternal overweight and obesity, smoking during pregnancy and fetal growth restriction are potentially modifiable factors (Flenady *et al.,* 2011; Gardosi *et al.,* 2013). The study conducted in the United State America concluded that maternal drinking during pregnancy is closely related to stillbirth (Aliyu *et al.,* 2008).

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1.8 Road map of the thesis

This thesis contains four chapters.

Chapter 1 describes the background and rationale, objectives, expected advantages of this study, scope of the research and literature review.

Chapter 2 provides a description of the methodology and overview of the statistical methods for data analysis.

Chapter 3 shows preliminary data analysis and statistical modeling.

Chapter 4 presents the conclusions, discussion and recommendations of the study.

Chapter 2

Methodology

This chapter describes the overall methodology used in thesis. This chapter consists of all aspects of methodology and organizes it in subheading including a discussion of data sources, study area, data management, study diagrams and an overview of the statistical methods for data analysis associated to the statistical models. All statistical analysis and graphical display were carried out using R program (R Development Core Team, 2015).

2.1 Study design

The descriptive and cross-sectional strategy was adopted, including application of multivariate statistical method called logistic regression model in Demographic and Health Survey data.

2.2 Data sources and study area

The study analyzed data from Nepal Demographic and Health Survey (NDHS), 2011 which is nationally representative cross-sectional survey conducted every five years based on multistage stratified cluster sampling with subject sampled from village and municipalities within 75 districts of Nepal. The NDHS was implemented by New ERA under the leadership of the Ministry of Health and Population. Technical support for the survey was provided by ICF International with financial support from the United States Agency for International Development through its mission of Nepal.

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Nepal officially the federal democratic republic of Nepal, is a landlocked country in South Asia, with an area of 147,181 square kilometers and a population of approximately 30 million. It is bordered to the North by the People's Republic of China and to the South, East and West by Republic of India. It is divided into 14 zones and 75 districts. The Villages Development Committees (VDC's) are the smallest administrative unit of districts which are further divided into wards in rural area and sub-ward in urban areas. An enumeration area (EAs) is defined as a ward in rural areas and a sub-ward in urban areas. The black dots in the map of Nepal show 289 EAs (Figure 2.1)

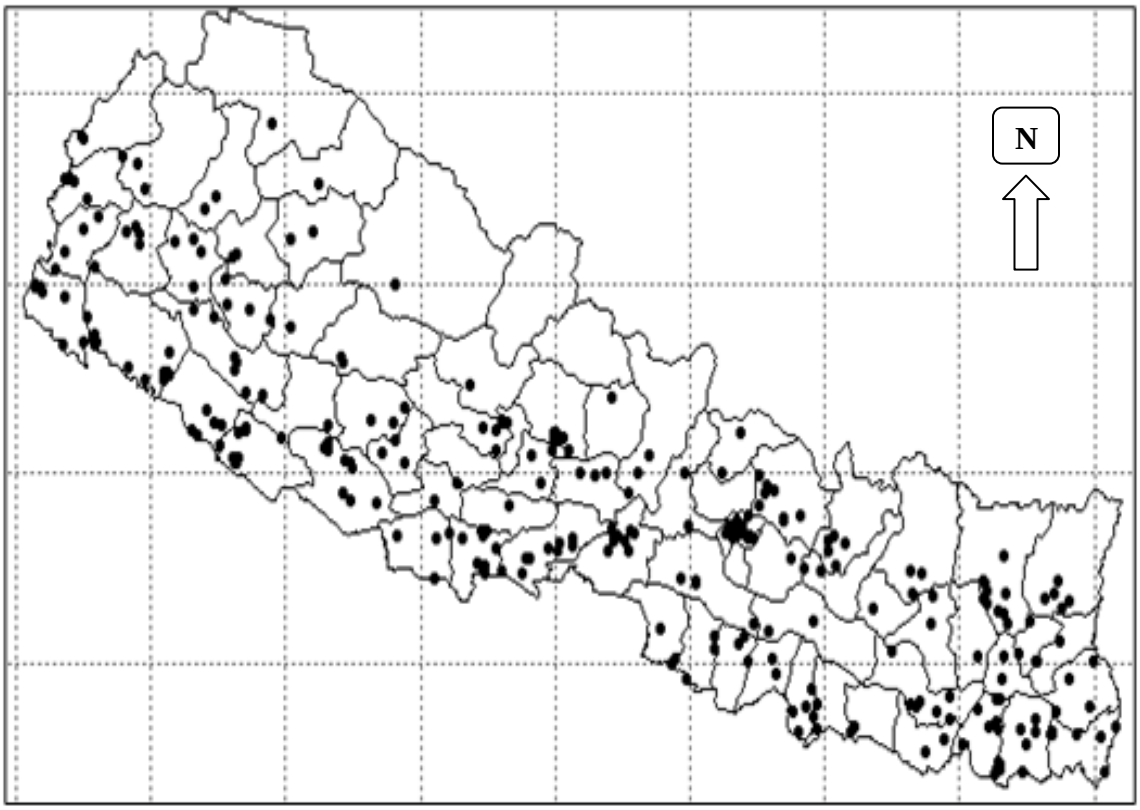

Figure 2.1: Enumeration areas in NDHS-2011

2.3 Subregions

Nepal is broadly divided into three horizontal ecological zones (mountain, hill, and terai) and vertically, into five development regions (eastern, central, western, mid-western and far-western). A cross section of these zones and regions results in 15 eco-development regions, which referred to in the 2011 NDHS as subregions or domains. However, the western, mid-western, and far-western mountain regions were combined to form a single region because of their small population size, resulting in a total of 13 subregions. Stratification of each of the 13 subregions in urban and rural areas was done. The majority of the population in Nepal resides in the rural areas. In order to provide national urban estimates, urban areas of the country were oversampled.

2.4 Sampling design and sample size

The NDHS 2011, studies based on a multistage stratified cluster sample. In the first stage, the primary sampling units (EAs) were selected using a probability-proportional-to-size-(PPS) strategy. In order to achieve the target sample size in each domain, the number of EAs allocated to the urban and rural areas of each region was roughly in the ratio of one urban to two rural EAs to provide for 95 urban and 194 rural EAs. A listing of the household and mapping was carried out in all selected EAs. In the second stage, household were randomly selected from the wards and sub wards (35 households in each urban EAs and 40 households in each rural EAs).

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Data collection was carried out 10,826 out of 11,353 households. In selected households, 12,918 women were identified as eligible for interview; however, 12,674 women aged 15-49 years recruited and interviewed. Of the 4,323 eligible men identified in selected subsample of households, 4,121 were interviewed. From these records 7 types of data sets were generated, these are household recode, household member recode, individual women's recode, male recode, couple's recode, children's recode, and birth's recode.

Household recode

This dataset has one record for each household. It includes household member's roster. But in this file, there is no information from the individual women/men questionnaires is present.

Household member recode

This dataset has one record for every household member. It includes variables like sex, age, education, orphan hood, height and weight measurement, hemoglobin etc. It also includes the characteristics of the households where the individual lives or was visiting.

Individual women's recode

This dataset has one record for every eligible woman as defined by the household schedule. It contains all the data collected in the women's questionnaire plus some variables from the household. Up to 20 births in the birth history, and up to 6 children under age 5 years, for whom pregnancy and postnatal care as well as immunization and

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health data were collected, can be found in this file. The fertility and mortality programs distributed by DHS use this file for data input.

Male recode

This dataset has one record for every eligible man as defined by the household schedule. It contains all the data collected in the men's questionnaire plus some variables from the household.

Couple's recode

This dataset has one record for every couple. It contains data for married or living together men and woman who both declared to be married (living together) to each other and with completed individual interviews (questionnaires).

Children's recode

This dataset has one record for every child of interviewed women, born in the five years preceding the survey. It contains the information related to the child's pregnancy and postnatal care and immunization and health. The data for the mother of each of these children is included. This file is used to look at child health indicators such as immunization coverage, vitamin A supplementation, and recent occurrences of diarrhea, fever, and cough for young children and treatment of childhood diseases.

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Birth's recode

This dataset has one record for every child ever born to interviewed women. Essentially, it is the full birth history of all women interviewed including its information on pregnancy and postnatal care as well as immunization and health for children born in the last 5 years. Data for the mother of each of these children is also included. This file can be used to calculate health indicators as well as fertility and mortality rates.

The survey consists of three sets of internationally validated questionnaires for the collection of different levels of information: i) household information; ii) women's information; and iii) men's information.

2.5 Study sample

This study utilized individual women's data set that contains demographic and reproductive characteristics of the women aged 15-49 years. Out of 12,674 women, 8,918 women aged 15-49 years had experienced at least one pregnancy outcome during their lifetime. Thus leaving 3,756 women who have never been pregnant prior to the survey and were excluded from this study. Thus the study sample comprises 8,918 women as shown in Figure 2.2.

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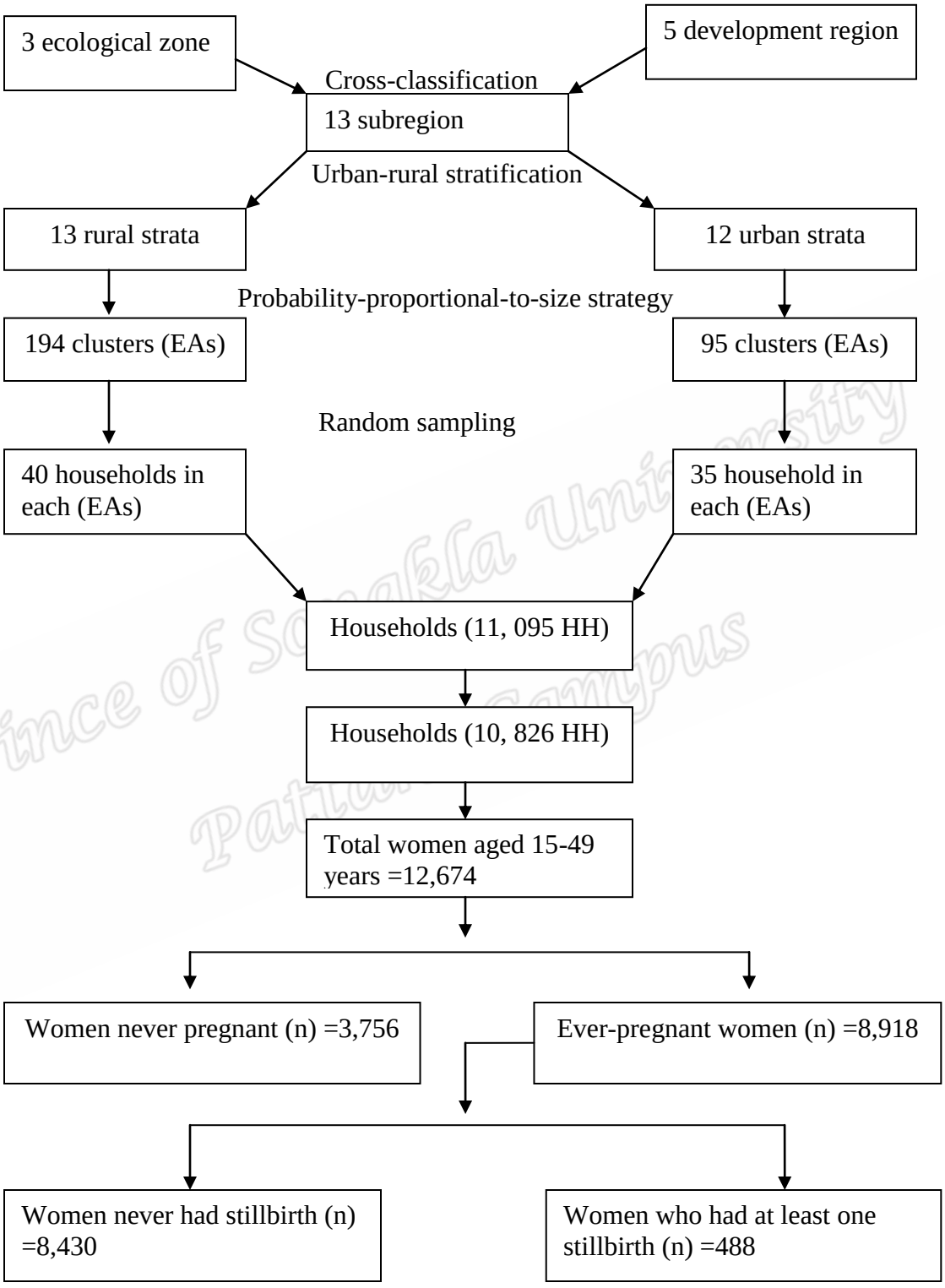

Figure 2.2: Diagram of selecting study sample

2.6 Approach of data analysis

This study retrieved women's recode data from the Demographic and Health Survey, 2011 were stored in a SPSS database format. Read SPSS data file in R and checked for errors and explore all the variables and selected only the interested variables saved into another name. The following steps had been performed until begin the statistical analysis The flow diagram for data management and analysis is summarized in Figure 2.3.

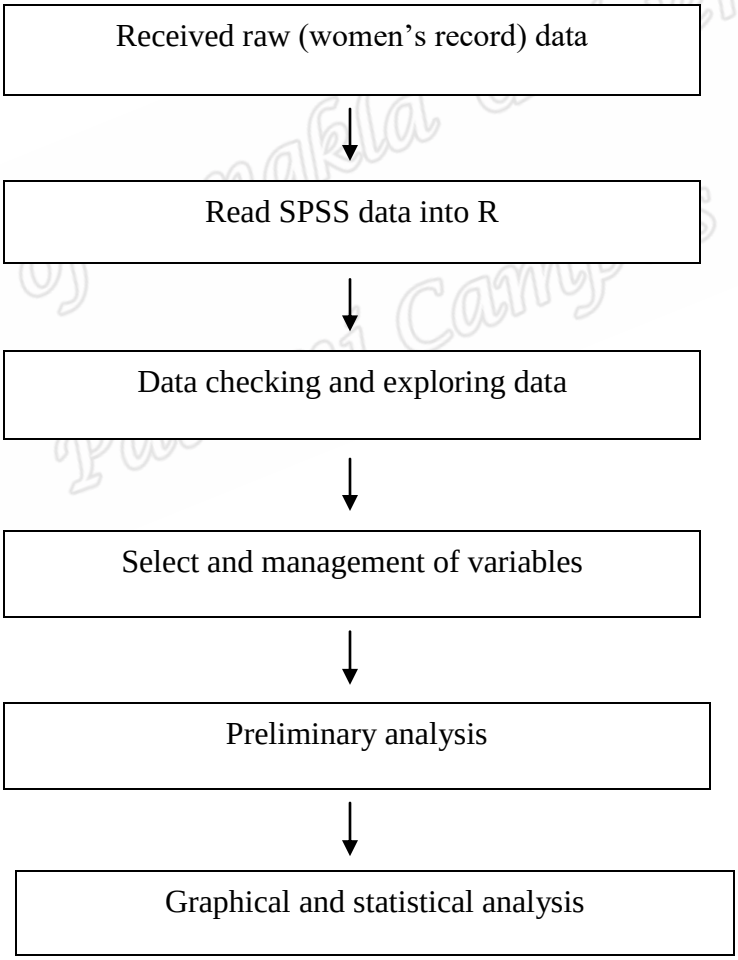

Figure 2.3: The flow diagram for data analysis

2.7 Variables under study

Figure 2.4 shows variables under study and their association. In this study, we create a binary outcome. The outcome variable of interest was whether or not the women had at least one stillbirth during their lifetime. The unit of analysis is women.The women who have had at least one or more stillbirth during their life time period are counted as one stillbirth. The NDHS 2011 consists of information on the woman's pregnancy outcome during their lifetime: live birth, stillbirth, abortion and miscarriage. The determinants under study were grouped into mainly three factors as demographic factors, household factors and geographic factors.

Demographic factors:

Age of the mother: The age groups were categorized as: 15-24, 25-29, 30-39 and 40-49 years.

Occupation status of the mother: Maternal occupation status was classified as; (i) not working, (ii) agriculture and (iii) others (eg. professional/technical/managerial, clerical, sales and service, skilled and unskilled manual).

Use of tobacco: Mothers who were reported as smoking cigarettes, pipe, bidi and the chewing and snuffing of tobacco were classified as (i) using tobacco (ii) not using tobacco.

Education status of the mother: The mother education status was arranged as (i) no education, (ii) primary education and (iii) secondary-higher level.

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Education of husband: The husband education status was arranged as (i) no education, (ii) primary education and (iii) secondary-higher level.

Household factors:

Wealth index: During the interviews with mothers, data were collected on ownership of durable assets (e.g. car, refigerator, bicycle, radio, television), housing characteristics (e.g. number of rooms, dwelling floor and roof materials, toilet facilities), and access to services (e.g. electricity supply, drinking water sources). Using the scores from first principal component analysis, a wealth index (asset index) was contructed. Based on the value of this index, individuals were sorted and population quintiles were established using cut-off values. These quintiles were then ranked from bottom to top as poorest, poorer, middle, richer and richest. In this study we classified as (i) poor: poorest and poor, (ii) middle and (iii) rich: richer and richest.

Cooking fuel: Cooking fuel was classified as (i) relatively non-polluting: biogas, electricity, natural gases, LPG and (ii) relatively polluting: kerosene, coal, ignites, charcoal, wood, straw, agricultural crop and animal dung.

Geographic factors:

Place of residence: The locations was categorize as urban and rural.

Subregions: The subregions was comprises eastern mountain, central mountain, western mountain, eastern hill, central hill, western hill, mid-western hill, far-western hill, eastern Terai, central terai, western terai, mid-western terai and far-western terai.

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2.7.1 Path diagram

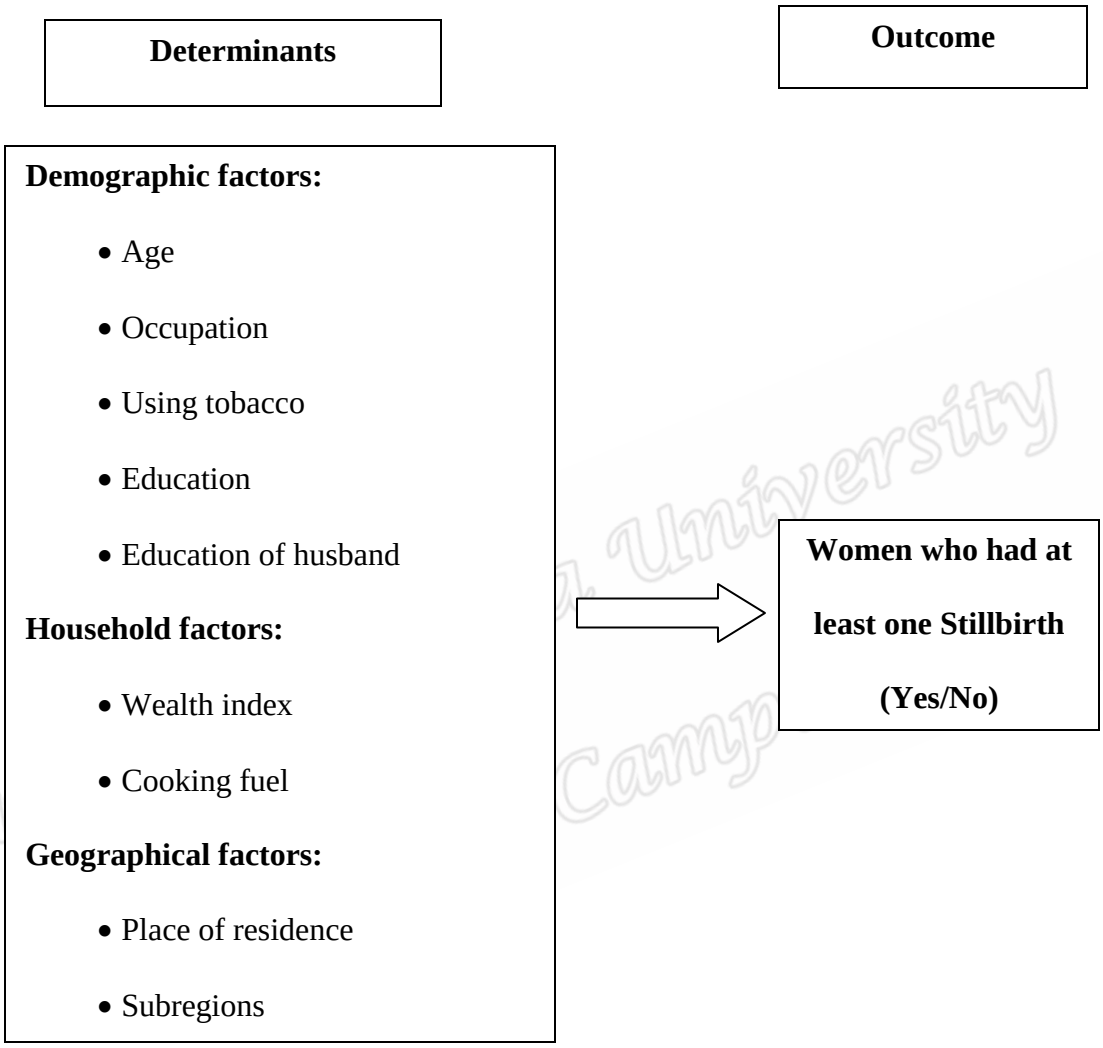

Figure 2.4: Path diagram of study variables

2.8 Statistical methods

The statistical methods comprise methods for descriptive statistics, univariate analysis and statistical modeling.

2.8.1 Descriptive statistics

The determinants for the preliminary analysis are done by examining the frequency distribution and using cross-tabulation of the determinants.

2.8.2 Univariate analysis

Pearson's chi-squared test is used to identify the association between determinants and the outcome and gives the p-value for testing no relationship between the determinants and the outcome.

A) *2×2 table*

To illustrate the methods, a *2×2* contingency table is constructed as follows. Let *x* be the binary determinant and *y* the binary outcome coded as zero or one, and *a*, *b*, *c*, and *d* the cell counts.

		y = 1	*y* = 0
x	1	*a*	*b*
	0	*c*	*d*

$n = a + b + c + d$

The odds ratio is

$$OR = \frac{ad}{bc} \qquad (2.1)$$

Its asymptotic standard error is given by

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$$SE(\ln OR) = \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}} \qquad (2.2)$$

A 95% confidence interval is thus

$$95\%\ CI\ = OR \times \exp\left(\pm 1.96\ SE\ [ln\ OR]\right) \qquad (2.3)$$

Pearson's chi-squared statistic is defined as

$$\chi^2 = \frac{(ad - bc)^2 n}{(a+b)(c+d)(a+c)(b+d)} \qquad (2.4)$$

B) Non stratified $r \times 2$ tables

In this study, some of the determinants are multi-categorical, having more than two category levels. We use non-stratified $r \times 2$ tables to compare them. For example, x is age group level and y is women having stillbirth (1: the women who had at least one stillbirth during their lifetime, 0: indicate that the women never had stillbirth during their lifetime).

		y	
		1	0
x	1	a_{11}	a_{12}
	2	a_{21}	a_{22}
	…	..	..
	r	a_{r1}	a_{r2}

Thus the estimate of the odds ratio (OR) is

$$OR_{ij} = \frac{a_{ij} d_{ij}}{b_{ij} c_{ij}}\ , \qquad (2.5)$$

where $b_{ij} = \sum_{j=1}^{2} a_{ij} - a_{ij}$, $c_{ij} = \sum_{j=1}^{r} a_{ij} - a_{ij}$, $d_{ij} = n - a_{ij} - b_{ij} - c_{ij}$, $n = \sum_{i=1}^{r}\sum_{j=1}^{2} a_{ij}$

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The standard error of the natural logarithm of the odds ratio is given by the same formula as for the *2×2* table. In general, the association is composed of $r \times c$ odds ratios, but only (r-1) ×(c-1) of them are independent.

The standard error is given by

$$SE(\ln OR_{ij}) = \sqrt{\frac{1}{a_{ij}} + \frac{1}{b_{ij}} + \frac{1}{c_{ij}} + \frac{1}{d_{ij}}} \qquad (2.6)$$

A 95 % confidence interval is thus

$$95\ \%\ CI = OR \times \exp\left(\pm 1.96\ SE\ [ln\ OR]\right) \qquad (2.7)$$

Pearson's chi-squared statistic for independence (i.e., no association) in an $r \times c$ table is defined as

$$\chi^2_{(r-1)(c-1)} = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{\left(a_{ij} - \hat{a}_{ij}\right)^2}{\hat{a}_{ij}} \qquad (2.8)$$

where $b_{ij} = \sum_{j=1}^{c} a_{ij} - a_{ij}$, $c_{ij} = \sum_{j=1}^{r} a_{ij} - a_{ij}$, $d_{ij} = n - a_{ij} - b_{ij} - c_{ij}$, $n = \sum_{i=1}^{r}\sum_{j=1}^{c} a_{ij}$

When the null hypothesis of the independence is true, this has a chi-squared distribution with (r-1)×(c-1) degrees of freedom for a binary outcome, c = 2.

2.8.3 Logistic Regression

Logistic regression analysis is used to identify the strength of association between determinants and the outcome, using the additive model. It is commonly use analysis of the association between dichotomous outcome and determinants, which can be either

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continuous or categorical. These models very useful since covariates can be included in the model to account for variability and to determine the effect of covariates on response variable.

2.8.3.1 Simple logistic regression

Simple logistic regression refers to the regression application with one dichotomous outcome and single determinant. For a single categorical variable, the model takes the form as:

$$ln\left(\frac{p_i}{1-p_i}\right) = \mu + \alpha_i \qquad (2.9)$$

Where p_i denotes the probability of women having stillbirth, μ is a constant and α_i is the effect of an exposure level.

2.8.3.2 Multiple logistic regression

Multiple logistic regressions apply when there is a single dichotomous outcome and more than one determinants. The outcome in logistic regression analysis is often coded as 0 or 1, where 1 indicates that the women who had at least one stillbirth during their lifetime and 0 indicates that the women never had stillbirth during their lifetime. If we define $p_{ij\ldots k}$ as the probability that outcome is 1, the multiple logistic regression model takes form as

$$ln\left(\frac{p_{ij\ldots k}}{1-p_{ij\ldots k}}\right) = \mu + \alpha_i + \beta_j + \cdots + \gamma_k \qquad (2.10)$$

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Where $p_{ij\ldots k}$ denotes the expected probabilities of the outcome, μ is a constant, α_i through γ_κ refers to the determinants.

To calculate the adjusted percentage for each category $i, j, \ldots, k$ of the determinant of interest, the value of μ is chosen to ensure that sum of the expected number, that is $\sum(p_{ij\ldots k}) \times (n_{ij\ldots k}) = \sum(p_{ij\ldots k}) \times (n_{ij\ldots k})$ where $n_{i,j,\ldots k}$ is the sample size in category $i, j, \ldots k$ of the determinants of interest. The adjusted probabilities of having a stillbirth can be expressed as $p_{ij\ldots k}$=1/(1+exp(-(μ + α_i + $\beta_j + \cdots + \gamma_\kappa$)) (Tongkumchum and McNeil, 2009; Kongchouy and Sampantarak, 2010).

The model with treatment contrasts was fitted to the data to get adjusted odds ratio but the model with weighted sum contrasts was used to get the adjusted percentage. In this study, sample size in each categories of the determinants are different so we used weighted sum contrasts. A weighted sum contrast was used to obtain confidence intervals for comparing each proportion with the overall proportion. The computed 95% confidence intervals provide classifying levels of each factor into three groups according to whether each corresponding confidence interval exceeds, crosses or is below the overall mean. They are more appropriate compared to the corresponding confidence intervals based on the treatment contrasts (Tongkumchum and McNeil, 2009). This model gives a percentage of women who have at least one stillbirth for each level of each factor adjusted for other factors with confidence interval and p-value for assessing the strength of association between determinants and outcome.

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2.8.3.3 Odds ratio

The coefficient in model is the estimate for the parameter *b* which is the natural logarithum of the odds ratio.

$$OR=\exp(b) \qquad 2.11$$

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Chapter 3

Results

In this chapter, we present our results from preliminary data analysis and results of the logistic regression model. Among 12,674 women aged 15-49 years, we found that 8,918 women who had experienced at least one pregnancy outcome during their lifetime. There were 488 mothers had experienced at least one stillbirth during their lifetime (5.47%).

3.1 Pattern of stillbirth among ever-pregnant women

Table 3.1 shows the pattern of stillbirth among ever-pregnant women in Nepal. Out of 8,918 ever-pregnant women 8,430 women did not experienced stillbirth during their lifetime (94.52%). Four hundred and twenty women experienced one stillbirth during their lifetime. Fifty six, nine and three women experienced two, three and four stillbirths during their life time, respectively.

Table 3.1: Pattern of stillbirth among ever-pregnant women

Pattern of stillbirth	Number of women	Percent (%)
No stillbirth	8,430	94.52
One stillbirth	420	4.70
Two stillbirth	56	0.62
Three stillbirth	9	0.10
Four stillbirth	3	0.03

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3.2 Preliminary analysis

A preliminary statistical analysis involved examining the frequency distribution and cross tabulation of the determinants and outcome. Chi-squared test was done to identify associations between each determinants and outcome.

Table 3.2 shows the distribution of the ever-pregnant women in each determinants. The majority of ever-pregnant women were of 30-35 years (35%). The proportion of women was highest among those working in the agriculture sector (60.09%). A great majority of the ever-pregnant women were not using tobacco (80.85%). By education, about fifty percent of ever-pregnant women were no education. Whereas, majority of husband were higher level of education (55.68%). In terms of wealth index, majority of ever-pregnant women were found to the rich class (42%), followed by poor class (39.29%). The highest proportion of women used relatively polluting cooking fuel like kerosene and wood (77.53%). Most of the ever-pregnant women were residue in rural areas (72.63%). Out of 13 subregion, the majority of women from central terai, eastern terai western terai and western hill were 10.02%, 9.57%, 9.25% and 9.04% respectively.

Table 3.2: Distribution of ever-pregnant women in Nepal

Characteristics	Number (n=8,918)	Percent
Age		
15-24 years	1736	19.46
25-29 years	1889	21.19
30-39 years	3151	35.33
40-49 years	2142	24.02
Maternal occupation		
Not working	1798	20.16
Agriculture	5359	60.09
Other	1761	19.75

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Table 3.2 (continue)

Characteristics	Number (n=8,918)	Percent
Using tobacco		
Yes	1707	19.15
No	7211	80.85
Maternal education		
No education	4501	50.47
Primary	1660	18.61
Secondary/Higher	2757	30.92
Paternal education		
No education	1783	19.99
Primary	2169	24.32
Secondary/Higher	4966	55.68
Wealth index		
Poor	3504	39.29
Middle	1662	18.63
Rich	3752	42.07
Cooking fuel		
Relatively non polluting	2003	22.46
Relatively polluting	6915	77.53
Residence		
Urban	2440	27.36
Rural	6478	72.63
Subregions		
Eastern mountain	504	5.65
Central mountain	459	5.14
Western mountain	502	5.62
Eastern hill	701	7.86
Central hill	735	8.24
Western hill	807	9.04
Mid-western hill	641	7.18
Far-western hill	599	6.71
Eastern terai	854	9.57
Central terai	894	10.02
Western terai	825	9.25
Mid-western terai	754	8.45
Far-western terai	643	7.21

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Pearson's chi-squared test is used to assess the statistical significance of the association between the outcome and each determinants.

Table 3.3 shows the association between determinants and women having stillbirth. The proportion of women having stillbirth was found to be highest in the age group 40-49 years (9.0%), followed by 30-39 years (6.3%). The occurrence of women having stillbirth was highest among those working in the agriculture sector (6.2%), about seven percent of the women having stillbirth were among tobacco users. Regarding maternal education, women with a history of stillbirth were highest among those with no education (7.2%). Similarly, the proportion of women having stillbirth was highest among those whose husbands had no education (7.1%). In terms of wealth index, women having stillbirth was found to be highest in the women belonging to the poor class (6.8%). Also, six percent of the women who had stillbirth used relatively polluting cooking fuel like kerosene and wood. The occurrence of women having stillbirth was found to be high among women residing in rural area (6.1%). Out of the 13 subregions; women who live in western mountain, far-western hills and eastern mountain had stillbirth of 8.4, 8.3 and 7.3%, respectively. All variables were significantly associated with women having stillbirth (p-value<0.05).

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Table 3.3: Association between determinants with women having stillbirth

Characteristics	Women who had stillbirth (n=488) [%]	Women who had no stillbirth (n=8430) [%]	p-value
Age			< 0.001
15-24 years	34 (2.0)	1702 (98.0)	
25-29 years	61 (3.2)	1828 (96.8)	
30-39 years	200 (6.3)	2951 (93.7)	
40-49 years	193 (9.0)	1949 (91.0)	
Maternal occupation			< 0.001
Not working	72 (4.0)	1726 (96.0)	
Agriculture	333 (6.2)	5026 (93.8)	
Other	83 (4.7)	1678 (95.3)	
Using tobacco			< 0.001
Yes	122 (7.1)	1585 (92.9)	
No	366 (5.1)	6845 (94.9)	
Maternal education			< 0.001
No education	326 (7.2)	4175 (92.8)	
Primary	91 (5.5)	1569 (94.5)	
Secondary/Higher	71 (2.6)	2686 (97.4)	
Paternal education			< 0.001
No education	126 (7.1)	1657 (92.9)	
Primary	133 (6.1)	2036 (93.9)	
Secondary/Higher	229 (4.6)	4737 (95.4)	
Wealth index			< 0.001
Poor	238 (6.8)	3266 (93.2)	
Middle	97 (5.8)	1565 (94.2)	
Rich	153 (4.1)	3599 (95.9)	
Cooking fuel			< 0.001
Relatively non polluting	75 (3.7)	1928 (96.3)	
Relatively polluting	413 (6.0)	6502 (94.0)	
Residence			< 0.001
Urban	96 (3.9)	2344 (96.1)	
Rural	392 (6.1)	6086 (93.9)	

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Table 3.3 (continue)

Characteristics	Women who had stillbirth (n=488) [%]	Women who had no stillbirth (n=8430) [%]	p-value
Subregions			< 0.001
Eastern mountain	37 (7.3)	467 (92.7)	
Central mountain	20 (4.4)	439 (95.6)	
Western mountain	42 (8.4)	460 (91.6)	
Eastern hill	44 (6.3)	657 (93.7)	
Central hill	21 (2.9)	714 (97.1)	
Western hill	36 (4.5)	771 (95.5)	
Mid-western hill	39 (6.1)	602 (93.9)	
Far-western hill	50 (8.3)	549 (91.7)	
Eastern terai	39 (4.6)	815 (95.4)	
Central terai	32 (3.6)	862 (96.4)	
Western terai	50 (6.1)	775 (93.9)	
Mid-western terai	43 (5.7)	711 (94.3)	
Far-western terai	35 (5.4)	608 (94.6)	

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3.3 Logistic regression model

Logistic regression analysis was used to identify the strength of association between these determinants and the outcome. These determinants, which were significant in the univariate analysis, were consequently included in the multiple logistic regression model (based on the reduction in residual deviance using the chi-squared test). In the first step, all determinants significant in univariate analysis were fitted in the final logistic regression model based on sum contrasts. Backward elimination procedure was used and remove one determinant at a time on the basic of its “F statistics”.

as shown in Table 3.4.

Table 3.4: Coefficients, standard errors and p-values based on multiple logistic regression model

Characteristics	Coefficients	Std. error	p-value (Wald's test)	p-value (LR-test)
Constant	-3.220	0.106		<0.001
Age				<0.001
15-24 years	-0.827	0.142	<0.001	
25-29 years	-0.303	0.111	0.006	
30-39 years	0.391	0.081	<0.001	
40-49 years	0.738	0.089	<0.001	
Maternal occupation				0.386
Not working	0.029	0.097	0.763	
Agriculture	-0.110	0.083	0.185	
Other	0.081	0.091	0.375	
Using tobacco				0.248
Yes	0.068	0.059	0.252	
No	0.067	0.059	0.251	
Maternal education				<0.001
No education	0.202	0.083	0.015	
Primary	0.224	0.086	0.009	
Secondary/Higher	-0.425	0.103	<0.001	
Paternal education				0.821
No education	-0.013	0.080	0.875	
Primary	-0.031	0.073	0.668	
Secondary/Higher	0.043	0.073	0.553	
Wealth index				0.187
Poor	0.118	0.084	0.158	
Middle	0.054	0.084	0.517	
Rich	-0.172	0.098	0.080	
Cooking fuel				0.841
Relatively non-polluting	0.017	0.086	0.841	
Relatively polluting	-0.017	0.086	0.841	
Residence				0.048
Urban	-0.135	0.069	0.051	
Rural	0.135	0.069	0.051	

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Table 3.4 (continue)

Characteristics	Coefficients	Std. error	p-value (Wald's test)	p-value (LR-test)
Subregions				<0.001
Eastern mountain	0.265	0.171	0.121	
Central mountain	-0.423	0.220	0.054	
Western mountain	0.381	0.165	0.021	
Eastern hill	0.091	0.156	0.560	
Central hill	-0.575	0.216	0.008	
Western hill	-0.192	0.167	0.252	
Midwestern hill	0.083	0.164	0.613	
Far-western hill	0.376	0.153	0.014	
Eastern terai	-0.050	0.167	0.763	
Central terai	-0.422	0.179	0.018	
Western terai	0.242	0.153	0.113	
Mid-western terai	0.112	0.155	0.470	
Far-western terai	0.112	0.172	0.514	

Table 3.4 shows the result from full logistic model based on sum contrasts. Weighted sum contrasts used to obtain confidence intervals for comparing each percentage with the overall percentage. The model initially fitted contained additive effects for age, maternal occupation, using tobacco, maternal education, paternal education, wealth index, cooking fuel, place of residence and subregions. The numbers labeled coefficients and standard errors are the estimate of the parameters (natural logarithm of the odds ratio) and its standard errors, respectively. The p-values shows the maternal age, maternal education, place of residence and subregions were statistically associated with women having stillbirth (p-value <0.05).

Figure 3.1 shows 95% confidence intervals of the women who had at least one stillbirth during their lifetime for each level of the determinants. This graph shows the

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corresponding crude and adjusted percent with respect to the various levels of each of the nine determinants. With regard to the results with women having stillbirth as an outcome, all determinants were associated in bivariate analysis, four determinants retained significantly associated in the multivariate analysis. Mother's age and education, residence and subregion were statistically associated with women having stillbirth (p-value <0.05). The horizontal red line is the overall mean percentage of women who had at least one stillbirth during their lifetime (5.47%).

There was an increased risk of women having stillbirth with increasing maternal age. The adjusted percent of women having stillbirth was found to be higher among above 40 years (8.68%, 95% CI: 7.44-10.06) followed by 30-39 years (6.43%, 95% CI: 5.67-7.26) and lower in lower than 30 years compared with the overall percent. Residence is significantly associated with women having stillbirth. Adjusted percent of women residing in rural areas was (5.83%, 95% CI: 5.49-6.25) which is higher than the residing in urban areas (4.51%, 95% CI: 3.73-5.45). Similarly, the risk of a women having stillbirth was found to be higher for uneducated mother (6.31%, 95% CI: 5.68-7.00) which is significantly higher than the secondary and higher secondary educated women (3.50 %, 95% CI: 2.85-4.29). With respect to the 13 subregions, the women from far-western hill (7.77%, 95% CI: 5.92-10.12) and western mountain (7.73%, 95%: CI: 5.72-10.36) had a significantly higher percent of stillbirth in compare to overall percent. However, central hill (3.08%, 95% CI: 2.06-4.58) and central terai (3.56%, 95% CI: 2.58-4.89) had significantly lower percent of stillbirth compared with overall percent. The

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figure shows that, there is no statistical association between women having stillbirth with maternal occupation, using tobacco, paternal education, wealth index and cooking fuel.

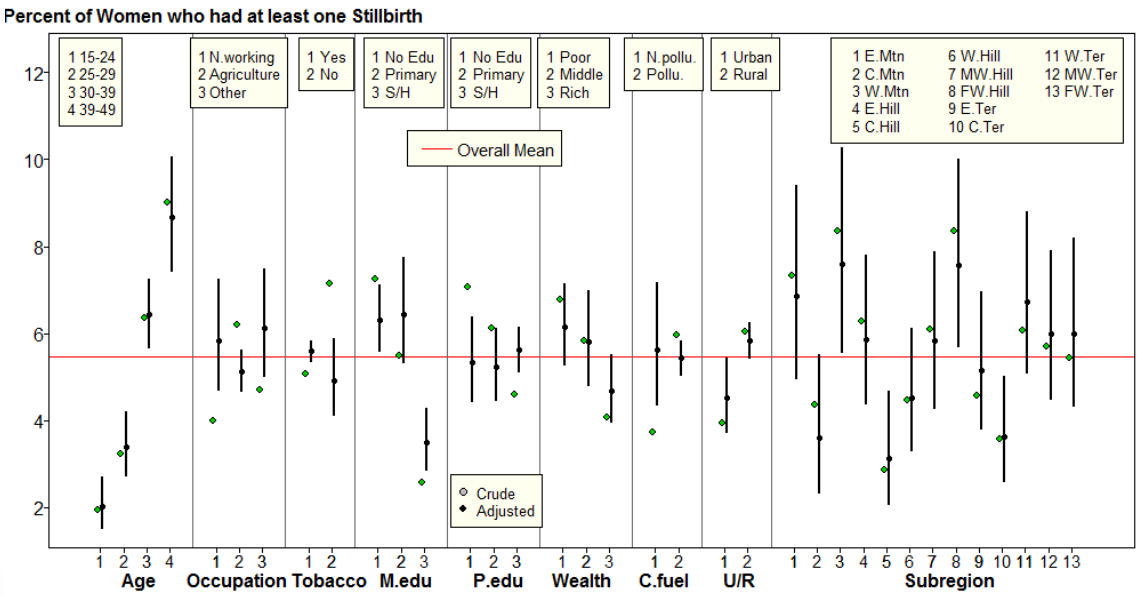

Figure 3.1: Crude and Adjusted percentage of women who had at least one stillbirth

Abbrevations: Age, maternal age; Occupation, maternal occupation; N.working, not working; Other, (eg. Professional/technical/managerial, clerical, sales and service, skilled and unskilled manual); Tobacco, use of tobacco; M.edu, maternal education; No edu, no education; S/H, secondary and higher secondary education; P edu, paternal education; wealth, wealth index; C. fuel, cooking fuel; N. pollu, relatively non-polluting; Pollu, relatively polluting; U/R, urban and rural; in subregion, E. mtn, eastern mountain; C. mtn, central mountain; W. mtn, western mountain; E.hill, eastern hill; C. hill, central hill; W. hill, western hill; MW hill, midwestern hill; FW. hill, Far-western hill; E. ter, eastern terai; C. ter, central terai; W. ter, western terai; MW. Ter, Mid-western terai; and FW.ter, far-western terai.

3.4 Reduced model

Table 3.5: Coefficients, standard errors and p-values based on reduced multiple logistic regression model

Characteristics	Coefficients	Std error	p-value (Wald's test)
Constant	-3.226	0.075	<0.001
Age			
15-24 years	-0.787	0.139	<0.001
25-29 years	-0.284	0.111	0.010
30-39 years	0.383	0.080	<0.001
40-49 years	0.688	0.086	<0.001
Maternal education			
No education	0.201	0.073	0.006
Primary	0.219	0.086	0.010
Secondary/Higher	-0.420	0.094	<0.001
Residence			
Urban	-0.144	0.063	0.022
Rural	0.144	0.063	0.022
Subregions			
Eastern mountain	0.297	0.168	0.076
Central mountain	-0.438	0.218	0.044
Western mountain	0.400	0.161	0.012
Eastern hill	0.094	0.154	0.540
Central hill	-0.586	0.211	0.005
Western hill	-0.194	0.166	0.242
Midwestern hill	0.100	0.162	0.536
Far-western hill	0.406	0.147	0.005
Eastern terai	-0.059	0.162	0.714
Central terai	-0.439	0.174	0.011
Western terai	0.199	0.145	0.170
Mid-western terai	0.111	0.155	0.474
Far-western terai	0.109	0.171	0.524

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Table 3.5 shows the reduced multiple logistic regression model based sum contrasts after omitting determinants with p-value greater than 0.05, using backward elimination strategies. The model with weighted sum contrasts was used to obtain confidence intervals for comparing each percent with the overall percentage.

Table 3.6: AIC value, p-value and degree of freedom from multiple logistic regression model

Characteristics	Df	AIC value	p-value (LR-test)
Constant		3614.7	
Age	3	3698.1	<0.001
Residence	1	3618.1	0.020
Maternal education	2	3632.9	<0.001
Subregion	12	3628.6	<0.001

Table 3.6 shows the results of reduced model. The p-value shows that all four determinants in the model are highly statistically associated with women having stillbirth (p-value <0.05). In addition, the determinants AIC value greater than 3614.7 are maternal age, maternal education, place of residence and subregion were statistically associated with women having stillbirth.

Table 3.7 shows odds ratio for each determinant together with the corresponding 95% confidence intervals after adjusting for the other variables using logistic regression model based on treatment contrasts. The natural logarithm of odds ratio was estimated from coefficient and its 95% confidence interval.

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The odds of women having stillbirth were found highest in women aged 40-49 years (OR 4.37; 95% CI (2.97-6.44)), followed by 30-39 years (OR 3.22; 95% CI (2.21-4.69)) were more likely to have stillbirth compared with women's age 15-24 years. Women residing in the rural area were more likely (OR 1.33; 95% CI (1.04-1.71)) to have stillbirth residing in urban. With respect to the maternal education, the women who are uneducated (OR 1.86; 95% CI (1.40-2.48)) and primary education (OR 1.90; 95% CI (1.37-2.62)) have higher probability of having stillbirth compared with higher level of education. Out of 13 subregions, the women from far-western hill (OR 2.70; 95% CI (1.59-4.58)), western mountain (OR 2.68; 95% CI (1.55-4.65) and eastern mountain (OR 2.42; 95% CI (1.39-4.21)) were more likely to have stillbirth compared to mothers from the central hill.

Table 3.7: Unadjusted and adjusted odds ratio and 95% CI of study variables

Characteristics	Unadjusted ORs (95% CI)	Adjusted ORs (95% CI)	p-value (Wald's test)	p-value (LR-test)
Age				<0.001
15-24 years	1.00	1.00		
25-29 years	1.67 (1.09-2.55)	1.65 (1.08-2.54)	0.021	
30-39 years	3.39 (2.35-4.90)	3.22 (2.21-4.69)	<0.001	
40-49 years	4.96 (3.42-7.18)	4.37 (2.97-6.44)	<0.001	
Residence				0.020
Urban	1.00	1.00		
Rural	1.57 (1.25-1.98)	1.33 (1.04-1.71)	0.023	
Maternal education				<0.001
No education	2.95 (2.27-3.84)	1.86 (1.40-2.48)	< 0.001	
Primary	2.19 (1.60-3.01)	1.90 (1.37-2.62)	< 0.001	
Secondary/Higher	1.00	1.00		

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Table 3.7: (continue)

Characteristics	Unadjusted ORs (95% CI)	Adjusted ORs (95% CI)	p-value (Wald's test)	p-value (LR-test)
Subregions				< 0.001
Eastern mountain	2.69 (1.56-4.66)	2.42 (1.39-4.21)	0.002	
Central mountain	1.55 (0.83-2.89)	1.16 (0.62-2.18)	0.646	
Western mountain	3.10 (1.81-5.31)	2.68 (1.55-4.65)	< 0.001	
Eastern hill	2.28 (1.34-3.87)	1.97 (1.15-3.38)	0.013	
Central hill	1.00	1.00		
Western hill	1.59 (0.92-2.75)	1.48 (0.85-2.57)	0.164	
Mid-western hill	2.20 (1.28-3.75)	1.99 (1.15-3.44)	0.014	
Far-western hill	3.10(1.84-5.22)	2.70 (1.59-4.58)	< 0.001	
Eastern terai	1.63 (0.95-2.79)	1.69 (0.98-2.92)	0.057	
Central terai	1.26 (0.72-2.21)	1.16 (0.66-2.04)	0.609	
Western terai	2.19 (1.30-3.69)	2.19 (1.30-3.71)	0.003	
Mid-western terai	2.06 (1.21-3.50)	2.01 (1.17-3.43)	0.011	
Far-western terai	1.96 (1.13-4.40)	2.00(1.15-3.50)	0.014	

Figure 3.2 shows the residual plot which indicates that the models provided an acceptable fit both women having at least one stillbirth and different demographic, house-hold and geographical determinants. The residuals are normally distributed, because they lie along a straight line.

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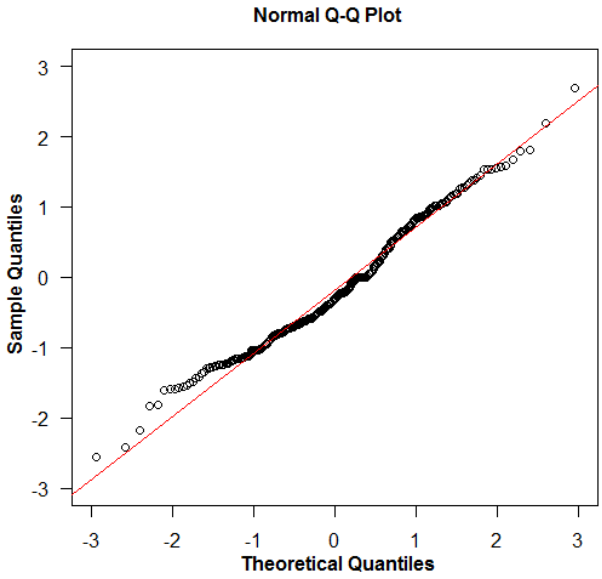

Figure 3.2: Normal Q-Q plot (quantiles plots)

Figure 3.3 shows observed and expected value that almost of all value are going together along the straight line.

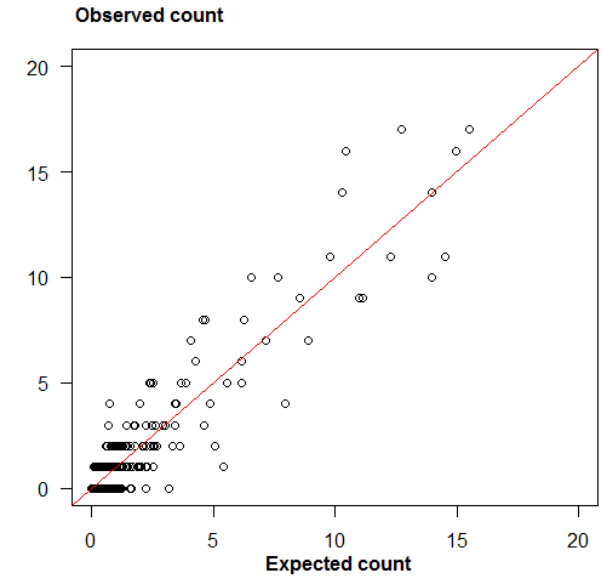

Figure 3.3: Observed and expected value.

Figure 3.4 shows 95% confidence intervals of the women who had at least one stillbirth during their lifetime for each level of each factor adjusted for other factors which is significant for multivariate analysis. The graph shows the corresponding crude and adjusted percent with respect to the various levels of each of the determinants. The horizontal line is the overall percentage of women who had at least one stillbirth during their lifetime (5.47%).

There was an increased risk of women having stillbirth with increasing maternal age. The adjusted percent of women having stillbirth was found to be higher among women above 30 years and lower in women whose age is lower than 30 years compared with the overall percent. Adjusted percent of women residing in urban areas was (4.45%, 95%: CI: 3.75-5.29), which is lower than those residing in rural areas (5.85%, 95% CI: 5.49-6.23). The figure shows that, the risk of women having stillbirth was higher for uneducated mothers (6.31%, 95%: CI: 5.68-7.00), which is higher than the overall percentage. With respect to the 13 subregions, the women from far-western hill (7.77%, 95% CI: 5.92-10.12) and western mountain (7.73%, 95% CI: 5.72-10.36) had a significantly higher percentage of stillbirth compared with overall percent. However, central mountain (3.56%, 95% CI: 2.32-5.42), central hill (3.08%, 95% CI: 2.06-4.58) and central terai (3.56%, 95% CI: 2.58-4.89) had significantly lower percentage of stillbirth compared with the overall percent.

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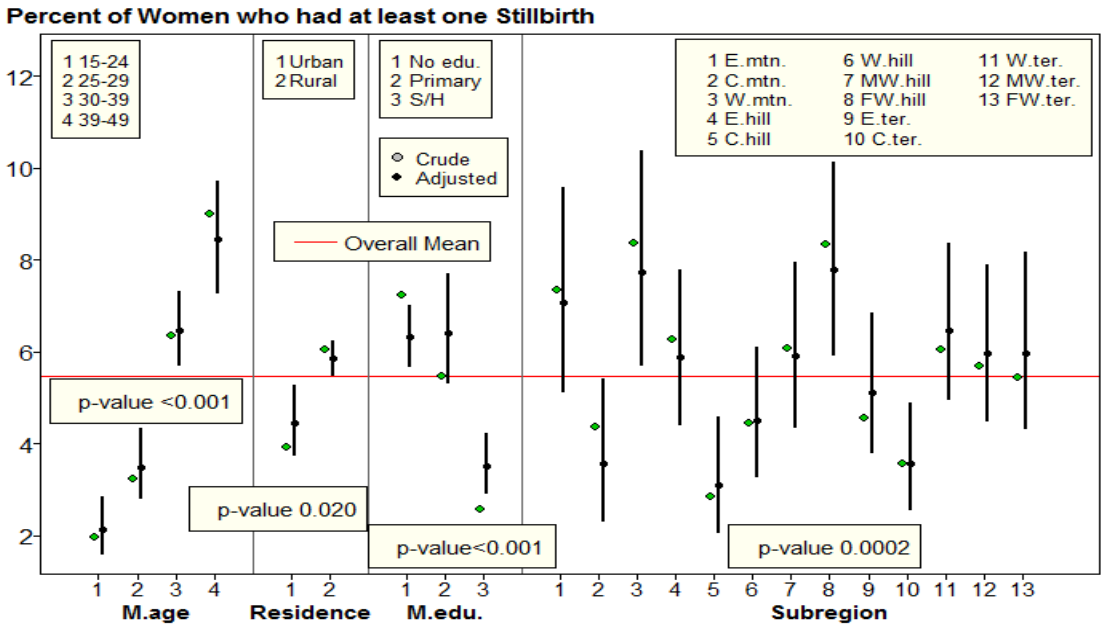

Figure 3.4: Crude and Adjusted percentage of women who had at least one stillbirth

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Chapter 4

Discussion and Conclusions

This chapter includes the summary of findings, discussions, conclusions, limitations and recommendation for further studies.

4.1 Summary of findings

Finding from this analysis indicated that 8,918 women who had experienced at least one pregnancy outcome during their lifetime. There were 488 mothers had experienced at least one stillbirth during their lifetime representing a 5.47% of the total. Univariate analysis showed that age of the mother, maternal occupation, using tobacco, maternal education, paternal education, wealth index, cooking fuel, place of residence and subregions were associated with women having stillbirth.

Logistic regression analysis was used to identify the strength of association between these determinants and the outcome. These variables, which were significant in the univariate analysis, were consequently included in the multiple logistic regression model (based on the reduction in residual deviance using the chi-squared test). After adjusting for other factors, maternal age, maternal education, place of residence and subregion were significantly associated with women having stillbirth during their lifetime.

The result from logistic regression model based on sum contrasts showed that the women having stillbirth was significantly higher among above 30 years and low in lower than 30

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years. Women residing in rural areas were significantly higher than the residing in urban areas. Similarly, the risk of a women having stillbirth was significantly higher on uneducated mother in compare to the secondary and higher educated women. With respect to the 13 subregions, the women from far-western hill and western mountain had a significantly higher percent of stillbirth compared to overall percent. However, central mountain, central hill and central terai had significantly lower percent of stillbirths compared to overall percent. There is no statistical association between women having stillbirth with maternal occupation, using tobacco, paternal education, wealth index and cooking fuel in multivariate analysis.

4.2 Discussions

This study was carried out to identify the factors associated with women having stillbirth in ever-pregnant women in Nepal. Maternal age, place of residence, maternal education and subregions were the statistically associated factors of women having stillbirth in Nepal.

Stillbirth was found to be higher among younger than older maternal age. Our findings were consistent with several studies conducted in various countries, that is, increased maternal age is a significant factor for stillbirth (Waldenstrom *et al.,* 2015; Ashish *et al.,* 2015; Asiki *et al.,* 2015). This study showed that the risk of stillbirth is higher among woman above 40 years and lower among those aged 15-24 years. This might be that these women have had many pregnancies, with a risk of stillbirths.

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Residing rural area has been found to be a significant associated factor of women having stillbirth, and this finding was supported by a previous study conducted in India (Avachat *et al.,* 2015), and Nepal (Lee *et al.,* 2011). The majority of the rural areas of Nepal had a high level of illiteracy, lack of health awareness, low socioeconomic status, lack of transportation facility, lack of accessibility of health facility, lack of health service utilization and lack of trained health personnel. Therefore, women from these areas are more likely to have stillbirth (Sharma *et al.,* 2014; Lama *et al.,* 2014).

Mothers who are uneducated or with only primary education are more likely to have stillbirth than educated mothers. Our finding agrees with the study conducted in Canada found that there was a significant association between stillbirths and maternal education at all gestational ages (Auger *et al.,* 2012). In a similar way, study conducted in developing countries reported that the women without education were more likely to have stillbirths compared to those women who had higher levels of education (McClure *et al.,* 2015). The relationship of the education status of mothers with stillbirth can be explained in a different ways. Educated mother is more conscious about maternal health, balanced diet as well as ANC visit and more likely to be aware unhealthy behavior like smoking and alcohol drinking.

Out of the 13 subregions, the women from the far-western hill and western mountain were significantly associated with having stillbirth than the women from central mountain, central hill and central terai. The complicated terrain, lack of transportation and road infrastructure facility, lack of health service facility as well as the poor economy

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and also scarcity of food for a long time are responsible for stillbirths among women in these regions (Upreti *et al.,* 2010; Choulagai *et al.,* 2013). Husband involvement is a prime essential factor during pregnancy, birth preparedness and health facility delivery (Thapa *et al.,* 2013). However, most of the husbands from these areas are migrants India looking for employment (Nepal, 2007). In contrast to literature, Sarlahi District situated in central terai had higher rate of stillbirth. Where three-quarters of the population live below the Nepalese poverty line. Transportation and road infrastructure are poor, with only two smooth roads in the district. The district hospital has the capacity for basic, but not comprehensive, emergency obstetric care. Most of the birth occurred at home without assistance of skilled health personnel (Tielsch *et al*.,2007).

Cooking fuel has been related to stillbirth in many studies, for example, the study conducted in India, reported that the risk of stillbirth was considerably higher among women who used firewood for cooking as compared to those who used LPG (Lakshmi *et al.,* 2013). Furthermore the result of the study is related to the study, conducted by Pope *et al.* (2010) found that internal air pollution was closely related to increased risk of stillbirth. However, this study did not find this factor to be significant in the multivariate analysis. A possible reason for this non-significant result may be the method of questionnaires asked what was the main sources of cooking fuel. In Nepal, majority of rural households use woods as the main sources of fuel (MOHP, 2012). It is also possible to use multiple source of fuels such as non-polluting fuels for cooking (biogas, LPG) and use polluting fuels for other purposes (eg boiling water and cooking food for the cattle). This is especially true for rural areas.

In this study, the use of tobacco was not found to be significantly associated with stillbirth in multivariate analysis. However, this has been found to be a risk factor in developed as well as developing countries. The study conducted by Maruf *et al.* (2015) investigated that smoking had a positive relationship with the happening of stillbirth in developed countries and it is rapidly growing in the developing world. Similarly, a cohort study conducted in Mumbai, India, found that women, smokeless tobacco use during pregnancy increase risk of stillbirth (Gupta and Subramoney, 2006*).* In this study there might be a response bias because using tobacco is socially and culturally unacceptable behavior in Nepal.

Paternal education has been associated with stillbirth in both developed and developing countries. According to the study conducted in the eastern part of Nepal (Lee *et al.,* 2011). North East Tanzania (Habib *et al.,* 2008), low paternal education was highly associated with stillbirth. As well as, the study conducted in Norway supported the same as the result that paternal education was more important in predicting stillbirth, whereas maternal education was more significant in predicting post neonatal death (Arntzen, 1996). However, this study did not find a significant association in the multivariate analysis.

In conclusion, this study demonstrated factors associated with women having stillbirth in Nepal include increased maternal age, residing in rural areas, lack of maternal education and women who live in western mountain and the far-western hill regions. Stillbirth is still a major public health problem in Nepal. To minimize the stillbirth in Nepal, plans

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and policies should be focused on low education and also on mothers living in rural areas with a special focus on women who reside in western mountain and far-western hill regions.

4.3 Implication of the study

The study highlights the factors associated with women having stillbirth in Nepal using logistic regression model based on sum contrasts. The information from this study can be used to create guidelines for setting of health plans and policies as well facilitate the development of better public health intervention for preventing and controlling stillbirth and improve maternal health.

4.4 Limitations and recommendation of the study

Our study had some limitations. Firstly, we used secondary data so it was not possible to evaluate other factors known to be associated with stillbirth, such as the maternal medical factors, maternal nutritional status before pregnancy and ANC visit and access to care, especially obstetric care. Secondly, there is a chance of some response bias may suffer from recall bias and possible social desirable responses.

Further study is needed to explore other factors known to be associated with stillbirth, such as the maternal medical factors, maternal nutritional status before pregnancy and ANC visit and access to care, especially obstetric care.

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Appendix

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Certificate of Appreciation

This is to certify that

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Risk Factors for Stillbirth in Ever-Pregnant Women in Nepal: Further Analysis of Nepal Demographic and Health Survey 2011

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Abstract

Background: Stillbirth is one of the most common adverse pregnancy outcomes and it is a devastating and traumatic event for women and their partners. This is a serious and neglected maternal health and child health problem in developing countries. Our study is aimed to identify risk factors associated with stillbirth in ever-pregnant women in Nepal.

Methods: This study used the data from the 2011 Nepal Demographic and Health Survey (NDHS), which is a nationally representative cross sectional survey using two stage cluster sampling. In first stage, the primary sampling units (wards in rural and sub-wards in urban areas) were selected. In second stage households were randomly selected from the wards and sub-wards. This survey interviewed 10,826 households. In selected households, 12,674 women aged 15-49 years and 4,121 men aged 15-49 years in every second household. The response rate was 95.3%. The association between stillbirth and explanatory variables was analyzed using Chi-square test, followed by logistic regression model.

Results: We found that 8,918 of the 12,674 interviewed women, aged 15-49, had experienced at least one pregnancy outcome during her life time, and 488 ever-pregnant women had experienced at least one stillbirth. Maternal age, place of residence (urban or rural), maternal education and sub- region were significantly associated with stillbirth. The risk of stillbirth increased as the maternal age increased. The risk of having stillbirth were higher for women's residing in the rural area [OR 1.15; 95% CI (1.02-1.30)] compared to mother from urban area [OR 0.86; 95% CI (0.58-0.95)]. Whereas the women's with did not had education and had primary educational level were more likely to have stillbirth [OR 1.21; 95% CI (1.05-1.40)], [OR 1.24; 95% CI (1.05-1.47], respectively than the women who had higher level of education [OR 0.65; 95% CI (0.54-0.79]. Out of 13 sub- region, the women who were from the far-western hills, western mountain and eastern mountain had significantly higher chances to have stillbirth compared to women from the Central hill, Central mountain and Central terai.

Conclusion: Stillbirth is still the major public health problem in Nepal. To minimizing the stillbirth in Nepal plans and policies should be focused on low education and living in rural area mother.

Key words: Ever-Pregnant Women, Chi-squared test, Logistic regression model, Odds ratio.

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Introduction

Perinatal mortality is one of the most sensitive indices of maternal and child health which reflect the socioeconomic, cultural and environmental conditions of the community. This is responsible for about 7% of the total global burden of the disease (Moss et al, 2002). The World Health Organization (WHO) defines perinatal mortality as the "number of stillbirths and deaths in the first week of life per 1,000 live births, the perinatal period commences at 22 complete weeks (154 days) of gestation and ends seven complete days after birth". Globally stillbirth accounts for two thirds of all perinatal deaths and most of them are preventable (Mario, et al, 2007).

Stillbirth is important, untill now weakly understood, adverse outcome of pregnancy. There is no clear guideline as well as changing terminology over time and there is a much difference between countries with high inconsistency in developed countries than developing countries (Woods, 2008). Most of the developed countries use lower gestational age cutoff for birth as 20 weeks. Sweden is one of the few developed countries that use 28 weeks as lower gestational age cutoff. Most of the developing countries use lower cutoffs of 28 weeks or 1000 grams (McClure et al, 2006; Goldenberg et al, 2004 and Marufu et al, 2015). For international comparability, WHO promotes the definition of stillbirth (or late fetal death) "as an infant born without any signs of life occurring at least 28 weeks of gestation or at least 1000 grams birth weight, at least 35 cm body length" (WHO, 1996). Demographic Health Survey (2011) defined as stillbirth is fatal death in pregnancies lasting seven or more months.

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Globally, each year 2.65 million babies are born dead, with more than 8,200 deaths a day. It is found that 98% of these deaths occur in developing countries, and large differences exist; in high-income countries like Finland, 2.0 per 1000 total births; whereas countries like Nigeria and Pakistan have more than 40 stillbirths per 1000 total births. Worldwide, 1995 to 2009 stillbirth rate declined by 14%, representing a 1.1% decrease per year although improvement occurs only in developed countries not in developing countries. For instance 0.7% decline in the African region as compared to Western Pacific region with 3.8% (WHO, 2009 and Cousens et al, 2011).

It is estimated that some 1.55 million (51%) stillbirth occurs in our neighboring countries; India, China, Pakistan and Bangladesh (Stanton et al, 2006). Despite higher number of stillbirths reported in Southeast Asian countries, data on this topic from this area have been scarce. The rate of stillbirth has been declining during recent decades in Nepal. It is reported that stillbirth rate is 21 per 1000 live births nationally (Cousens et al, 2011), but stillbirth rate is as high as 35.4 per 1000 births in Sarlahi, a rural district of Nepal, where most of the birth occurred at home without a health professionals (Lee et al, 2011). However, the result of the Nepal Demographic Health Survey 2011 showed that 1% of pregnancies are stillbirth.

Risk factors and causes of stillbirths differ between developing and developed countries (McClure et al, 2006). Maternal factors like as nutritional status, socioeconomic disadvantage, nulliparity, previous stillbirth, marginal class, single marital status, lack of maternal education, higher maternal age, short inter-pregnancy interval, smoking, alcohol and drug use are risk factors of stillbirth. However, lack of antenatal care, maternal

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syphilis, chorioamnionitis, hypertensive diseases of pregnancy, syphilis and gram-negative infection and malaria in endemic areas as well as obstructed or prolonged labor and those delivered without a skilled birth attendant are the most important causes of still birth in developing countries. Stillbirths in developing countries are preventable because more than two-thirds of all stillbirths are non-macerated (McClure et al, 2006; Mario et al, 2007; McClure et al, 2009; Yakoob et al, 2010 and McClure et al, 2015). In developed countries, higher maternal age, pre- existing diabetes, hypertension, primiparity, small size for gestational age and abruption, ante- partum haemorrhage, parity, ethnicity and the past of psychological health problems and fetal growth restriction are the important factors to still birth. However, maternal overweight and obesity, smoking in pregnancy, and fetal growth restriction are potentially modifiable resk factors. Maternal alcohol drinking during pregnancy is closely related to stillbirth (Aliyu et al, 2008; Flenady et al, 2011 and Gardosi et al, 2013). The study conducted in rural Sarlahi, Nepal found that Null parity, earlier child loss, increased maternal age, madhesi ethnicity, and socially deprived women were momentous risk factors for stillbirth (Lee et al, 2011).

Stillbirth is a devastating and traumatic event for women and their partners. It is a significant indicator in determining the disease burden for mother and child (Kelley et al, 2010). Many stillbirths are preventable through simple interventions, and a systematic registration of stillbirths is the first step towards improving health system planning (Bhutta, 2011). There is a need for research on stillbirths and its associated risk factors as a basis for developing preventive measures (Lawn et al, 2011). Knowledge of the relative importance of the different causes of stillbirth in developing countries is still lacking. A

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very few study are conducted based on some districts as well as hospital- based study of Nepal, but there is lack of nationally representative study on stillbirth in Nepal. This study aims is to investigate distribution of stillbirth in ever-pregnant women in Nepal and to identify the risk factors associated with stillbirth in ever-pregnant women in Nepal using the large administrative database.

Methods

Study area, Data sources and sample size

Our analysis uses data from Nepal demographic and health survey 2011, which is nationally representative cross-sectional survey conducted every five years based on multistage stratified cluster sampling with subject sampled from village and municipalities within 75 districts of Nepal. The survey was conducted from January to May, 2011.

The NDHS 2011 studies based on multistage stratified cluster sample. In the first stage, the enumeration areas (EAs) were selected using a probability- proportional-to-size-strategy. In order to achieve the target sample size in each domain, the number of EAs allocated to the urban and rural areas of each domain was roughly in ratio of one urban to two rural EAs to provide for 95 urban and 194 rural EAs (a total of 289 EAs). Complete household listing and mapping was carried out in all selected EAs. In the second stage, households were randomly selected from the wards and sub wards (35 households in each urban EA and 40 households in each rural EAs).

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The 2011 survey interviewed 10,826 households. In selected households, 12,674 women aged 15-49 years and 4,121 men aged 15-49 years in every second household. The response rate was 95.3%. The NDHS 2011consists of three sets of internationally validated questionnaires for the collection of different levels of information: i) household information- covered information about all the members of the household; ii) women's information; and iii) men's information. This study utilized women's record data set that contains demographic and reproduction characteristics of the women aged 15-49 years. The present study included data from women aged 15-49 years. Total of 8,918 women aged 15-49 years who had experienced a least one pregnancy outcome during her life time were included in this study.

Variables

Outcome variable

Stillbirth was defined as stated above. In this study the unit of analysis was mother rather than number of pregnancies. Those women who had at least one or more stillbirth during her life time period counted as one stillbirth. The NDHS 2011 consists information on women pregnancy outcome during her life time: live birth, stillbirth, abortion and miscarriage.

Independents variable

In this study, we follow previous published NDHS data based study to categories the independent variables (Khanal et al, 2014). The age groups of mother were categorized as: 15-24, 25-29, 30-34, 35-39, 40-44 and 45-49 years. The maternal education status was

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arranged as no education, primary education and secondary-higher level. Maternal occupation was classified not working, agriculture and others-professional/technical/ managerial, clerical, sales and service, skilled manual and unskilled manual. The wealth status was hierarchic as poorest, poorer, middle, richer and richest. The areas was comprises of mountain, hill and terai.The location was categories as urban and rural. The sub- region were categorized eastern mountain, central mountain, western mountain, eastern hill, central hill, western hill, mid-western hill, far-western hill, eastern terai, central terai, western terai, mid-western terai and far-western terai.

Statistical Analysis

A preliminary statistical analysis involved examining the frequency distribution of the independent variables, cross tabulation and their univariate association with the outcome. Association between stillbirth and study determinants was determined by pearson's chi-squared test. The significant variables, identified in the univariate analysis were further examined using logistic regression model to identify the strength of association between determinants and outcome and express as crude and adjusted odds ratio (ORs) with 95% confidence interval (CI). This model was conducted to adjust for the interaction of exposure variables with each other. To obtain the final model, we used backward elimination process.

All statistical analysis was carried out using the R program (R Development Core Team, 2015).

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Results

Among 12,674 women aged 15-49, we found that 8,918 women who had experienced at least one pregnancy outcome during her life time. There were 488 ever-pregnant women had experienced at least one stillbirth.

Univariate analysis

Table 1 shows the characteristics of ever- pregnant women and the comparison between women who have had at least one stillbirth and those who have not experience any stillbirth during their life time. The proportion of stillbirth were found to be highest in the age above 45 years (9.5%), followed by those with in the age group 40-44 years (8.7%). Out of the 13 sub region; western mountain, far western hills and eastern mountain had stillbirth of 8.4, 8.3, 7.3% respectively, while the central hill and central terai had 2.9 and 3.6% stillbirth respectively. The occurrence of stillbirth was found to be higher percentage those women residing in rural area (6.1%) in compare to those women residing in urban areas (3.9%). However, there was not much difference in stillbirth between women living in the mountain, terai and hill.

The proportion of stillbirth was lower among women whose educational status was higher as compare to those whom with primary educational status and no education. Regarding maternal occupation, stillbirth was higher percentage among those who working in the agriculture sector (6.2%). Also, 7.1% of the women having stillbirth belongs to the poorest and 6.4% belongs to the poorer economic status. However, 4.8 and 3.4% of the women belongs to the rich and richest economic status, respectively.

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Maternal age, sub region, place of residence, maternal education, wealth index, maternal occupation were associated with stillbirth (p-value<0.05).

Table 1 Characteristics of ever- pregnant women and comparison between women who had stillbirth and who had not stillbirth.

Characteristics	Women who had stillbirth (n=488)	Women who had no stillbirth (n=8430)	p value
Age			<0.001
15-24 years	34 (2.0)	1702 (98.0)	
25-29 years	61 (3.2)	1828 (96.8)	
30-34 years	98 (6.0)	1529 (94.0)	
35-39 years	102 (6.7)	1422 (93.3)	
40-44 years	106 (8.7)	1119 (91.3)	
45-49 years	87 (9.5)	830 (90.5)	
Region			0.043
Mountain	99 (6.8)	1366 (93.2)	
Hill	190 (5.5)	3293 (94.5)	
Terai	199 (5.0)	3771 (95.0)	
Residence			<0.001
Urban	96 (3.9)	2344 (96.1)	
Rural	392 (6.1)	6086 (93.9)	
Maternal education			<0.001
No education	4175 (92.8)	326 (7.2)	
Premary	1569 (94.5)	91 (5.5)	
Higher	2686 (97.4)	71 (2.6)	

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Table 1 (continue)

Characteristics	Women who had stillbirth (N=488)	Women who had no stillbirth (N=8430)	p value
Sub region			<0.001
Eastern mountain	467 (92.7)	37 (7.3)	
Central mountain	439 (95.6)	20 (4.4)	
Western mountain	460 (91.6)	42 (8.4)	
Eastern hill	657 (93.7)	44 (6.3)	
Central hill	714 (97.1)	21 (2.9)	
Western hill	771 (95.5)	36 (4.5)	
Mid-western hill	602 (93.9)	39 (6.1)	
Far-western hill	549 (91.7)	50 (8.3)	
Eastern terai	815 (95.4)	39 (4.6)	
Central terai	862 (96.4)	32 (3.6)	
Western terai	775 (93.9)	50 (6.1)	
Mid - western terai	711 (94.3)	43 (5.7)	
Far-western terai	608 (94.6)	35 (5.4)	
Wealth indix			<0.001
Poorest	1718 (92.9)	132 (7.1)	
Poorer	1548 (93.6)	106 (6.4)	
Middle	1565 (94.2)	97 (5.8)	
Richer	1655 (95.2)	84 (4.8)	
Richest	1944 (96.6)	69 (3.4)	
Maternal occupation			<0.001
Not working	1726 (96.0)	72 (4.0)	
Agriculture	5026 (93.8)	333 (6.2)	
Other *	1678 (95.3)	83 (4.7)	

Other * includes professional/technical/managerial, clerical, sales and service, skilled manual and unskilled manual.

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Logistic Regression Model

The significant variables in univariate analysis were further analyzed using logistic regression (Table 2). This model was conducted to adjust for the interaction of exposure variables with each other. In this final model, the maternal age, sub region, place of residence and maternal education remained statistically significant predictors of women who have had at least one stillbirth during her life time.

There was an increase risk of having stillbirth with increasing maternal age. The odds ratio of stillbirth were found to be highest in women aged 44-49 years [OR 1.73; 95% CI (1.39-2.15)], followed by those with the aged group 40-45 years [OR 1.61; 95% CI (1.32-1.95)] had significantly increased risk of stillbirth compared with women's 15-29 years. Out of the 13 sub- region, the women who were from the far-western hill [OR 1.50; 95% CI (1.12-2.00)], western mountain [OR1.49; 95% CI (1.08-2.04)] and eastern mountain [OR 1.33; 95% CI (0.96-1.86)] had higher chance to have stillbirth compared to women from the central hill [OR 0.55; 95% CI (0.36-0.84)], central mountain [OR 0.64; 95% CI (0.42-0.98)] and central terai [OR 0.64; 95% CI (0.45-0.90)].

The risk of having stillbirth were found to be higher for women's residing in the rural area [OR 1.15; 95% CI (1.02-1.30)] compared to mother who were from urban area [OR 0.86; 95% CI (0.58-0.95)].With respect to the maternal education, the women who were uneducated and attended only primary educational level were more likely to have stillbirth [OR 1.21; 95% CI (1.05-1.40)], [OR 1.24; 95% CI (1.05-1.47] respectively, than the women who had higher level of education [OR 0.65; 95% CI (0.54-0.79].

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Table 2 Risks factors associated with stillbirth in Nepal, NDHS 2011

Characteristics	Unadjusted ORs [95%CI]	Adjusted ORs [95%CI]	p-value*
Age group			<0.001
15-24 years	0.35 (0.26-0.47)	0.37 (0.28-0.51)	
25-29 years	0.59 (0.47-0.75)	0.62 (0.49-0.79)	
30-34 years	1.14 (0.94-1.39)	1.19 (0.97-1.44)	
35-39 years	1.28 (1.06-1.55)	1.25 (1.03-1.52)	
40-44 years	1.69 (1.40-2.05)	1.61 (1.32-1.95)	
44-49 years	1.87 (1.52-2.30)	1.73 (1.39-2.15)	
Sub region			<0.001
Eastern mountain	1.38 (1.00-1.90)	1.33 (0.96-1.86)	
Central mountain	0.79 (0.52-1.21)	0.64 (0.42-0.98)	
Western mountain	1.59 (1.17-2.16)	1.49 (1.08-2.04)	
Eastern hill	1.16 (0.86-1.57)	1.09 (0.81-1.48)	
Central hill	0.51 (0.34-0.77)	0.55 (0.36-0.84)	
Western hill	0.81 (0.59-1.12)	0.82 (0.59-1.13)	
Mid-western hill	1.13 (0.82-1.54)	1.10 (0.80-1.52)	
Far-western hill	1.59 (1.19-2.10)	1.50 (1.12-2.00)	
Eastern terai	0.83 (0.61-1.13)	0.94 (0.68-1.29)	
Central terai	0.64 (0.46-0.90)	0.64 (0.45-0.90)	
Western terai	1.12 (0.85-1.48)	1.21 (0.91-1.61)	
Mid–western terai	1.05 (0.78-1.42)	1.11 (0.82-1.51)	
Far-western terai	1.00 (0.72-1.39)	1.11 (0.79-1.54)	
Residence			<0.001
Urban	0.8 (0.71-0.89)	0.86 (0.58-0.95)	
Rural	1.25 (1.12-1.41)	1.15 (1.02-1.30)	
Maternal education			<0.001
No education	1.58 (1.39-1.80)	1.21 (1.05-1.40)	
Premary	1.17 (0.99-1.38)	1.24 (1.05-1.47)	
Higher	0.53 (0.44-0.63)	0.65 (0.54-0.79)	

*P value for LR test.

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Discussion

This study was carried out to identify the risk factors associated with stillbirth in ever pregnant women in Nepal. We found that increased maternal age, maternal education, place of residence and sub region were statistically significant risk factors of stillbirths in Nepal.

Stillbirth was found to be higher among younger than older maternal age. Our finding was similar with the earlier studies conducted in various countries that advanced maternal age was significant risk factors for stillbirth (Lee et al, 2011; Feresu et al, 2005 and Carolan and Frankowska, 2011). This study showed that the risk of stillbirths highest among the aged above 40 years and gradually decreased to reach a lowest point among mothers of age 15-24 years.

Residing rural area has been found to be a significant determinant of stillbirth, and this supports previous study conducted in india (Lakshmi et al, 2013), Tanzania, (Habib et al, 2008) and Zimbabwe (Feresu et al, 2004).The majority of the rural areas of Nepal, there is lack of accessibility of health facility, lack of transportation facility, high level of illetracy, lack of health service utilization, lack of food availability so women from these area are more likely to have of stillbirth (Jahn et al, 2000 and Thapa et al, 2000).

Maternal education was significantly associated with high rate of stillbirth. Our findings are supported by the study conducted in rural southern part of Nepal, found that Literacy was statistically significant factor for the occurrence of miscarriage and fetal death (Katz et al, 2008). Similarly, study conducted in developing countries reported that the

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women without education were more likely to have stillbirths compared to those women who had higher level of education (McClure et al, 2015). The relationship of the education status of mothers with stillbirth can be explained in a different ways. Educated mother are more conscious about maternal health, balanced diet as well as antenatal care visit and more likely to be aware unhealthy behavior like smoking, alcohol drinking.

Out of the 13 sub- region, the women who were from the far-western hill, western mountain and eastern mountain had statistically significant having stillbirth compared to women from the central hill, central mountain, and central terai. Far-western region western mountain and eastern mountain regions are characterized by its complicated terrain, lack of transportation and road infrastructure facility and lack of health service facility as well as poor economy and scarcity of food for long time (Khanal et al, 2013 and Upreti et al 2010). Thus, 3 delays are common and represent a severe risk factor to maternal health and pregnancy outcome. i) delay in decision making ii) delay in transpiration iii) delay in receiving adequate services in the facility of the women (lawn et al, 2009).

There are numerous strengths of our study. Firstly, study based on national level data that used internationally validated questionnaire and methodology. The NDHS 2011 is nationally representative cross sectional survey and has a high response rate (>95%). Secondly, to the best of our knowledge, this is the first study from Nepal which reports the risk factors with stillbirth based on the data which cover the entire country. Our study had some limitations. Firstly, we used secondary data so it was not possible to study other factors known to be associated with stillbirth, such as the maternal medical factors,

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maternal nutritional status before pregnancy and socioeconomic disadvantage and access to care, especially obstetric care. Secondly, there is a chance of some responses as well recall bias.

Conclusion

This study demonstrated that the major risk factors associated with stillbirths in Nepal includes increased maternal age, residing in rural area, sub region and maternal education. Stillbirth is still the major public health problem in Nepal. To minimizing the stillbirth in Nepal plans and policies should be focused on low education and living in rural area mother.

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