MODELING FACTORS ASSOCIATED WITH INTIMATE PARTNER VIOLENCE AGAINST WOMEN IN INTIMATE PARTNERSHIP IN RWANDA

Elysée TUYISHIME

A research project report submitted to the department of Statistics and Actuarial Sciences in the school of Mathematical Sciences in partial fulfillment of the requirement for the award of degree Master of Science in applied Statistics of Jomo Kenyatta University of Agriculture and Technology

2015

DECLARATION

This project report is my original work and has not been presented for a degree in any other University.

Signature…… Date…**05/07/2015**…….

Elysée Tuyishime

SC-384-C010-4693/2013

This project report has been submitted for examination with our approval as the university supervisors

Signature……..Date…**05/07/2015**…….

Dr. Joseph K. Mung'atu.

Jomo Kenyatta University of Agriculture and Technology, Kenya.

Signature…….. Date…**05/07/2015**…….

Dr. Jairu NDIGA DESIDERIO

Jomo Kenyatta University of Agriculture and Technology, Kigali campus.

DEDICATION

Dedicated to my family and friends for their encouragement and good wishes.

ACKNOWLEDGMENT

First of all I thank the Almighty God for giving good health and wisdom during my studies up to final project report. Also, I would like to appreciate the JKUAT community and especially Department of statistics and actuarial sciences for this chance to undertake the project. I would as well like to express my sincere gratitude to my supervisors, Dr. Jairu NDIGA DESIDERIO and Dr. Joseph K. Mung'atu, for their wonderful support throughout the whole period I was undertaking this project. It was a pleasure to work with you in this project; thank you for your advice, guidance and assistance from the beginning to the end. More specifically to the associate research at Rwandan school of public Health (SPH) Miss.Dana Thomson, your encouragement and guidance on the use Rwanda Demographic health survey data during Population survey analysis courses will forever be remembered. Also your committed guidance throughout the research kept my progress steady.

Thank you all!

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS / ACRONYMS

DHS Demographic Health Survey

IPV Intimate Partner Violence

MDG's Millennium Development Goals

MLE Maximum Likelihood Estimation

NISR National Institute of Statistics of Rwanda

PSU's Primary Sampling Units

RDHS Rwanda Demographic Health Survey

DEFINITION OF TERMS

Gender Based Violence:

The physical, mental or social abuse that is directed against a person because of his or her gender role in a society or culture. It includes Rape, Sexual Harassment, Wife Inheritance, Female Genital Mutilation, Widow Eviction and Intimate Partner Violence(Balian et al., 2014).

Intimate Partner Violence:

A pattern of abusive behavior in any intimate relationship that is directed towards a current or former spouse, boyfriend or girlfriend. Intimate Partner Violence can be physical, emotional, economic, or sexual in nature(Balian et al., 2014).

Physical Abuse:

Any behavior that involves the intentional use of force against the body of another person that risks physical injury, harm, and/or pain. Physical abuse includes pushing, hitting, slapping, choking, using an object to hit, twisting of a body part, burning, forcing the ingestion of an unwanted substance, and use of a weapon(Balian et al., 2014).

Sexual Abuse:

Any unwanted sexual intimacy forced on one individual by another. It may Include oral, anal, or vaginal stimulation or penetration, forced nudity, forced exposure to Sexually explicit material or activity, or any other unwanted sexual activity(Balian et al., 2014).

Emotional/Psychological Abuse:

Behavior that is intended to intimidate or humiliate. It may include threats of abandonment or abuse, confinement to the home, stalking, threats to take away custody of the children, destruction of objects, verbal aggression and constant degradation or humiliation(Balian et al., 2014).

Economic abuse:

Includes acts such as the denial of funds, refusal to contribute financially, Denial of food and basic needs, and controlling access to health care or employment(Balian et al., 2014).

ABSTRACT

Intimate partner violence (IPV) against women is a global public health and human rights concern in Rwanda. As reviewed from two national surveys, in Rwanda, women's experience of physical or sexual IPV in their lifetime almost doubled from 34% in the 2005 DHS, to 56% in the 2010 DHS, while globally IPV rates at 30% and in other sub-Saharan African countries, such as Uganda (40%); Zimbabwe (37%) and Kenya (24), placing Rwanda among the countries with the highest rates of IPV against women in the world, in order to inform the designers of IPV prevention programs. A secondary analysis of RDHS 2010 was done and descriptive statistics was used to summarize continuous data, and categorical data, bivariate statistics (Chi-square test) was used to compare two study groups to provide strong evidence of any study group differences, The test for collinearity was done before fitting Multivariate logistic regression model to produce parsimonious (efficient) multivariable models, backward stepwise logistic regression was used to find the final model. Of the 3042 women included in the analysis 56% (n=1718) had experienced at least one form of IPV in the last 12 months prior to the survey. Women corresponding to 53.1% (n=911) reported to have experienced severe form of IPV whereas other women equivalent to 46.9% (n=807) reported a less severe form of IPV. Young women whose husband have not attained high school and having multiple sex partners, living in a high density household in rural areas are more likely to face IPV. IPV prevention programs should increase focus and development initiatives to improve access to education for girls and boys which may have an important role in violence prevention.

Chapter 1

INTRODUCTION

1.1. Background of the Study

Intimate partner violence remains a global health issue. It occurs in all settings and among all socioeconomic, religious and cultural groups. Domestic violence, and intimate partner violence (IPV) in particular, is a risk factor for many adverse physical and psychological health outcomes. Indeed, intimate partner violence is a major public health issue with short-term and long term consequences which include negative psychological damage, physical injuries, heightened risk of HIV and sexually transmitted infections, pregnancy complications, miscarriages and low birth weight(Uwayo, 2014).The factors associated with IPV in women is potentially important to be addressed to in line with reducing its prevalence, and not yet well understood.

A 2013 report from the World Health Organization (WHO) found that intimate partner violence affects 30% of women worldwide and is the most prevalent type of violence against women(WHO, 2013). Though, in current history and in limited developing nations, intimate partner violence has gained recognition as a Human Rights and Public Health issue. This is attributed to growing awareness of women's political, economic and sexual rights sparked during the latter half of the twentieth century. IPV is now increasingly being viewed as a violation of the rights of women as it poses a major risk to health and well-being(WHO, 2013). These risks have directed the international community, in recent years, to implement laws and measures that protect women from gender based violence, including intimate partner violence. Regardless of these international initiatives still, women in developing nations, particularly in sub-Saharan Africa, continue to experience intimate partner violence at high rates(Bonomi et al., 2006). Rwanda has no exception. Rwanda is still intensely plagued by intimate partner violence. According to Gender monitoring Office in Rwanda (GMO), almost all cases of GBV and injustice received, were reported by females. It also shows that cases of Intimate Partner Violence were high as compared to other forms of GBV reported (GMO, 2013). Two Demographic health surveys in Rwanda found that women's experience of physical or sexual IPV in her lifetime almost doubled in the period of five years(DHS, 2011). Still widely regarded as historical characteristics of unbalance social power relations between men and women, boys and girls that later translate into male's dominance and women's subordination. In addition extreme poverty, which has been shown in several studies to increase the risk of IPV present throughout the nation serve to complex the issue(Hindin, 2008).

Although progresses have been made to control the prevalence of IPV in the nation, including the nation's law on the Prevention and Punishment of Gender-Based Violence(GMO, 2013) and the Gender Monitoring Office set up and started operation on 31st October 2008 as an autonomous body with a mandate of monitoring and evaluating

the implementation of gender principles and the fight against Gender Based Violence, while contributing to Rwanda's commitment to equitable wellbeing of all Rwandans, IPV continues to be a major issue in Rwanda. As a result, this study seeks to determine the extent and factors which relate to IPV in Rwanda, as well as providing a model that describes the contribution of individual risk factor to Intimate Partner Violence.

1.2. Problem Statement

Intimate partner violence (IPV) towards women is an important issue to address to since it affects family's welfare economically and socially as well; and for the country as a whole, however often neglected public health issue. The existence of gender norms imbalance expressed by men's and women's attitudes in relation to power and decision-making in intimate relationships may influence the degree of IPV. The aim is to examine potential risk factors of physical, sexual and psychological IPV among couples in Rwanda.

The Government of Rwanda inspired by the philosophy behind the Convention on the Elimination of All Forms of Discrimination and Violence against Women to achieve the Millennium Development Goals (MDGs). In this context, there is a need of evidence-based policies on the country level to address this serious issue (GMO, 2013).

As Rwanda is classified among the highest levels of IPV in the world, therefore, there is still a gap to be filled and this needs an insights into the problem in order to empower policy makers to understand violence against women, especially preventing this type of violence. Also based on the recommendations from this research appropriate interventions will hopefully be set with the purpose of preventing IPV in Rwanda, it is with this need that this project has been put forward.

1.3. Justification

Rwanda is classified among the highest levels of IPV in the world, with national estimates showing that 55.6 percent of women have experienced physical violence and 17.5 percent have experienced sexual violence in the past 12 months from their current or most recent husband/partner (Mannell & Jackson, 2014). Therefore, if we can be able to identify potential risk factors associated with IPV, it will be possible for policy maker to understand violence against women, including preventing this type of violence. Findings from this study will be published so that interested organizations and institutions be informed ways to act early to prevent the occurrence of intimate partner violence and promote health in Rwanda.

Prevention approaches needs evidences to be based on to understand potential risk factors and respond to the intimate partner violence public health problem. This research aims at providing a mathematical model that will describe the extent at which individual risk factors influence the IPV.

1.4. Objectives of the Study

1.4.1. General Objective

To find the prevalence of IPV and model potential factors associated with IPV against women in intimate partnership in Rwanda.

1.4.2. Specific Objective

1. To determine the extent of IPV in Rwanda
2. To identify potential demographic and socioeconomic factors associated with IPV in Rwanda.
3. To model potential risk factors associated with IPV in Rwanda.

1.5. Research question

What factors are associated with the extent of all forms of Intimate Partner Violence against women in intimate partnership in Rwanda?

1.6. Scope

The study population includes all Rwandan women participated in Rwanda Demographic Health Survey version 2010, whose age lies between 15 to 49 years old as in the Demographic Health Survey (DHS) context. Analysis methodology was constructed in a way that complex sampling methods used is controlled and insure that the results of this research are generalized to the whole Rwandan female population.

1.7. Limitations

Due to the limited resources and time, this research used a secondary data analysis of Rwanda Demographic Health survey 2010 database (RDHS 2010). This presents a limitation to the research since it is not exhaustive on the expected IPV risk factors, it only uses those variables collected during the survey. In addition RDHS 2010 looks a bit old since it is repeated every 5 years interval, this 2010 version is the current information regardless the past 5 years. So with in the past 5 years things may have been changed, thus this may affect the research results to be a bit out of date.

Chapter 2

LITERATURE REVIEW

2.0. Introduction

This chapter on literature review takes into account published articles, studies, global reports and strategies on intimate partner violence. It focuses on global context, then goes down to African and regional level, finally on Rwandan situation.

The first attested use of the expression "Intimate Partner Violence" in a modern context was in 1977 and can be broadly defined as a pattern of abusive behaviors by one or both partners in an intimate relationship such as marriage, dating, family, friends or cohabitation(Balian et al., 2014). IPV affects adolescent girls as well as older adult women, within formal unions and within informal partnerships. The most widely used model for understanding violence is the ecological model, which proposes that violence is a result of factors operating at four levels: individual, relationship, community and societal. Researchers have begun to examine evidence at these levels in different settings, to understand better the factors associated with variations in prevalence; however, there is still limited research on relationship level(Towle & Lende, 2013). Some risk factors are consistently identified across studies from many different countries, while others are context specific and vary among and within countries. It is also important to note that, at the individual level, some factors are associated with perpetration, some with victimization, and some with both.

2.1. The theoretical review/Conceptual framework

Over the years, recognition of the scope and significance of Intimate Partner Violence globally has increased. Intimate Partner Violence has been defined as ‘‘the range of sexually, psychologically and physically coercive acts used against adult and adolescent women by current or former male intimate partners’’(Bair-Merritt, 2010). A growing body of evidence is highlighting the magnitude of the problem of IPV in developing countries (Bonomi et al., 2006). In sub-Saharan Africa, empirical evidence on the prevalence of domestic violence is limited and confined to a small number of population-based(WHO, 2012)or special-population studies (Garcia-Moreno, Jansen, Ellsberg, Heise, & Watts, 2006). Recognition of the links between IPV and a range of adverse reproductive health outcomes — including non-use of contraception and unintended pregnancy (Ismayilova, 2010), poor outcomes of pregnancy and birth (Boe, 2004), gynecological morbidity (Garcia-Moreno et al., 2006) and sexually transmitted diseases and human immunodeficiency virus (HIV) (Abramsky et al., 2011)— is also growing. Our understanding of the underlying determinants of IPV in developing countries remains limited. A number of studies have found strong associations between socioeconomic status and IPV, with indicators of household wealth or education of the

male partner significantly inversely associated with the risk of violence (Andersson, Ho-Foster, Mitchell, Scheepers, & Goldstein, 2007). Demographic characteristics are also significant risk factors for domestic violence, with several studies finding that higher age (United Nations & UNFPA, 2005) and having older children (Rennison & Welchans, 2011) are associated with a reduced risk of violence. Other studies have found that women with a high status — as measured by their educational attainment, degree of autonomy or control over resources — are more protected from the risk of IPV (Tjaden, Patricia & Thoennes, 2013). One consistent finding is an inverse association between women's educational attainment and the risk of IPV (World Health Organization, 2013a). Studies have also reported that women with greater autonomy and control over resources are more protected from violence (Eswaran & Malhotra, 2009)However, some evidence shows that this association may be context-specific and that, in more conservative settings, women with high autonomy may actually be at increased risk of violence (Vetten, 2014). Several studies in developing countries have also found a strong association between consumption of alcohol or drugs and the risk of violence (Hindin, Kishor, & Ansara, 2012). A potential link between HIV status and IPV has also been recognized (W.Know 2014), with studies from Africa showing an increased risk of violence when the man is HIV positive (W.Know 2014)or when the woman perceives herself to be at high risk of acquiring HIV from the man (Towle & Lende, 2013). Finally, evidence highlights the role of intergenerational transmission of IPV; studies have shown that women who witness IPV violence are more likely to become the victim.

2.1.1. Causes and risk factors for intimate partner violence

2.1.1.1.Individual factors

Some of the most consistent factors associated with a man's increased likelihood of committing violence against his partner(s) are(WHO, 2012):

1. Young age;
2. Low level of education;
3. Witnessing or experiencing violence as a child;
4. Harmful use of alcohol and drugs;
5. Personality disorders;
6. Acceptance of violence (e.g. feeling it is acceptable for a man to beat his partner) (10); and
7. Past history of abusing partners.

Factors consistently associated with a woman's increased likelihood of experiencing violence by her partner(s) across different settings include(WHO, 2012):

1. Low level of education;
2. Exposure to violence between parents;
3. Sexual abuse during childhood;

4. Acceptance of violence; and
5. Exposure to other forms of prior abuse.

2.1.1.2.Relationship factors

Factors associated with the risk of both victimization of women and perpetration by men include(WHO, 2013):

1. Conflict or dissatisfaction in the relationship;
2. Male dominance in the family;
3. Economic stress;
4. Man having multiple partners; and
5. Disparity in educational attainment, i.e. where a woman has a higher level of education than her male partner.

2.1.1.3.Community and societal factors

The following factors have been found across studies(WHO, 2013):

1. Gender-inequitable social norms (especially those that link notions of manhood to dominance and aggression);
2. Poverty;
3. Low social and economic status of women;
4. Weak legal sanctions against IPV within marriage;
5. Lack of women's civil rights, including restrictive or inequitable divorce and marriage laws;
6. Weak community sanctions against IPV;
7. Broad social acceptance of violence as a way to resolve conflict; and
8. Armed conflict and high levels of general violence in society.

2.1.2. Measurement of violence

Collecting valid, reliable, and ethical data on intimate partner violence poses particular challenges because (1) what constitutes violence or abuse varies across cultures and individuals; (2) a culture of silence usually surrounds domestic violence and can affect reporting; and (3) the topic is a sensitive one. Assuring the safety of respondents and interviewers and protecting women who disclose violence, when asking about domestic violence in a familial setting, are responsibilities that raise specific ethical concerns. The responses to these challenges by the 2010 RDHS respondents and interviewers are described in the paragraphs that follow.

2.1.3. Valid Measures of Violence

The 2010 RDHS measures violence committed by spouses and by other household members. Accordingly, information was obtained from ever-married women on violence by spouses and by others, and from never-married women on violence by anyone, including boyfriends. International research on violence shows that intimate partner violence is one of the most common forms of violence against women. Thus, spousal/partner violence was measured in more detail than violence by other perpetrators by using a greatly shortened and modified Conflict Tactics Scale (CTS) (Strauss, 1990). Specifically, spousal violence was measured using the following set of questions for women:

(Does/did) your (last) husband/partner ever do any of the following things to you?

a) Slap you?
b) Twist your arm or pull your hair?
c) Push you, shake you, or throw something at you?
d) Punch you with his fist or with something that could hurt you?
e) Kick you, drag you or beat you up?
f) Try to choke you or burn you on purpose?
g) Threaten or attack you with a knife, gun, or any other weapon?
h) Physically force you to have sexual intercourse with him even when you did not want to?
i) Force you to perform any sexual acts you did not want to?

When the answer to the question was "yes," women were asked about the frequency of the act in the 12 months preceding the survey. An affirmative answer to one or more of items (a) through (g) constitutes evidence of physical violence, while a similar answer to items (h) or (i) constitutes evidence of sexual violence.

Two levels of severity are assessed for this type of violence: moderate and severe.

- Moderate physical violence was assessed using the following questions:

Does/Did your (last) husband/partner ever:

a. Push you, shake you, or throw something at you?
b. Slap you or twist your arm?
c. Strike you with his fist or with something that could hurt you?
d. Kick you or drag you?

- Severe physical violence was assessed using the following questions:

  Does/Did your (last) husband/partner ever:

e. Try to strangle or burn you?
f. Threaten you with a knife, gun, or other type of weapon?
g. Attack you with a knife, gun, or other type of weapon?

2.2.The critiques of the existing literature relevant to the study

World Health Organization (WHO) in 2013 reported that intimate partner violence affects 30% of women worldwide and is the most prevalent type of violence against women(WHO, 2013)**.**

A growing number of population-based surveys have measured the prevalence of IPV, most particularly the WHO multi-country study on women's health and domestic violence against women, which collected data on IPV from more than 24 000 women in 10 countries representing diverse cultural, geographical and urban/rural settings. The study confirmed that IPV is widespread in all countries studied. Among women who had ever been in an intimate partnership:

a. 13–61% reported ever having experienced physical violence by a partner;
b. 4–49% reported having experienced severe physical violence by a partner;
c. 6–59% reported sexual violence by a partner at some point in their lives; and
d. 20–75% reported experiencing one emotionally abusive act, or more, from a partner in their lifetime.

Furthermore, a comparative analysis of Demographic and Health Survey (DHS) data from nine countries found that the percentage of ever-partnered women who reported ever experiencing any physical or sexual violence by their current or most recent husband or cohabiting partner ranged from 18% in Cambodia to 48% in Zambia for physical violence, and 4% to 17% for sexual violence(Boe, 2004). In a 10-country analysis of DHS data, physical or sexual IPV ever reported by currently married women ranged from 17% in the Dominican Republic to 75% in Bangladesh. Similar ranges have been reported from other multi-country studies(Abramsky et al., 2011).

Several studies are increasingly conducted on individual level IPV, (Rennison & Welchans, 2011) by examining the economic and social dynamics of physical spousal abuse, in Zambia, Rwanda and Tanzania. Working from economic, sociological and psychological frameworks, González-Brenes's main objective was to determine the causes of physical spousal abuse. Data for the study come from 2000-2002 Demographic and Health Surveys and family surveys in Zambia and Rwanda as well as original data obtained by González-Brenes in Meatu District, Tanzania. The author analyzed 4,588 couples in total and found that 42% of currently married women had experienced physical spousal abuse(Uwayo, 2014).

The IPV prevalence reported in other sub-Saharan African countries, such as Uganda (40%), Zimbabwe (37%), and Kenya (24%),(Bazargan-Hejazi, Medeiros, Mohammadi, Lin, & Dalal, 2013) The incidence of physical IPV in Botswana, Lesotho, Mozambique, Namibia, Swaziland, Zambia and Zimbabwe ranges between 8 to 27%. Rwanda is classified among the highest levels of IPV in the world, with national estimates showing that 55.6 percent of women have experienced physical violence and 17.5 percent have experienced sexual violence in the past 12 months from their current or most recent husband/partner(Mannell & Jackson, 2014).

IPV remains a major public health problem in Africa and internationally, with consequences that include physical injury, significant morbidity and even death. According to the WHO, 2013 Regional Estimates of Violence Against Women reported that 36% women ever experienced physical/sexual IPV, 42% of these women have ever been

injured by IPV, Greater odds of having low-birth-weight baby, induced abortion, depression, and HIV/STIs (some regions), 38% murders of women are reported as committed by intimate partners, 7% women ever experienced sexual violence by non-partner(WHO, 2013). Furthermore, two national surveys in Rwanda found that women's experience of physical or sexual IPV in her lifetime almost doubled from 34% in the 2005 DHS(DHS, 2006), to 56% in the 2010 DHS(DHS, 2011), placing Rwanda among the countries with the highest rates of IPV against women in the world despite the set measures and governmental effort. This study aims at identifying and measure the individual risk factors associated with IPV against women in intimate partnership in Rwanda: Evidence from 2010 RDHS.

2.2.1. Conceptual framework

As the literatures reveals, many studies have been conducted across the countries on Intimate Partner Violence and their findings were adjusted to Rwanda situation, therefore the following conceptual framework was constructed that explains the constructs to be studied, either visually or in words, and their relationship. The levels of the conceptual framework show the extent to which the factors are related to the outcome of interest.

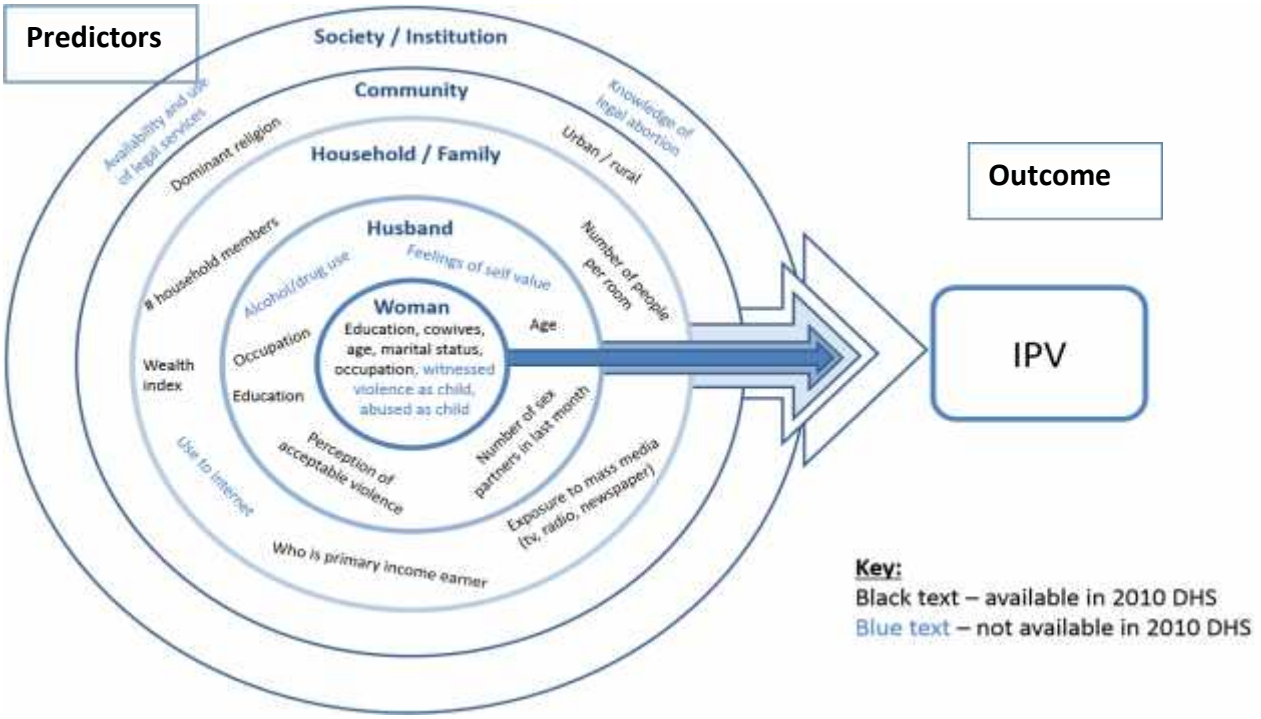

Figure 1.0: Conceptual framework

This conceptual framework helped to decide which variables are relevant to the study, make decisions about how to define variables during data analysis, and interpret model results.

2.3.Summary

Intimate Partner Violence is a serious public health problem that affects more than one third of all women globally, according to a new report by the World Health Organization. The findings of the report "send a powerful message that violence against women is a global health problem of epidemic proportions," says Dr. Margaret Chan, director-general of WHO(World Health Organization, 2013b).

The WHO report, "Global and regional estimates of violence against women: Prevalence and health effects of intimate partner violence and non-partner sexual violence,'' is the first systematic study of global information on the prevalence of violence against women — both by partners and by non-partners. Intimate partner violence is the most common kind of violence experienced by women worldwide, both in developing and in industrialized countries.

According to WHO, the prevalence rates for intimate partner among all women 15 years old or older, are the following: Africa: 45.6 percent; Americas: 36.1 percent; Eastern Mediterranean: 36.4 percent; Europe: 27.2 percent; South-East Asia: 40.2 percent; Western Pacific: 27.9 percent. In high income countries, the prevalence of this problem is 32.7 percent. Because of the extent of this phenomenon, a global momentum for more effective action is building up, according to the medical Women victims of violence suffer a wide variety of health problems such as organ and bone damage, miscarriage, exacerbation of chronic illness, gynecological problems and sexually transmitted diseases including HIV/AIDS. In addition, they are more susceptible to a variety of mental health problems such as depression, post-traumatic stress disorder, sleep and eating disorders, emotional distress and suicide(World Health Organization, 2013b).

Harmful effects of IPV are not limited to the women victims, but they also extend to their children. Children who grow up in families where there is domestic violence are prone to a wide range of behavioral and emotional disturbances. One of three abused children becomes an adult abuser or victim. Domestic violence by a partner has also been associated with higher rates of infant and child mortality and morbidity.

Violence against women has also a high economic cost for society. The Centers for Disease Control and Prevention estimates the cost of the consequences of violence against women in $37 billion annually. This violence results in almost two million injuries and nearly 1,300 annual deaths(Europe, 2012).

In Kenya and Uganda, 42 percent and 41 percent respectively of women surveyed reported having been beaten by their husbands. For Rwandan Situation, national estimates shows that 55.6 percent of women have experienced physical violence and 17.5 percent have experienced sexual violence in the past 12 months from their current or most recent husband/partner (Mannell & Jackson, 2014).

As Rwanda is classified among the highest levels of IPV in the world, therefore, there is still a gap to be filled and this needs an insights into the problem in order to empower policy makers to understand violence against women, specifically preventing this type of violence.

2.4.Research gaps

Due to the limited time and resources, a secondary data analysis was conducted for this research which resulted in using RDHS 2010 version database looking a bit old. In addition the analysis have not been exhaustive on consideration of all expected factors of Intimate Partner Violence, Only those collected during RDHS 2010 were used for this research.

Chapter 3

METHODOLOGY

3.0. Research Designs

The main aim of the research is to model predictors of Intimate Partner Violence, (IPV) in Rwanda. Rwanda Demographic Health Survey datasets available on National Institute of Statistics of Rwanda website (http://www.statistics.gov.rw) was used. DHSs are cross sectional, and repeated approximately every five years in low and middle income countries. This means that entirely unique sets of villages and neighborhoods are sampled each time a DHS is conducted. Complex sampling methods are used. Urban areas, for example, often comprise a small portion of the overall population in low income countries, but are oversampled in a DHS to ensure that there is sufficient sample size to make urban population estimates. In a typical DHS, 6,000 to 30,000 households are being sampled across a country.

3.1. Target population

In the selected households, all women age 15-49 are invited to complete an interview. In many countries including Rwanda , a subsample of households also include male respondents age 15-59(Balian et al., 2014).

3.2. Sampling techniques

The DHS Sample Selection Process is multi stage sampling methods. The first step is stratification. The Rwandan government decided to make estimates of demographic and health outcomes at the district level since their health system administers care and implements policy by district. This means that the sample was stratified by district, or in other words, an independent sample of households was drawn in each of the 30 districts.

Within each district, all primary sampling units, or PSUs, are listed with their population size. Typically PSUs are the enumeration areas of the last census. In the 2010 Rwanda DHS, villages were used as the PSUs. Then a sample of PSUs are selected with probability proportionate to population size(Balian et al., 2014).

In the second stage of sampling, a specific number of households are selected systematically from the selected villages depending on whether the villages is classified as urban or rural. Village Maps are used by planners to select which households would be included in the final sample and it is done outside of the field to prevent any conscious or subconscious bias. DHS surveys are comprised of multiple questionnaires: household questionnaire, women's questionnaire, and men's questionnaire(Balian et al., 2014).

3.3. Data collection tool

The 2010 RDHS used paper based questionnaire including a series of questions that focused on specific aspects of domestic and interpersonal violence. These questions addressed women's experience of interpersonal violence, including acts of physical and sexual violence. Information was collected on both domestic violence (also known as spousal violence or intimate partner violence) and violence by other family members or unrelated individuals.

Specifically, this project presents findings on women who have experienced spousal violence, ever and in the past 12 months.

3.4. Data collection procedures

Only one eligible woman in each household was administered the questions on violence. The DHS protocol specifies that the domestic violence module can only be administered to one randomly selected woman per household. Therefore, in households with more than one eligible woman, the respondent for the module was randomly selected through a specially designed simple selection procedure based on the "Kish Grid", which was built into the Household Questionnaire. Interviewing only one woman in each household using the domestic violence module provides assurance to the selected respondent that other respondents in the household will not know about the types of questions the selected respondent was asked.

Informed consent for the survey was obtained from the respondent at the beginning of the individual interview. In addition, at the beginning of the section on domestic violence, respondents were read an additional statement informing them that the subsequent questions could be sensitive, and reassuring them of the confidentiality of their responses.

The domestic violence module was implemented only if privacy could be obtained. If privacy could not be obtained, the interviewer was instructed to skip the module, thank the respondent, and end the interview. To maintain privacy, when a translator needed to conduct the interview, respondents were not asked questions from the domestic violence module.

3.4.1. Selection probability and Sampling weight

Because of the non-proportional allocation of the sample to the different provinces and to their districts and the possible differences in response rates, sampling weights is required for any analysis using 2010 RDHS data; this ensures the actual representativeness of the survey results at the national level as well as at the domain level. Because the 2010 RDHS sample is a two-stage stratified cluster sample, sampling weights was calculated based on separate sampling probabilities for each sampling stage and for each cluster. The Following notations were used:

P_{1hi} : First-stage sampling probability of the i^{th} village in stratum *h*.

P_{2hi} : Second -stage sampling probability within the i^{th} village (household selection)

Let a_h be the number of villages selected in stratum h, M_{hi} be the total population according to the sampling frame in the i^{th} village and $\sum M_{hi}$ be the total population in the stratum *h*. The probability of selecting the i^{th} village in the 2010 RDHS sample is calculated as follows:

$$\frac{a_h M_{hi}}{\sum M_{hi}} \qquad (1)$$

Let b_{hi} be the proportion of households in the selected segment compared with the total number of households in the village i in stratum h if the village is segmented; otherwise b_{hi} = 1. Then the probability of selecting village i in the sample is:

$$P_{1hi} = \frac{a_h M_{hi}}{\sum M_{hi}} * b_{hi} \quad (2)$$

A 2010 RDHS cluster is either a village or a segment of a large village. Let L_{hi} be the number of households listed in the household listing operation in the cluster *i* in stratum *h*, Let g_{hi} be the number of households selected in the cluster. The second stage's selection probability for each household in the cluster is calculated as follows:

$$P_{2hi} = \frac{g_{hi}}{L_{hi}} \quad (3)$$

The overall selection probability of each household in cluster i of stratum h is therefore the production of the two stages of selection probabilities:

$$P_{hi} = P_{1hi} * P_{2hi} \quad (4)$$

The design weight for each household in cluster *i* of stratum his the inverse of its overall selection probability:

$$W_{hi} = \frac{1}{P_{hi}} \quad (5)$$

The next is design weights, design weights was adjusted for household nonresponse as well as for individual non-response to get the sampling weights for women's and men's surveys, respectively. The differences in the household sampling weights and the individual sampling weights are introduced by individual nonresponse. The final sampling weights was normalized to give the total number of unweighted cases, equal to the total number of weighted cases at the national level, for both household weights and individual weights, respectively. The normalized weights are relative weights, which are valid for estimating means, proportions, and ratios.

3.5. Data processing and analysis

3.5.1. Controlling for complex survey design

As the DHS methodology is complex, a systematic approach is needed for this secondary analysis to construct a prepared dataset for analysis. This analysis will consider three dataset to be combined in order to get full information needed for analysis. The three datasets will be merged including; Individual women's recode (IR) file, Male recode (MR) file, and Household recode (HR) file.

Several characteristics of complex survey design can bias mean and variance estimates. Any survey design characteristic which effects the probability of selection including stratification, oversampling, and response rates must be accounted for with the application of sampling probability weights in descriptive data analysis. Descriptive

data analysis must also adjust for clustering by widen the variance estimates to avoid making type I errors. Accounting for stratification can slightly narrow confidence intervals in analyses of multiple strata, but the effect is usually negligible, and so the effect of stratification on variance can be ignored in descriptive data analysis(Balian et al., 2014).

3.5.2. Descriptive analysis

This analysis will cover three descriptive statistics; means and medians will be used to summarize continuous data, and percentages will be used to summarize categorical data.

3.5.3. Bivariate analysis

Bivariate statistics will be used to compare two study groups to see if they are similar. When comparing groups, we want to provide strong evidence of any group differences, so we will use a conservative threshold of $p\text{-}value<0.05$ to determine statistical significance. Since research questions is with binary outcomes, bivariate statistics will be used to summarize and compare characteristic across groups.

We will also use bivariate statistics to identify potential covariates that are worth testing in a multivariable model. If a variable is independently associated with the outcome, it might continue to explain the outcome once other factors are taken into account. In this case, when bivariate statistics are used for the purpose of filtering potential covariates in multivariate analysis, we use a generous threshold of $p\text{-}value<0.1$ to determine statistical significance to ensure that we do not drop any potentially useful variables from the analysis. Here the same statistical test that will be used to compare two groups is the chi-square test in logistic regression, is the same test and output that we will use here to filter variables will be the same. The only difference is in purpose of the test, and therefore our interpretation of its results will be different.

Pearson's chi-square test will be used to test whether the distribution in a categorical variable is statistically different in two or more groups. The chi-square test gives a yes/no answer a p-value less than the threshold will mean, yes, there are differences between the two groups.

A t-test will be used to test whether the distribution of a continuous variables are statistically different across groups, a p-value less than the threshold will mean, yes, there are differences

Before fitting any kind of multivariate model whether a general explanatory model or a hypoproject report test model we will need to test for collinearity. Collinearity occurs when two covariates in a multivariable model are highly related; usually this is because the two variables represent the same thing (the same concept, or they happen simultaneously). As a result, the model becomes unstable. To produce parsimonious (efficient) multivariable models, and to prevent strange, unstable results, we test for strong associations among covariates and remove any collinear covariates from the analysis.

The Pearson's R correlation coefficient will be used to identify binary, ordinal, and continuous covariates that are correlated. Correlations of $r>0.5$ will be considered as collinear as in the social sciences. When two or more covariates will be found to be collinear, we will keep the one variable that will be most strongly associated with the outcome, unless there will be a conceptual reason to keep one over the other.

3.5.4. Multivariate logistic regression analysis

Logistic regression will be used to model the odds of a binary outcome. Results will be reported as odds ratios, a ratio of the odds that the outcome occurs over the odds the outcome does not occur. We will need to consider the effects/associations of multiple variables at once, thus Multivariate logistic regression modeling. Multivariate modeling has an advantage over bivariate modeling by identifying the additional explanatory power of a given variable, accounting for any overlap with other explanatory variables.

Finally after obtaining an explanatory model, we will interpret all variables that remained statically significant in the model. A general explanatory model will be used to answer the research question "What factors are associated with IPV in Rwanda".

3.5.5. Data analysis flow

In this chapter, main findings from the study are presented according to the study objectives. Stata version 13 was used to analyze the data. The study findings are presented according to the following data analysis flowchart:

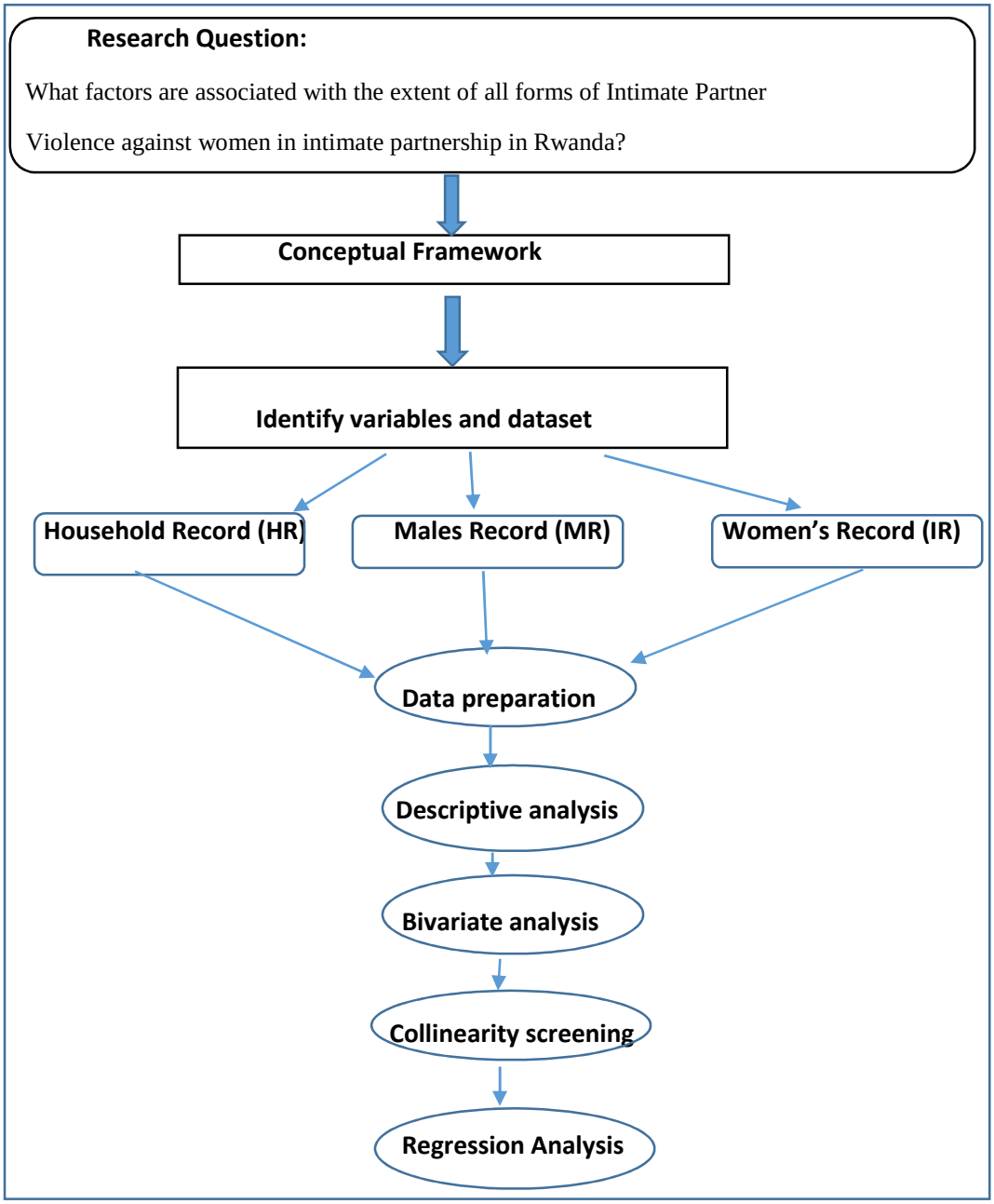

Figure 2.1 Data analysis flowchart

3.5.6. Introduction to logistic regression analysis

Statistical methods are tools that empower us to answer questions about possible patterns in empirical data. It is not amazing, then, to learn that many important techniques of statistical analysis were developed by scientists who were interested in answering very specific empirical questions. So it was with regression analysis. The history of this particular statistical technique can be traced back to late nineteenth-century England and the pursuits of a

gentleman scientist, Francis Galton. His most important insight came to him while he was studying the inheritance of one of the most obvious of all human characteristics: height. In order to understand how the characteristic of height was passed from one generation to the next, Galton collected data on the heights of individuals and the heights of their parents. After constructing frequency tables that classified these individuals both by their height and by the average height of their parents, Galton came to the unremarkable conclusion that tall people usually had tall parents and short people usually had short parents. Galton termed this patterns of inheritance "Regression to the mean" and later derived and applied linear regression to problems of heredity(Gillard, 2012). In statistics, linear regression is a method for modeling the relationship between a scalar dependent variable ***y*** and one or more explanatory variables denoted ***X***. The case of one explanatory variable is called simple linear regression. For more than one explanatory variable, the process is called multiple linear regression. In linear regression, data are modeled using linear predictor functions, and unknown model parameters are estimated from the data. Such models are called linear models(Pohar, Blas, & Turk, 2004).

Linear regression has many practical usages. Most applications fall into one of the following two broad categories:

1. If the goal is prediction, or forecasting, or reduction, linear regression can be used to fit a predictive model to an observed data set of *y* and *X* values.
2. Given a variable *y* and a number of variables X_1... X_p that may be related to *y*, linear regression analysis can be applied to quantify the strength of the relationship between *y* and the X_j(Gillard, 2012)

Regression is used in estimating the conditional expectations of continuous variables or at estimating distributions. There are many situations where however we are interested in input-output relationships, as in regression, but the output variable is discrete rather than continuous. In particular there are many situations where we have binary or more outcomes(Dr.Avishek Mallick, 2014). In addition to the binary outcome, we have some input variables, which may or may not be continuous.

We could try to come up with a rule which guesses the binary or more output from the input variables. This is called classification, and is an important topic in statistics. However, simply guessing for instance "yes" or "no" coded as "1" or "0" is pretty basic, especially if there is no perfect rule. So there should be something which takes noise into account, and doesn't just give a binary answer. In short, we want probabilities, which means we need to fit a stochastic model. What would be nice, in fact, would be to have conditional distribution of the response Y, given the input variables, *Pr (y/X)*. This would tell us about how precise our predictions are(Hellevik, 2009).

Having a binary output variable y, and we want to model the conditional probability *Pr (Y=1|X=x)* as a function of x; any unknown parameters in the function are to be estimated by maximum likelihood. By now, it not surprising to learn that statisticians have approached this problem by asking themselves "how can we use linear regression to solve this?" The appropriate alternative found to be logistic regression(Turner, 2008).

3.5.7. Introduction to logistic regression models

Logistic regression is widely used to model the outcomes of a categorical dependent variable. For categorical variables it is inappropriate to use linear regression because the response values are not measured on a ratio scale and the error terms are not normally distributed. In addition, the linear regression model can generate as predicted values any real number ranging from negative to positive infinity, whereas a categorical variable can only take on a limited number of discrete values within a specified range. This has allowed for the development of modeling techniques that can be used for categorical variables in a way roughly analogous to that in which the linear regression model is used for continuous variables. Logistic regression has proven to be one of the most useful techniques in the class of generalized linear models(Turner, 2008).

Whereas linear regression models equate the expected value of the dependent variable to a linear combination of independent variables and their corresponding parameters, generalized linear models equate the linear component to some function of the probability of a given outcome on the dependent variable. In logistic regression, that function is the logit transform: the natural logarithm of the odds that some event will occur. In linear regression, parameters are estimated using the method of least squares by minimizing the sum of squared deviations of predicted values from observed values. This involves solving a system of N linear equations each having N unknown variables, which is usually an algebraically straightforward task. For logistic regression, least squares estimation is not capable of producing minimum variance unbiased estimators for the actual parameters. In its place, maximum likelihood estimation is used to solve for the parameters that best fit the data. The aim of this project is to specify the logistic regression model for a binary dependent variable and show how the model is estimated using maximum likelihood. Following that, the model will be generalized to a dependent variable having two or more categories.

3.5.8. Simple Logistic Regression model

Regression models are usually thought of as only being appropriate for target variables that are continuous. But in our situation we are interested in prediction of a categorical target variable. Considering our situation, attributes of families are recorded, including the household size, and so on. The target variable is whether or not the couple experienced IPV or not (a 0/1 variable, with 0 for no violence and 1 for the presence of violence). A natural question is then “What factors can be used to predict whether or not a couple will have intimate partner violence?

The fundamental difference between this question and the kind of regression questions is that Rather than modeling the value of a target variable y, we are trying to model a probability and the sensible way to do that is simply do an ordinary least squares regression, treating the 0/1 variable as the target, but does this make sense? Define “success” to be the occurrence of the outcome coded 1, and let p|x be the probability of success given a set of predictor values. A linear regression model is consistent with:

$$p/x = \beta_0 + \beta_1 x_1 \quad (6)$$

That is, the probability of success is linear in the predictors(Hellevik, 2009). Consider our study situation. We wish to model the probability of a couple to experience IPV as a function of household size (Assuming that this variable predict IPV). There are three distinct kinds of situations:

(1) For a household size of around 5, we might believe that each additional person on the household size is associated with a fixed (constant) increase in the probability of experiencing IPV. That is, a linear relationship is reasonable.

(2) However, for household size around 20, this is no longer true. At that point the probability of experiencing IPV is so high that an additional individual point on the household size adds little to the probability of experiencing IPV. In other words, the probability curve as a function of household size levels off for high values of household size.

(3) The situation is similar for smaller household size (say around 2 or 3). At that point the probability of experiencing IPV is so low that one point lower on the household size subtracts little from the probability of experiencing IPV. In other words, the probability curve as a function of IPV levels off for low values of household sizes. These three patterns propose that the probability curve is probable to have an S–shape, as in the next picture.

Probability.

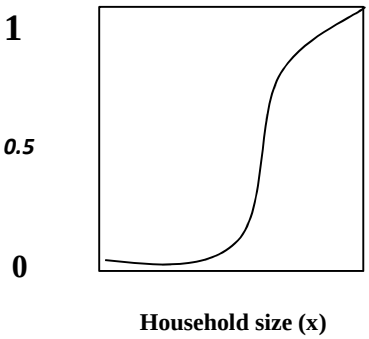

Figure 3. 3 : Logistic regression model shape

So we are going to try to approach this problem by using linear regression;

1. the most obvious idea is to let *p(x)* be a linear function of *x*. Every increment of a component of x would add or subtract so much to the probability. The conceptual problem here is that p must be between 0 and 1, and linear functions are unbounded thus Linear models can't do this.

2. The next most obvious idea is to let log *p(x)* be a linear function of x, so that changing an input variable multiplies the probability by a fixed amount. The problem is that logarithms are unbounded in only one direction, and linear functions are not.

3. Finally, the easiest modification of log p which has an unbounded range is the Logistic (or logit) transformation, $\log \frac{p}{1-p}$. We can make this a linear function of *x* without fear of nonsensical results. (Of course the results could

still happen to be wrong, but they're not guaranteed to be wrong.) This last alternative is logistic regression(Project, n.d.).

Formally, the logistic regression model is that;

$$\text{Log}\frac{p(x)}{1-p(x)} = \beta_0 + x\cdot\beta_1 \quad (7)$$

Solving for p, this gives

$$P(x;\ \beta_i) = \frac{e^{\beta_0 + x\cdot\beta_i}}{1+e^{\beta_0 + x\cdot\beta_i}} = \frac{1}{1+e^{-(\beta_0 + x\cdot\beta_i)}} \quad (8)$$

3.5.9. Multiple logistic regression models

More generally, consider a random variable *Z* that can take on one of two possible values. Given a dataset with a total sample size of *M*, where each observation is independent, Z can be considered as a column vector of M binomial random variables Z_i. By convention, a value of 1 is used to indicate "success" and a value of either 0 or 2 (but not both) is used to signify "failure." To simplify computational details of estimation, it is convenient to aggregate the data such that each row represents one distinct combination of values of the independent variables. These rows are often referred to as "populations." Let *N* represent the total number of populations and let n be a column vector with elements n_i representing the number of observations in population i for $i = 1$ to N where $\sum_{i=1}^{N} n_i$ = M, the total sample size. Now, let *Y* be a column vector of length *N* where each elements Y_i representing the number of successes of *Z* for population *i*. Let the column vector *y* contain elements y_i representing the observed counts of the number of successes for each population. Let ® be a column vector also of length *N* with elements $®_i = P(Z_i = 1/i)$, i.e... The probability of success for any given observation in the i^{th} population(Pohar et al., 2004).

The linear component of the model contains the de sign matrix and the vector of parameters to be estimated. The design matrix of independent variables, *X*, is composed of *N* rows and *K+1* columns. There is one parameter corresponding to each of the *K* columns of independent variable settings in *X*, plus one β_0 the intercept.

The logistic regression model equates the logit transform, the log-odds of probability of success, to the linear component:

$$\text{Log}\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{k=0}^{k} x_{ik}\,\beta_k \quad i=1, 2 \ldots N \quad (9)$$

3.5.10. Parameter Estimation

The goal of logistic regression is to estimate the $K + 1$ unknown parameters β in Eq (9). This is done with maximum likelihood estimation which entails finding the set of parameters for which the probability of the observed data is greatest. The maximum likelihood equation is derived from the probability distribution of the dependent variable(Czepiel, 2010). Since each y_i represents a binomial count in the ith population, the joint probability density function of Y is:

$$F(y/\beta) = \prod_{i=1}^{N} \frac{n_i!}{y_i!\ n_i - y_i\ !} ®_i^{y_i} (1-®_i)^{n_i - y_i} \quad (10)$$

For each population, there are $\binom{n_i}{y_i}$ different ways to arrange y_i successes from among n_i trials. Since the probability of a success for any one of the n_i trials is π_i, the probability of y_i successes is $®_i^{y_i}$ Likewise, the probability of $n_i - y_i$ failures is $(1-®_i)^{n_i - y_i}$

The joint probability density function in Eq. (10) expresses the values of $\boldsymbol{y}$ as a function of known, fixed values for β. (Note that β is related to π by Eq. (9). The likelihood function has the same form as the probability density function, except that the parameters of the function are reversed: the likelihood function expresses the values of β in terms of known, fixed values for y. Thus,

$$L(\beta|y) = \prod_{i=1}^{N} \frac{n_i!}{y_i!\ n_i - y_i\ !} ®_i^{y_i} (1-®_i)^{n_i - y_i} \quad (11)$$

The maximum likelihood estimates are the values for β that maximize the likelihood function in Eq. (11). The critical points of a function (maxima and minima) occur when the first derivative equals 0. If the second derivative evaluated at that point is less than zero, then the critical point is a maximum Thus, finding the maximum likelihood estimates requires computing the first and second derivatives of the likelihood function. Attempting to take the derivative of Eq. (11) with respect to β is a difficult task due to the complexity of multiplicative terms. Fortunately, the likelihood equation can be considerably simplified.

First, note that the factorial terms do not contain any of the $®_i$ As a result, they are essentially constants that can be ignored: maximizing the equation without the factorial terms will come to the same result as if they were included. Second, note that since $a^{x-y} = a^x/a^y$ and after rearranging terms, the equation to be maximized can be written as:

$$\prod_{i=1}^{N} \left(\frac{\pi_i}{1-\pi_i}\right)^{y_i} (1 - \pi i)^{n_i} \quad (12)$$

Note that after taking e to both sides of Eq. (9),

$$\left(\frac{\pi i}{1-\pi i}\right) = e^{\sum_{k=0}^{K} x_{ik}\beta_k} \quad (13)$$

Which, after solving for π_i becomes,

$$\pi i = \left(\frac{e^{\sum_{k=0}^{K} x_{ik}\beta_k}}{1+e^{\sum_{k=0}^{K} x_{ik}\beta_k}}\right) \quad (14)$$

Substituting Eq. (10) for the first term and Eq. (11) for the second term, Eq. (12) becomes:

$$\prod_{i=1}^{N}\left(e^{e^{\sum_{k=0}^{K} x_{ik}\beta_k}}\right)^{y_i}\left(1 - \frac{e^{\sum_{k=0}^{K} x_{ik}\beta_k}}{1+e^{\sum_{k=0}^{K} x_{ik}\beta_k}}\right)^{n_i} \quad (15)$$

Use $a^{x-y}=a^x/a^y$ to simplify the first product and replace 1 with $\frac{e^{\sum x\beta}}{e^{\sum x\beta}}$ to simplify the second product. Eq. (15) can now be written as:

$$\prod_{i=1}^{N} e^{y_i \sum_{k=0}^{K} x_{ik}\beta_k}\left(1 + e^{\sum_{k=0}^{K} x_{ik}\beta_k}\right)^{-n_i} \quad (16)$$

This is the kernel of the likelihood function to maximize. However, it is still cumbersome to differentiate and can be simplified a great deal further by taking its log. Since the logarithm is a monotonic function, any maximum of the likelihood function will also be a maximum of the log likelihood function and vice versa. Thus, taking the natural log of Eq. (16) yields the log likelihood function:

$$l(\beta)=\sum_{i=1}^{N} y_i\left(\sum_{k=0}^{K} x_{ik}\beta_k\right) - n_i.\log\left(1 + e^{\sum_{k=0}^{K} x_{ik}\beta_k}\right) \quad (17)$$

To find the critical points of the log likelihood function, set the first derivative with respect to each β equal to zero. In differentiating Eq. (17), noting that

$$\frac{\partial}{\partial \beta_k}\sum_{k=0}^{K} x_{ik}\beta_k = x_{ik} \quad (18)$$

Since the other terms in the summation do not depend on β_k and can thus be treated as constants. In differentiating the second half of Eq. (17), taking note of the general rule that $\frac{\partial}{\partial x}\log y = \frac{1}{y}\frac{\partial y}{\partial x}$ Thus, differentiating Eq. (17) with respect to each β_k,

$$\frac{\partial l(\beta)}{\partial \beta_k} = \sum_{i=1}^{N} y_i\, x_{ik} - n_i * \frac{1}{1+e^{\sum_{k=0}^{K} x_{ik}\beta_k}} * \frac{\partial}{\partial \beta_k}\left(1 + e^{\sum_{k=0}^{K} x_{ik}\beta_k}\right)$$

$$= \sum_{i=1}^{N} y_i\, x_{ik} - n_i * \frac{1}{1+e^{\sum_{k=0}^{K} x_{ik}\beta_k}} * e^{\sum_{k=0}^{K} x_{ik}\beta_k} * \frac{\partial}{\partial \beta_k}\sum_{k=0}^{K} x_{ik}\beta_k$$

$$= \sum_{i=1}^{N} y_i\, x_{ik} - n_i * \frac{1}{1+e^{\sum_{k=0}^{K} x_{ik}\beta_k}} * e^{\sum_{k=0}^{K} x_{ik}\beta_k} * x_{ik}$$

$$= \sum_{i=1}^{N} y_i\, x_{ik} - n_i \pi_i x_{ik} \quad (19)$$

The maximum likelihood estimates for β can be found by setting each of the $K + 1$ equations in Eq. (19) equal to zero and solving for each β_k.

Each such solution, specifies a critical point–either a maximum or a minimum. The critical point will be a maximum if the matrix of second partial derivatives is negative definite; that is, if every element on the diagonal of the matrix is less than zero . Another useful property of this matrix is that it forms the variance covariance matrix of the parameter estimates. It is formed by differentiating each of the $K + 1$ equations in Eq. (19) a second time with respect to each element of β, denoted by $\beta_{k'}$. The general form of the matrix of second partial derivatives is

$$\frac{\partial^2 l(\beta)}{\partial \beta_k \partial \beta_{k'}} = \frac{\partial}{\partial \beta_{k'}} \sum_{i=1}^{N} y_i x_{ik} - n_i \pi_i x_{ik}$$

$$= \sum_{i=1}^{N} - n_i x_{ik} \pi_i$$

$$= - \sum_{i=1}^{N} n_i x_{ik} \frac{\partial}{\partial \beta_{k'}} \left(\frac{e^{\sum_{k=0}^{K} x_{ik} \beta_k}}{1 + e^{\sum_{k=0}^{K} x_{ik} \beta_k}} \right) \quad (20)$$

To solve Eq. (20) we will make use of two general rules for differentiation. First, a rule for differentiating exponential functions:

$$\frac{d}{dx} e^{u(x)} = e^{u(x)} * \frac{d}{dx} u(x) \quad (21)$$

In our case, let u(x) = $\sum_{k=0}^{K} x_{ik} \beta_k$. Second, the quotient rule for differentiating the quotient of two functions:

$$\left(\frac{f}{g} \right)' a = \frac{g\ a\ .f'\ a - f\ a\ .g'(a)}{[g\ a\ ]^2} \quad (22)$$

Applying these two rules together allows us to solve Eq. (20).

$$\frac{d}{dx} \frac{e^{u(x)}}{1 + e^{u(x)}} = \frac{1 + e^{u\ x} * e^{u\ x} \frac{d}{dx} u\ x - e^{u\ x} * e^{u\ x} \frac{d}{dx} u\ x}{(1 + e^{u\ x})^2}$$

$$= \frac{e^{u\ x} \frac{d}{dx} u\ x}{(1 + e^{u\ x})^2}$$

$$= \frac{e^{u\ x}}{1 + e^{u\ x}} * \frac{1}{1 + e^{u\ x}} * \frac{d}{dx} u(x) \quad (23)$$

Thus, Eq. (20) can now be written as:

$$- \sum_{i=1}^{N} n_i x_{ik} \pi_i (1 - \pi_i) x_{ik'} \quad (24)$$

Chapter 4

RESULTS

4.0. Presentation of data

4.0.1. Description of study participants

Table 4-1 Participant's social demographics and economic distribution

	n	%
Over all	**3042**	**100%**
Woman's age		
15-24	443	14.6
25-34	1276	42
35-49	1323	43.5
Woman's education		
Less than secondary	2744	90.2
Secondary +	298	9.8
Woman's marital status		
Married/union	2499	82.2
Divorced/separated/widowed	543	17.8
Never married	0	0
Woman's employment		
Employed	381	12.5
Unemployed, agriculture	2658	87.4
Woman's perception of violence		
Acceptable	1744	57.3
Unacceptable	1297	42.7
Husband's education		
Less than secondary	2640	86.8
Secondary +	402	13.2
Husband's occupation		
Employed	858	28.3

Unemployed, agriculture	2176	71.7
Husband's age		
15-24	165	5.4
25-34	996	32.7
35-44	691	22.7
45+	1190	39.1
Husband's # sex partners last 12 months		
0-1	1928	65.8
2 +	1002	34.2
Husband's perception of violence		
Acceptable	408	13.4
Unacceptable	2634	86.6
Residence		
Urban	409	13.4
Rural	2633	86.6
Household wealth		
Bottom quintile	1886	62
Not bottom quintile	1155	38
Average number of people per sleeping room		
1	212	7.1
2_3	2368	77.9
4+	462	15.2
Wife's earning in relation to husband		
More than him	156	9.8
Less than him	1048	66.4
Same as him	304	19.2
Husband doesn't work	49	3
Other	25	1.6

Tables 4.1 shows the percent distribution of all covariates that have been identified as predictors of Intimate Partner Violence using the developed conceptual framework from variety of literatures. The analysis includes a total number of 5008 women of which 3042 (60.7%) have been interviewed about Intimate Partner Violence and their partners answered questionnaire.

85% of the study respondents are above 25 years of age against 94.6% of their partners, where the age distribution in the two age intervals 25-34 and 35-49 is almost the same for women with corresponding percentages 42% and 43.5% respectively. Whereas for their partners, a big number exceed 49 years old (39%).

Only 9.2% of responded women have completed secondary school i.e their education level is less secondary school whereas only 13.3% of their partners completed secondary school.

82.2% of respondents lives together with their partners, this includes married women or cohabitating women.

Only 12.5 % of respondents employed against 28.3 % of their partners, the corresponding compliments includes unemployed and famers.

Perception of violence among respondents correspond to 43.7 % of women responding that violence toward them is unacceptable against 86.6% of their partners. Reveling that women are not aware of their wright compared to their partners

4.0.2 Intimate Partner Violence period prevalence

Table 4-2Intimate Partner Violence period prevalence

	N	%
Total number of women responded about IPV	3042	100
Classification of Intimate Partner Violence		
Moderate	807	46.9
Severe	911	53.1
IPV in the last 12 months	1718	56.6

More than a half of women interviewed (56.6 percent) reported that they had been victims of either physical or sexual violence at least once during the past 12 months. Whether physical or sexual, the severity of violence was classified into two groups. Over a half of women experienced violence (53.1.%), the violence reported was Severe and (46.9%) of them reported moderate violence.

4.0.3. Multicollinearity screening test

Table 4-3 Multicollinearity screening

	w_age	w_edu	w_occ	w_acceptipv	h_edu	h_occ	h_age	h_part	h_acceptipv	hh_res	hh_wealth	hh_room_cat	earnings
w_age	1												
w_edu	-0.03	1.00											
w_occ	-0.01	0.29	1.00										
w_acceptipv	-0.02	0.20	0.11	1.00									
h_edu	-0.03	0.44	0.22	0.16	1.00								
h_occ	0.06	0.31	0.47	0.11	0.33	1.00							
h_age	0.70	0.01	0.01	-0.01	-0.03	0.05	1.00						
h_part	-0.01	0.00	0.03	0.01	0.02	0.00	0.01	1.00					
h_acceptipv	-0.06	0.10	0.06	0.09	0.10	0.06	-0.05	0.08	1.00				
hh_res	0.04	0.35	0.33	0.12	0.26	0.41	0.03	0.00	0.03	1.00			
hh_wealth	0.07	-0.28	-0.22	-0.10	-0.27	-0.32	0.07	-0.02	-0.11	-0.31	1.00		
hh_room_cat	0.14	0.05	0.06	0.04	0.07	0.07	0.13	0.03	0.01	0.05	-0.09	1.00	
earnings	-0.02	0.02	0.23	0.02	-0.02	0.03	-0.03	-0.03	0.04	0.00	-0.05	0.03	1.00

Table4.3 provides the test for Multicollinearity among covariates. We are testing if there is a correlation of at least one independent variable with a combination of the other independent variables. Here the Pearson's R correlation coefficient is used. Correlations of r>0.5 are considered as collinear.

The test shows us that Women's age and Husband's age are collinear, this may results in the fact that the same generation of men are more likely to marry the same generation of women. This means that Women's age and Husband's age will explain the same the outcome in the logistic model, Thus to produce parsimonious (efficient)

multivariable models, and to prevent strange, unstable results, we remove one variable of collinear pairs. To remove one variable we need a judgment of which to remove. By using a chi-square test for association between Woman's age, Husband's age and experience of violence we found the p-values p-value=0.001 and p-value = 0.1359 respectively, This suggest that we drop husband's age in sake of Women's age.

4.1. Bivariate associations between social demographic characteristics and intimate partner violence in Rwanda

Table 4.4 provides the cross tabulation of individual covariate with intimate partner violence to see if there is individual association of covariates and intimate partner violence. In this context a bivariate analysis was conducted using chi-square test with the purpose of filtering potential covariates in multivariate analysis, we use a generous threshold of α=0.1 to determine statistical significance to ensure that we do not drop any potentially useful variable from the analysis.

As the table below shows, Women's age, women's education level, woman's marital status, woman's employment, woman's perception of violence, husband's education, husband's occupation, husband's number of sex partners in the last 12 months, husband's perception of violence, residence, Household wealth, Average number of people per sleeping room, Wife's earning in relation to husband became statistically significant thus prompts to consider all the variables for multivariate logistic analysis.

Bivariate associations between social-economic and demographic characteristics and intimate partner violence.

Table 4-4 Bivariate associations between social-economic and demographic characteristics and intimate partner violence in Rwanda, 2010 DHS

	No violence (%)	Any violence (%)	p-value
Woman's age			0.0010
15-24	15.48	1.13	
25-34	43.15	4.32	
35-49	32.24	3.69	
Woman's education			0.0041
Less than secondary	82.05	8.54	
Secondary +	8.82	.59	
Woman's marital status			0.000
Married/union	90.37	9.63	
Divorced/separated/widowed	0.00	0.00	
Never married	0.00	0.00	
Woman's employment			0.0190
Employed	12.04	.83	
Unemployed, agriculture	78.72	8.26	
Woman's perception of violence			0.0007
Acceptable	51.17	5.71	
Unacceptable	39.7	3.43	
Husband's education			0.0010
Less than secondary	80.15	8.6	
Secondary +	10.69	.56	
Husband's occupation			0.0893
Employed	25.41	1.66	
Unemployed, agriculture	65.44	7.5	
Husband's # sex partners last 12 months			0.0002
0-1	85.86	8.35	
2 +	5.01	.79	
Husband's perception of violence			0.0190

Acceptable	17.5	2.41	
Unacceptable	73.37	6.73	
Residence			0.0067
Urban	12.05	.62	
Rural	78.81	8.52	
Household wealth			0.0128
Bottom quintile	52.88	6.16	
Not bottom quintile	37.99	2.98	
Average number of people per sleeping room			0.0004
1	5.26	.44	
2-3	66.6	6.06	
4+	19.09	2.56	
Wife's earning in relation to husband			0.0354
More than him	5.29	.5	
Less than him	39.24	4.65	
Same as him	12.11	.99	
Husband doesn't work	34.2	3.01	
Other			

Table4.4 shows whether individual covariate is associated with the outcome (IPV). Of all the variables included in the model, some became statistically significant and other did not. Using a threshold of ***α=0.05***, Women's age, Women's education level, Women's marital status, Women's employment status, Women's perception of violence, Husband's education level, Husbands' number of sex partners in the last 12 months prior to the survey, Husbands' perception of violence, Residence, Household wealth, Average number of person per sleeping room, and Wife's earning in relation to husband found to be associated with women's experience of Intimate Partner Violence with corresponding p-values (p-value=0.001, p-value=0.0041, p-value= 0.000, p-value= 0.0190, p-value=0.0007, p-value=0.0010, p-value=0.0002, p-value=0.0190, p-value=0.0067, p-value=0.0128, p-value=0.0354 respectively). Whereas husbands' occupation shows no association with IPV (p-value=0.0893).

The table above enable us to say that experience of IPV increases with women's age from 15 years aged women to 34 years aged women and from there, it starts to decrease. It is evident that women in the age group between 15 to 34 years were significantly at one time risk of facing IPV compared to the women belonged 34 years and above. There is a slight IPV prevalence decline after 34 years and above age group, which was quite expected as women of higher age group were bound to reduce violence with the passage of time by virtue of their position betters with having adult sons in the family.

IPV decreases with the increase of Women's education level, husband's number of sex partners in the last 12 months and is prevalent among unemployed or farmer women. IPV is also prevalent among those women whose perception accepts to be victims of ipv and those women whose husbands knows that ipv is unacceptable. Women's whose husbands are unemployed or farmer are more likely to experience IPV.

IPV is prevalent among women's residing in rural areas, lying in the bottom household wealth, whose families have an average number of people per sleeping room of 2 to 3 person, Women earning less than his husband or whose husband doesn't work, Thus this variable will not be considered in Multiple logistic regression model.

4.1.1. Multiple logistic regression analysis

All the covariates identified by binary logistic analysis to be associated with the outcome are going to be considered in multiple logistic regression model. First we are going to run a full mode by incorporating all significant covariates.

Table 4-5 Multiple logistic regression full model

	Odds Ratio	Std.Err.	t	P>|t|	[95% Conf. Interval]	
Woman's age						
15-24	**1**					
25-34	1.54	0.17	3.91	0.00	[1.24	1.91]
35-49	1.53	0.21	3.14	0.00	[1.17	1.99]
Woman's education						
Secondary +	**1**					
Less than secondary	1.11	0.20	0.58	0.56	[0.78	1.57]
Woman's employment						
Employed	**1**					
Unemployed, agriculture	1.11	0.19	0.62	0.53	[0.80	1.54]
Woman's perception of violence						
Unacceptable	**1**					
Acceptable	1.28	0.12	2.65	0.01	[1.07	1.54]
Husband's education						
Secondary +	**1**					
Less than secondary	1.41	0.24	2.04	0.04	[1.01	1.98]
Husband's occupation						
Unemployed, agriculture	**1**					
Employed	0.92	0.11	-0.70	0.49	[0.73	1.16]
Husband's # sex partners last 12 months						
0-1	**1**					
2 +	2.21	0.53	3.31	0.00	[1.38	3.55]
Husband's perception of violence						
Acceptable	**1**					
Unacceptable	1.24	0.15	1.81	0.07	[0.98	1.57]
Residence						
Urban	**1**					
Rural	1.20	0.19	1.13	0.02	[1.08	1.64]
Household wealth						
Bottom quintile	**1**					
Not bottom quintile	0.88	0.10	-1.14	0.25	[0.71	1.10]
Average number of people per sleeping room						
1	**1**					
2_3	1.54	0.29	2.31	0.02	[1.07	2.22]
4+	1.86	0.38	3.03	0.00	[1.24	2.78]
Wife's earning in relation to husband						
More than him	**1**					
Less than him	0.55	0.13	-2.52	0.01	[0.34	0.88]
Same as him	0.49	0.13	-2.68	0.01	[0.29	0.83]
Husband doesn't work	0.51	0.13	-2.73	0.01	[0.31	0.83]
Constant	0.49	0.19	-1.85	0.07	[0.23	1.05]

In the multivariate logistic regression analysis, we found that for women whose age lying in 25 to 34 age interval or 35 and above (***OR* 1.54; *95% CI* :1.24-1.91; *p-value* <0.01** and ***OR* 1.53; *95% CI:* 1.17-1.99; *p-value*<0.01 respectively**), having perceptions that accepting intimate partner violence (***OR* 1.28; *95% CI* :1.07-1.54; *p-value*=0.01**), having a husband whose education level is less that secondary (***OR 1.41; 95% CI: 1.01-1.98; p-value<0.01***) or a husband who had multiple sex partners in the last 12 months prior to the survey (***OR 2.21; 95% CI: 1.38-3.55, p-value<0.001***), and women whose household's average number of people per sleeping room exceeds one person (2_3 persons : ***OR 1.54; 95% CI:1.07-2.22; p-value=0.02*** and 4+ persons: ***OR 1.86; 95% CI:***

1.24-2.78; p-value<0.01), and women living in Rural areas (***OR 1.2; 95% CI: 1.08-1.64, p-value=0.02***) were statistically significant risk factors for women's exposure to intimate partner violence. Whereas for wives earning less than or same as her husband or whose husband does not work (***OR*** 0.55; ***95% CI*** : 0.34-0.88; ***p-value*** =0.01, OR 0.49; ***95% CI***: 0.29-0.83; ***p-value*** =0.01, and ***OR*** 0.51; ***95% CI:*** 0.31-0.83; ***p-value***=0.01 respectively) was statistically significant protective factors against Intimate Partner Violence. Husband employment, Household wealth, and Husband perception of Intimate Partner Violence found to have no association with IPV (OR 0.92; ***95% CI***:0.73-1.16, ***p-value*** = 0.49, OR 0.88; ***95% CI*** :0.71-1.10, ***p-value*** = 0.25, and OR 1.24; ***95% CI*** :0.98-1.57, ***p-value*** = 0.07 respectively). Performing a manual backward stepwise logistic regression by removing any covariate which shows no significance, we finally get the following reduced model as illustrated by the following table.

Table 4-6 multiple logistic regression reduced model

	Odds Ratio	Std.Err.	T	P>|t|	[95% Conf. Interval]	
Woman's age						
15-24	**1**					
25-34	1.50	0.16	3.77	0.00	[1.21	1.85]
35-49	1.49	0.20	3.00	0.00	[1.15	1.94]
Woman's perception of violence						
Unacceptable	**1**					
Acceptable	1.28	0.12	2.63	0.01	[1.06	1.54]
Husband's education						
Less than secondary	**1**					
Secondary +	0.66	0.11	-2.55	0.01	[0.48	0.91]
Husband's # sex partners last 12 months						
0-1	**1**					
2 +	2.31	0.54	3.57	0.00	[1.46	3.67]
Average number of people per sleeping room						
1	**1**					
2_3	1.56	0.29	2.42	0.02	[1.09	2.24]
4+	1.86	0.38	3.06	0.00	[1.25	2.76]
Residence						
Urban	**1**					
Rural	1.24	0.18	1.50	0.04	[1.03	1.65]
Constant	0.39	0.09	-4.27	0.00	[0.25	0.60]

Table 4-6 provides the final model with all covariates being statistically significant and the overall significance of the model test shows that the model fits well the data and is significant with p-value < 0.0001.

Women whose age exceeds 25 years are more likely to experience intimate partner violence compared with women below 25 years old. Moreover, the risk of experiencing Intimate Partner violence increases with age from 15 years to 34 years **(*OR* 1.5; *95% CI*: 1.21-1.8; *p-value*<0.01)** and start to decrease slightly for older women 35 years and above **(*OR* 1.49; *95% CI*: 1.15-1.94; *p-value*<0.01)**. Which was quite expected as women of higher age group were bound to reduce violence with the passage of time by virtue of their position betters with having adult sons in the family.

The risk of women to experience Intimate Partner Violence increases with knowledge of women's rights. Woman's perception of violence becomes statistically significant showing that women's IPV perceptions influence experience of IPV for women by their intimate partners. The model shows that women who knows that IPV is accepted are more likely to experience IPV compared to those who know that IPV is not accepted **(*OR* 1.28; *95% CI*: 1.06-1.54; *p-value*=0.01)**.

Husband's education level became a protective factor for women to experience IPV. Women whose partners' education level is at least secondary school are less likely to face IPV compared to those women whose husbands' education level is less than secondary school **(*OR* 0,66; *95% CI*: 0.48-0.91; *p-value*=0.01)**.

Multiple sex partners in this context means husbands who have more than one sex partner. Husband's number of sex partners in the last 12 months prior to the survey became statistically significant revealing that there is a difference in experiencing IPV between women whose husbands had multiple sex partners in the last 12 months prior to the survey compared to those women whose husband did not. The model shows that women whose husbands had had multiple sex partners in the last 12 months prior to the survey are more than two times more likely to face IPV compared to those whose husband did not **(*OR* 2.31; *95% CI*: 1.46-3.67; *p-value*=0.01).**

Sleeping room density is associated with occurrence of IPV in the household, the risk of experience of IPV for women increases with sleeping room density. Women living in household with average number of people per sleeping room of more than one person are more likely to face IPV compared to those with one person per sleeping room on average. The model shows that women whose household's average number of people per sleeping room of 2 to 3 or 4 and above has a greater risk of experiencing IPV compared to those women whose household's average number of people per sleeping room is one person **(*OR* 1.56; *95% CI*: 1.09-2.24; *p-value*=0.02, *OR* 1.86; *95% CI*: 1.25-2.76; *p-value*<0.01 respectively).**

Residence also found to be associated with IPV. Depending on whether the woman live in Rural or urban areas influence differently on IPV experience. The modes illustrates that women living in rural areas are more exposed to IPV compared to those women living in urban areas (***OR* 1.24; *95% CI*: 1.03-1.65; *p-value*=0.04).**

Chapter 5 SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.0. Extent of Intimate Partner Violence in Rwanda

As reviewed from different literatures in Rwanda the extent of Intimate Partner Violence (IPV) tends to increase over time. Where IPV found to be doubled in a 5 year period from 2005 to 2010. Different media in Rwanda are still reporting IPV related cases regardless of the government effort against it, including creation of a

governmental organization such as Gender Monitoring Office (GMO) aims at fighting against all Gender based violence cases and the adaptation of the national laws that sets serious sanctions for those found guilty.

The results of the current study shows that of the 3042 women included in the analysis 56.6% (n=1718) had experienced at least one form of IPV in the last 12 months prior to the survey, this is consistent with Rwanda Demographic Health Survey 2010 report. Considering the severity of the violence, women corresponding to 51.9% (n=1580) reported to have experienced severe form of IPV whereas other women equivalent to 33% (n=1007) reported a less severe form of IPV.

Based on these figures there is evidence of the presence of IPV cases in Rwanda despite all the Rwandan government effort. So one may wonder the factors associated with this trend of IPV in the country.

5.1. Factors expected to be associated with Intimate Partner Violence in Rwanda

Intimate Partner Violence does not happen at random in Rwandan society, there should be factors related with this occurrence, either economic or demographic. Rwanda Demographic health Survey version 2010 (RDHS 2010) has collected information on IPV. This was measured by examining the factors which led to the incidents of abuse reported by women. The survey collected different information expected to filter out of them and get the real factors which contribute to the current extent of IPV in Rwanda. The collected information include:

1. **Women's and Husband's age:** This was expected to be associated with intimate partner violence in the way that, the difference in age between wife and husband may lead to the less compromising between them and late results in any form of IPV. Furthermore, it was expected that younger husbands are more likely to commit IPV.
2. **Women's and Husband's education level:** Education level of the wife and husband was expected to be associated with some form of IPV in the way that illiterate families are more likely to experience IPV due to the ignorance of human rights and tendency to be governed by the ancient Rwandan culture.
3. **Women's and Husband's occupation :** Occupation for the wife or husband was also expected to be among the factors associated with the occurrence of IPV based on the fact that unemployed wife and husband in the same house tend to spend a long time together and become the risk of occurrences of IPV.
4. **Women's and Husband's perception of violence:** Wife's and husband's perception of violence was among the expected causes of IPV due to the influence of ancient culture.
5. **Husband's number of sex partners:** Husbands with multiple sex partners were expected to more likely commit IPV.
6. **Household residence (Urban vs Rural):** It was expected for women's from rural areas to be more likely the victims of IPV due to their mentality with regards to violence committed by ones' husband.

7. **Household wealth (Ubudehe)**: The household wealth was thought to be included in this list of expected factors due to the prior experience of wealthy families to less likely report IPV related cases. May be it is due to the conservation of the family's dignity***(Exploring Community Perceptions and Women's)***.
8. **Household room's density:** Room density was thought as one of the expected predictor of IPV based on the Rwandan proverb saying that living together sometimes creates conflicts.
9. **Women's earnings relative to the husband's earnings:** Women's earnings relative to the husband's earnings was considered as a predictor of IPV based on the under estimation of ones' partner that identified to sometimes occur between couples on the satisfaction on the family which may later results in one form of IPV ***(VAW_COUNTRY_ASSESSMENT-Rwanda-1)***.

All these factors were included in the univariate analysis. First multicolinearity screening test was conducted with the purpose of preventing strange, and unstable results during logistic regression modeling and found women's age and husband's age to be collinear ($r>0.5$). Therefore the chi-square test for association was done and showed the p-value=0.001 and p-value = 0.1359 respectively, hence we dropped husband's age in sake of Women's age. This was expected to be caused by the fact that in Rwandan society the same generations of boys and girls are more likely to marry among themselves proven by a low rate of cross generation marriages in Rwanda(United Nations & UNFPA, 2005). All other variables were considered for bivariate analysis where factors were assessed individually.

5.1.1. Level of association of individual factor on occurrence of Intimate Partner Violence

Bivariate analysis was conducted to identify among the expected predictors of IPV in Rwanda which individually contributes to the occurrence of IPV in the country. A chi-square test for association was used with the specified threshold ($\alpha=0.05$).

Women's age, Women's education level, Women's marital status, Women's employment status, Women's perception of violence, Husband's education level, Husbands' number of sex partners in the last 12 months prior to the survey, Husbands' perception of violence, Residence, Household wealth, Average number of person per sleeping room, and Wife's earning in relation to husband shows a statistically significant association with women's experience of Intimate Partner Violence with corresponding p-values (p-value=0.001, p-value=0.0041, p-value= 0.000, p-value= 0.0190, p-value=0.0007, p-value=0.0010, p-value=0.0002, p-value=0.0190, p-value=0.0067, p-value=0.0128, p-value=0.0354 respectively). Whereas husbands' occupation shows no association with IPV (p-value=0.0893).

These statistics are consistent with the ones provided by the United Nations country assessment on violence against women 2013 report where, men found to be culturally trained to be breadwinners, with women playing a more subservient role. Therefore, men find it a challenge to accept women's earning capacities as this is likely to challenge their powers; thus Wife's earning in relation to husband become an IPV predictor.

Also the report shows that one form of IPV named economic violence occurs when the abuser has complete control over the victim's money and other economic resources. Usually, this involves putting the victim on a strict "allowance," withholding money at will and forcing the victim to beg for the money until the abuser gives them some money. It is common for the victim to receive less money as the abuse continues. This was found to be caused by several factors including a low women's education level, women's employment status, husband's education level, and household wealth.

Due to ignorance, and some cultural norms and practices residence, husbands' perception of violence and women's perception of violence found to be among the predictors of IPV. In Rwandan history women's behavior was shaped by attitudes that a good mother keeps her family together, despite any problems, including IPV. Also men were taken as idols. They had that mindset that whatever they say is true and must be done or obeyed by their partners if not beat her. So till now that mindset is somehow there, they think they are superior to women. They can't listen to women's advices; they just want them to follow their orders. The way they found the society at their birth, they think that is how it should be and this found to be common in rural areas than urban areas(Mannell & Jackson, 2014).

Men 'cheating' and having multiple partners or wives was mentioned as a contributing factor for IPV. This was found to be among the causes of psychological and emotional violence to the women in intimate partnership which later may result in other forms of IPV such as economic and sexual violence(Ntaganira et al., 2008).

5.1.2. Overall level of association of factors on occurrence of Intimate Partner Violence

All covariates showed a statistically significant association with Intimate Partner violence were included in the multiple logistic regression analysis model to see the overall contribution of factors to the outcome of interest. The final model with all covariates being statistically significant and the overall significance of the model test shows that the model fits well the data and is significant with p-value < 0.0001.

Women whose age exceeds 25 years are more likely to experience intimate partner violence compared with women below 25 years old. Moreover, the risk of experiencing Intimate Partner violence increases with age from 15 years to 34 years **(*OR* 1.5; *95% CI*: 1.21-1.8; *p-value*<0.01)** and start to decrease slightly for older women 35 years and above **(*OR* 1.49; *95% CI*: 1.15-1.94; *p-value*<0.01)**. Which is quite consistent with a current study done in one east African country, Kenya in Kisumu district where Uwayo et al shows that young women whose ages ranges from 15 to 24 years old were more likely to experience IPV in all its forms than those with older ages.

The risk of women to experience Intimate Partner Violence increases with knowledge of women's rights. Woman's perception of violence becomes statistically significant showing that women's IPV perceptions influence experience of IPV for women by their intimate partners. The model shows that women who knows that IPV is accepted are more likely to experience IPV compared to those who know that IPV is not accepted **(*OR* 1.28; *95%***

***CI*: 1.06-1.54; *p-value*=0.01)**. This confirms with the study conducted by the National Commission for Unity and Reconciliation (NURC) in Rwanda, where ignorance, cultural norms and practices were shown to be predictors of violence.

Husband's education level became a protective factor for women to experience IPV. Women whose partners' education level is at least secondary school are less likely to face IPV compared to those women whose husbands' education level is less than secondary school **(*OR* 0,66; *95% CI*: 0.48-0.91; *p-value*=0.01)**, which was shown by a secondary analysis of KDH survey where violence was significantly lower for women whose partners had attained at least a postsecondary education(Garcia-Moreno et al., 2006).

Multiple sex partners in this context means husbands who have more than one sex partner. Husband's number of sex partners in the last 12 months prior to the survey became statistically significant revealing that there is a difference in experiencing IPV between women whose husbands had multiple sex partners in the last 12 months prior to the survey compared to those women whose husband did not. The model shows that women whose husbands had multiple sex partners in the last 12 months prior to the survey are more than two times more likely to face IPV compared to those whose husband did not **(*OR* 2.31; *95% CI*: 1.46-3.67; *p-value*=0.01).** This confirms with Kenyan study where Diane et all reported that women indicated that their male partner's multiple sexual partners habit was a factor which contributed to their abuse. This sentiment was espoused in the women's focus group in Obunga where one woman noted "some men leave work with little money and instead of bringing it [home] they go and pay for sex with sex workers or in other kinds of leisure with their concurrent partners(Uwayo, 2014).

Sleeping room density is associated with occurrence of IPV in the household, the risk of experience of IPV for women increases with sleeping room density. Women living in household with average number of people per sleeping room of more than one person are more likely to face IPV compared to those with one person per sleeping room on average. The model shows that women whose household's average number of people per sleeping room of 2 to 3 or 4 and above has a greater risk of experiencing IPV compared to those women whose household's average number of people per sleeping room is one person **(*OR* 1.56; *95% CI*: 1.09-2.24; *p-value*=0.02, *OR* 1.86; *95% CI*: 1.25-2.76; *p-value*<0.01 respectively).**

Residence also found to be associated with IPV. Depending on whether the woman live in Rural or urban areas influence differently on IPV experience. The model illustrates that women living in rural areas are more exposed to IPV compared to those women living in urban areas (***OR* 1.24; *95% CI*: 1.03-1.65; *p-value*=0.04).** This shows the same results as UN country assessment 2013 report on Violence Against Women (VAW) that reported that rural women are recognized as being at special risk of violence due to the prevalence of traditional attitudes in many rural communities(United Nations & UNFPA, 2005).

5.2. Conclusion

The first objective of the study was to determine the extent of IPV in Rwanda. It was found that of the 3042 women included in the analysis 56.6% (n=1718) had experienced at least one form of IPV in the last 12 months prior to the survey. Based on the severity of the violence, women corresponding to 51.9% (n=1580) reported to have experienced severe form of IPV whereas other women equivalent to 33% (n=1007) reported a less severe form of IPV.

. To identify potential demographic and socioeconomic factors associated with IPV in Rwanda

The second objective was to identify potential demographic and socioeconomic factors which contribute to IPV in Rwanda. This was measured by examining the factors which led to incidents of abuse reported by women in the survey. Individual factor was tested for association with the outcome of interest. As results women's age, women's education level, women's marital status, women's employment status, women's perception of violence, husband's education level, husbands' number of sex partners in the last 12 months prior to the survey, husbands' perception of violence, Residence, Household wealth, Average number of person per sleeping room, and Wife's earning in relation to husband found to be associated with women's experience of Intimate Partner Violence.

The third and final objective of the study was to model potential risk factors associated with IPV in Rwanda and provide the overall model of all significant IPV associated factors. All variables that showed an individual statistically significant association with Intimate Partner violence were included in the multiple logistic regression analysis model to see the overall contribution of factors to the outcome of interest. The final model with all covariates being statistically significant and the overall significance of the model test shows that the model fits well the data and is significant with p-value < 0.0001. Women whose age exceeds 25 years are more likely to experience intimate partner violence compared with women below 25 years old. Moreover, the risk of experiencing Intimate Partner violence increases with age from 15 years to 34 years **(*OR* 1.5; *95% CI*: 1.21-1.8; *p-value*<0.01).** The model shows that women who knows that IPV is accepted are more likely to experience IPV compared to those who know that IPV is not accepted **(*OR* 1.28; *95% CI*: 1.06-1.54; *p-value*=0.01)**.

Women whose partners' education level is at least secondary school are less likely to face IPV compared to those women whose husbands' education level is less than secondary school **(*OR* 0,66; *95% CI*: 0.48-0.91; *p-value*=0.01)**.

Women whose husbands had multiple sex partners in the last 12 months prior to the survey are more than two times more likely to face IPV compared to those whose husband did not **(*OR* 2.31; *95% CI*: 1.46-3.67; *p-value*=0.01).**

Women whose household's average number of people per sleeping room of 2 to 3 or 4 and above has a greater risk of experiencing IPV compared to those women whose household's average number of people per sleeping room

is on person **(*OR* 1.56; *95% CI*: 1.09-2.24; *p-value*=0.02, *OR* 1.86; *95% CI*: 1.25-2.76; *p-value*<0.01 respectively).**

Finally the modes illustrates that women living in rural areas are more exposed to IPV compared to those women living in urban areas (***OR* 1.24; *95% CI*: 1.03-1.65; *p-value*=0.04).**

5.3. Recommendations and scope for further work

Based on my findings and previous research on intimate partner violence, IPV is still a major problem in Rwanda. I recommend the following:

1. Continue efforts in raising awareness among and training of both men and women around human rights with a specific focus on women's rights at all levels in the communities.
2. Recognize, expand and increase access to services that improve women's decision-making ability in response to IPV, particularly counselling and support groups that provide benefits through discussion with others.
3. Expand opportunities for collective discussions about broader gender issues and attitudes that contribute to IPV.
4. At the individual level, continue to support women in seeking assistance from the police, while linking this more strongly to additional supports for those in both married and unmarried relationships, and for communities.

As for future research recommendations, due to time constraints this study did not cover all predictors of IPV in Rwandan context, it only used RDHS 2010 data set and limited on those factors collected by the survey. Thus further studies would explore deeply all other factor that did not covered by the current study.

References

Abramsky, T., Watts, C. H., Garcia-Moreno, C., Devries, K., Kiss, L., Ellsberg, M., … Heise, L. (2011). What factors are associated with recent intimate partner violence? findings from the WHO multi-country study on women's health and domestic violence. *BMC Public Health*. http://doi.org/10.1186/1471-2458-11-109

Andersson, N., Ho-Foster, A., Mitchell, S., Scheepers, E., & Goldstein, S. (2007). Risk factors for domestic physical violence: national cross-sectional household surveys in eight southern African countries. *BMC Women's Health*. http://doi.org/10.1186/1472-6874-7-11

Bair-Merritt, M. H. (2010). Intimate partner violence. *Pediatrics in Review / American Academy of Pediatrics*, *31*(4), 145–150; quiz 150. http://doi.org/10.1542/pir.31-4-145

Balian, S., Bornstein, T., Bradley, S., Cross, A., Fishel, J., Florey, L., … Zweimueller, S. (2014). Understanding and Using the Demographic and Health Surveys DHS Curriculum Facilitator's Guide About the DHS Curriculum Facilitator's Guide.

Bazargan-Hejazi, S., Medeiros, S., Mohammadi, R., Lin, J., & Dalal, K. (2013). Patterns of intimate partner violence: a study of female victims in Malawi. *Journal of Injury & Violence Research*. http://doi.org/10.5249/jivr.v5i1.139

Boe, P. (2004). *DHS Comparative Reports*.

Bonomi, A. E., Thompson, R. S., Anderson, M., Reid, R. J., Carrell, D., Dimer, J. A., & Rivara, F. P. (2006). Intimate Partner Violence and Women's Physical, Mental, and Social Functioning. *American Journal of Preventive Medicine*. http://doi.org/10.1016/j.amepre.2006.01.015

Czepiel, S. (2010). *Maximum likelihood estimation of logistic regression models: theory and implementation. Avaiable at http://czep.net/stat/mlelr.pdf*.

DHS. (2006). *Rwanda Demographic and Health Survey*. Retrieved from http://www.measuredhs.com

DHS. (2011). *Demographic and Health Survey 2010 Rwanda*.

Dr.Avishek Mallick. (2014). Logistic regression — modeling the probability of success. In *Modeling the probability of success* (p. 71).

Eswaran, M., & Malhotra, N. (2009). Domestic Violence and Women ' s Autonomy : Evidence from India, 1–39.

Europe, C. of. (2012). Overview of studies on the costs of violence against women and domestic violence, (October). Retrieved from http://www.coe.int/t/dghl/standardsetting/convention-violence/Background info/Overview of studies on the costs of violence against women and domestic violence_INTERNET VERSION.pdf

Garcia-Moreno, C., Jansen, H. A. F. M., Ellsberg, M., Heise, L., & Watts, C. H. (2006). Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet*, *368*(9543), 1260–9. http://doi.org/10.1016/S0140-6736(06)69523-8

Gillard, J. W. (2012). Method of moments estimation in linear regression with errors in both variables. http://doi.org/10.1080/03610926.2012.698785

GMO. (2013). *Gender Monitoring Office Annual Report 2012-2013*.

Hellevik, O. (2009). Linear versus logistic regression when the dependent variable is a dichotomy. *Quality and Quantity*. http://doi.org/10.1007/s11135-007-9077-3

Hindin, M. J. (2008). DHS ANALYTICAL STUDIES 18.

Hindin, M. J., Kishor, S., & Ansara, D. L. (2012). *Intimate Partner Violence Among Couples in 10 DHS Countries: Predictors and Health Outcomes*. *DHS Analytical Studies* (Vol. 18).

Ismayilova, L. (2010). Intimate P artner Violence, (December).

Know, W. W. (2014). CDC Intersection of Intimate Partner Violence and HIV in Women, 1–8.

Mannell, J., & Jackson, S. (2014). Intimate Partner Violence in Rwanda: Women's voices.

Ntaganira, J., Muula, A. S., Masaisa, F., Dusabeyezu, F., Siziya, S., & Rudatsikira, E. (2008). Intimate partner violence among pregnant women in Rwanda. *BMC Women's Health*. http://doi.org/10.1186/1472-6874-8-17

Pohar, M., Blas, M., & Turk, S. (2004). Comparison of Logistic Regression and Linear Discriminant Analysis: A Simulation Study. *Metodološki Zvezki*.

Project, M. A. P. (n.d.). Modeling Conditional Probabilities 1 : Lucky Dip Modeling Conditional Probabilities 1 : Lucky Dip.

Rennison, C. M., & Welchans, S. (2011). Intimate Partner Violence. *Bureau of Justice Statistics Special Report*, (NCJ 178247), 1–11.

Tjaden, Patricia & Thoennes, N. (2013). Consequences of IntiLeary, M. L. (n.d.). Consequences of Intimate research report. Juvenile Justice.mate research report. *National Institute of Justice*, 1–62.

Towle, M., & Lende, D. (2013). Community approaches to preventing mother-to-child HIV transmission: perspectives from rural Lesotho. *African Journal of AIDS Research*, *7*, 219–228. http://doi.org/http://dx.doi.org/10.2989/AJAR.2008.7.2.7.524

Turner, H. (2008). Introduction to Generalized Linear Models.

United Nations, & UNFPA. (2005). *Country Assessment on Violence against Women Rwanda*.

Uwayo, D. (2014). Factors Contributing to Intimate Partner Violence and the Effectiveness of Services Available to Help Victims in Kisumu , Kenya .

Vetten, L. (2014). South Africa. *British Medical Journal*, *2*(2386), 730. http://doi.org/10.1016/S0264-2751(00)00012-3

WHO. (2012). Understanding and addressing violence against women Sexual violence, 12.

WHO. (2013). *Understanding and Preventing Violence*.

World Health Organization. (2013a). Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. *2013*, 57.

World Health Organization. (2013b). Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. *2013*, *2008*, 57.

APPENDICES

Data analysis codes

```
////////////////////////////////////////////////////////////////////////////////
/// Title: Predictors of Intimate Partner Violence, Rwanda  //
/// Name: Elysee TUYISHIME                                  //
/// Date: 15,April, 2015                                    //
////////////////////////////////////////////////////////////////////////////////
```

RESEARCH QUESTION: What factors are associated with sexual and physical violence

against women in marriage in Rwanda?

```
/// D A T A  P R E P A R A T I O N///
//////////////////////////////////////////////////
```

Individual women's recode (IR) file

****

```
use "D:\Courses\Population Survey Analysis\Data\RWIR61FL.DTA", clear
keep caseid-v025 v044 v106 v012 v013 v115 v130 v161 v190 v201-v205 v501 v505 ///
v701 v705 v714 v717  v730 v739 v741 v746 ///
        v743a-v743e v744a-v744e d005 d104-d114 d121 d106 d107 d108
count //13671 women
///// delete women who were not interviewed about domestic violence.
tab v044
codebook v044
label list v044
drop if v044~=1
count //5008 women interviewed about domestic violence
///// create woman ID and household ID for merge
gen long wid = ((8000+v001)*10000) + (v002*100) + v003
gen long hid = ((8000+v001)*100) + v002
list caseid wid hid in 1/20
save "D:\Courses\Population Survey Analysis\Data\ir",replace
```

Male recode (MR) file

****

```
use "D:\Courses\Population Survey Analysis\Data\RWMR61FL.DTA", clear
keep mcaseid-mv003 mv005 mv011 mv013 mv034_1-mv034_8 mv106 mv714 ///
        mv741 mv744a-mv744e mv766a mv766b mv717 mv016

///// transform from wide-to-long so the male dataset is organized by wife ID
reshape long mv034_, i(mcaseid) j(wifenum)
///// check the number of men whose wives were interviewed
tab mv034_
rename mv034_ mv034
```

```
gen check = 1 if mv034>0 & mv034<.
tab check // husbands where a woman in the household was also interviewed
drop check // 3132 men with wives that were interviewed
drop if mv034 ==. | mv034 ==0
count // 3132 men with wives who were interviewed
///// create woman ID for merge
gen long wid = ((8000+mv001)*10000) + (mv002*100) + mv034
list wid in 100/120
isid wid  // no error indicates that each record (woman) has a unique id
sort wid
save "D:\Courses\Population Survey Analysis\Data\mr.dta",replace
Household recode (HR) file
**************************
use "D:\Courses\Population Survey Analysis\Data\RWHR61FL.DTA", clear
keep hhid-hv002 hv101_01-hv101_16 hv105_01-hv105_16 hv009 hv216
count //12540 households
///// create household ID for merge
gen long hid = ((8000+hv001)*100) + hv002
list hhid hid in 1/20
save "D:\Courses\Population Survey Analysis\Data\hr.dta",replace
 Merge, by woman
**************************
use "D:\Courses\Population Survey Analysis\Data\ir.dta",clear
///// merge the men's data onto the women's data
merge m:1 wid using "D:\Courses\Population Survey Analysis\Data\mr.dta"
tab _merge
* 2558 women, husband not interviewed
* 682 umarried men
* 2450 women whose husband was interviewed
keep if _merge==1 | _merge==3
count //5008 women interviewed about domestic violence
gen couple = 1 if _merge==3 // this identifies women in the subpopulation
```

```
*analysis who are married/partnered/divorced/separated
replace couple = 0 if _merge==1
tab couple // 2450 women interviewed about domestic violence whose husband
*answered questionnaire
drop _merge
///// merge the household data onto the women+men data
merge m:1 hid using "D:\Courses\Population Survey Analysis\Data\hr.dta"
tab _merge
keep if _merge==3
count //we still have 5008 women!
drop _merge
save "D:\Courses\Population Survey Analysis\Data\ipv.dta",replace
Generate analysis variables
**************************
use "D:\Courses\Population Survey Analysis\Data\ipv.dta",replace


////// sampling weight
gen weight = d005/1000000
svyset [pweight=weight],psu(v021) strata(v023)
////// subpopulation
labelbook v501
recode v501 (1/5 = 1 "Ever married") (0=0 "Never in union"), g(marriage)
label var marriage "Ever married subpopulation"
tab v501 marriage, m
///OUTCOME: woman experienced any physical or sexual violence in last 12 months
*Replace: Categorical-->Categorical
lookfor d106 d107 d108
tab1 d106 d107 d108
labelbook d106 d107 d108
tab1 d106 d107 d108,m
gen anyviolence = .
```

```
replace anyviolence = 0 if d106==0 | d106==8 | d107==0 | d107==8 | d108==0 | d108==8
replace anyviolence = 1 if d106==1 | d107==1 | d108==1
label var anyviolence "Woman experienced physical or sexual violence in the last 12 months"
label define anyviolence_label 0 "No" 1 "Yes"
label value anyviolence anyviolence_label
tab d106 anyviolence,m
tab d107 anyviolence,m
tab d108 anyviolence,m
///// woman's age
*Replace: Categorical-->Categorical
tab v013
label list v013
tab v013,m
recode v013 (1/2 = 1 "15-24") (3/4 = 2 "25-34") (5/7 = 3 "35-49"), gen(w_age)
label var w_age "Woman's age"
tab v013 w_age, missing
///// woman's education
*Replace:Categorical-->Categorical
tab v106
label list v106
tab v106,m
recode v106 (2 3 = 0 "Secondary +") (0 1 = 1 "Less than secondary"), gen(w_edu)
label var w_edu "Woman’s education"
tab v106 w_edu, missing
///// woman's marital status
*Replace:Categorical-->Categorical
tab v501
label list v501
gen w_mar=.
replace w_mar=1 if v501==1 | v501==2
replace w_mar=2 if v501==3 | v501==4 | v501==5
lab var w_mar "Woman’s marriage status"
label define w_mar_label 1 "Married/union" 2 "Divorced/separated/widowed"
```

```
label value w_mar w_mar_label
tab v501 w_mar, missing
///// woman's employment
*Replace:Categorical-->Categorical
tab v717
label list v717
generate w_occ =.
replace w_occ= 1 if v717==0 | v717==4
replace w_occ= 0 if v717==1 | v717==2 | v717==3 | v717==5 | v717==6 | v717==7 | v717==8 | v717==9
label var w_occ"Woman’s employment"
label define w_occ_label  1"Unemployed, self-employed agriculture" 0 "Employed"
label value w_occ w_occ_label
tab v717 w_occ, missing
///// Woman's acceptance of any IPV
*Replace: Categorical-->Categorical
tab1 v744a v744b v744c v744d v744e
label list v744a v744b v744c v744d v744e
gen w_acceptipv =0
replace w_acceptipv = . if v744a==9 | v744b==9 | v744c==9 | v744d==9 | v744e==9
replace w_acceptipv = 1 if v744a==1 | v744b==1 | v744c==1 | v744d==1 | v744e==1
label var w_acceptipv "Woman's acceptance of any IPV "
label define w_acceptipv_label 0 "Unacceptable" 1 "Acceptable"
label value w_acceptipv w_acceptipv_label
tab v744a w_acceptipv,m
tab v744b w_acceptipv,m
tab v744c w_acceptipv,m
tab v744d w_acceptipv,m
tab v744e w_acceptipv,m
///// husband's education
*Replace: Categorical-->Categorical
tab v701
label list v701
tab v701,m
```

```
recode v701 (2 3 = 0 "Secondary +") (0 1 = 1 "Less than secondary")(8 9=.), gen(h_edu)
label var h_edu "Husband’s education"
tab v701 h_edu, m
```

///// husband's occupation

***Replace: Categorical-->Categorical**

```
tab v705
label list v705
tab v705,m
recode v705(1 2 3 5 6 7 8 /9 = 1 "Employed") (0 4 = 2 "Unemployed, agriculture") (98 99=.), gen(h_occ)
label var h_occ "Husband’s occupation"
tab v705 h_occ,missing
```

////// husband's age

***Replace: Continuous-->Categorical**

```
lookfor v730
codebook v730
histogram v730
list v730 in 1/20
generate h_age=.
replace h_age=1 if v730>=15 & v730<25
replace h_age=2 if v730>=25 & v730<35
replace h_age=3 if v730>=35 & v730<45
replace h_age=4 if v730>=45 & v730<97
label var h_age"Husband’s age"
label define h_age_label 1 "15-24" 2 "25-34" 3 "35-44" 4 "45+"
label value  h_age h_age_label
list v730 h_age in 1/20
```

////// Husband’s number of sex partners in last 12 months

***Replace: Continuous-->Categorical**

```
codebook mv766b
label list mv766b
histogram mv766b if mv766b<98
list mv766b in 1/20
gen h_part = .
```

```
replace h_part=1 if mv766b<=1
replace h_part=2 if mv766b>=2 & mv766b<98
lab var h_part "Husband's number of sex partners in last 12 months"
label define h_part_label 1 "0-1" 2 "2+"
label value h_part h_part_label
tab mv766b h_part,missing
```

//////Husband's perception of violence

***Replace: Categorical-->Categorical**

```
tab1 mv744a mv744b mv744c mv744d mv744e
label list mv744a mv744b mv744c mv744d mv744e
gen h_acceptipv = 0
replace h_acceptipv = . if mv744a==9 | mv744b==9 | mv744c==9 | mv744d==9 | mv744e==9
replace h_acceptipv = 1 if mv744a==1 | mv744b==1 | mv744c==1 | mv744d==1 | mv744e==1
label var h_acceptipv "Husband's acceptance of any IPV"
label define h_acceptipv_label 0 "Unacceptable" 1 "Acceptable"
label value h_acceptipv h_acceptipv_label
tab mv744a h_acceptipv,m
tab mv744b h_acceptipv,m
tab mv744c h_acceptipv,m
tab mv744d h_acceptipv,m
tab mv744e h_acceptipv,m
tab couple h_acceptipv,m
```

////// Residence

***Replace: Categorical-->Categorical**

```
tab v025
label list v025
tab v025,m
recode v025(1 = 1 "Urban") (2 = 2 "Rural"), gen(hh_res)
label var hh_res "Residence"
tab v025 hh_res,missing
```

////// household wealth

***Replace: Categorical-->Categorical**

```
tab v190
label list v190
tab v190,m
recode v190(1 2 3 = 1 "Bottom quintile")(4 5 = 2 "Not bottom quintile"), gen(hh_wealth)
label var hh_wealth "Household wealth"
tab v190 hh_wealth, missing
```

////// Average number of people per sleeping room

***Replace: continuous-->Categorical**

```
lookfor hv009
lookfor hv216
codebook hv009
codebook hv216
histogram hv009
histogram hv216
gen hh_room = hv009/hv216
histogram hh_room

gen hh_room_cat=.
replace hh_room_cat=1 if hh_room<=1
replace hh_room_cat=2 if hh_room>1 & hh_room<=3
replace hh_room_cat=3 if hh_room>3 & hh_room<.
lab var hh_room_cat "Number of people per sleeping room"
label define hh_room_cat_label 1 "1" 2 "2-3" 3 "4+"
label value hh_room_cat hh_room_cat_label
tab hh_room hh_room_cat,missing
```

////// wife's earning in relation per sleeping

***Replace: Categorical-->Categorical**

```
lookfor v746
label list v746
tab v746,m
```

```
generate earnings=4
replace earnings=1 if v746==1
replace earnings=2 if v746==2
replace earnings=3 if v746==3
replace earnings=. if v746==9
label var earnings" Woman versus husband earnings"
label define earnings_label 1 "More than him" 2 "Less than him " ///
 3 "Same as him" 4 "Husaband or Wife doesn't work, other"
label value earnings earnings_label
tab v746 earnings,m
save "D:\Courses\Population Survey Analysis\Data\ipv.dta",replace
**********************************************************************************
svyset [pweight=weight],psu(v021) strata(v023)
**********
* Descriptive: Table1
svy,subpop(couple):tab w_age,count miss
svy,subpop(couple):tab w_age,percent

svy,subpop(couple):tab w_edu,count miss
svy,subpop(couple):tab w_edu,percent

svy,subpop(couple):tab w_mar,count miss
svy,subpop(couple):tab w_mar,percent



svy,subpop(couple):tab w_occ,count miss
svy,subpop(couple):tab w_occ,percent

svy,subpop(couple):tab w_acceptipv,count miss
svy,subpop(couple):tab w_acceptipv,percent

svy,subpop(couple):tab h_edu,count miss
svy,subpop(couple):tab h_edu,percent
```

svy,subpop(couple):tab h_occ,count miss

svy,subpop(couple):tab h_occ,percent

svy,subpop(couple):tab h_age,count miss

svy,subpop(couple):tab h_age, percent

svy,subpop(couple):tab h_part,count miss

svy,subpop(couple):tab h_part,percent

svy,subpop(couple):tab h_acceptipv,count miss

svy,subpop(couple):tab h_acceptipv,percent

svy,subpop(couple):tab hh_res,count miss

svy,subpop(couple):tab hh_res,percent

svy,subpop(couple):tab hh_wealth,count miss

svy,subpop(couple):tab hh_wealth,percent

svy,subpop(couple):tab hh_room_cat,count miss

svy,subpop(couple):tab hh_room_cat,percent

svy,subpop(couple):tab earnings,count miss

svy,subpop(couple):tab earnings,percent

****

Intimate Partner Violence (IPV) prevalence: Table2

****

svy,subpop(marriage):tab d106, cou miss

svy,subpop(marriage):tab d106,percent

svy,subpop(marriage):tab d107, cou miss

svy,subpop(marriage):tab d107,percent

svy,subpop(marriage):tab anyviolence, cou miss

svy,subpop(marriage):tab anyviolence,percent

Bivariate analysis

****

*Open saved analysis file.

use"D:\Courses\Population Survey Analysis\Data\ipv.dta", clear

****Specification that we are going to perform survey analysis**

svyset [pweight=weight],psu(v021) strata(v023)

Look for all covariates associated with IPV at p<0.1:Table3

****

svy,subpop(couple):tab w_age anyviolence,col percent

svy,subpop(couple):tab w_edu anyviolence,col percent

svy,subpop(couple):tab w_mar anyviolence,col percent

svy,subpop(couple):tab w_occ anyviolence,col percent

svy,subpop(couple):tab w_acceptipv anyviolence,col percent

svy,subpop(couple):tab h_edu anyviolence,col percent

svy,subpop(couple):tab h_occ anyviolence,col percent

svy,subpop(couple):tab h_part anyviolence,col percent

svy,subpop(couple):tab h_acceptipv anyviolence,col percent

svy,subpop(couple):tab hh_res anyviolence,col percent

svy,subpop(couple):tab hh_wealth anyviolence,col percent

svy,subpop(couple):tab hh_room_cat anyviolence,col percent

svy,subpop(couple):tab earnings anyviolence,col percent

Search for all collinear pairs

****

findit corr_svy

corr_svy w_age w_edu w_occ w_acceptipv h_edu h_occ h_age h_part h_acceptipv ///

hh_res hh_wealth hh_room_cat earnings ///

[pweight=weight],subpop(marriage)psu(v021) strata(v023)

***w_age and h_age are collinear r=0.6967**

svy, subpop(couple):tab w_age anyviolence, col percent // p=0.0010

svy, subpop(couple):tab h_age anyviolence, col percent // p=0.1359

***w_age is more associated with anyviolance, so omit h_age**

****

*** M U L T I V A R I A T E L O G I S T I C M O D E L ***

****

/* Variables in Final full model

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.h_acceptipv ///

i.hh_res ///

i.hh_wealth ///

i.hh_room_cat ///

i.earnings

////// Run Final full model

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.h_acceptipv ///

i.hh_res ///

i.hh_wealth ///

i.hh_room_cat ///

i.earnings

//////Manual backward stepwise logistic regression

test _Iearnings_2 _Iearnings_3 _Iearnings_4

***p-value=0.0481 Keep**

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0098 Keep**

test _Ihh_wealth_2

***p-value=0.2529 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.h_acceptipv ///

i.hh_res ///

i.hh_room_cat ///

i.earnings

test _Iearnings_2 _Iearnings_3 _Iearnings_4

***p-value=0.0546 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.h_acceptipv ///

i.hh_res ///

i.hh_room_cat

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0107 Keep**

test _Ihh_res_2

***p-value=0.1366 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.h_acceptipv ///

i.hh_room_cat

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0119 Keep**

test _Ih_accepti_1

***p-value=0.0829 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_occ ///

i.h_part ///

i.hh_room_cat

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0119 Keep**

test _Ih_part_2

***p-value=0.0004 Keep**

test _Ih_occ_2

***p-value=0.8635 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_edu ///

i.w_acceptipv ///

i.h_edu ///

i.h_part ///

i.hh_room_cat

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0105 Keep**

test _Ih_part_2

***p-value=0.0004 keep**

test _Ih_edu_1

***p-value=0.0163 Keep**

test _Iw_accepti_1

***p-value=0.0087 Keep**

test _Iw_edu_1

***p-value=0.3316 Drop**

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_acceptipv ///

i.h_edu ///

i.h_part ///

i.hh_room_cat

test _Ihh_room_c_2 _Ihh_room_c_3

***p-value=0.0098 Keep**

test _Ih_part_2

***p-value=0.0004 Keep**

test _Ih_edu_1

***p-value=0.0033 Keep**

test _Iw_accepti_1

***p-value=0.0061 Keep**

test _Iw_age_2 _Iw_age_3

***p-value=0.0005 Keep**

/////Variables in the final reduced model, p-value<0.05:

/* these variables remained statistically significant in the final reduced model

xi: svy, subpop(couple):logistic anyviolence ///

i.w_age ///

i.w_acceptipv ///

i.h_edu ///

i.h_part ///

```
i.hh_room_cat
/////Run final reduced model
char h_edu[omit] 1
xi: svy, subpop(couple):logistic anyviolence ///
i.w_age  ///
i.w_acceptipv ///
i.h_edu ///
i.h_part ///
i.hh_room_cat ///
i.hh_res
test _Ihh_room_c_2 _Ihh_room_c_3
```