COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF SATATISTICS

ANALYSIS OF FACTORS AFFECTING EARLY MARRIAGE AND SCHOOL DROP OUT AMONG WOMEN IN KENYA

A thesis submitted to the Department of Statistics in partial fulfillment of the requirements for the Degree of Master of Science in Statistics (Biostatistics)

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This is to certify that the thesis prepared by Bezawit Sewalem entitled: "*Analysis of factors affecting early marriage and school dropout among women in Kenya"* submitted in partial fulfillment of the requirements for the Degree of Master of Science in Statistics (Biostatistics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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DECLARATION

I, the undersigned, declare that this thesis is my own work, has not been presented for consideration to this or any other university, and all sources of material used for the thesis have been duly acknowledged.

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This thesis has been submitted for consideration with my approval as a university advisor.

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Advisor's name	**Signature**	**Date**

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ACRONYMS

AIC	Akaike's information criteria
BIC	Bayesian information criteria
DHS	Demographic and Health Survey
KDHS	Kenya Demographic and Health Survey
GIS	Geographic Information System
GLMM	Generalized Linear Mixed Model
GPS	Global positioning System
MLR	Maximum Likelihood Ratio
NSR	nugget-to-sill ratio
OR	Odds Ratio
SNNR	Southern Nations Nationalities and Peoples' Region
UNCF	United Nation Children's Fund
UNICEF	United Nation Children's Emergency Fund
UNPFA	United Nations Population Fund Agency
USAID	United States Agency for International Development
WHO	World Health Organization

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ABSTRACT

Dropping out of school is described as leaving school without completing a minimum requirement due to harmful practices like early marriage, whereas early marriage is marriage before the age of 18. The primary goal of this study was to examine and identify factors that influence early marriage and school dropout in Kenya applying binary multilevel logistic regression model to the 2022 KDHS data. A community based cross-sectional study was conducted on a total 17,778 and 16,416 married and school enrolled weighted sample of women registered between February 17 and July 19, 2022 for KDHS in all regions of Kenya. From the total of 17,778 and 16,416 married and school enrolled women, 27.91% and 33.56% have experienced early marriage and school dropout respectively. Separate and binary and multilevel models were fitted with the help of STATA and SPSS version 27 software. AIC and BIC were used to compare all fitted models. Compared to other models, the binary multilevel logistic regression model provided the best fit for early marriage and school dropout. Based on the binary multilevel model, both early marriage and school dropout varied across clusters in Kenya. The results show that women in rural areas and women from the poor wealth index are more likely to be exposed to early marriage and school dropout. Therefore, there is a need for an enormous intervention on these indicators to minimize early marriage and school dropout.

Key words: Early marriage, school dropout, binary multilevel logistic regression

CHAPTER ONE

1. INTRODUCTION

1.1BACKGROUND OF THE STUDY

School dropout and early marriage are two intertwined issues that have significant consequences on individuals, families, and societies. School dropout is described as leaving school without completing a minimum requirement; most often a higher secondary education diploma (De Witte et,al., 2013). Early school exit is frequently cited as one of the most harmful impact of early marriage and mother-hood for females in developing countries. Once a female is married, she is likely to be leaving school. Why do adolescent girls drop out of school? Is the issue related to early marriage and pregnancies (De Witte et,al., 2013); (LloydC.& Mensch B., 2008)?

Women are subject to so many factors including; socio economic abuse, and political discrimination. Sexual abuse, early marriage, traditional practices have significant effect on early marriage and school dropout. Women and girls are denied access to school, health care, work and other opportunities as a result of inhuman and discriminatory policies (Mengistu, 2015).

Early marriage is defined as a marriage carried out before the age of 18 years when the girl is not physically; physiologically and psychologically ready to take on the duties of marriage and child bearing. Child marriage occurs when one or both of the couples are children and can take place with or without official registration as well as under civil, religious, or customary rules (IPPF, 2007); (Tezera, 2019).

Among harmful traditional practices, early marriage is the common one. It is a health and human right issue that mainly affects women and girls. It may be formal or informal marriage of children aged below 18 years when they are not physically or emotionally mature enough to take the social responsibility of the wife (Nguyen N.C and Wondo Q,

2015).Early marriage is one of the ways of violating human and women's right (Mengistu, 2015).

Early marriage is the violation of the fundamental rights of the child. Article 21 of the 1990 African charter on the Right and Welfare of the child states that, "Child marriage and betrothal of girls and boys shall be prohibited and effective action including legislation shall be taken to specify the minimum age of marriage to be 18 years". Also the Maputo protocol on the rights of Women in Africa (October 2005) and the newly adopted criminal low of Ethiopia (2005) acknowledge the minimum age of marriage for women to be 18 years and state that marriage shall only take place with full consent of both parties. Unfortunately, knowledge of and respect for the low is limited among many rural communities (Alemu, 2007).

Throughout the world, millions of children are affected by early marriage. It is most common in South Asian countries, where millions of girls in their preteens and teens marry older men every year. Early marriage impacts their development with a lack of education and occupational training in addition to the gendered dimension of poverty and frequently leading to early pregnancy and social isolation. It also affects both females and males, but it affects females in considerably greater percentages, greater with intensity and far broader scope (Tezera, 2019); (UNICEF & UNPA , 2018).

Early marriage is still common throughout the world, but it is most widespread in Africa, South Asia, Latin America and Caribbean, where it affects primarily females (Tezera, 2019); (Malhotra, 2010).Over the world , millions of women are affected by early marriage. According to UNICEF (2023), 6500 million women were married before the age of 18 in the current world population. However, the child marriage rates are declining globally, but progress is too slow. Child marriage is still quite common today, and it has serious negative consequences for education, labor force participation, health, violence and empowerment (Nguyen N.C and Wondo Q, 2015).In Kenya Child marriage rates vary across regions and among ethnic groups. It is most common in Northern Kenya (56%), followed by the Coast Province (41%) and Nyanza (32%) (UNICEF, 2020).

Child marriage is also associated with lower levels of schooling for girls in every region of the world and is a barrier to international development goals .A lost opportunity for education is not only harmful to girls but has a wide reaching results for their children and communities. Educating girls create many positive outcomes for economic development and poverty reduction by improving a girl's income earning potential and socio-economic status (ICRW, 2005).

In recent decades, the median age at marriage has risen across Africa, although progress has been uneven and there has been significant variation across and within nations (Petroni et al, 2017). Female's education is influenced by social conventions such as early marriage, the financial burden of school fees and the lack of opportunities for girls after marriage. In Kenya early marriage endangers girl's capacity to return to school after marriage. Exposing them to plenty of negative social and health consequences is connected with dropping out of school (Ikamari, 2023).This study aim's to identify factors affecting early marriage and school dropout in Kenya using KDHS 2022 data.

1.2. STATEMENT OF PROBLEM

After marriage, young girl's access to formal and informal education is severely limited because of domestic burdens, childbearing and social norms that view marriage and schooling as incompatible. Millions of girls have been forced into early marriage in recent decades, and their fundamental rights to life, freedom of choice, and access to education and other critical necessities have been greatly diminished (Erulkar et,al., 2004); (ICRW, 2005); (Mengistu, 2015).

In addition to dropping out of school, early marriage affects women's health. The WHO report shows that, thousands of women have died because of early pregnancy and childbirth and confirmed that around 70,000 early married women aged 15 to 19 die each year due to complications of pregnancy and childbirth (Mehra, 2018). To achieve 8 of the 17 sustainable development goals by 2030, we must end child marriage (GIRLS, 2020) but, still it is a familiar practice.

Many Kenyan are dying, dropping out of school, and living and working in slave like conditions in various regions of the country as a result of early marriage. Kenya has seen positive progress

in school enrolment and attainment at all levels for both girls and boys. The determining factors associated with early marriage among women have been examined in several studies using different statistical models. But most studies on early marriage among women have been conducted as a single outcome at the regional level without other outcomes like school dropout. This motivates the researcher to identify the determinants of these outcomes in Kenya's administrative zones. This can help Policymakers to develop target interventions to decrease early marriage and school dropout.

Moreover, the association between early marriage and school dropout as a function of covariates was not examined in previous studies. In order to fill such a gap, this study attempts to assess and identify factors affecting both early marriage and school dropout in Kenya using KDHS2022 data.

In general the motivation behind this study is to address the following main research questions.

- What is the risk factors affecting both early marriage and school dropout separately?
- What is the risk factors affecting both early marriage and school dropout simultaneously?
- Is classical or a multilevel model better for this binary outcome data?

1.3 OBJECTIVE OF THE STUDY

1.3.1. GENERAL OBJECTIVE

The general objective of this study was to identify factors affecting early marriage and school dropout in Kenya using multilevel binary logistic regression analysis of KDHS2022.

Specific objective

- To identify the risk factors that affect early marriage and school dropout in Kenya Separately.
- To identify the factors influencing early marriage and school dropout in Ethiopia Simultaneously.
- To identify classical or multilevel model better for binary outcome data.

1.4. SIGNIFICANCE OF THE STUDY

The finding of this study is expected to shed light on the factors of early marriage and school dropout among women in Kenya. Specifically, the finding is expected to

- Create awareness regarding the significant consequences of school dropout and early marriage on individuals, families, and societies
- Provide information to the government and relevant organizations and encourage them to formulate and enforce laws and policies that prohibit the marriage of girls before 18 years of age.
- Improve public awareness about the factors associated with early marriage and school dropout.

CHAPTER TWO

2. LITRATURE REVIEW

2.1. TREND AND LEVELS OF EARLY MARRIAGE

More than one in every four females is married before the age of 18 through the world. In East and Southern Africa, 36% of girls are married before the age of 15, while 10% of females in the region are married by age of 15 (UNICEF & UNPA , 2018). If current trends continue the number of early married women annually is estimated to increase from 14.2 million in 2010 to 15.1 million in 2030. Early marriage is a problem in 41 nations, with an estimated frequency of 30% or more (UNFPA, 2012).

In the world, Niger (76%), Central Africa Republic (68%), Bangladesh (65%), Chad (68%), Mali (55%), south Sudan (52%), Guinea (52%), Burkina Faso (50%), Malawi (50%) and Mozambique (48%) have the highest rates of early marriage before the age of 18 (Cardozo & Corbett, 2015).The rate of early marriage in South African countries is the second highest (Cardozo & Corbett, 2015); (ICRW, 2005).

Africa has a greater rate of early marriage than the rest of the world, if present trends continue, Africa will have the highest number and proportion of early marriages in the world by 2050 (Fund, 2015). Although early marriage is common throughout Africa, it is most common in west and Central Africa, where four out of ten women aged 20 to 24 are reported to have married before the age of 18 (UNICEF & UNPA , 2018). The estimates of global and regional trends in child marriage (Nguyen N.C and Wondo Q, 2015) are based on age at first marriage in the DHS for 60 different countries of most large developing countries. The average incidence of child marriage across the 60 countries stands at 36.4% nationally, 41.6% in rural areas and 28.6% in urban areas.

A study done by Scott et, al., (2021) found that early marriage is still widespread in Bangladesh (69%), India (41%), Nepal (52%) and Pakistan (37%), with significant sub national variation in most countries.

Child marriage is relatively less common in East Africa, where Malawi was the only country where half of the women born between 1985 and 1989 reported being married before 18 (Koski,et al., 2017). Ethiopia has one of the highest adolescent fertility rates in sub Saharan Africa by contribution of early marriage (UNICEF & UNPA , 2018). The median aged at first marriage among women aged 25-49 has increased slightly since 2011, from 16.5 years to 17.1 years in 2016. The percentage of women married before the age of 18 has declined from 63% to 58% from 2011 to 2016 in 25-49 age groups. Eight percent of women married before their 15th birth day in 2011, as compared with 6% in 2016 (EDHS, 2016). In Kenya, A staggering 23 percent of girls are married before their 18th birthday.

2.2. TREND AND LEVEL OF SCHOOL DROPOUT

How women may perceive the role of marriage in school dropout may vary across and within countries, especially since marriage in Africa is more a process than a well defined event that can be precisely timed (LloydC.& Mensch B., 2008). In a (LloydC.& Mensch B., 2008) study from 14 to 20 countries in Africa, over 80% of young women aged 20-24 who ever attended had left school early. Based on this study, proportion of women who report marriage as the main reason ranges from 2% to 26 -28%.

In most cases, the countries in which women report high rates of dropping out of school for marriage is different from these in which they report high rates of school living for pregnancy. Among the 20 African countries, including Chad with 28%, Mozambique with 26% and Nigeria with 27%, are countries where rates of early marriage are the main reason for leaving school (LloydC.& Mensch B., 2008).

According to several analysis of DHS data, the proportion of females aged 15-17 who had sexual experience is substantially lower among presently enrolled students than among these who never went to school or are longer in school in the majority of Sub Saharan Africa nations (LloydC.& Mensch B., 2008).

A study done by (LloydC.& Mensch B., 2008) revealed that school girl pregnancy typically accounts for 5-10% to dropout from school. Furthermore, the risks of dropping out from school

due to pregnancy or early marriage have decreased over time with the decline in rates of early marriage and childbearing.

Another study by (Talukder,et al., 2020) indicated that the rate of high school dropout was 7.3% higher for students who reported having sexual intercourse during middle school as compared with students who had not had sexual intercourse during middle school.

In Ethiopia 25% of women were attending school before they got married and the majority of these women (75.4%) stopped attending school after they were married. Among these 62% of women said that they were too busy with family to going to school. However, more than 1 in 5 women (23%) said they stopped going to school because their husbands did not want them to go to school (EDHS, 2016).

2.3. RELATED LITERATURE ON FACTORS ASSOCIATED WITH EARLY MARRIAGE

A multilevel logistic regression analysis done by (Tezera, 2019) using Ethiopia Demographic and Health Survey (EDHS 2011)demonstrated that there is a considerable variation in early marriage among regions and according to the results of fixed effects models, residence, media exposure, religion (Muslim and Orthodox) , women's education level, husbands educational level, respondents employment status and wealth index were found to be significant predictors of early marriage when compared to the equivalent reference groups. The employment status of husband and the number of siblings on the other hand are not found to be significant.

Another study conducted by (Adebowal et, 2012)in Nigeria, (Bezie & Addisu, 2019) and (Tezera, 2019) in Ethiopia as well as (Kamal et, 2014) in Bangladesh revealed that women who had no education, had primary and secondary education were more likely to be married early compared to women with higher education level. A study on the place of residence, was conducted in Ethiopia (Tezera, 2019); (Bedasa Tessema et,al., 2015), in Nigeria (Adebowal et, 2012), in Amhara, Ethiopia (Tekile, 2020), and (Setognal Birara et,al., 2021) indicated that women living in rural areas were more likely to experience early marriage than women who living in urban areas by controlling other variables in the model constant.

A study conducted in Ethiopia by (Tessema, 2020) after controlling confounding factors, age group, women's education level and area were revealed to be significant predictors of early marriage in Ethiopia. The likely hood of an early marriage decreases as one's age group increases. Women in the 20-34 and 35-49 aged groups had a lower risk than women in the 15-19 age groups.

A study conducted by Bezie and Addisu (2019) in Injibara, Ethiopia found out that family size, ethnicity, father's educational status, husband's educational statues respondent's educational status and family income are significant predictors of early marriage. Another study (Lata & Aboma, 2022) done in Ethiopia also found out that place of residence, religion of women, women educational level, wealth index, husband educational level, husband occupation status and total number of sibling are factors that significantly affects the early marriage of women at 5% significant level.

A study done by (Sarkar, 2017) in Bangladesh and (Tezera, 2019) (Baneerje, 2016) in Ethiopia showed that media exposure to mass media has a significant effect on age at marriage. Women with no access to any of the mass media were more likely to have married early compared to those who had access media. Religion is also another significant on early marriage. In Bangladesh (Kamal et, 2014) also concluded that Muslim followers were more likely to marry early than others and the proportion of women married early were high for husbands working in labor and (Sarkar, 2017).

The results of a study in Kenya by Ikamari (2023) show that, with the exception of Nairobi, early marriage was higher in rural than in urban areas in each region and at the national level. The results also depict statistically significant variation in the prevalence of early marriage in each region and at the national level.

2.4. RELATED LITERATURES ON FACTORS ASSOCIATED WITH SCHOOL DROPOUT

A study done in rural Ghana by (Saeed Adam e, al., 2016) stated that poverty, child labor, teenage and child bring, age of respondents, menstruation day, sickness, death of parents and school distance are major factors for dropout from school. A study conducted by (Talukder,et al.,

2020)s indicates that engaging in regular smoking and sexual activity during middle - school years predict high-school dropout independent of school performance.

Another study in Turkish (Boyaci, 2019) demonstrated that married, living in a village/ region, working in a job, living away from separate family, economic issues and low achievement were important and significant factors to school dropout. In country such as Cameroon, the maximum estimates is that school-leaving associated with child birth affects less than one fifth of girls by age 20 who were still enrolled in school at age 12 (LloydC.& Mensch B., 2008).

A study done by (Chouhan, 2017) in Rajasthan showed that gender, age, residence, religion, caste, monthly household expenditure, distance from school education level of household head and educated parents have significant effect on school dropout. Additional study done by (LloydC.& Mensch B., 2008) shows that the marriage and pregnancy are reasons for leaving school. Especially marriage is core one.

Another study done in rural India (Rachana Patel et, al., 2018) communities with high concentrations of poverty and women and husband illiteracy are disadvantages with low gender perception and high levels of dropouts. A study done by (I Wayan,et al., 2019) in Indonesia, in the development of the world today, social net working continues to influence the education of children and youth. The use of social media has both positive and negative impacts because it can speed up communication, eliminate distance, reduce costs and be very simple and if its use will not out of controlled especially for schoolchildren and adolescents it will provide a negative impact on the continuity of children's education.

A study done by (Sekine & Hodding M., 2017)in Nepal a multilevel logistic regression model was used to assess risk factors of school dropout due to child marriage. According to (Sekine & Hodding M., 2017) study, as age of girls increased, girls were more likely to have drop out of school and girls living in a husband with a household head with no education or who had only attend primary education were significantly associated with school dropout. Another study conducted in Ethiopia and India (Raj et al., 2019) shows social norms of early marriage, financial burden of school fees and minimal opportunity for girls beyond marriage affect girls' education.

Although child marriage is considered a human rights violation, more than 30% of today's women in developing countries were married before their 18th birthday and a total of 70 million

girls worldwide are affected, mostly in South Asia and Sub-Saharan Africa (UNICEF 2014). In Kenya, the age at first marriage has increased over time; from 19 to 20 as the mean age of first marriage among women aged 25-49 (KDHS 2014, 2003, 1998). However, child marriage is common, even though it is illegal (KNBS and ICF Macro 2010).

2.5. RELATED LITERATURES ON FACTORS ASSOCIATED WITH BOTH EARLY MARRIAGE AND SCHOOL DROPOUT

The problem of dependence in the outcome variable has become an increasingly important issue of concern during the past two decades attributable mainly to the increase in the demand for techniques in analyzing repeated or correlated measure of data. The joint or bivariate models are examined mainly to focus on the effect of covariates on correlated dependent outcomes (M. A. ISLAM et,al., 2012); (Workie and Tesfaw , 2012).

Even if, there is no Multilevel binary logistic regression analysis on early marriage and school drop out in the earlier studies the researcher take common predictors for early marriage and school dropout literatures discussed above.

CHAPTER THREE

3. METHEDOLOGY

3.1. STUDY AREA AND DESIGN

A community based cross-sectional study design was conducted on 32,156 women (15-49) interviewed during the2022 KDHS.

Kenya is found in East African of region of Africa at (approximately 4 $^{1}/_{2}$ degree North and $4^{1}/_{2}$ South of the Equator) and is bordered by Ethiopia North, Somalia East, Uganda West, Tanzania South, and South Sudan North West. The land covers 582,646 square kilometers.

Kenya is the largest and 7th most populated country in the horn of Africa and their official languages are Swahili and English; however, including second-language. Kenya as a whole has more than 70 ethnic groups (http//enen.wikipedia.org wiki/ Kenya). Kenya is divided into eight provinces, which were subdivided into 46 districts, which were further subdivided into 262 divisions. The divisions were subdivided into 2,427 locations and 6,612 sub locations. A province was administered by a Provincial Commissioner.

3.2. DATA SOURCE AND STUDY POPULATION

The study were used the 2022KDHS conducted from February 17, 2022, to July 13, 2022 based on a nationally representative sample that provided estimates at the national and regional levels and for urban and rural areas. The KDHS2022dataset has hierarchical structures and the sample was stratified and selected in two stages. All married women aged 15-49 in Kenya who were in the selected enumeration areas (EAs) were serve as the study population.

3.2.1 ELIGIBILITY CRITERIA

In this study, all married women aged 15-49 in the last five years preceding the survey in the selected enumeration areas were included. Conversely, missing values, respondents under 15 years of age or over 49 years, and women who are not married were excluded.

3.3. SAMPLING TECHNIQUE

The Kenya Demographic and Health survey uses a two stage stratified cluster sampling technique with the sample selected from a population and housing census frame.

3.4. VARIABLES IN THE STUDY

The response variables for this study are early marriage and school dropout. Thus, the response variable for the i^{th} married women in the j^{th} cluster is represented by a random variable Y_{ij} with two possible values coded as 0 and 1.

3.4.1. THE RESPONSE VARIABLE

- The first response variable early marriage is dichotomous

$$Y_{ij} = \begin{cases} 1 if\ age\ at first\ marriage\ of\ the\ i^{th} woman\ is\ below\ 18\ years \\ 0\ if\ age\ at\ first\ marriage\ of\ the\ i^{th}\ woman\ is\ 18\ and\ above \end{cases}$$

- The second response variable school dropout is also dichotomous. The i^{th} woman dropout from school in the j^{th} cluster is represented by a random variable Y_{ij} with two possible values coded as 0 and 1.

$$Y_{ij} = \begin{cases} 1 if\ the\ i^{th}\ woman\ in\ the\ j^{th}\ cluster\ droped\ out\ from\ school \\ 0\ if\ the\ i^{th} woman\ in\ cluster\ j\ did\ not\ dropout\ from\ school \end{cases}$$

- The third response variable, early marriage and school dropout is also dichotomous

$$Y_{ij} = \begin{cases} 1\ if\ the\ i^{th}\ \ woman\ had\ early\ marriage\ and\ droped\ out\ from\ school \\ 0\ if\ the\ i^{th}\ woman\ married\ at\ 18\ or\ after\ the\ age\ of\ 18\ or\ did\ not\ dropout\ from\ school \end{cases}$$

3.4.2. EXPLANATORY VARIABLES

The independent factors for this study are individual level and community level obtained from women's record in the 2022 KDHS as secondary data and selected based on related literature.

Individual Level variables

The individual level variables considered are demographic and socio-economic variables (age of respondent, women's level of education , wealth index, respondents work status, religion,

husband's occupation, husband's level of education , child birth, age of husband, media exposure, ethnic group and place of Recidense).

Community Level Variable

The community level variable considered is region.

Table 3.1: Description and Coding of Explanatory variables

No.	Description	Category
Individual level variable		
1	Age of respondent	15-24, 25-29, 30-34, 45- 49(Ref)
2	Women's educational level	No, Primary, Secondary, Higher (Ref)
3	Wealth index	Poorest, Poorer, Middle Rich, Richest(Ref)
4	Religion	Protestant, Evangelical churches, Catholic, Islam, Others(Ref)
5	Husband's educational level	No, Primary, Secondary, Higher (Ref)
6	Respondents work status	Working, Not working(Ref)
7	Husbands work status	Working , Not working(Ref.)
8	Child birth	Yes , No (Ref)
9	Age of husband	Continuous
10	Media exposure	No , Yes (Ref)
11	Ethnic group	Kalenj , Kamba, Kikuyu , Kisii, Luhya, Luo, Meru, Mijik and Kalenjin(Ref)
12	Place of residence	Rural, Urban (Ref)
Community level variable		
13	Region	Nairobi, Central, Eastern, North Eastern, Rift Valley, Western, Nyanza, Kenya and Cost(Ref)

Nowadays, most of the population in the world , both in rural and urban areas, use mobile phone as mass-media by using Face book, Telegram, FM radio, Internet and other applications. Due to

this, the researcher used media exposure as an individual level predictor. For categorical variables, the less likely category was considered as the reference category.

3.5 METHODOLOGY

Different statistical techniques have been used to analyze the collected data. In this study both descriptive and inferential statistics were employed. Sampling weights would also be applied to compensate for unequal chance of selection between the strata that are geographically defined and for non responses and to ensure the actual representativeness of the survey results at the national level as well as the domain level. STATA version 14 and SPSS version 27 were used.

Presenting and summarizing the characteristics of the study participants using tables, graphs, weighted frequencies and percentage is the first step to examine the community and individual level variables. The chi-square test was employed to evaluate the association between the outcomes and the variables at the individual and community level.

3.6. MULTILEVEL BINARY LOGISTIC REGRESSION

A multilevel model evaluates how factors at different levels affect the response variable. Multilevel models also statistical models which allow not only independent variable at any level of hierarchical structure but also at least one random effect above level one unit. The multilevel logistic regression model in this study has a binary outcome.

The two important uses of multilevel models by taking into account the hierarchical structure usually present in data are provide a flexible framework for analyzing a variety of different types of response variables and for incorporating covariate at different levels of hierarchical structure (H Goldsetin et,al., 2009).

Multilevel logistic model is the special case of generalized linear mixed model (GLMM) when the response variable is binomial, and which incorporate random effects into the models to deal with a non-independence of the data through estimating the intra-class correlation coefficient (ICC) in the multilevel data (Hox et,al., 2018). The lower level predictors may have random variation for the higher levels, due to this GLMM will be considered in all multilevel analysis of this study.

The GLMM is an extension of the generalized linear model (GLM) by incorporating unobservable random effects as the linear predictor. Linear mixed model (LMM) contained fixed and random effects that are used for analyzing longitudinal repeated measures or clustered data of the normally distributed responses. The random-effects part will be used to account for unobservable factors in the dependent variables through individual-specific or cluster-specific in different levels of the data (Wang, 2013). The cluster-specific will consider in this study. The linear mixed model assumes that the response variables follow the normal distribution. However, in many cases, this is not fulfilled so the data cannot be analyzed by using LMM rather the GLMM is applied (Wang and Luo, 2019).

Among the most commonly used covariance structures unstructured (UN) covariance structure will be used in this study to consider unique correlation for each correlation for each pair of cluster. Unstructured (UN) covariance structure estimates unique correlations for each pair of clusters.

3.6.1 ASSUMPTION OF BINARY MULTILEVEL LOGISTIC REGRESSION

1. The response variable is binary
2. The observations are independent
3. Little or no multicolinearity
4. Require large sample size
5. The linear relationship between independent variables and log odds

3.7 PARAMETER ESTIMATION METHOD

Estimation of parameters (regression coefficients and variance components) in multilevel modeling is mostly done by the maximum likelihood method (H. MIDI, S. K. SARKAR AND S. RANA, 2013). The maximum likelihood method is a general estimation technique, which provides estimates for the population parameters that maximize the probability of observing the data given the model. Maximum likelihood estimation (MLE) is the most commonly used estimation method in multilevel modeling by maximizing the likelihood function. Advantage of the MLE method was it produces estimates that are asymptotically efficient and consistent by maximizing the likelihood function (Hox et,al., 2018). The MLE involves maximizing the

marginal likelihood. The marginal likelihood is the joint probability of all observed responses given the observed predictors. For linear mixed models, this marginal likelihood can be evaluated and maximized relatively easily (Rabe-H, 2012). However, in the generalized linear mixed models, the marginal likelihood does not have a closed form and should be evaluated by approximate methods. The responses are conditionally independent given the random intercept u0j and covariate X_{ij}. Therefore, the joint probability of all the responses y_{ij} (1,..., j) for cluster j given the random intercept is simply the product of the conditional probabilities of the individual.

$$P(y_{ij}, \cdots\cdots\cdots, y_{nj} | x_{ij}, u_{0j}, \ \sigma_u^2) = \prod_{i=1}^{nj} P(y_{ij} = 1 | x_{ij}, u_{0j}, \sigma_u^2)$$

$$= \prod_{i=1}^{nj} \frac{e^{\beta_0 \sum_{i=1}^{k} \beta_i x_{1ij} + u_{0j}}}{1 + e^{\beta_0 \sum_{i=1}^{k} \beta_i x_{1ij} + u_{0j}}} \text{ ……..eqn 8}$$

Where: $P(y_{ij}, \ldots \ldots \ldots, y_{nj} | x_{ij}, u_{0j}, \sigma_u^2$ denotes the conditional density of y_{ij}, x_{ij}, β_i represents the covariates and the corresponding coefficients, $j = 1,2 \ldots N$ denotes the cluster (community level), and $i = 1,2, \ldots . nj$ denotes the subject (individual level) of the jth cluster. The likelihood function of the above model can be written by exploiting the conditional independence following from the assumptions:

$$L(\beta, \sigma_u^2) = \prod_{j=1}^{N} \int [\prod_{i=1}^{nj} P(y_{ij} = 1 | X_{ij}, u_{0j}, \sigma_u^2)] f(u_{0j}, \sigma_u^2) d_u \text{ .....eqn 9}$$

The fixed effects β and the variance are the unknown parameters to be estimated.

3.8 TEST OF MODEL PARAMETERS

3.8.1 TEST FOR FIXED EFFECT

Maximum likelihood procedures provide standard errors for most of the estimates. These standard errors can be used for significance testing.

The Wald Test

The Wald statistics is commonly used to test the significance of individual logistic regression coefficients for each predictor variable. Let β denote an arbitrary parameter. If the parameter of

an explanatory variable significantly differs from zero then the associated variable should be included in the model.

The hypothesis to be tasted is:

H_0: βl = 0 VsH_1: $\beta_1 \neq 0$, l = 1, 2 … k at α level of significance.

The Wald test statistics Z for this hypothesis

$$W=Z^2 = [\frac{\beta_i}{SE(\beta_i)}]^2 \approx X^2_{\alpha(1)}$$ ………………eqn 10 (David W and Lemeshow, 2013)

If the Wald statistics W > $X^2_{\alpha(1)}$, we reject the null hypothesis, this implying that the explanatory variable is significant.

3.8.2 TEST FOR RANDOM EFFECT

Random effect test examines hypotheses about whether the variance of intercept or slopes (and their covariance) is significantly different from zero. The tests of variances and covariance mostly made using a Wald, Z-test, and chi-square test. The Wald test for variances is simply a ratio of the variance estimate divided by the standard error estimate. But, the chi-square approach generally a preferable approach to testing the random effects, as the sampling distribution of variances is skewed (Hox et,al., 2018); (Berhanu et al., 2022).

3.9. MODEL SELECTION CRITERIA

The model selection method is the best process of finding the simplest and well-fitted model for the data from the different proposed models. There are some model selection criteria, Such as Akaike information criteria (AIC) and Bayesian Information Criteria (BIC) used for selecting the non-nested models (Melissa, 2009). These models are used to select the most parsimonious model since the non-nested model is considered.

The Akaike information criterion (AIC) is most commonly used for model selection criteria for comparison of non-nested model based on fitted log-likelihood functions. The AIC model selection criteria are summarized as follows (Vallejo et al., 2014).

$$AIC = -2 \log (L) + 2P$$ ……………………………………………………………………..eqn 11

Where: log (L) is maximized likelihood functions for the estimated model and P is the number of the parameter in the model. By these criteria, the model with a small value of AIC is preferred.

Bayesian Information Criteria (BIC) is also one of model selection methods and unlike the AIC the BIC takes into account the size of data under considerations. BIC is given as follow.

BIC = −2 log L + Plog (n)……eqn 12

Where: log L is maximized Log-likelihood function, n is the sample size of the data and p is the number of parameter in the model. The models with a small value of AIC and BIC are considering the appropriate models.

3.10. GOODNESS OF FIT TEST

It is useful to be able to judge whether a model is a good fit for the data. Even if, there are no exact suggested ways to evaluate the goodness fit of the model. The appropriate one is to check whether over or under dispersion by using Pearson Chi-square over the degree of freedom and deviance value.

$$X^2 = \frac{\sum_{j=1}^{J}(y-\hat{\mu})^2}{v(\hat{\mu})} = X^2/\phi \sim X^2_{\text{n-p}} \quad \text{……eqn 13}$$

The maximum likelihood procedure also produces a statistic called the deviance, which indicates how well the model fits the data. This deviance can regarded as a measure of fit between models. We can compare models statistically using their deviances as:

$D = D_0 - D_1 = -2\log(\lambda_0/\lambda_1)$…… ……eqn 12

Where: λ_0 and λ_1, are the likelihoods for the null and alternative hypotheses respectively. The difference in the deviances of two nested models has a chi-square distribution, with degrees of freedom equal to the difference in the number of parameters estimated in the two models. This can be used to perform a formal chi-square test to check whether the more general model fits significantly better than the simpler model. In general, models with lower deviance values fit better than models with higher deviance. In the univariate logistic regression both deviance and

Pearson chi-square are applied whereas, Pearson deviance over degree of freedom near to one is better compared to others (Berhanu et al., 2022) and is used to check the model's goodness of for univariate multilevel, bivariate classical, and multilevel models.

3.11 MODEL DIAGNOSTICS

One of the main purposes of multilevel model is to deal with cases where the assumption of independence is violated; multilevel models do, however, assume that:

(i) The level 1 and level 2 residuals are uncorrelated and

(ii) (ii) The errors (as measured by the residuals) at the highest level are uncorrelated.

It is the best interest to obtain the residual values from the fitted multilevel model. Plots are a good way to examine the residuals. However, in a multilevel logistic model, many different residual plots can be used to inspect model assumptions. As we have more than one residual in multilevel model, many different residual plots can be made to inspect the model assumptions. Scatter plot of the residuals against the predicted values provides information about possible meets of normality, linearity, & Heteroscedasticity. In the multilevel logistics model, the higher level variance should fulfill the assumptions of linearity and normality (H. MIDI, S. K. SARKAR AND S. RANA, 2013).

CHAPTER FOUR

4. RESULTS

In this study a total of 16,948 married and 15,975 school enrolled women that participated in the 2022 KDHS were included. Since the KDHS data is collected from different clusters and strata, all analyses of the study were weighted or standardized with the women's sample weight.

4.1. DESCRIPTIVE STATISTICS

Out of the total of 17,778 and 16,416weighted samples of married and school enrolled women aged 15-49 years, 4,962(27.91%) had early marriages (married under the age of 18) and 5,51 0(33.56%) dropped out from school (Figure 4.1).

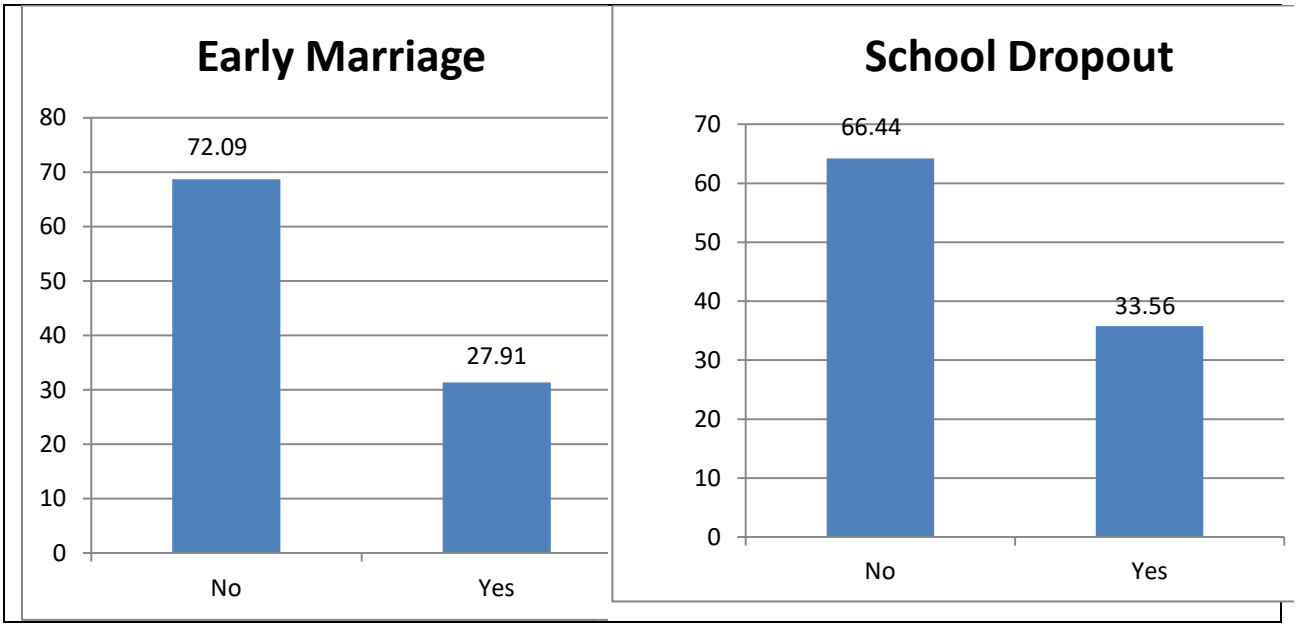

Figure 4. 1: Percentages of early marriage (left) and school dropout (right) of women in Kenya, KDHS 2022

Table 4.1 presents cross tabulations of categorical predictors with early marriage and school dropout. The results indicate that the highest proportion of women aged 30-34 and 15-24 had early marriage and dropped out of school respectively. Similarly, the highest proportion of women with primary education had early marriage and dropped out of school. About 3,144(63.36%) and 3,292(59.75%) women with primary education married before 18 years and

dropped out of school respectively while only 122(2.45%) of women with higher education married early.

Table 4.1: Cross classification of individual level predictors with early marriage and school dropout of women in Kenya from KDHS 2022

Independent variables	Category	Early Marriage (n =17,778) Frequency (%)		School Dropout (n = 16,416) Frequency (%)	
		Yes	No	Yes	No
Age in year	15-24	924(18.60)	2,164(16.88)	1,070(19.41)	1,833(16.80)
	25-29	964(19.42)	3,090(24.10)	1,069(19.40)	2,737(25.09)
	30-34	1,004(20.22)	2,442(19.05)	997(18.08)	2,148(19.69)
	35-39	1,001(20.16)	2,224(17.35)	1,010(18.33)	1,907(17.48)
	40-44	615(12.39)	1,627(12.69)	779(14.13)	1,294(11.86)
	45-49	458(9.21)	1,273(9.93)	587(10.65)	991(9.08)
Women's educational level	No	743(14.97)	619(4.83)	-	-
	Primary	3,144(63.36)	4,213(32.87)	3,292(59.75)	4,065(37.26)
	Secondary	954(19.22)	4,774(37.25)	2,218(40.25)	3,511(32.18)
	Higher	122(2.45)	3,212(25.06)	0(0.00)	3,333(30.56)
Wealth index	Poorest	1,317(26.54)	1,665(12.99)	1,311(23.78)	793(7.27)
	Poorer	1,220(24.58)	1,890(14.75)	1,425(25.85)	1,518(13.91)
	Middle	959(19.32)	2,368(18.47)	1,183(21.47)	2,019(18.50)
	Richer	853(17.19)	3,090(24.11)	1,010(18.32)	2,816(25.81)
	Richest	614(12.37)	3,805(29.68)	583(10.58)	3,763(34.50)
Religion	Protestant	1,718(34.62)	4,851(37.81)	1,963(35.63)	4,353(39.90)
	Evangelical churches	1,286(25.92)	3,122(24.35)	1,556(28.23)	2,655(24.34)
	Catholic	722(14.54)	2,413(18.82)	880(15.96)	2,072(18.99)
	Islam	528(10.63)	809(6.31)	330(5.98)	442(4.05)
	Others	710(14.30)	1,624(12.67)	783(14.20)	1,389(12.73)

Husband's educational level	No education	544(11.11)	562(4.42)	202(3.73)	85(0.78)
	Primary	2,599(53.14)	4,028(31.70)	3133(57.91)	3,116(28.75)
	Secondary	1,392(28.46)	4,372(34.41)	1753(32.40)	3,904(36.01)
	Higher	358(7.30)	3,744(29.47)	323(5.95)	3,736(34.46)
Respondent's work status	Working	2,820(56.82)	7,737(60.37)	3,253(59.03)	6,930(63.52)
	Not working	2,143(43.18)	5,080(39.63)	2,257(40.97)	3,979(36.48)
Husband's work status	Working	4,399(88.65)	11,967(93.37)	5,097(92.50)	10,418(95.52)
	Not working	564(11.35)	850(6.63)	414(7.50)	489(4.48)
Child birth	Yes	4,861(97.97)	11,970(93.43)	5,342(96.95)	10,181(93.45)
	No	101(2.03)	847(6.60)	168(3.05)	727(6.66)
Media Exposure	Yes	4,513(90.95)	12,253(95.60)	5,052(91.70)	10,68797.98)
	No	450(9.05)	564(4.40)	458(8.30)	221(2.02)
Ethinicity	Kalenj	993(20.01)	2,337(18.23)	1,164(21.12)	1,934(17.73)
	Kamba	349(7.02)	1,717(13.39)	512(9.29)	1,542(14.13)
	Kikuyu	508(10.24)	2,574(20.08)	618(11.21)	2,455(22.50)
	Kisii	331(6.66)	720(5.62)	349(6.33)	697(6.39)
	Luhya	780(15.70)	2,021(15.76)	1,112(20.18)	1,628(14.93)
	Luo	834(16.81)	1,458(11.37)	777(14.09)	1,358(12.45)
	Meru	548(11.03)	1,052(8.20)	540 (9.79)	717(6.57)
	Mijik	622(12.53)	941(7.34)	441(8.00)	578(5.30)
Place of residence	Rural	3,611(72.77)	7,228(56.39)	4,045(73.41)	5,750(52.75)
	Urban	1,352(27.23)	5,589(43.61)	1,465(26.59)	5,158(47.28)

Key "-" refers to not applicable.

Table 4.2 show the cross tabulation of early marriage and school dropout with community level variables. Out of the total sampled respondents, 3,611(72.77%) of the early married women and 4045(73.41%) of school dropouts were from rural areas. The highest number (proportion), 1400(28.21%) of early marriage and 1,488(27%) school dropouts occurred in Rift valley, whereas the smallest proportion of early marriage 190(3.83%) and school dropout 52 (0.93%) were observed in the North Eastern region of Kenya.

Table 4.2: Cross tabulation of early marriage and school dropout with community level variables.

Independent variables	Category	Early Marriage n =17,778 Frequency (%)		School Dropout (n= 16,416) Frequency (%)	
		Yes	No	Yes	No
Region	Nairobi	378(7.60)	1,818(14.18)	369(6.68)	1,781(16.32)
	Central	381(7.66)	1,806(14.08)	559(10.13)	1,618(14.83)
	Eastern	619(12.47)	1,870(14.59)	825(14.97)	1,538(14.10)
	North Eastern	190(3.83)	210(1.63)	52(0.93)	36(0.33)
	Rift Valley	1,400(28.21)	3,505(27.35)	1,488(27.00)	2,887(26.46)
	Western	555(11.18)	1,292(10.08)	813(14.75)	981(8.99)
	Nyanza	867(17.47)	1,273(9.93)	910(16.52)	1,206(11.06)
	Coast	575(11.58)	1,047(8.16)	497(9.02)	862(7.90)

However, the table does not provide any information on the determinant factors of early marriage and school dropout, the socio-economic and demographic characteristics of the women.

4.2. TEST OF ASSOCIATION

Table 4.3 shows the results for the test of association between early marriage and the individual level predictor variables. It also shows the test of association between school dropout and the individual level predictor variables. The results revealed that all predictor variables have significant association with both outcomes (early marriage and school dropout) at 5% level of significance.

Table 4.3: Test of association between early marriage and the individual level predictor variables as well as between school dropout and the individual level predictor variables

Independent variable	Early marriage (chi square)	P-value	School dropout(chi square)	P-value	DF
Age of respondent	108.96	<0.0001	104.54	<0.0001	5
Women's educational level	50.21	<0.0001	40.17	<0.0001	3
Wealth index	22.09	<0.0001	36.15	<0.0001	4
Religion	264.51	<0.0001	88.60	<0.0001	5
Husband's educational level	28.112	<0.0001	40.17	<0.0001	3
Respondent's	92.62	<0.0001	57.71	<0.0001	1

work status					
Husband's work status	92.62	<0.0001	84.34	<0.0001	1
Child birth	77.85	<0.0001	40.20	<0.0001	1
Media Exposure	191.69	<0.0001	350.89	<0.0001	1
Ethinicity	543.54	<0.0001	337.25	<0.0001	7
Place of residence	302.54	<0.0001	464.53	<0.0001	1

Table 4.4 shows the test of association results between early marriage and the community level predictor variables. It also displays the test of association results between school dropout and the community level predictor variable. The test results indicate that Region has significance association; with both early marriage and school dropout implying that the rate of early marriage and school dropout vary across the different regions of Kenya.

Table 4.4: Test of association between early marriage and the community level predictor variables as well as between school dropout and the community level predictor variables

Independent variable	Statistic (Early marriage)	p- value	Statistic (School dropout)	p- value	DF
Region	435.82	<0.0001	263.84	<0.0001	7

4.3. MODEL FITTING AND PARAMETER ESTIMATION

Before estimating the coefficients of the regression model, assumptions and the adequacy of the model was checked.

According to the results presented in table 4.5and table 4.6 in the appendix, there is no dependency between independent variables. By using stepwise variable selection method in univariate logistic regression analysis (table 4.7), respondent age, women's education level, wealth index, husband's education level, women's occupation, region, media exposure and religion were found to be important predictors of early marriage.

Like that of early marriage, the same procedure was applied to school dropout. Diagnostic test results indicated that the assumptions were fulfilled.

4.4. MULTILEVEL BINARY LOGISTIC REGRESSION

4.4.1 UNIVARIATE MULTILEVEL MODEL: EARLY MARRIAGE

Intercept only model

The intercept-only model (without explanatory variables) was constructed to measure the effect of community (cluster) variation on early marriage.

Table 4.8 presents the parameter estimates and standard errors for both fixed and random effects. The estimated intercept is -1.082, which is simply the log odds of women being married early when all predictors are constant or zero.

The variance of the random effect at the cluster level (σ_{u0}^2) is estimated to be 0.621 with a p-value<0.0001 which is significant at 5% level of significance. This reflects that there is evidence of between-cluster variation or statistically significant variation in the early marriage among women across the community. It also supports using a two-level model.

The estimated intra-class correlation is computed as $ICC = \frac{\sigma_{u0}^2}{\sigma_{u0}^2+\sigma_{\epsilon 0}^2} = \frac{0.621}{0.621+3.289} = 0.1588$

This indicates that about 15.88% of the total variation for early marriage was due to the difference between clusters, whereas, the remaining 84.12% of the variability to be accounted by individuals (women) and other unknown factors, which indicates that multilevel analysis is meaningful.

Table 4.8: Intercept only model for early marriage

Effect	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
Intercept	-1.028	.029	-35.53	0.000	-1.08463, - .97123
	Covariance parameter estimate				
Cluster(variance)	.621	.0443			.53991 , .7142

Using Akaike's Informatrion Criteria and Bayesisan Information Criteria, the best model having the least AIC and BIC values is the one with all predictor variables which we call as the Full model (Table 9).

Table4. 9: AIC, and BIC values for different models of early marriage

Model	AIC	BIC
Intercept only	20101.47	20117.04
Random predictor and Fixed effect	17008.54	17328.42
Full model	16947.61	17283.09

Random Intercept and fixed slope Model

The results of the two-level random intercept with fixed coefficient model are presented in table 4.10 in the appendix and age in year, women's education, wealth index, husband education,

media exposure, respondent work, child birth, husband age, Residence, region and ethnicity are found to be statistically significant at 5% level of significance.

Random coefficient model

We considered the results of the selected model for further interpretation of early marriage among married women. The overall test in Table 4.11 below shows that age in year, women education, wealth index, husband educational level, respondent work, child birth, husband age, and Residence from the individual level predictors and region from the community level predictors have a statistically significant effect on women's early marriage practice at 5% level of significance.

The intercept (0.00145) represents the estimated log odds of women being or falling in to the early married women cluster when all predictors are zero/constant. Also, P (y_{ij} = 1) = $\frac{\exp(\gamma_{00})}{1+\exp(\gamma_{00})}$ = $\frac{\exp(0.00145)}{1+\exp(0.00145)}$ = 0.5004 implying that women have on average 50.04% chance of experiencing early marriage (before age of eighteen) across all clusters. The Wald value (Z = 2093.52 with p-value < 0.0001) indicates that the random effects were statistically significant. The following interpretations are made holding all other predictors in the model constant.

The odds ratio (OR) for women aged 15-24 is 5.543, which means that the odds of early marriage (before age 18) for women aged 15-24 is higher by 5.543 times compared to the age group of 45-49. This implies that early marriage for women aged 15-24 have higher odds than the odds of early marriage in the age group of 45-49. The same logic applies to other age groups. The odds of women aged 25-29, 30-34, 35-39 and 40-44 is 3.218, 2.828, 2.247 and 1.394 times higher compared to women in the age group 45-49 respectively.

The odds ratio (OR) for women who had no education is 26.383, which means that the odds of early marriage for non-educated women is higher by 26.383 times compared to higher educated women. The odds of early marriage for primary and secondary educated women are 14. 508 and 4.009 times higher than the odds of early marriage for higher educated women respectively.

The odds ratio (OR) for poorest, middle and richer women are 0.781, 0.813 and 0.822 respectively. This means that the odds of early marriage for poorest, poorer, middle and richer women are 0.781, 0.813 and 0.822 times lower than that for richest women respectively.

The odds ratio (OR) for women whose husband is not educated is 1.328, 1.772 and 1.380, which means that the odd of early marriage for women whose husband is not educated, primary educated and secondary educated is 1.328, 1.772 and 1.380 times higher compared to women whose husband had higher education respectively.

The odds ratio (OR) for women who have a job is 1.173, which means that the odds of being married early for women who have job is higher by 1.173 times compared to women who did

not have job. That is, women with job are 17.3% more to experience early marriage compared to women with no job.

The odds ratio (OR) for women who brings (gave birth to) child is 2.343, which means that the odds of early marriage for women who gave birth to a child/brings child is 2.343 times higher compared to women who did not give birth to a child.

The odds ratio (OR) corresponding to husband age is 1.039 and significant. Thus, when a husband is one year older (his age increases by one year), the odds of being married early increases by 1.039 times.

The odds ratio (OR) for women who lived in rural area is 1.188, which means that the odd of early marriage for women living in rural areas is higher by 1.188 times compared to women who live in urban areas. That is, women in rural areas are 18.8% more to experience early marriage than women in urban areas.

The odds ratio (OR) for women who lived in Central, Rift valley and Nairobi are 0.598, 0.768 and 0.742 respectively, which means that the odds of early marriage for women who lived in Central, Rift valley and Nairobi regions of Kenya are lower by 0.598, 0.768 and 0.742 times compared to women who lived in Coast respectively.

The odds ratio (OR) corresponding to women whose Ethinicity is Kamba and Kikuyu are 0.527 and 0.779, which means that the odds of early marriage for Kamba and Kikuyu women's are lower by 0.527 and 0.779 times compared to Kalenjin women respectively. This implies that Kamba and Kikuyu women are less likely to experience early marriage than Kalenjin Women.

Table4.11: Results for the random coefficient model (for early marriage of women in Kenya), KDHS 2022

Predictors	Estimates	Odds Ratio	Std. Err	Z	P>Z	95%[Confidence interval]	
						Lower	Upper
Intercept	-6.741	0.0014	0.000	-22.17	<0.0001	0.0007	0.0021
women's age							
15-24	1.7125	5.543	0.699	13.58	<0.0001	4.3290	7.0967
25-29	1.169	3.218	0.356	10.57	<0.0001	2.5909	3.9973
30-34	1.040	2.828	0.281	10.48	<0.0001	2.3283	3.4351
35-39	0.810	2.247	0.203	8.96	<0.0001	1.8826	2.6827
40-44	0.332	1.394	0.125	3.7	<0.0001	1.1689	1.6619
45-49(Ref)							
Womens educational level							
no education	3.273	26.383	3.920	22.03	<0.0001	19.7183	35.3011

primary	2.675	14.508	1.694	22.91	<0.0001	11.5403	18.2378
secondary	1.388	4.009	0.453	12.29	<0.0001	3.2126	5.0021
Higher(Ref)							
wealth_index							
poorest	-0.247	0.781	0.086	-2.24	0.025	0.6286	0.9699
poorer	-0.047	0.954	0.097	-0.46	0.645	0.7825	1.1641
middle	-0.207	0.813	0.077	-2.19	0.029	0.6754	0.9787
richer	-0.196	0.822	0.065	-2.48	0.013	0.7041	0.9597
Richest(Ref)							
Religion							
protestant	0.035	1.036	0.070	0.52	0.601	0.9080	1.1814
evangelical churches	0.052	1.054	0.074	0.74	0.458	0.9179	1.2092
Catholic	-0.072	0.931	0.072	-0.92	0.358	0.7993	1.0844
Islam	0.950	0.950	0.110	-0.44	0.660	0.7574	1.1924
Others(Ref)							
Husband_educational_level							
no education	0.284	1.328	0.168	2.25	0.024	1.0373	1.7008
primary	0.572	1.772	0.147	6.9	<0.0001	1.5063	2.0853
secondary	0.322	1.380	0.110	4.04	<0.0001	1.1803	1.6143
Higher (Ref)							
respondent_work							
yes	0.159	1.173	0.053	3.51	<0.0001	1.0727	1.2817
No (Ref)							
Husband_work							
Yes	0.037	1.038	0.080	0.48	0.632	0.8923	1.2063
No (Ref)							
Child_birth							
Yes	0.885	2.422	0.315	6.8	<0.0001	1.8772	3.1250
Husband_age	0.039	1.040	0.003	12.32	<0.0001	1.0333	1.0462
No (Ref)							
Recidense_							
rural	0.180	1.197	0.093	2.3	0.021	1.0272	1.3949
Urban(Ref)							
exposure_to_MME							
Yes	0.117	1.124	0.094	1.41	0.159	0.9552	1.3238
No (Ref)							
region							
North	-0.064	0.938	0.163	-0.37	0.711	0.6672	1.3179
Eastern	-0.261	0.770	0.102	-1.96	0.049	0.5934	0.9994
Central	-0.531	0.588	0.089	-3.52	0.000	0.4373	0.7902
Rift Valley	0.766	0.766	0.096	-2.13	0.033	0.5990	0.9794
Western	-0.214	0.808	0.120	-1.44	0.150	0.6038	1.0804
Nyanza	0.079	1.082	0.150	0.57	0.568	0.8252	1.4190
Nairobi	-0.277	0.758	0.118	-1.78	0.076	0.5584	1.0292

Cost(Ref)							
Ethinicity							
kamba	-0.638	0.528	0.059	-5.74	<0.0001	0.4251	0.6570
kikuyu	-0.244	0.783	0.079	-2.43	0.015	0.6432	0.9538
kisii	0.219	1.245	0.150	1.81	0.070	0.9825	1.5772
luhya	-0.151	0.860	0.079	-1.63	0.103	0.7177	1.0309
luo	0.124	1.132	0.117	1.2	0.230	0.9244	1.3865
meru	-0.094	0.911	0.091	-0.94	0.346	0.7492	1.1066
mijikenda/swahili	0.828	0.828	0.113	-1.38	0.169	0.6338	1.0829
Kalenjin(Ref)							

4.4.2 UNIVARIATE MULTILEVEL MODEL: SCHOOL DROPOUT

Intercept only model

The intercept-only model (without explanatory variables) was constructed to measure the effect of community (cluster) variation on school dropout.

Table 4.12 presents the parameter estimates and standard errors for both fixed and random effects of the intercept only model. The estimate for the intercept is -0.716, which is simply the log odd of Women School dropout when all predictors are constant or zero.

The variance of the random effect at the cluster level (σ_{u0}^2) is estimated to be 0.672 with a p-value<0.0001 which is significant at 5% level of significance (Table 4.12). This reflects that there is evidence of between-cluster variation or statistically significant variation in school dropout among women across the community. It also supports using a two-level model.

Table4.12: Intercept only model for school dropout

Effect	Estimate	Std. Err.	z	P>z	[95% Conf.	Interval]
Intercept	-.716	.030	-23.99	<0.0001	-.77393	-.65700
	Covariance parameter estimate					
Cluster	.672	.048			.58447	.77166

The results of the two-level random intercept with fixed coefficient model are presented in table 4.13. The full model with all predictor variables has the least AIC and BIC values and is, therefore, the best fitting model (Table 4.13).

Table 4.13: AIC, and BIC values for different models of school drop out

Model	AIC	BIC
Intercept only	19894.93	19910.19
Random predictor and fixed effect	15805.64	16094.92
Full model	15690	15994.12

Random Intercept Model

The results in Table 4.14 show that women's education, wealth index, religion, child birth, husband age, Residence, exposure to mass media, region and ethnicity are statistically significant factors influencing school dropout at 5% level of significance.

Random coefficient model

We considered the results of the selected model for further interpretation of school dropout among school enrolled women. The overall test in Table 4.15 below shows that individual level predictors (women education, wealth index, religion, husband educational level, child birth, husband age, Residence, exposure to mass media) and community level predictors (region and Ethnicity) have a statistically significant effect on women's school dropout at 5% level of significance.

The intercept (0.112) represents the estimated log odds of women dropping out of school when all predictors are zero/constant. In dichotomous outcome intercept is optional and is used to estimate the probability of women in cluster *j* fall in the category of interest (school dropout = "Yes"). In our case P (y_{ij} = 1) = $\frac{\exp(\gamma_{00})}{1+\exp(\gamma_{00})}$ = $\frac{\exp(0.112)}{1+\exp(0.112)}$ = 0.5279 that is, women on average have 52.79% chance of dropping out of school across all clusters. The Wald value (Z= 1131.33 with p-value<0.0001) indicates that the random effects were statistically significant.

The odds ratio (OR) corresponding to women with primary education is 0.543, which means that the odds of dropping out of school for women with primary education is lower by 0.543 times compared to women with higher education.

The odds ratio (OR) for poorest women category is 4.192, which means that the odds of school dropout for poorest women is 4.192times higher than that for richest women keeping other factors constant. The odds of women from poorer, middle and richer families dropping out of school are 2.806, 1.988, 1.488times higher than the odds of women from richest family respectively.

The odds ratio (OR) for women whose religion is Islam is 1.311, which means that the odds of dropping out of school for Islam women is 1.311times higher than that of other religion

followers. That is, Islam women are 31.1% more to drop-out of school than women following religions other than protestant, catholic and evangelical churches.

The odds ratio (OR) for women whose husband is not educated is 4.047, which means that the odds of dropping out of school for women having uneducated husband is 4.047 times higher compared to women having higher educated husband. The odds of school dropout for husbands with primary and secondary education are 2.057 and 2.057 times higher than the odds for women whose husbands have higher education respectively.

The odds ratio (OR) for women who gave births to a child is 1.376, which means that the odd of dropping out of school for women who gave birth to a child is 1.376times higher compared to women who did not give birth. That is, the odds of school dropout for women who gave birth to a child are higher than women who did not give birth to a child sby37.6%.

The odds ratio (OR) corresponding to age of husband is 1.021 implying that when an increase in the age of husbands by one year results in an increase in the odds of dropping out of school before completing a minimum requirement by 1.02 times.

The odds ratio (OR) corresponding to women in rural areas is 0.747, which means that the odds of dropping out of school for women in rural areas is lower by 0.747 times compared to women in urban areas. That is, the odds of dropping out of school for a woman in rural areas is lower than women's who live in urban area by 37.8% less. But this result is not true.

The odds ratio (OR) for women who are exposed to any mass media is 0.583, which means that the odds of dropping out of school for women that are exposed to any mass media is 0.583 times that of women's who are not exposed to any mass media. That is, the odds of dropping out of school for women that are exposed to any mass media is lower by 41.7% compared to women's who are not exposed to any mass media.

The odds ratio (OR) corresponding to women living in North is 2.343, which means that the odds of school dropout for women living in northern region of Kenya is 2.343 times higher than women living in Coast region. The same logic applies to other regions. The odds of dropping out from school for women living in Central, Western and Nyanza is 1.641, 1.479 and 1.371 times higher than the odds of women who lived in Coast respectively.

The odds ratio (OR) for women whose Ethinicity is Kamba is 0.514, which means that the odds of dropping out of school for Kamba woman is 0.514times lower than Kalenjin women. This implies that the odd of school dropout for women's in Kamba lower by 48.6% compared to women's in Kalenjin. The same logic applies for women from the kikuyu and kisii Ethnic groups.

The odds of dropping out from school for women from the kikuyu and kisii Ethnic group are 0.435 and 0.746 times lower than the odds for women from the Kalenjin Ethnic group respectively**.**

Table 4.15: Random coefficient model fit results for school dropout of women in Kenya, KDHS2022

Predictors	Estimates	Odds Ratio	Std .Err	Z	P>Z	95% confidence interval	
						Lower	Upper
Intercept	0.210	0.112	0.035	-6.92	<0.0001	0.06025	0.20820
Womens' age							
15-24	0.191	1.211	0.161		0.150	0.93297	1.57074
25-29	-0.062	0.940	0.109	-0.53	0.595	0.74888	1.18035
30-34	0.053	1.054	0.109	0.51	0.610	0.86046	1.29191
35-39	0.041	1.042	0.098	0.43	0.664	0.86652	1.25214
40-44	0.109	1.115	0.103	1.18	0.238	0.93037	1.33647
45-49(Ref)							
Women's education level							
no education	-	1.000	-	-	-	-	-
primary	-0.610	0.543	0.027	-12.15	<0.0001	0.49230	0.59942
secondary	-	1.000	-	-	-	-	-
Higher (Ref)							
Wealth index							
poorest	1.433	4.192	0.478	12.56	<0.0001	3.35187	5.24238
poorer	1.032	2.806	0.290	9.99	<0.0001	2.29192	3.43524
middle	0.687	1.988	0.191	7.15	<0.0001	1.64694	2.40042
richer	0.397	1.488	0.119	4.96	<0.0001	1.27166	1.74134
Richest(Ref)							
Religion							
protestant	-0.026	0.975	0.067	-0.38	0.707	0.852222	1.114604
evangelical churches	-0.0179	0.982	0.07	-0.25	0.802	0.854114	1.129663
Catholic	-0.046	0.955	0.075	-0.58	0.562	0.818669	1.114945
Islam	0.271	1.311	0.168	2.11	0.035	1.019799	1.68509
Others(Ref)							
Husband 's							

educational level							
no education	1.942	4.047	0.339	16.69	<0.0001	3.43379	4.76867
primary	1.398	2.057	0.164	9.05	<0.0001	1.75962	2.40482
secondary	-	-	-	-	-	-	-
Higher (Ref)							
Respondent work							
Yes	0.008	1.008	0.046	0.16	0.870	0.92083	1.10243
No(Ref)							
Husband work							
Yes	-0.048	0.953	0.087	-0.53	0.598	0.79635	1.14028
No(Ref)							
Child birth							
Yes	0.319	1.376	0.164	2.68	0.007	1.08944	1.73687
Husband age	0.021	1.021	0.004	5.88	<0.0001	1.01419	1.02859
Residence							
Rural(Ref)	-0.292	0.747	0.060	-3.64	<0.0001	0.63785	0.87386
Urban							
Media exposure							
Yes	-0.583	0.558	0.057	-5.69	<0.0001	0.45647	0.68238
No(Ref)							
Region							
North	0.852	2.343	0.765	2.61	0.009	1.23604	4.44291
Eastern	0.239	1.270	0.181	1.68	0.092	0.96133	1.67873
Central	0.495	1.641	0.253	3.21	0.001	1.21302	2.21901
Rift Valley	0.240	1.272	0.170	1.8	0.071	0.97932	1.65173
Western	0.391	1.479	0.226	2.56	0.010	1.09631	1.99511
Nyanza	0.316	1.371	0.201	2.15	0.031	1.02852	1.82880
Nairobi	0.040	1.041	0.167	0.25	0.801	0.76079	1.42478
Cost							
Ethnicity							
kamba	-0.665	0.514	0.057	-6.03	<0.0001	0.41413	0.63807
kikuyu	-0.833	0.435	0.043	-8.34	<0.0001	0.35769	0.52889
kisii	-0.294	0.746	0.092	-2.38	0.017	0.58539	0.94954
luhya	-0.112	1.118	0.101	1.24	0.216	0.93662	1.33524
luo	-0.083	0.920	0.099	-0.77	0.441	0.74496	1.13678
meru	0.210	1.234	0.135	1.92	0.055	0.99590	1.52848
mijikenda/swahili	0.150	1.122	0.164	0.79	0.432	0.84192	1.49505
Kalenjin(Ref)							

4.5 BINARY LOGISTIC REGRESSION ANALYSIS FOR EARLY MARRIAGE AND SCHOOL DROPOUT

The results in Table 4.16 show that the estimated odds ratio (OR), 3.237 is greater than or different from one indicating dependency between the two outcome variables. Thus, the probability of early marriage and school dropout as a function of a set of predictors is fitted using binary multilevel logistic regression model.

Table 4.16: Joint and marginal probability of early marriage and school dropout of women in Kenya, KDHS 2022

		Early marriage		Marginal count(Prob) of early marriage	Odds Ratio
		No	Yes		
School dropout	No	7956(0.522)	3122(0.205)	11078(0.727)	3.237
	Yes	1832(0.120)	2327(0.153)	4159(0.273)	
Margin of school dropout		9788(0.642)	5449(0.358)	15237(1.000)	

4.5.1. DETERMINANT OF EARLY MARRIAGE AND SCHOOL DROPOUT: BINARY MULTILEVEL ANALYSIS

Two level (weighted) multilevel binary logistic regressions were used to analyze the effect of each independent variable on both early marriage and school dropout while controlling for the other independent variables.

Intercept only model

Based on the values of Akaike's Information Criterion and Bayesisan Information Criterion, the best fitting model with the least AIC and BIC values is the one that include all predictor variables which we call as Full model (Table 4.17).

Table 4.17: AIC, and BIC values for different models of early marriage and school dropout

Model	AIC	BIC
Intercept only	12655.97	12671.24
Random predictor and Fixed effect	10438.08	10716.72
Full model	10421.13	10706.92

Random Intercept Model

The results of the random intercept model fit revealed that women's age, Women's educational level, wealth index, Religion, husband educational level, child birth and husband age from the individual level predictors and region from the community level predictors have a statistically significant effect on both women's early marriage and school dropout practice at 5% level of significance. On the other hand Residence, media exposure and ethnicity have not statistically significant effect on early marriage and school dropout taken together.

The intercept (3.037) represents the estimated log odds of women being or falling in to married early and dropped-out from school category when all predictors are zero/constant. In dichotomous outcome intercept is optional and used to estimate probability of women in cluster *j* fall in category (both early marriage and school dropout = "Yes"). In this case $P\ (y_{ij} = 1) = \frac{\exp(\gamma_{00})}{1+\exp(\gamma_{00})} = \frac{\exp(3.037)}{1+\exp(3.037)} = 0.9542$ implying that women have on average 95.42% chances of experiencing early marriage and school dropout across all clusters.

4.6. COMPARISON OF MODELS

The results of the separate models of each outcome variable and the results of the model when early marriage and school dropout are taken as a single outcome variable are different. Comparing the AIC and BIC values of single and multilevel models, the multilevel model has a lower value of AIC, and BIC (Table 4.18). In this study, binary multilevel logistic regression model are the preferred and selected models.

Table 4.18: Comparison of different models

Model type	**AIC**	**BIC**
Single level Logistic regression for early marriage	17270.74	17582.82
Multilevel logistic regression for early marriage	17004.18	17331.86
Single level Logistic regression for school dropout	15969.53	16251.4
Multilevel logistic regression for school dropout	15784.31	16081.01
Multilevel logistic regression for early marriage and school drop out	10758.31	11055.02

Table 4.20 shows that women's age, Respondents educational level, wealth index, husband's educational level, respondent work, child birth, husband age and ethnicity are statistically significant explanatory variables for both early marriage and school dropout.

The odds ratio (OR) for women aged 15-24 is 3.600, which means that the odds of early marriage (before age 18) and school dropout for women aged 15-24 is higher than that for women aged 45-49 by 3.600 times keeping other factors constant. The same logic applies to other age groups. The odds of women in the age group 25-29, 30-34, 35-39 and 40-44 are 2.350, 1.978 and 1.195 times higher than the odds of women aged 45-49 respectively.

The odds ratio (OR) corresponding to women with primary education is 1.528, which means that the odds of getting married early and dropping out from school for women with primary education is 1.528 times higher than that for women with higher education.

The odds ratio (OR) for poorest women is 1.910, which means that the odds of early marriage and school dropout for poorest women is 1.910 times higher than that for richest women keeping other factors constant. The odds of early marriage and school dropout for women from poorer, middle and richer families were 1.904, 1.402 and 1.286 times higher than the odds of women from richest family respectively.

The odds ratio (OR) for women whose husband is not educated is 3.366, which means that the odds of getting married early and dropping out of school for women whose husband is non-educated is 3.366 times higher compared to women whose husband has higher education. The odds of early marriage and school drop out for women whose husband's level of education is primary and secondary are 2.583 and 1,478 times higher than the odds of women whose husband has higher educational level respectively.

The odds ratio (OR) for women having a job is 1.198, which means that the odds of getting married early and dropping out from school for women with a job is 1.198 times higher compared to women without job.

The odds ratio (OR) for women who gave births to a child is 2.060, which means that the odd of being married early and dropping out of school for women who gave birth to a child is 2.060 times higher compared to women who did not give birth.

The odds ratio (OR) corresponding to husband age is 1.039 indicating that an increase in the age of a husband by one year increases the odds of early marriage and school dropout of women by 1.039 times.

The odds ratio (OR) for women whose Ethinicity is Kamba is 0.386, which means that the odds of getting married early and dropping out of school for Kamba women is 0.386 times lower than that for Kalenjin women. This implies that Kamba women are 61.4% less to have early marriage and school dropout than Kalenjin women. The same logic applies for kikuyu Ethnic group (OR =0.490)

Table 4. 20: A binary multilevel logistic regression model fit results for early marriage and school dropout of women in Kenya, KDHS-2022

Predictors	Estimates	Odds Ratio	Std. Err.	Z	P>z	[95% Conf. Interval]
Intercept	-6.053	3.037	.917	3.68	<0.0001	1.680185 5.487571
Age of respondent						
15-24	1.281	3.600	.562	8.43	<0.0001	2.704133 4.940878
25-29	.919	2.350	.324	6.21	<0.0001	1.794537 3.078117
30-34	.803	1.976	.246	5.46	<0.0001	1.547179 2.521772
34-39	.702	1.798	.204	5.18	<0.0001	1.439945 2.245655
40-44	.255	1.195	.1356	1.57	0.117	.9562793 1.493253
45-49	Ref					
Respondent education						
no education	0					
Primary	.430	1.528	.097	6.66	<0.0001	1.348574 1.730776
Secondary	0	1	-	-	-	-
Higher	Ref					
Wealth index						
Poorest	.685	1.910	.280	4.41	<0.0001	1.432407 2.546127
Poorer	.681	1.904	.261	4.70	<0.0001	1.45569 2.491582
Middle	.337	1.402	.184	2.58	0.010	1.084636 1.813114
Richer	.288	1.286	.146	2.22	0.027	1.029384 1.606511
Richest	Ref					
Religion						
Protestant	.043	1.044	.089	0.50	0.616	.8829496 1.233621
evangelical churches	.125	1.135	.100	1.44	0.150	.9551201 1.34947
Catholic	-.075	9202	.093	-0.83	0.409	.7553142 1.121132
Islam	.165	1.225	.186	1.33	0.183	.9089517 1.649567
Others	Ref					
Husband educational level						
No education	1.250	3.366	.628	6.51	<0.0001	2.335846 4.851524
Primary	1.001	2.583	.303	8.08	<0.0001	2.051844 3.25133
Secondary	.407	1.478	.172	3.36	0.001	1.176683 1.85561
Higher	Ref					
Respondent work						
Yes	.195	1.198	.069	3.13	0.002	1.06974 1.340576
No	Ref					
Husband work						
Yes	.016	1.004	.105	0.04	0.968	.8176412 1.233432
No	Ref					
Child birth						
Yes	.805	2.060	.368	4.04	<0.0001	1.451179 2.924495
No	Ref					
Husband_age	.040	1.039	.004	9.62	<0.0001	1.030938 1.047134
Recidense						
Rural	-.030	.950	.098	-0.49	0.622	7761479 1.163515

Urban	Ref						
Media exposure							
Yes	-.189	.830	.087	-1.78	0.075	.675707	1.019103
No	Ref						
Region							
Cost	Ref						
North	.563	1.806	.605	1.76	0.078	.9363271	3.481591
Eastern	-.120	.886	.164	-0.65	0.513	.6160085	1.273883
Central	-.087	.905	.186	-0.49	0.627	.6059072	1.352621
Rift Valley	-.030	.962	.164	-0.23	0.820	.6890995	1.34304
Western	.188	1.182	.228	0.87	0.387	.8094711	1.725971
Nyanza	.225	1.301	.238	1.44	0.150	.9088656	1.863383
Nairobi	-.086	.856	. 182	0.73	0.464	.5644942	1.297903
Ethinicity							
Kalenjin	Ref						
Kamba	-.960	.386	.059	-6.28	<0.0001	.286711	.5194565
Kikuyu	-.743	.490	.066	-5.28	<0.0001	.3754411	.6380763
Kisii	-.050	.885	.134	-0.81	0.420	.6581734	1.190346
Luhya	-.307	.731	.083	2.76	0.006	.5852905	.9128833
Luo	-.113	.827	.109	1.44	0.151	.6386679	1.071679
Meru	.085	1.08	.142	0.61	0.542	.8375416	1.401127
Mijikenda	.078	1.01	.181	0.03	0.978	7054494	1.431636

4.7. DISCUSSIONS

The main aim of this study was to identify factors affecting early marriage and school dropout in Kenya using multilevel binary logistic regression analysis using the 2022 Kenya Demographic and Health Survey data. In this study, separate multilevel and single level binary logistic regression models were fitted with early marriage and school dropout as response variables. In addition to this, multilevel binary and single level binary logistic regression models were fitted considering early marriage and school dropout as a single outcome variable.

Based on the model comparison criteria, multilevel binary logistic regression model was found to be the better and preferred model. Although, there have been no previous studies that carried out binary multilevel model analysis of early marriage and school dropout as a single outcome, the findings of this study agree with the findings of numerous studies (Workie and Tesfaw , 2012) that fitting a binary logistic regression model for related outcomes and hierarchical data provides consistent estimates of the population parameters and has lower type I error.

This study verified that the prevalence of early marriage in Kenya was 27.91% among 15-49 aged women based on data taken from KDHS 2022.

The prevalence of early marriage in Kenya based on this study was lower than a study conducted by (Scott et, al., 2021) in Nepal (52%), India (41%), and Pakistan (37%). The reason might be the economic, cultural, and educational levels of the countries.

This study demonstrated that the prevalence of school dropouts in Kenya was 33.56% among 15-49 aged women based on KDHS 2022 data.

The multilevel binary logistic regression model fit results revealed that women's age, Women's educational level, wealth index, husband educational level, respondent work, child birth, husband age, and ethnicity are significant predictors of both outcomes (early marriage and school dropout); whereas respondent's work status was significant predictor of only early marriage. Exposure to mass media and Ethnicity were found to be significant predictors of only school dropout.

This study demonstrated that women with no, primary and secondary education are more likely to be married early compared to those with higher education. The result of this study is in agreement with the results of (Adebowal et, 2012); (Bezie & Addisu, 2019); (Kamal et, 2014); (Tessema, 2020); (Tezera, 2019). The lower risk of becoming married early among highly educated women may be due to the fact that women with higher education have a better knowledge of the harmful effects of early marriage.

This study demonstrated that wealth index has an effect on school dropout. Women in the poorest wealth index were more likely to drop out of school than women in the richest wealth index category in the same clusters. This finding is consistent with the findings of other studies (Boyaci, 2019); (Chouhan, 2017) on school dropouts.

This study found out that women whose husbands are illiterate had a high probability of dropping out of school. This means that girls with uneducated partners were more likely to drop out of school than those with educated partners. The possible justification may be that educated partners give attention to their spouse going to school.

This study found out that women living in the rural areas are more likely to experience early marriage as compared to the women living in urban areas. This finding is similar to the results of other studies; (Tekile, 2020); (Tessema, 2020) (Tezera, 2019) on early marriage. The possible

justification may be that in rural areas, there are different beliefs and religious dogmas like “getting married early is better”.

Regarding mass media, a study done by (Wang and Luo, 2019) reported that mass media has both a positive and a negative impact on school dropout. But, in this study, it is not the case that peoples who did not have access to mass media are more likely to drop out of school.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

This study aimed to identify determinants of early marriage and school dropout (separately and simultaneously) among women in Kenya using KDHS 2022 data. The study employed different statistical models (separate single level and multilevel logistic regression models for each outcome, and single level and multilevel logistic regression models for the analysis of early marriage and school dropout as a single outcome variable). Interpretations were made based on the multilevel binary logistic regression model fit results as it was the model with the smallest AIC and BIC values.

5.1. CONCLUSIONS

The study showed that there was dependency between early marriage and school dropout. In this study multilevel binary logistic regression model performed better. The study showed that there were a significant variation of early marriage and school dropout of women across the clusters in Kenya. Furthermore, the following risk factors were statistically significantly associated with the two outcomes, at the individual level: women's age, Women's educational level, wealth index, Religion, husband educational level, child birth and husband age, and at the community level : Residence and region.

Based on the finding of this study the following points are concluded:

- Women who were not, primary and secondary educated were more likely to get married early.
- Women in the poorest wealth index were more likely to be exposed to school dropout.
- Women whose husbands are not educated and were not exposed to mass media were more likely to drop out of school.
- A multilevel binary logistic regression model has good fitted as compared to the single level model.

5.2. RECOMMENDATIONS

Based on the findings of this study, the researcher recommends the following to the concerned bodies.

In this study, early marriage and school dropout were dependent outcomes. So, the

- ✓ In this study, early marriage and school dropout were dependent outcomes. So, the integration of the two programs with their risk factors can have advantages. Therefore, the intervention measures should be taken in order to decrease the prevalence of early marriage and school dropout across clusters.
- ✓ In the poorest families and no and primary educated, early marriage is more probable, so attention should be given to women in the poorest wealth index and those are no and primary educated.
- ✓ It is recommended that future extension of this work can be done possible by incorporating other important predictors like geographical weights and time.

Limitations

- ✓ DHS was questionnaire based survey that relies on the respondent's memory, so recall bias might have occurred in the outcome.
- ✓ The data set does not include important variables like cultural, behavioral and social norms of the society.

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APPEDIXES

Table 4.5: Correlation among predictor variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) region	1.000											
(2) Residence_	0.045	1.000										
(3) Respondents educational Level	0.041	-0.273	1.000									
(4) Ethinicity	-0.116	-0.119	-0.098	1.000								
(5) Husband educational Level	0.059	-0.274	0.610	-0.079	1.000							
(6) respondent_work	0.107	-0.012	0.107	-0.091	0.087	1.000						
(7) Husband_age	0.023	0.119	-0.179	-0.017	-0.126	0.178	1.000					
(8) School_dropout	0.020	0.176	-0.322	0.072	-0.362	-0.063	0.077	1.000				
(9) Age_of_respondent	0.000	0.090	-0.117	-0.058	-0.073	0.241	0.790	0.023	1.000			
(10) Religion	-0.161	-0.049	-0.096	0.166	-0.093	-0.107	-0.006	0.043	-0.033	1.000		
(11) Husband_work	0.044	-0.065	0.095	-0.026	0.113	0.156	-0.048	-0.076	0.005	-0.068	1.000	
(12) exposure_to_MME	0.021	-0.107	0.151	-0.013	0.155	0.099	0.061	-0.151	0.094	-0.028	0.099	1.000

Table 4. 6: Tolerance and VIF for checking Multicolinearity

	Early marriage		School dropout	
	VIF	Tolerance	VIF	Tolerance
wealth index	2.771	.361	2.894	.346
Respondents educational	2.707	.369	2.866	.349
Husband age	2.7	.37	2.621	.382
Age of respondent	2.062	.485	2.04	.49
Husband educational	2.05	.488	1.836	.545
Recidense	1.963	.509	1.804	.554
Ethinicity	1.133	.882	1.095	.913
respondent work	1.108	.903	1.089	.918
Husband work	1.093	.915	1.077	.929
Religion	1.087	.92	1.049	.953
Region	1.073	.932	1.044	.958
exposure to MME	1.056	.947	1.041	.96
Child birth	1.038	.963	1.027	.973
Mean VIF	1.68	.	1.653	.

Table 4.7 Forward stepwise variable selection

Label	Early marriage	School dropout
	P>|z|	P>|z|
Respondents_education_level	<0.0001	<0.0001
wealth_index	0.005	<0.0001
Child_birth	<0.0001	<0.0001
Region	<0.0001	<0.0001
Age_of_respondent	<0.0001	<0.0001
Husband_age	<0.0001	0.001
Husband_educational_level	<0.0001	<0.0001
respondent_work	<0.0001	<0.0001
Ethinicity	<0.0001	<0.0001
Husband_work	0.010	0.004
Recidense_	0.025	<0.0001
exposure_to_MME	0.026	
Religion	0.095	

Table 4.10 Random intercept model for early marriage

Predictor	Coef.	Std.Err	Z	P>z	[95% confidence interval	
					Lower	Upper
Age of respondent						
15-24	1.614	0.113	14.29	0	1.39	1.84
25-29	1.064	0.100	10.67	0	0.87	1.26
30-34	0.935	0.090	10.33	0	0.76	1.11
35-39	0.727	0.083	8.71	0	0.56	0.89
40-44	0.277	0.084	3.28	0.001	0.11	0.44
45-49						
Womens educational level						
no education	3.211	0.145	22.19	0	2.9278	3.4950
primary	2.623	0.114	22.97	0	2.3993	2.8469
secondary	1.371	0.111	12.37	0	1.1535	1.5877
Higher						
wealth_index						
poorest	-0.246	0.107	-2.29	0.022	-0.4566	-0.0354
poorer	-0.052	0.098	-0.53	0.594	-0.2452	0.1403
middle	-0.196	0.092	-2.14	0.032	-0.3761	-0.0165
richer	-0.202	0.077	-2.64	0.008	-0.3523	-0.0522
Richest						
Religion						
protestant	0.036	0.065	0.55	0.58	-0.0919	0.1642
evangelical churches	0.056	0.068	0.82	0.413	-0.0780	0.1899

Catholic	-0.064	0.076	-0.84	0.4	-0.2121	0.0846
Islam	-0.035	0.112	-0.31	0.757	-0.2549	0.1854
Others						
Husband 's educational level						
no education	0.292	0.123	2.38	0.017	0.05150	0.53308
primary	0.552	0.081	6.83	0	0.39347	0.71023
secondary	0.320	0.078	4.11	0	0.16726	0.47246
higher						
Respondent work						
Yes	0.152	0.044	3.45	0.001	0.06591	0.23905
No						
Husband's work						
Yes	0.401439	0.0747	0.54	0.591	-0.1062658	0.186554
No						
Child birth						
Yes	0.858	0.126	6.83	0	0.61147	1.10385
No						
Husband age	0.038	0.003	12.28	0	0.03182	0.04391
Recidense						
rural	0.170	0.076	2.24	0.025	0.02121	0.31957
Urban						
Media exposure						
Yes	0.101	0.081	1.24	0.214	-0.05807	0.25964
No						
region						
North	-0.070	0.169	-0.41	0.68	-0.40131	0.26176
Eastern	-0.254	0.130	-1.96	0.05	-0.50808	0.00021
Central	-0.519	0.147	-3.54	0	-0.80666	-0.23125
Rift Valley	-0.260	0.122	-2.13	0.033	-0.49970	-0.02091
Western	-0.205	0.144	-1.42	0.156	-0.48779	0.07788
Nyanza	0.098	0.135	0.73	0.466	-0.16562	0.36197
Nairobi	-0.308	0.150	-2.05	0.041	-0.60262	-0.01297
Ethinicity						
kamba	-0.635	0.108	-5.88	0	-0.84690	-0.42343
kikuyu	-0.245	0.098	-2.51	0.012	-0.43659	-0.05398
kisii	0.187	0.117	1.59	0.111	-0.04317	0.41657
luhya	-0.143	0.090	-1.6	0.11	-0.31942	0.03244
luo	0.102	0.101	1.01	0.311	-0.09515	0.29882
meru	-0.097	0.097	-1	0.319	-0.28664	0.09350
mijikenda/swahili	-0.186	0.133	-1.4	0.162	-0.44592	0.07477
_cons	-6.499	0.293	-22.19	0	-7.0734	-5.9255

Table 4.14 Random intercept model for school drop out

Predictor	Coef.	Std.Err	Z	P>z	[95% confidence interval	
					Lower	Upper
Age of respondent						
15-24	0.208	0.116	1.79	0.073	1.7900	0.4361
25-29	-0.037	0.103	-0.36	0.719	-0.2384	0.1644
30-34	0.068	0.093	0.73	0.467	-0.1145	0.2499
35-39	0.067	0.085	0.79	0.429	-0.0993	0.2335
40-44	0.120	0.084	1.43	0.152	-0.0443	0.2849
45-49						
Women's education level						
no education	0.000	-	-	-	-	-
primary	-0.566	0.048	-11.81	0.000	-0.6601	-0.4722
secondary	0.000	-	-	-	-	-
Higher	0.000	-	-	-	-	-
Wealth index						
poorest	1.358					
poorer	0.977	0.109	12.47	0.000	1.1445	1.5713
middle	0.671	0.099	9.92	0.000	0.7842	1.1706
richer	0.359	0.092	7.32	0.000	0.4917	0.8510
Richest		0.076	4.71	0.000	0.2097	0.5088
Religion						
protestant	-0.036	0.065	-0.55	0.580	-0.1646	0.0921
evangelical churches	-0.012	0.068	-0.18	0.861	-0.1458	0.1218
Catholic	-0.057	0.075	-0.75	0.452	-0.2041	0.0909
Islam	0.315	0.121	2.59	0.009	0.0771	0.5533
Others						
Husband 's educational level						
no education	1.841	0.170	10.82	0.000	1.5079	2.1749
primary	1.322	0.080	16.51	0.000	1.1650	1.4789
secondary	0.688	0.076	9.01	0.000	0.5386	0.8381
Higher						
Respondent work						
Yes	0.013	0.044	0.3	0.767	-0.0731	0.0991
No						
Husband work						
Yes	-0.060	0.087	-0.69	0.491	-0.2313	0.1110
No						
Child birth						
Yes	0.290	0.113	2.56	0.010	0.0684	0.5116
	0.020	0.003	5.9	0.000	0.0135	0.0269

Recidense						
Rural	-0.282	0.077	-3.68	0.000	-0.4322	-0.1321
Urban						
Yes	-0.560	0.099	-5.68	0.000	-0.7529	-0.3667
North						
Region						
North	0.802	0.312	2.57	0.010	0.1909	1.4124
Eastern	0.250	0.135	1.85	0.065	-0.0151	0.5154
Central	0.508	0.146	3.47	0.001	0.2209	0.7950
Rift Valley	0.272	0.127	2.15	0.032	0.0237	0.5205
Western	0.397	0.145	2.73	0.006	0.1124	0.6817
Nyanza	0.388	0.140	2.78	0.005	0.1145	0.6615
Nairobi	0.012	0.150	0.08	0.935	-0.2819	0.3065
Ethnicity						
kamba	-0.606	0.105	-5.79	0.000	-0.8107	-0.4006
kikuyu	-0.796	0.095	-8.4	0.000	-0.9822	-0.6106
kisii	-0.332	0.118	-2.82	0.005	-0.5623	-0.1014
luhya	0.100	0.086	1.16	0.244	-0.0687	0.2696
luo	-0.128	0.103	-1.25	0.213	-0.3292	0.0733
meru	0.198	0.104	1.91	0.056	-0.0050	0.4019
mijikenda/swahili	0.105	0.140	0.75	0.453	-0.1688	0.3784
Const	-2.112	0.299	-7.06	0.000	-2.6990	-1.5255
Var (cons)	0.244	0.029			0.1923	0.3087

Table 4.19: Random intercept only model for Both Early marriage and School dropout

Predictors	Coef.	Std. Err	z	95%[Confidence interval]		
				Lower	Upper	
women's age	1.158	0.143	8.08	0.000	0.8769	1.4385
15-24	0.734	0.128	5.72	0.000	0.4827	0.9861
25-29	0.585	0.117	4.99	0.000	0.3555	0.8149
30-34	0.516	0.107	4.81	0.000	0.3058	0.7268
35-39	0.140	0.109	1.28	0.200	-0.0740	0.3533
40-44						
45-49						
Women's education level						
no education	0	-	-	-	-	-

primary	0.427	0.063	6.74	0.000	0.3028	0.5509
secondary	0.000	-	-	-	-	-
Higher						
Wealth index						
poorest	0.647	0.145	4.45	0.000	0.3621	0.9312
poorer	0.641	0.136	4.73	0.000	0.3753	0.9067
middle	0.336	0.130	2.59	0.010	0.0817	0.5898
richer	0.240	0.112	2.13	0.033	0.0193	0.4598
Richest						
Religion	0.042	0.084	0.49	0.622	-0.1237	0.2069
protestant	0.121	0.087	1.38	0.166	-0.0502	0.2915
evangelical churches	-0.077	0.100	-0.78	0.437	-0.2726	0.1178
Catholic	0.192	0.150	1.28	0.201	-0.1023	0.4863
Islam						
Others						
Husband 's educational level	1.196	0.185	6.47	0.000	0.8336	1.5583
no education	0.938	0.117	8.03	0.000	0.7087	1.1665
primary	0.389	0.116	3.36	0.001	0.1619	0.6152
secondary						
Higher						
Respondent work	0.179	0.057	3.14	0.002	0.0674	0.2910
Yes						
No						
Husband work	0.009	0.103	0.08	0.934	-0.1941	0.2113
Yes						
No						
Child birth	0.732	0.179	4.09	0.000	0.3812	1.0828
Yes	0.038	0.004	9.62	0.000	0.0300	0.0453
Residence	-0.044	0.102	-0.43	0.666	-0.2431	0.1553
Rural						
Urban						
	-0.182	0.104	-1.75	0.081	-0.3862	0.0224
Yes						
North						
Region	0.589	0.335	1.76	0.079	-0.0679	1.2459
North	-0.121	0.182	-0.66	0.508	-0.4783	0.2369
Eastern	-0.081	0.202	-0.4	0.689	-0.4758	0.3144
Central	-0.031	0.168	-0.19	0.852	-0.3605	0.2979
Rift Valley	0.178	0.190	0.94	0.350	-0.1946	0.5500
Western	0.275	0.181	1.53	0.127	-0.0783	0.6293

Nyanza	-0.174	0.210	-0.83	0.408	-0.5844	0.2373
Nairobi						
Cost						
Ethnicity	-0.934	0.148	-6.31	0.000	-1.2241	-0.6439
kamba	-0.709	0.133	-5.34	0.000	-0.9698	-0.4490
kikuyu	-0.117	0.149	-0.79	0.430	-0.4089	0.1742
kisii	-0.296	0.112	-2.65	0.008	-0.5146	-0.0766
luhya	-0.174	0.130	-1.34	0.181	-0.4294	0.0812
luo	0.074	0.130	0.57	0.566	-0.1800	0.3289
meru	0.028	0.178	0.16	0.874	-0.3216	0.3781
mijikenda/swahili						
Kalenjin						
Const	-5.570	0.394	-14.13	0.000	-6.3424	-4.7974
Var(cons)	0.389	0.048			0.3055	0.4945