



UNIVERSITY OF NAIROBI

**Multinomial Logistic Regression To Study The
Determinants Of Choices Of Contraceptive Methods
Among Married Muslim Women In Indonesia**

BY

SIMIYU KEVIN MUKUBWA

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A Thesis Submitted to the Department of Mathematics for Examination in Partial
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Multinomial Logistic Regression

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SIMIYU KEVIN MUKUBWA

Department of Mathematics
College of Biological and Physical sciences
Chiromo, off Riverside Drive
30197-00100 Nairobi, Kenya

Abstract

Family planning has been a topic of major concern in the research field for years. The correspondence between sociodemographic characteristics and choice of contraceptive method of use specifically among married couples has not been sufficiently studied and thus imperfectly acknowledged in Indonesia. The intention of this study was to establish if an association exists between choices of contraceptive methods and socio-demographic factors, evaluate the consequences sociodemographic characteristics have on the use and choice of contraceptive and determine the factors that influence the choices and use of various contraceptive methods among married Muslim women in Indonesia. The data obtained from Demographic and Health Survey (DHS) dataset was applied in this cross-sectional study design. A total of 1252 women aged 15-49 years who were currently married at the moment of survey were included in the analysis. Descriptive and bivariate analysis to ascertain difference in choices and use of contraceptive methods by sociodemographic factors conducted. Multinomial logistic regression model was used to assess if an association exists between the response variable "choices of contraceptive methods" and the set of predictor factors, identify the significant determinants and fit a model for predicting the choice of contraceptive methods. The estimates, adjusted odds ratio together with 95% CI of the determinants linked with choices of contraceptive methods were evaluated by multinomial logistic regression with 5% level of significance. This study revealed low contraceptive prevalence among married Muslim women 55.8% with 44.2%, 20.5% and 35.3% proportion of non-users, long-term and short-term contraceptive method users respectively. Standard of living index, respondent and partner education level, age and number of births were found to be significant determinants of the choice of contraceptive methods among married Muslim women. Poor women were less likely to use any contraceptive method compared to their richer and richest counterparts, there seems to be a larger gap in use and choice of contraceptive methods between the poor and rich women. Concerned stakeholders should target the uneducated, poor, younger and older women and bring awareness on family planning this will translate to increased use of various contraceptive methods hence reduced unwanted and unintended pregnancies and maternal mortality rates. Comprehension of determinants of choices of contraceptive methods could give confirmation for the concerned stakeholders to evolve policies, programs and interventions for married Muslim Indonesian women grounded on the use of the various contraceptive methods.

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Declaration and Approval

I the undersigned declare that this dissertation is my original work and to the best of my knowledge, it has not been submitted in support of an award of a degree in any other university or institution of learning.



22/11/2022

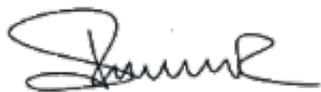
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SIMIYU KEVIN MUKUBWA

Reg No. I56/38760/2020

In my capacity as a supervisor of the candidate's dissertation, I certify that this dissertation has my approval for submission.



23/11/2022

Signature

Date

Dr George Muhua
Department of Mathematics,
University of Nairobi,
Box 30197, 00100 Nairobi, Kenya.
E-mail: muhugeorge@gmail.com

Dedication

I dedicate this project to my late father John Simiyu Mukubwa, my mother Esther Khakasa Wanyonyi and myself.

Contents

Abstract	ii
Declaration and Approval	iv
Dedication	v
List of Tables	viii
List of Figures	ix
Acknowledgments	x
1 Chapter 1: Introduction	1
1.1 Introduction	1
1.2 Background of the study	1
1.3 Problem statement.....	2
1.4 Objectives.....	2
1.5 Research Questions.....	3
1.6 Hypotheses.....	3
1.7 Study Justification	3
1.8 Limitations Of The Study	4
2 Chapter 2:Literature Review	5
2.1 Introduction	5
2.2 Contraception and Maternal Mortality	5
2.3 Side-Effects of Contraceptives	7
2.4 Different Contraceptive Methods.....	7
2.5 Knowledge and Utilization of various contraceptive methods.....	8
2.6 Factors of Contraceptive Use	9
2.6.1 Level of Education.....	9
2.6.2 Mass Media	9
2.6.3 Socio-Economic Status	10
2.6.4 Gender.....	10
2.6.5 Religion.....	11
2.6.6 Culture,Norms,Beliefs and Values	13
2.7 Summary.....	13
3 Chapter 3: Research Methodology	15
3.1 Introduction	15
3.2 Study Design and Data	15
Inclusion Criteria	15
3.2.1 Description Of Variables.....	15
3.2.2 Data Analysis Tool	16

3.3	Emperical Model.....	16
3.3.1	Multinomial Distribution.....	16
3.3.2	Multinomial Logistic Regression Model.....	17
4	Chapter 4:Data Analysis And Results	22
4.1	Introduction	22
4.2	Choices of Contraceptive Methods by Factors.....	23
4.2.1	Choice of Contraceptive Method by Education level	25
4.2.2	Choice of Contraceptive Method by Partner Education Level	26
4.2.3	Choice of Contraceptive Method by Standard of Living.....	27
4.2.4	Choices of Contraceptive Method by Employment Status.....	28
4.2.5	Choices of Contraceptive Method by Quality of Media Exposure	28
4.3	Test for Significance of the predictors	30
4.3.1	Education level	31
4.3.2	Partner education level.....	32
4.3.3	Standard of Living Index.....	32
4.3.4	Age.....	33
4.3.5	Number of Birth	33
4.3.6	Quality of media exposure	34
4.3.7	Employment status.....	34
4.4	Significance Test for Overall Model Fit.....	36
4.4.1	Interpretation of Coefficient Estimates	37
5	Chapter 5: Discussion,Conclusion and Recommendation.....	40
5.1	Introduction	40
5.2	Discussion	40
5.3	Conclusion	42
5.4	Recommendation.....	43
	References	44

List of Tables

Table 3.1. List of Variables used	15
Table 4.1. A table showing the mean and standard deviation of the age and number of children born by a woman	22
Table 4.2. Table showing the structure of the variables and missing values	23
Table 4.3. Table showing the $GVI\bar{F}^{(1/(2 \times Df))}$ of the variables	23
Table 4.4. Table showing the mean and SD for age in the contraceptive methods.....	23
Table 4.5. Table showing the mean and SD for number of children ever born by a woman in the contraceptive methods	23
Table 4.6. Descriptive Analysis of the Determinants of Contraceptive Choices among Married Muslim women in Indonesia	25
Table 4.7. Contraceptive Choice according to Education Level	26
Table 4.8. Contraceptive Choice according to Partner Education Level	26
Table 4.9. Contraceptive Choice according to Standard of Living	27
Table 4.10. Contraceptive Choice according to Employment status	28
Table 4.11. Contraceptive Choice according to quality of media exposure.....	29
Table 4.12. The odds ratio of multinomial regression model for predictors of Choice of contraceptive methods among married Muslim women.....	30
Table 4.13. The likelihood ratio test statistic of model fit with dummy variables for education level.....	31
Table 4.14. The likelihood ratio test statistic of model fit without dummy variables for education level..	32
Table 4.15. The likelihood ratio test statistic of model fit with dummy variables for partner education level.....	32
Table 4.16. The likelihood ratio test statistic of model fit without dummy variables for education level..	32
Table 4.17. The likelihood ratio test statistic of model fit with dummy variables for standard of living index	33
Table 4.18. The likelihood ratio test statistic of model fit without dummy variables for standard of living index	33
Table 4.19. The likelihood ratio test statistic of model fit with age as a factor	33
Table 4.20. The likelihood ratio test statistic of model fit without age as a factor	33
Table 4.21. The likelihood ratio test statistic of model fit with number of births as a factor	34
Table 4.22. The likelihood ratio test statistic of model fit without number of birth as a factor.....	34
Table 4.23. The likelihood ratio test statistic of model fit with quality of media exposure as a factor.....	34
Table 4.24. The likelihood ratio test statistic of model fit without quality of media exposure as a factor.	34
Table 4.25. The likelihood ratio test statistic of model fit with employment status as a factor.....	35
Table 4.26. The likelihood ratio test statistic of model fit without employment status as a factor.....	35
Table 4.27. Table showing the overall significance of all the predictors 4.12.....	35
Table 4.28. The Reduced Multinomial Logistic regression model of the Determinants of contraceptive method among Married Muslim women in Indonesia	36
Table 4.29. Table showing Likelihood ratio test for reduced multinomial logistic regression model.....	36

List of Figures

Figure 4.1. A graph of the ages of the women.....	22
Figure 4.2. A graph of the number of children born by a woman	22
Figure 4.3. A graph of contraceptive methods by age of woman	23
Figure 4.4. correlation matrix for the contraceptive data(Age and Number of Births)	24
Figure 4.5. Scatterplot for age and number of children ever born.....	24

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SIMIYU KEVIN MUKUBWA

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1 Chapter 1: Introduction

1.1 Introduction

This chapter outlines the driving purpose to carry out the research. The research objectives together with the research questions and hypotheses are detailed in this chapter. The study justification and limitations of the study are also contained in this section.

1.2 Background of the study

Health care systems risk threats from maternal mortality which has proven a consequential health problem globally. Complications from birth of children and during pregnancy period result to deaths among women. Earlier works have revealed the use of contraceptives to help lower maternal mortality. According to the UN inter agency approximations, a decline 38% in the maternal mortality ratio has been witnessed globally from 342 deaths per 100,000 live births to 211 from 2000 to 2017. This results to average rate reduction of 2.9% mortality ratio annually. The rates are still low in comparison to the 6.4% required to actualize the Sustainable Development Global goal which intends to actualize 70 maternal deaths in every 100,000 live births. There have been significant progress witnessed globally with South Asia registering 59% overall reduction in maternal mortality ratio [Trends in Maternal Mortality, 2000-2017 WHO, Geneva 2019]. Estimates for maternal deaths from preventable causes linked to pregnancy were 810 deaths daily round the globe in 2014. Greater number of these maternal deaths are experienced in countries with middle and low income. Indonesia is among the many parts globally that have exceedingly high maternal deaths. Recent approximations by the government of Indonesia has indicated a maternal mortality ratio of 305 lives in every 100,000 live births in 2015. In comparison to the previous Millenium Development Goals target set up, the number is three times higher. According to the UN analysts, the challenge of the government of Indonesia will be difficult as United Nations (UN) moved to the new goals. Lowering maternal deaths to 70/100,000 live births is United Nation's 2030 Sustainable Development Goals. There is unevenness in the accessible approximation of the maternal mortality ratio, all existing approximation reveal the rate of maternal mortality ratio to be way above the level it should be given the development made in the health system and Gross National Income (GNI) level of the country. This high level of maternal deaths reveal deficiencies in the health system showing unequal access to services of health. Thus achieving the SDG's launched in 2016 will be an appreciable challenge for Indonesian government.

According to UN family planning is one of the fundamental intercessions that can be used to lower maternal mortality across the countries. According to Indonesian director of maternal health, the progress on goals lowering maternal mortality the country was lagging behind with risks of 1/150 in comparison to 1/4,000 in countries that are developed. Family planning was set as a national plan to enhance the attainment of the country's MDGs of 102 per 100,000 live births. Through family planning the number of pregnancies together with percentages of pregnancies that are considered to be of higher risk are lowered hence reducing maternal deaths. The several occasions a woman is prone to the dangers of maternity-related loss of life are lowered since with family planning the number of pregnancies are reduced. Levels of maternal deaths in various countries have been approximate to reduce by 6% to 60% and 44% round the globe through the use of family planning. Apart from reduction in maternal death, family planning helps to reduce infants death, rates of abortions especially abortions carried out in unsafe environments coupled with reducing the spread of sexually transmitted infections together with proper timing and spacing of pregnancies, improving and maintaining women well-being.

1.3 Problem statement

A variation of contraceptive methods, directed to ameliorate the health and survival of married women by lowering maternal mortality, are accessible in Indonesia. Nonetheless, the use of these contraceptive methods is still very low and its determining factors unspecified therefore posing challenges to the use of various contraceptive methods. In an attempt to solve this dilemma, this study seeks to use Multinomial logistic regression model to identify the determinant factors associated with the choices of contraceptive methods among married Muslim women in Indonesia, fit a model for predicting the choices of contraceptive method and determine the association. This will boost the use of the various contraceptive methods thus leading to reduced maternal mortality rates in the long-run.

1.4 Objectives

The specific objectives of this study include;

- i Determine whether the choices of contraceptive methods vary with the levels among the determinant factors.
- ii Determine the significant factors associated with the choice of contraceptive methods among married Muslim women.
- iii To fit a significant multinomial logistic regression model for predicting the choices of contraceptive methods among married Muslim women given the set of significant predictor factors.

1.5 Research Questions

To achieve the goals for this study, these research questions were proposed;

- i Choices of contraceptive methods do they significantly differ depending with the levels of determinant factors?
- ii What are the significant factors responsible for the choices of the contraceptive methods among the married Muslim women in Indonesia?
- iii In Indonesia among the married Muslim women, is there an association between "Choice of Contraceptive Methods" and the set of significant predictor factors?

1.6 Hypotheses

The study hypotheses are outlined below;

- i H_0 : Choices of contraceptive methods used in Indonesia among married Muslim women are similar across all levels of determinant factors.
 H_1 : Choices of contraceptive methods used in Indonesia among married Muslim women significantly differs depending on the levels of determinant factors.
- ii H_0 : The effect of the predictor variable on the response variable varies after adjusting for all other predictors is not significant.
 H_1 : The effect of the predictor variables on the response variable after adjusting for all other predictors is significant.
- iii H_0 : There is no association between the response variable "Choice of Contraceptive Methods" and the set of predictor factors.
 H_1 : There exists an association between the response variable "Choice of Contraceptive Methods" and the set of predictor factors.

1.7 Study Justification

A clear picture of the impact of contraceptive prevalence on the country's contraceptive situation together with contraceptive prevalence during the period of study will be obtained from the results of the study. Specific factors associated with choice of contraceptive methods among the married Muslim women through statistical modelling will be identified as a result this will set a platform to carefully create contraception control strategies that will yield high response to mitigate the spread of sexually transmitted infections, reduce maternal mortality, unwanted and unintended pregnancies and

control of family activities. Appropriate interventions such as informed family planning programmes, improved access to reproductive health services together with policy implementation on family planning which are in line with achieving sustainable development goal five will be recommended.

1.8 Limitations Of The Study

The ability to draw casual inferences is limited because of the nature of the study which is cross-sectional thus the study couldn't look at the causes and effects but only the associations. Data quality, variable selection and measurements of indicators was beyond my control as the data set was secondary. The data set used in the study was only 1987/1990 DHS data therefore the results of contraceptive usage and choice of contraceptive methods maybe limited to this particular period. The study focused on the married Muslim women without the perspective of women from other religions on the use and choice of contraceptive methods. The focus of this study was on the use and choices of contraceptive methods among the currently married women ignoring the unmarried and ever-married women therefore the results cannot be used to draw a generalization on all women in Indonesia. The study also used the variables selected in the preexisting DHS data therefore other variables with the potential of influencing the use and choice of contraceptive methods could not be added.

2 Chapter 2:Literature Review

2.1 Introduction

This section contains a review of some of the earlier works in relation to this research topic. In this study the literature review has been conducted based on the research problem and research questions. Much attention has been placed on the utilization and knowledge of the various contraceptive methods, reasons for using and discontinuing the use of the different contraceptive methods and challenges experienced before and when a woman makes use of the different contraceptives.

2.2 Contraception and Maternal Mortality

Belfied(1998) found out that one needs to understand why and how people make their choices on the use of various contraceptive methods, in order for one to be an efficient and effective provider of contraceptives. The possibility of reducing pregnancies that are unintended depends majorly on the user; the confidence one has on a given method, the effectiveness of the method and satisfaction of the user. It's impossible to create a method which is perfect because that means having a method which is cheap, effective and 100% safe, not related to intercourse and without side-effects. Therefore having a method which is acceptable and usable by everyone becomes a big challenge. Spazer, Magnani and Hubbard(2000) points out its common for contraceptive use to have challenges. Indonesia as a country has deficiency of resources therefore using the contraceptives effectively has the capability of bettering the lives of not only the women but also the men, children, families and communities involved. According to DOH(2001) the use of contraceptives is influenced by several factors; socio-economic status, area of residence, education level, knowledge about contraceptives, cultural values and beliefs and user's attitude on contraceptive use.

In an effort to determine the protective effects of contraception on maternal mortality, a study conducted to determine the interaction between use of contraceptive and maternal mortality in an effort to understand best the family planning protective effects. The high rates of maternal mortality were linked to lower contraceptive prevalence in Indonesia. Each time contraceptive prevalence rate increased by one percent, maternal mortality ratio were reduced by 7 percent (95%CI(0.9,14.3)). Use of contraceptive played a significant role to lowering maternal mortality in Indonesia. There was need to increase use of various contraceptive methods to reduce maternal mortality. [Riznawaty Imma Aryanty et.al "contraceptive use and maternal mortality in Indonesia"].

Significant emphasis maternal health care has received globally and wide changes in the system has seen the outcomes of pregnancies and maternal deaths reduced. Proper distribution of skilled staffs and proper application of clinical skills has contributed majorly to great decline in maternal mortality. Nonetheless, the impact was not witnessed in all countries and regions. Even with the significant increase in the number of skilled attendants and births at facilities promoted, these didn't see maternal mortality reduce in Indonesia. An analysis was conducted to determine the root causes of maternal deaths in order to come up with applicable strategies to help lower the persistently high maternal mortality. The study pointed out ineffective family services low usage of contraceptives despite the availability of a variety of contraceptive methods [mohammed afzal mahmood et.al causes of high maternal deaths in Indonesia]. The figures for Maternal mortality rates are different round the world. In 2019, France had maternal mortality rate of 7.6 per 100,000 live births with the proportions being 50.7/100,000 live births in Columbia. However regions southern Asia and sub-saharan Africa regions still experience the highest maternal mortality with the differences brought about by inaccessibility and inequality of health care services [John Elflein et.al 2022]. By reducing the number of births, the exposure of a woman to risks of mortality decrease hence reduction in maternal mortality through the use of contraceptives in family planning. As the use of family planning increased from 1990 to 2005; Total Fertility Rate reduced resulting to a decline of over 1 million maternal deaths. With the reduction of high-risk and high-parity births, through family planning, maternal mortality ratio is reduced translating to an indirect averted maternal deaths [John stover et al. Maternal child health j.2010]. Apart from lowering maternal deaths, family planning better a child survival. The use of family planning is on average 64% across the world which is nearly twice the uptake in Africa 33%. Even with the increase in demand, the use of contraceptives is still low in Africa birthing high maternal mortality rates. Niger with the highest fertility rate, 8, in the world experiences the highest under five years child mortality 104/1,000 live births and maternal mortality ratio of 555/100,000 live births. The high maternal mortality rates in sub-saharan Africa is as a result of low contraceptive prevalence rate. Increase in unintended pregnancies with child delivery carried out in presence of low skilled services scale up the rates of newborn births. Improving access to family planning services and contraceptive use will translate to less than 234,000 maternal deaths yearly in sub-saharan Africa [Maternal child Health j.2014]

Though modern contraceptives have risks, these risks aren't worse compared to pregnancy and childbirth health risks. From the third childbirth, a woman is more likely to experience maternal mortality. Women below 20 years of age experience 10.8 deaths out of 100,000 live births as a result of pregnancy and childbirth with the use of oral contraceptives causing death risks of 1.3/100,000 users. Offsprings are affected negatively with the intervals between births being small. For birth intervals of more than four years, there are 108 infant deaths out of 1,000 live births compared to 206 deaths/1,000 live births according to research carried out in India. With short birth intervals, the offsprings end up

with weights below minimum weights. The rates of death tend to increase with age (1.3-8.5),(1.8-12.1) and (24.5-69.1) among the 20-24,25-29 and 40-44 year olds respectively. Percentage of women using modern contraceptives is lower compared to proportion aware of any modern method of birth control according to fertility data. In an effort to lower the maternal mortality ratio and improve child life after birth,information on the use and advantage of contraceptives should be available.various contraceptives methods should be accessible and encouraged to be put in use [*N sadik Draper Fund Rep.1980 oct.*]

2.3 Side-Effects of Contraceptives

Essentially contraceptives are of benefits but they have related side-effects.Each and every one contraceptive method has its own side-effects. A woman who has or is making use of hormonal contraceptives is likely to encounter the following side-effects; amenorrhea,backaches,headaches,menorrhagia,nausea,fatigue and an increase in pigmentation(Wood et al 1999;Jalo and Lewis 1996).Women who were using IUCDs gave an account of increase in vaginal discharge,repeated infections of the vagina and ectopic pregnancies(Mofokeng et al 1996). Those concerned with the provision of contraceptives need be well versed with all the types of contraceptive methods keeping in mind that every contraceptive method has side-effects.Those responsible with the provision of contraceptives have to be cognizant of the fact that distinct contraceptive methods are utilized by different categories of women,this will aid if the side-effects have to be reduced (Popis 1998). Postnatal lactating,adolescents,post abortion and older women have need of their special situations to be contemplated in choosing a suitable contraceptive method.Contraceptive contributors should be in a position to control side-effects properly and switch contraceptive methods if need be.

2.4 Different Contraceptive Methods

Various contraception methods have been introduced to help increase contraceptive prevalence and curb unwanted pregnancies,low mortality and infant death.Females in the reproductive age can choose from the various birth control.It is important for one to know about birth control,currently people have intercourse even in their teens.For those that do not engage in coital practices in their teens,those who are lesbians,gay or wait until marriage will also have sexual activity at some point in their life.It is paramount for one to choose the birth control that best suit his or her situation and lifestyle,when it comes to sexual health.World wide there are more than 1.9 billion women who are using contraceptives.842 million which translate to 44% are users of modern methods while 790 million an equivalent of 42% make use of traditional methods.The natural methods include mucus inspection,calender rythm method,withdrawal,douching and urination.Methods of family planning which are modern are put into two sub-groups;short-term methods(The pills,condoms,foaming tablets,jelly and emergency contraceptive pill),Long-term methods include Implants,IUDs,injectables,male and female sterilization.Changes in fertility

rate trends, age structure of women in the reproduction age, child bearing desires will change the contraceptive prevalence hence the method of use. Short-term methods are preferred by women who are sexually active and want to delay their pregnancy for a shorter period. Short-term methods are used each time one has sexual intercourse. Long-term methods are used by women who are not sexually active and intend to delay their pregnancies for longer periods example, implant once inserted it works for three years, IUD for 6-12 years, vasectomy and female sterilization are permanent. The two most commonly used methods are male condoms and female sterilization. Common methods of contraception tend to change depending with the region. IUD and male condoms are common in southern-eastern and eastern Asia, pills and male condoms in Europe and America. Caribbean is female sterilization. Injectables are common in sub-saharan Africa while pills are common in west and north Africa. Southern and central Asia, female sterilization is the most common. [United Nations "contraceptive use by method" 2019]

Among the many birth control, there are those that work better as compared to others. Rhythm calendar method, male condom and withdrawal birth control types have been used for millenia, intrauterine device and pills came into use in the 1960s. Appropriate and effective methods have to meet the different pregnancy prevention needs. These needs evolve over lifetime based on childbearing preference and personal conditions. There are birth controls that can be accessed without prescription, they can be purchased over the counter; male condoms, sponges, female condom and spermicides. For diaphragms, vaginal rings, injections, patch, IUD, cervical cap, tubal ligation, male and female sterilization and oral contraceptives, one needs to see a doctor since prescription is necessary. Female and male condoms are the best types of birth control that help to protect from STIs. Dual protection is the best to prevent both pregnancy and STIs, using a condom each time one has coitus to prevent STIs at the same time using injection, implant or IUD as a more effective form of birth control. All birth control types have different level of effectiveness, since they both have strengths and weaknesses. [World Health Organization]

2.5 Knowledge and Utilization of various contraceptive methods

Contraception is a very useful tool used in family planning and controlling fertility and as a result it is very vital in enhancing child and maternal health. The inhibition of the usual process of implantation, ovulation and fertilization is what is described as contraception. Different contraceptive methods require different knowledge to prevent pregnancy. Contraceptive methods like IUDs, emergency and hormonal contraception and barrier methods require particular know-how to avert unwanted pregnancies from happening. To ascertain that one has absolute understanding on contraceptive methods, one must have information on the method of choice, ways of obtaining the supplies of the particular method, the side-effects and how to handle warning signals of complication and where to seek help in an event of an emergency (DOH 2001). A client needs assistance to select a method that meets the requirement of her personal situation which

is safe medically and takes into consideration HIV infection and STI exposure (DOH 2001). (Raliphada and Troskie 1999) findings from a study on rural women reproductive health showed 16% knew about the method of use and their possible side-effects compared to 83% who used a method without any understanding of the being used. Across the world Indonesia has the highest contraceptive implant programme, with an estimation of IUCD insertions 400,000 in every year, they had no knowledge about how the method worked (Hull 1998). Women in Thailand projected to have high knowledge of contraceptives when a study on attitude, knowledge and perception on various contraceptive methods was conducted (Manson 2000). 86%, 86%, 88% had knowledge on oral contraceptives, condoms, injectables respectively out of the 102 women who were interviewed however only 12% made use of modern contraceptives regardless of their intention stop or delay pregnancies. From various earlier works, teenagers had different reasons for not using contraceptives which included; being ignorant about contraceptives, fear of infertility and being found they were using contraceptives (Bugu, Amoko 1996; Ehlers et al 2000).

2.6 Factors of Contraceptive Use

2.6.1 Level of Education

Researches have been conducted to identify the factors that are associated with non-use of contraceptives. One of the strong predictors for not using contraceptives is lack of education experience. Findings from a research in Mexico, out of the 883 women who were interviewed 49%, 31% were illiterate and either primary or secondary education respectively were found to have never used contraceptives at any given point in their lives (Molina-Rosales, Zapata-Mertelo and Hebanin 1999). Numerous other works indicated that the higher the level of education the woman has, the more likely she is to make use of various contraceptive methods. The prevalence of unintended and unwanted pregnancies is low amongst the more educated women (Fikree, Kadir Sajan 2001; UN 1993). According to Raliphada and Troskie (1994), an educated woman is able to have the advantage of reproductive rights. Women with lower education are not able to understand information concerning various contraceptive methods and therefore aren't conscious of their human rights inclusive of their reproductive rights. A woman who has attained grade 9 level of education, the educational experience is likely to have an influence on her fertility conduct. In a research conducted in Trasnkei (SA) 67% of the women who had educational experience were making use of the various contraceptives in comparison to 16% of their uneducated counterparts (Chimere-Dan 1996).

2.6.2 Mass Media

Information on contraceptives can be spread with the help of media. This was established in Tanzania a study of the influence of media on the contraceptive behaviors and family planing comprising a sample of 4225 women. A woman was more likely to use contra-

ception the more she was exposed to various media sources. The findings of the study showed that a woman who could remember at least one type of media message was two times more likely to use contraceptives than their counterparts. Women who were able to remember any media message on contraceptives were more likely to share the use of contraceptives with their partners than their counterpart (Jato, Tarasevich, Awasum 1999). The family planning methods which are less practiced and least known are natural family planning methods. Very few studies have mentioned on natural family planning as contraceptive method. In a research carried out by Mofokeng et al (1996) one woman was reported to have used safe period. In a study by (Erasmus and Bokker 1996) the methods reported to prevent pregnancies were coitus interruptus and Lactation amenorrhoea. Vernon (1996) in his study identified rhythm method to be the least practiced and known method. Among the factors linked with the use of natural family planning methods include; cost and lack of accessibility of modern contraceptives, lack of information on modern contraceptives and fear of the perceived side-effects of the modern contraceptives (Suazo, Hubacher 1996).

2.6.3 Socio-Economic Status

Ehler (1999) pointed out the consequences socio-economic status have on the use of contraceptives. She indicated that the high socio-economic status of a woman places her in a situation she is independent of her husband. She can independently make a decision on the number of children to be born in a family, husband use of contraceptives and use of contraceptives. According to Orem's theory (George 2002) a woman with low socio-economic status cannot belong to self-care construct. This implies she cannot take action on contraceptive use on her own, but she needs someone to enter relationship with and provide support to her to make the decision. It can be contended that if not a significant other person is involved in a woman's life (husband or partner) she cannot go through the use of contraceptives on her own. When the socio-economic status of woman is high, she becomes assertive and likely to learn, enjoy and appreciate her rights of reproduction. Women with low socio-economic status are inclined to depend on their husbands for financial support as a result forfeit to decide on their reproduction rights, use of contraceptives in specific (Troskie and Raliphada 1994).

2.6.4 Gender

Gender has been a challenge concerning use of contraceptives. Being a man or woman means meeting different expectations on matters behaviors, appearance and qualities not just the different biological appearance. Nelson (1997) indicated clinics to belong to women and that men should be targeted and taught on contraception. Clinics are stigmatized. Men can help where emergency contraceptives are to be used in remembering the information. Matladi (1998) pointed out that educating women alone and leaving men amounts to paying no attention to social significance of men and their roles not only in the govern-

ment but also the community and family. Men hold a very ascendant position in making decisions concerning fertility and sexual correspondence and issues that influence gender associations and affect women therefore they should be treated as partners and potential patients who have their own reproductive and sexual demands. Communication within relationships will be improved, respect fostered and responsibilities on matters reproductive health shared if men were included in contraception education efforts. Mfono(1998) in her research indicated teenager boys in Gaoteng(SA) didn't make use of contraceptive method in preventing pregnancy as they claimed the use of protection was girls responsibilities.

2.6.5 Religion

Ehler(1999) pointed out that religion could to a greater extent hinder the use of contraceptives effectively. Bankole et al(1998) indicated that women in most cases end up using contraceptive methods with high failure rate example rhythm methods reason being religious values are against contraceptives. Makhetha(1996) in a study that he conducted to determine the factors linked with use of contraceptives among adolescents stated that adolescents were less likely to participate in premarital sexual relations because of high religiosity. Murray et al(1998) mentioned that teenagers who were more likely to delay the timing of their first sexual experience were the one who regularly attended religious services. The acceptance and usage of contraception by married couples who belong to varying backgrounds religiously can to a distinct manner be influenced by religious factors. Among the many religions, various facets may be tempted to interpret the subject on contraception in a different way, as a result the women together with their partner end up ignoring the teachings from religion. Within a faith, couples may not reach a common agreement on the teachings with some having a universal doctrine adhered to. Some religions have smaller denominations which carry out teachings and interpretations according to their own understanding this makes difficult to draw a common agreement. Furthermore having a common understanding on official teachings at a personal level may be difficult thus adherence on religious belief lies on an individual. Roman catholicism is one of the major denominations of christianity among protestantism and eastern orthodoxy. All those denominations have different teachings on matters contraception even though they share the same faith. Among catholics the sole purpose of coitus and marriage is procreation. Contraception is the leading reason as to why people are or should engage in sexual activities. Use of contraceptives goes against the primary purpose of marriage since it reduces or eliminates any chance of producing new life. However there are some contraception methods that are allowed while others are banned. Barrier and chemical methods are banned since they are not in line with the unnatural methods of contraception with abstinence and rhythm method as the only accepted methods for birth spacing. However in a situation where a mother's life is at risk, contraception is allowed but all emergency methods of contraception and abortion are prohibited since catholic consider a person new life from the time of conception. Among the orthodox

church,abstinence is the only method of contraception allowed with procreation being the main purpose for sex. Contraception stands a chance being used but within marriage however the idea of excluding children on principle is not welcomed.Contraception is not officially prohibited since any option that does not implicate or affect the product of contraception is welcomed.The decision on which contraceptive choice to use lies entirely on the couple. Reasons like avoiding genetic diseases,preventing unacceptable risk of mortality or morbidity or conditions that make child raising difficult may justify the use of permanent methods of contraception.[Babalola S,Adodini SA Role of religious leader in promoting contraceptive use 2018]

Among the Muslims actions of human beings are not generalized but instead categorized as permitted,obligatory,disapproved,recommended as opposed to forbidden or not forbidden.Muslims is a comprehensive system. Persons who are not in a position to provide,protect and take care of family responsibilities is allowed not to indulge in marriage. According to the holy Quran,children,product of marriage have to enjoy the basic rights of health care,clothing,education and shelter which are the primary duties of parents. The normalcy of sex drive are well understood with sex being allowed within marriage for either pleasure,procreation or both. Among the Islam sex is not exclusively for child-bearing. Most of the jurists in the religion show that family planning is not really forbidden with options of contraception lying between permissible and disapproved methods.Historically,in the Quran coitus interruptus is the allowed contraceptive choice. If reasons of contraception use are provided the coitus interruptus is the only recommended method. Need to improve the quality of offspring,preserve the appearance of a woman together with economic and health risks justify the use of contraception. methods that are modern are allowed only if they are safe,temporary and legal.Reversible contraception methods like hormonal are permitted while irreversible sterilization methods are discouraged.In discussion on matters contraception with Muslims the facilities providing the care services need to determine if the contraception method is permissible yet discouraged or permissible and encouraged whether one holds conservative beliefs on contraception.In the Islam religion,abortion is heavily preached against as it equals murder. Emergency contraception is also discouraged but both are allowed in certain conditions. Religious opinions,length of gestation and type of Islamic school,range from unconditional prohibition to unconditional permissibility with rape,non-viable foetus,economic and risk of maternal mortality being the valid reasons. Currently family planning among traditional Islam couples increased if it is used for birth spacing as opposed to limiting family size.Traditional,family coupled with religious pressure determine the decision to bear children. [Amirrtha Srikanthan,Robert I.Reid *Religious and cultural influence on contraception*]

Among the Hindus there are multiple deities that hold different faith. Like Muslims,sexual relations are to be mutually enjoyed and practiced within marriage. Both procreation and pleasure being the reasons for indulgence in sexual activities. With organized mar-

riages, social order is experienced. All methods of contraception are allowed since within the religious doctrine there are no obligations or prohibitions regarding the use of contraceptives. There is no spiritual or ethical harm when the motivation and intention for contraceptives is not morally wrong. According to Hinduism the decision to use or not use contraception is not under the religious doctrine instead is a decision to be made by the woman herself. With the concept of liberty being held dearly, the decision to make use and type of contraception is based on a person's choice. [Schenker JG, et al. 1993]

Young men and women in Indian families have no education about sexually transmitted infections, contraception and normal sexual intercourse since sex as a topic is a taboo. This results to low understanding of ovulation and timing of pregnancy. Education on contraception is presented to women only when they have had first birth as a result birth control is discouraged until first birth. Procreation is not stressed in Buddhism, fertility is not related to religion instead cultural factors. Marriage is not considered a religious duty even with it being positive. It is only through self-change and inner transformation that enlightenment can be achieved which is the objective of Buddhism. With this objective, sexuality is regarded as a block to enlightenment. Any form of contraception which is non-violent can be used since both men and women are allowed to family planning. With the intentions of contraception usage being wholesome family planning is encouraged. Like Islam, in Buddhist life begins at the point of conception thus those contraception which do not destroy the product of conception are allowed. There is no prohibition on contraception with abstinence being the method of choice however the modern contraceptives are not opposed. Emergency contraception and abortion are taken as murder but in certain situations, when the intentions are ethically sound, are allowed. [Pandya Health Editorial team 2021]

2.6.6 Culture, Norms, Beliefs and Values

Culture dictates one's practices, beliefs and values as it shows how people behave, perceive and evaluate their own world. Norms give directions on how one needs to stay with people but according to values which govern their behaviors (Andrew and Boyle 1995). Differences in culture greatly influence the preference, use and attitudes on matters contraceptives hence concerned stakeholder need to be well versed with these cultural beliefs. It's important to understand the level of cultural belief affiliation of an individual which might affect not only their behaviors of childbearing but also usage/non-usage of contraceptives (Noone 2000)

2.7 Summary

From previous research papers there existed gaps, which formed the basis for this research paper work. [Riznawaty Imma Aryanty 2021, "uses of contraceptive and maternal mortality"] in his study conducted to find the relation between the use of contraceptive

and maternal mortality, found that maternal mortality reduced by 7% each time contraceptive prevalence increased by 1% however the factors associated with the use of contraceptive methods was not addressed. Ehler(1999) in his study found religion to greatly hamper effective use of contraception. Bankole et al(1998) in his study discussed the use of contraceptive methods, found women use methods that have high failure rate like rhythm because religious values are against modern contraceptives. Religion was looked at in general when there are many denominations with different teachings and interpretations on subject contraception. The use and choice of contraceptive methods differs significantly with the religion. [United Nations("contraceptive use by method")2019] Measured progress in meeting the need for family planning by assessing the range and types of contraceptives. The study showed overall 45.2% users of contraceptives depend on long-term methods, 46.1% short-term and 8.7% on traditional. These methods choices are not similar in all continents. The factors influencing the choices of these methods in various continents was not looked at. Choices of contraceptive methods, significant determinants among married Muslim women has received little attention. This study seeks to address these gaps using multinomial logistic regression model to determine the association between choices of contraceptive methods and demographic and socio-economic factors, the significant factors associated with the choices of contraceptive method among married Muslim women in Indonesia.

3 Chapter 3: Research Methodology

3.1 Introduction

This section outlines the data, area of study as well as the model used in the statistical study of the prevalence of contraceptive and choice of contraceptive methods among Muslim women in the reproductive age. Multinomial logistic regression model was chosen as the best model for the study after taking into consideration the nature of the response variables under study. The subsequent sections address **Multinomial Logistic Regression Model** outlining parameter estimation, significance of the model and variable, prediction and interpretation of odds ratio. The chapter also outlines the data analysis tools and procedure.

3.2 Study Design and Data

A secondary data was used for this cross-sectional study, sourced from the DHS. The data was accessed by requesting it online from the DHS program. The women successfully interviewed were 1252 out of a potential 1472 that were eligible for the study. Married Muslim women aged 15 – 49 years were the respondents. The study was limited to 1252 married women based on the criteria for inclusion to assess the demographic and socio-economic factors linked with the choice of contraceptive methods among married Muslim women in Indonesia after filtering out for the potential confounders.

Inclusion Criteria

The research involved a sample comprising of currently married women in the reproductive age bracket (15-49) years of age. The married women had to be Muslim by religion.

3.2.1 Description Of Variables

Table 3.1. List of Variables used

Variable	Type of variable	Levels of variable
Choice of contraceptive method	Numeric	Nominal(1=Non-users,2=Long-term,3=Short-term)
Wife Age	Continuous	(15-49)years
Number of children ever born	Discrete	0, 1, 2, 3, 4, ...
Wife Education level	Numeric	Nominal(1=No schooling,2=Some Primary,3=Completed Primary,4=Secondary and Higher)
Wife Employment Status	Numeric	Binary(0=Yes,1=No)
Quality of Media Exposure	Numeric	Binary(0=Good,1=Poor)
Husband's Education level	Numeric	Nominal(1=No Schooling,2=Some Primary,3=Completed Primary,4=Secondary and Higher)
Standard of Living Index	Numeric	Nominal(1=Poorest,2=Middle,3=Richer,4=Richest)

The response variable in the study was "Choices of Contraceptive methods" with three categories and "Non-users" set as the reference category. The independent variables in this research comprised of three class that included the wife's sociodemographic factors, partner's socio-demographic factors and house-linked factors. Three variables were under the class of wife socio-demographic factors, namely wife age in years (15-49), employment status (employed (reference) and unemployed), education level (No schooling (reference), some primary, completed primary, secondary and higher). The category of the partner's socio-demographic factors had one variable, education level (No schooling (reference), some primary, completed primary, secondary and higher). In relation to house-associated factors, it had three variables; quality of media exposure (Good (reference), poor), number of births (0, 1, 2...) and standard of living index (Poorest (reference), middle, richer, richest) 3.1

3.2.2 Data Analysis Tool

R programming statistical software was used to analyze the data obtained from the DHS dataset used in the study. The data was checked for missing and duplicate values which were removed from the variables analysis. Structure of the variables checked and transformed to the right format. Descriptive analysis conducted with results presented as percentages and graphs. For the categorical variables, Chi-square test was used for purpose of describing and determining the association with the choice of contraceptive methods. Bivariate analysis and Multinomial logistic regression was used for assessing the significance of the independent variables. The results were reported with p values with significance of all the analyses set at $P < 0.05$. Multicollinearity which is a serious assumption on regression models was checked using GVIF (Generalized Variance Inflation Factor) where variables with values above 10 were removed. Prevalence of contraceptive was calculated and choices of contraceptives methods determined. The "choice of contraceptive" methods was the primary outcome measure defined as; non-users of contraceptives, long-term contraceptive method users and short-term contraceptive method users. First the net effect of selected sociodemographic factors on the choice of contraceptive methods was assessed using a multinomial regression irrespective of the predictors significance, all the covariates were at the same time entered into the multinomial logistic regression model. A reduced multinomial logistic regression model with only the significant predictors was fitted with the estimates, (OR_s) and 95% CI. Multinomial logistic regression model was used to test for the association between the dependent and independent variables. The predictor variables in the model were Age of the woman, wife and partner education level, number of births, standard of living index, employment status, quality of media exposure.

3.3 Empirical Model

3.3.1 Multinomial Distribution

Multinomial distribution is used to generalize binomial distribution where the response takes more than two values. Let Y_{ij} be the number of observations of the category j for an individual i . If $Y_{ij} \text{ Mul}(n_i, \pi_{ij})$ with $n_i = \sum_{j=1}^J Y_{ij}, \pi_{ij} \in (0, 1)$ and $\sum_{j=1}^J \pi_{ij} = 1$ then the Probability Mass Function (PMF) is given by ;

$$p(Y_{i1} = y_{i1}, \dots, Y_{iJ} = y_{iJ}) = \frac{n_i!}{y_{i1}! \dots y_{iJ}!} \pi_{i1}^{y_{i1}} \dots \pi_{iJ}^{y_{iJ}} \quad (3.1)$$

for multinomial random variable $E[Y_{ij}] = n_i \pi_{ij}$ and $\text{var}(Y_{ij}) = n_i \pi_{ij} (1 - \pi_{ij})$

3.3.2 Multinomial Logistic Regression Model

Consider a sample of n independent observation y_{ij} which assumes a multinomial distribution conditionally on a set of p covariates. The model is given by

$$\begin{aligned} g(E[y_{ij} | x_i]) &= \ln\left(\frac{\pi_{ij}}{\pi_{i1}}\right) \\ &= \beta_{j0} + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip} \\ &= x_i^T \beta_j \end{aligned} \quad (3.2)$$

with $i = 1, \dots, n, j = 2, \dots, J$, with $x_i^T = (1, x_{i1}, \dots, x_{ip})^T$ and $\beta_j = (\beta_{j0}, \dots, \beta_{jp})$ Multinomial regression is an extension of the binary logistic regression model fitted to determine the association between a set of predictors and multi-category nominal response variable. Since $\sum_{j=1}^J \pi_{ij} = 1$, For $j = 1, \pi_{i1} = 1 - \sum_{j=2}^J \pi_{ij}$.

$$\begin{aligned} \pi_{ij} &= \frac{e^{\beta_{j0} + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}}{1 + e^{\beta_{j0} + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}} \\ &= \frac{e^{x_i^T \beta_j}}{1 + \sum_{j=2}^J e^{x_i^T \beta_j}} \end{aligned} \quad (3.3)$$

One category can be made a reference group and dummy variables are then created for the remaining response variables. Basically multinomial model is a series of binary logistic models fitted for each dummy variable of response variable; a series for $(J - 1)$ binary models are fitted for J categories of responses. Each of the $(J - 1)$ binary model shows the impact of the determinants on the likelihood of success, in that level, in comparison to the reference level, with each binary model having unique regression coefficients and intercepts. If there are p predictors and J levels for response, the total number of predictors for the fit are $(J - 1) \times p$ with each regression coefficient to a unique predictor.

The $(J - 1)$ binary models are fitted simultaneously with the first level assumed as the reference group and the other categories labelled 2, 3, ..., J .

$$\begin{aligned} \ln\left(\frac{p(j=2)}{p(j=1)}\right) &= \beta_{02} + \beta_{12}X_1 + \beta_{22}X_2 + \cdots + \beta_{p2}X_p \\ \ln\left(\frac{p(j=3)}{p(j=1)}\right) &= \beta_{03} + \beta_{13}X_1 + \beta_{23}X_2 + \cdots + \beta_{p3}X_p \\ &\vdots \\ \ln\left(\frac{p(j=J)}{p(j=1)}\right) &= \beta_{0J} + \beta_{1J}X_1 + \beta_{2J}X_2 + \cdots + \beta_{pJ}X_p \end{aligned}$$

i Parameter Estimation

The likelihood of a sample of n *iid* observations y_{ij} is given by;

$$\mathcal{L}(\boldsymbol{\pi}|y) = \prod_{i=1}^n \left(\frac{n_i!}{\prod_{j=1}^J y_{ij}!} \prod_{j=1}^J \pi_{ij}^{y_{ij}} \right) \quad (3.4)$$

Removing the terms which do not contain π_{ij} , the function of the log-likelihood is shown by

$$l(\boldsymbol{\pi}|y, x, \boldsymbol{\beta}) = \sum_{i=1}^n \sum_{j=1}^J y_{ij} \ln(\pi_{ij}) \quad (3.5)$$

where the probabilities $\pi_{i1} = 1 - \sum_{j=2}^J \pi_{ij}$ and $\pi_{ij} = \frac{e^{x_i^T \beta_j}}{1 + \sum_{j=2}^J e^{x_i^T \beta_j}}$. Based on β_j the log-likelihood function is differentiated and the new function set to 0 to get the Maximum Likelihood equations. Numerical optimization is opted for to get the solutions for the Maximum Likelihood equations.

In this study, the number of independent observations $n=1252$, p total covariates equal to 13 and J the categories of the response variable equal to 3. The model is given by;

$$\begin{aligned} g(E[y_{ij} | x_i]) &= \ln\left(\frac{\pi^{ij}}{\pi_{i1}}\right) \\ &= \beta_{j0} + \beta_{j1}x_{i1} + \cdots + \beta_{jp}x_{ip} \\ &= x_i^T \beta_j \end{aligned} \quad (3.6)$$

with $i = 1, \dots, 1252, j = 2, 3$, with $x_i^T = (1, x_{i1}, \dots, x_{ip})^T$ and $\beta_j = (\beta_{j0}, \dots, \beta_{jp})$.

With $\sum_{j=1}^3 \pi_{ij} = 1$, For $j = 1$, $\pi_{i1} = 1 - \sum_{j=2}^3 \pi_{ij}$.

$$\begin{aligned}\pi_{ij} &= \frac{e^{\beta_{j0} + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}}{1 + e^{\beta_{j0} + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}} \\ &= \frac{e^{x_i^T \beta_j}}{1 + \sum_{j=2}^3 e^{x_i^T \beta_j}}\end{aligned}\quad (3.7)$$

The likelihood function is given by ;

$$\mathcal{L}(\pi|y) = \prod_{i=1}^{1252} \left(\frac{n_i!}{\prod_{j=1}^3 y_{ij}!} \prod_{j=1}^3 \pi_{ij}^{y_{ij}} \right) \quad (3.8)$$

the log-likelihood function after eliminating the terms missing π_{ij}

$$l(\pi|y, x, \beta) = \sum_{i=1}^{1252} \sum_{j=1}^3 y_{ij} \ln(\pi_{ij}) \quad (3.9)$$

with probabilities $\pi_{i1} = 1 - \sum_{j=2}^3 \pi_{ij}$ and $\pi_{ij} = \frac{e^{x_i^T \beta_j}}{1 + \sum_{j=2}^3 e^{x_i^T \beta_j}}$. By differentiating the function of the log-likelihood with respect to β_j and equating the new functions to zero, maximum likelihood equations are derived.

For the 3 categories of the response variable, 2 binary models are fitted with the first category "non-users of contraceptives" used as the reference category and 26, (2 × 13), total predictors for the model fit. The other categories are labeled 2, 3.

$$\begin{aligned}\ln\left(\frac{p(j=2)}{p(j=1)}\right) &= \beta_{02} + \beta_{12}X_1 + \beta_{22}X_2 + \dots + \beta_{p2}X_p \\ \ln\left(\frac{p(j=3)}{p(j=1)}\right) &= \beta_{03} + \beta_{13}X_1 + \beta_{23}X_2 + \dots + \beta_{p3}X_p\end{aligned}\quad (3.10)$$

ii Model Assumptions

- i Nominal multinomial response; The response variable y_{ij} is nominal. The dependent variable should be categorical with more than two categories.
- ii Independent observations; The observations are assumed to be independent of each other. The value of the variables do not depend on any of the others. Choices of one category is not related to the decision of another category
- iii Multicollinearity; two or more variables should not correlate amongst each other as this makes the regression coefficients unstable.

iii Significance of Predictors

significance of each predictor is determined using either;

i Z-test

Test hypothesis

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

The test for the statistic is performed by;

$$Z = \frac{\beta_{jp}}{se(\beta_{jp})}$$

$Z \sim N(0, 1)$. The predictor is statistically significant if the p – value $< \alpha$ level of significance. For categorical predictor variable with multiple categories say s categories. We create $s - 1$ dummy variables. The null hypothesis is that all partial regression coefficients corresponding to dummy variables are all zero against alternative hypothesis that atleast one is significantly different from one. To test for the hypothesis we compare two model fits; A model with dummy variables for categorical variables and another without the dummy variables. The test statistic is difference in likelihood ratio test statistics or residual deviance test statistics of the two model fits. This gives a chi-square distribution with $s - 1$ degrees of freedom. p – value $< \alpha$ implies categorical variable is a significant variable after adjusting for all other predictors in the fit.

ii Using the confidence interval obtained for the ;

odds

test hypothesis

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

$$Lower = \beta_{jp} - (Z_{\frac{\alpha}{2}} \times se(\beta_{jp})) = L$$

$$Upper = \beta_{jp} + (Z_{\frac{\alpha}{2}} \times se(\beta_{jp})) = U$$

$[\beta_{jp} - (Z_{\frac{\alpha}{2}} \times se(\beta_{jp})); \beta_{jp} + (Z_{\frac{\alpha}{2}} \times se(\beta_{jp}))]$, the predictor is significant if the value 0 is not included in the interval.

odds ratio

test hypothesis

$$H_0 : e^{\beta_{jp}} = 1$$

$$H_1 : e^{\beta_{jp}} \neq 1$$

$[e^{(\beta_{jp} - (Z_{\frac{\alpha}{2}} \times se(\beta_{jp})))}; e^{(\beta_1 + (Z_{\frac{\alpha}{2}} \times se(\beta_{jp})))}]$, the predictor is significant if the value 1 is not included in the interval.

iv Significance of Model Fit

To assess if a relationship exists, two models are created, statistical significance of the fitted model is tested using either Likelihood Ratio test or Residual deviance. The null hypothesis is that the model fit with the intercept alone is the best fit against alternative hypothesis the model fit with the predictors is the best model. The difference in Likelihood Ratio test or residual deviance of the two model fit is the test statistic which produces a distribution which is chi-square with $(J - 1 \times p)$ degrees of freedom. $H = D_{m_2} - D_{m_1} \chi_{df_{m_2} - df_{m_1}}^2$ where D_{m_2} is the Likelihood ratio of the model with predictors D_{m_1} Likelihood ratio of the model with the intercept alone. df_{m_2}, df_{m_1} as the degrees of freedom for the model with predictors and model with the intercept alone respectively.

v Interpretation of Parameters Estimates

- i If $\beta_{jp} < 0$, then $0 < e^{\beta_{jp}} < 1$ the outcome of interest is $100 \times (1 - \text{oddsratio})$ percent less likely to occur.
- ii If $\beta_{jp} > 0$, then $1 < e^{\beta_{jp}} < 2$, the outcome of interest is $100 \times (\text{oddsratio} - 1)$ percent more likely to occur, $e^{\beta_{jp}} > 2$, the outcome of interest is $e^{\beta_{jp}}$ times more likely to happen.
- iii If $\beta_{jp} = 0$ then $e^{\beta_{jp}} = 1$, the outcome of interest is not affected by change in the predictor.

vi Prediction of Choice of Response

For the 3 categories, there are 3 equations that can be used to compute the probability that an individual is using any of the 3 categories. An individual is predicted to belong to the group associated with the highest probability. The probabilities are; for categories $j = 2, 3$

$$P(y = j) = \frac{e^{\beta_0 + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}}{1 + \sum_{j=2}^3 e^{\beta_0 + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}} \quad (3.11)$$

For the reference group;

$$P(y = 1) = \frac{1}{1 + \sum_{j=2}^3 e^{\beta_0 + \beta_{j1}x_{i1} + \dots + \beta_{jp}x_{ip}}} \quad (3.12)$$

4 Chapter 4:Data Analysis And Results

4.1 Introduction

Results from the analyzed data and their interpretation are contained in this chapter. Results from descriptive and bivariate analysis are also discussed in this particular chapter. The results of the multinomial logistic regression model, significance of the model fit and predictors are detailed in this section.

Table 4.1. A table showing the mean and standard deviation of the age and number of children born by a woman

	min	1 _{st} Qu	median	mean	3 _{rd} Qu	max	SD	variance
wife age	16	25	31	32.06	38	49	8.33	69.39
number of children ever born	0	1	3	3.34	5.0	16	2.44	5.95

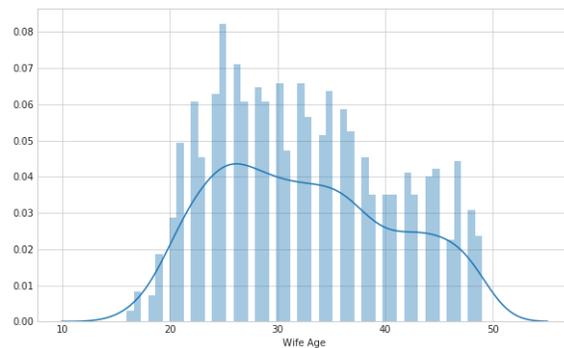


Figure 4.1. A graph of the ages of the women

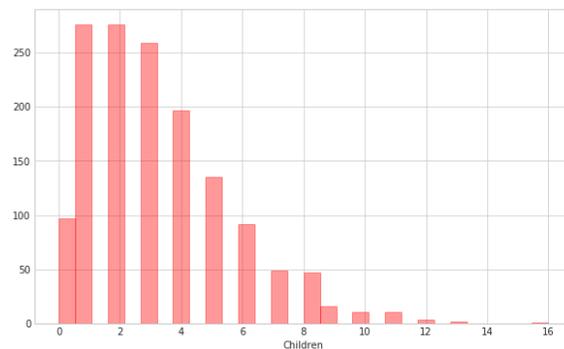


Figure 4.2. A graph of the number of children born by a woman

Multicollinearity is a serious assumption of multinomial logistic regression model. However there is no specific method of testing multicollinearity, this study used GVIF (generalized variance inflation factor) where it's recommended for the values of $GVIF^{(1/(2 \times Df))}$ to be less than 10. The results on 4.2 indicated there is no multicollinearity since the $GVIF^{(1/(2 \times Df))}$ of each variable was less than 10.

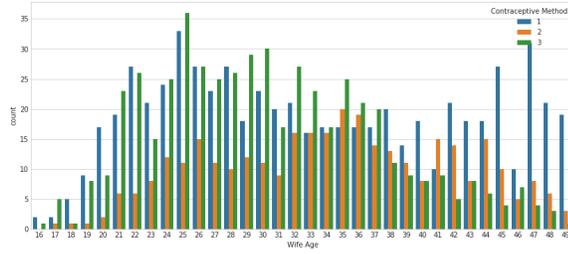


Figure 4.3. A graph of contraceptive methods by age of woman

Table 4.2. Table showing the structure of the variables and missing values

variable	contraceptive method	wife Age	wife education	partner education	number of children ever born	employment status	standard of living index	media exposure
structure	categorical	continuous	categorical	categorical	continuous	categorical	categorical	categorical
missing values	0	0	0	0	0	0	0	0

Table 4.3. Table showing the $GVIF^{(1/(2 \times Df))}$ of the variables

variable	GVIF	DF	$GVIF^{(1/(2 \times Df))}$
age	40.4168	1	6.3574
wife education	100.0087	3	2.1545
partner education	101.5423	3	2.1599
number of children ever born	7.6790	1	2.7711
employment status	4.7634	1	2.1825
standard of living index	58.2436	3	1.9688
media exposure	1.3352	1	1.1555

Table 4.4. Table showing the mean and SD for age in the contraceptive methods

contraceptive method	mean	standard deviation
non-users	32.1	8.33
long-term	32.1	8.33
short-term	32.1	8.33

Table 4.5. Table showing the mean and SD for number of children ever born by a woman in the contraceptive methods

contraceptive method	mean	standard deviation
non-users	3.33	2.44
long-term	3.33	2.44
short-term	3.33	2.44

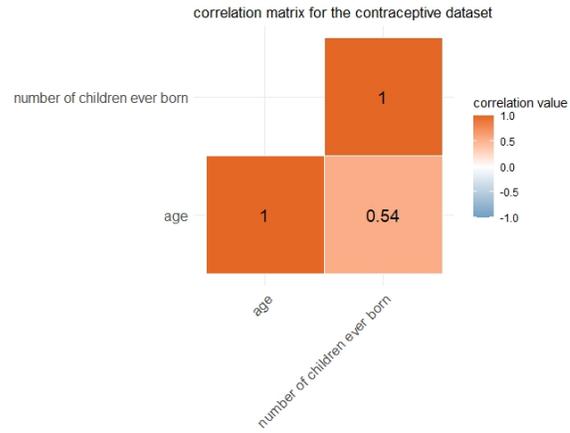


Figure 4.4. correlation matrix for the contraceptive data(Age and Number of Births)

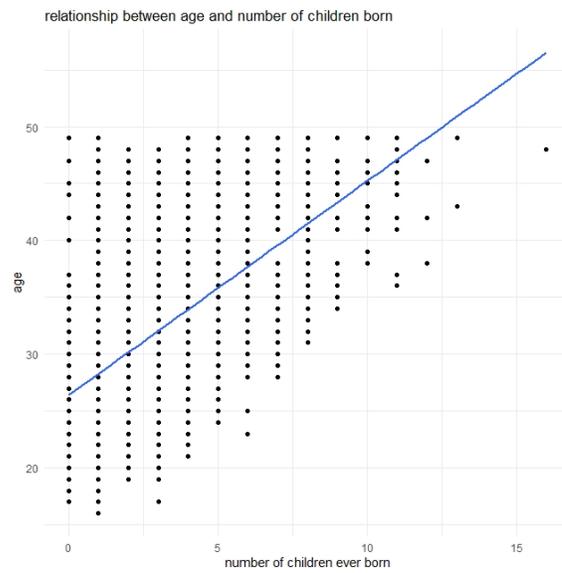


Figure 4.5. Scatterplot for age and number of children ever born

Table 4.6. Descriptive Analysis of the Determinants of Contraceptive Choices among Married Muslim women in Indonesia

Sociodemographic Characteristics	Choices of Contraceptive Method(Muslim)			
	Total	Non-Users	Long-Term Method	Short-Term Method
	1252	553(44.2)	257(20.5)	442(35.3)
	N(%)	N(%)	N(%)	N(%)
Wife Education				
No Schooling	149(11.9)	101(67.8)	9(6)	39(26.2)
Some Primary	311(24.8)	164(52.7)	33(10.6)	114(36.7)
Completed Primary	358(28.6)	156(43.6)	64(17.9)	138(38.5)
Secondary and Higher	434(34.7)	132(30.4)	151(34.8)	151(34.8)
Partner Education				
No Schooling	42(3.4)	29(69)	10(23.8)	3(7.1)
Some Primary	170(13.6)	96(56.5)	15(8.8)	59(34.7)
Completed Primary	324(25.9)	150(46.3)	45(13.9)	129(39.8)
Secondary and Higher	716(57.2)	278(38.8)	187(26.1)	251(35.1)
Employment Status				
Employed	298(23.8)	147(49.3)	64(21.5)	87(29.2)
Unemployed	954(76.2)	406(42.6)	193(20.2)	355(37.2)
Quality of Media Exposure				
Good	1151(91.9)	483(42)	248(21.5)	420(36.5)
Poor	101(8.1)	70(69.3)	9(8.9)	22(21.8)
Standard of Living Index				
Poorest	124(9.9)	77(62.1)	9(7.3)	38(30.6)
Middle	214(17.1)	109(50.9)	27(12.6)	78(36.4)
Richer	385(30.8)	165(42.9)	74(19.2)	146(37.9)
Richest	529(42.3)	202(38.2)	147(27.8)	180(34)

4.2 Choices of Contraceptive Methods by Factors

Standard of living index, education level, quality of media exposure and employment status play a role in the choices of contraceptives Methods. This section discusses the association between contraceptive method choices and these factors.

4.2.1 Choice of Contraceptive Method by Education level

The levels of education were four i.e those with no schooling experience, those with some primary education, those who had completed primary and those with secondary and higher education level. The results which are summarized, are contained in the table 4.7. From the results, the proportion using long-term methods were 6%, 10.6%, 17.9% and 34.8% among those with no schooling, some primary, completed primary and sec-

Table 4.7. Contraceptive Choice according to Education Level

		Contraceptive Choice			Total
		Non-users N(%)	Long-term N(%)	Short-term N(%)	
Education Level	No schooling	101(67.8)	9(6)	39(26.2)	149
	Some Primary	164(52.7)	33(10.6)	114(36.7)	311
	Completed Primary	156(43.6)	64(17.9)	138(38.5)	358
	Secondary and Higher	132(30.4)	151(34.8)	151(34.8)	434
Total		553	257	442	1252

ondary and higher education respectively.

$$H_0 : \mu_{noschooling} = \mu_{someprimary} = \mu_{completedprimary} = \mu_{secondaryandhigher}$$

$$H_1 : \mu_{noschooling} \neq \mu_{someprimary} \neq \mu_{completedprimary} \neq \mu_{secondaryandhigher}$$

The chi-square test results were $\chi^2_{0.05,4} = 121.76$ with p-value < 0.001. The null hypothesis that the choices of contraceptive methods are the same in all education level is rejected at 5% level of confidence and concluded that the choices are not similar in all the levels of education. The findings are similar to a study conducted in Zambia which revealed the likelihood of adolescent girls with advanced level of education i.e. secondary and higher to use contraceptives was higher than the girls with lower education levels [OR=0.556, 95% CI(0.317, 0.974)] (Chalo et al. BMC Women's Health (2020)). This is mainly due to their understanding of the various contraceptive methods together with the effects. The benefits of having smaller manageable families through family planning and how that impacts their productivity economically and upbringing of their children positively.

4.2.2 Choice of Contraceptive Method by Partner Education Level

Table 4.8. Contraceptive Choice according to Partner Education Level

		Contraceptive Choice			Total
		Non-users N(%)	Long-term N(%)	Short-term N(%)	
Partner Education Level	No schooling	29(69)	10(23.8)	3(7.1)	42
	Some Primary	96(56.5)	15(8.8)	59(34.7)	170
	Completed Primary	150(46.3)	45(13.9)	129(39.8)	324
	Secondary and Higher	278(38.8)	187(26.1)	251(35.1)	716
Total		553	257	442	1252

There were four categories of partner education level; no schooling, some primary, completed primary, secondary and higher education level. The results from the study indicated the proportion of non-users of contraceptives reduced as the level of partner education. 69%, 56.5%, 46.3% and 38.8% among those with no schooling, some primary, completed primary and secondary and higher education level respectively. The hypothesis under

consideration;

$$H_0 : \mu_{noschooling} = \mu_{someprimary} = \mu_{completedprimary} = \mu_{secondaryandhigher}$$

$$H_1 : \mu_{noschooling} \neq \mu_{someprimary} \neq \mu_{completedprimary} \neq \mu_{secondaryandhigher}$$

From the chi-square test results, $\chi^2_{0.05,4} = 57.42$ and $p\text{-value} < 0.001$, we reject the null hypothesis that the choices of contraceptive methods are similar in all levels of partner education. Similar results were found from a research in Bangladesh which revealed increase in level of partner education ($p\text{-value} < 0.001$) increased the probability of using contraceptives. The effect of partner education on use of contraceptives was almost similar to that of respondent's education level. (Islam et al)

4.2.3 Choice of Contraceptive Method by Standard of Living

Table 4.9. Contraceptive Choice according to Standard of Living

		Contraceptive Choice			
		Non-users N(%)	Long-term N(%)	Short-term N(%)	Total
Standard of Living	Poorest	77(62.1)	9(7.3)	38(30.6)	124
	Middle	109(50.9)	27(12.6)	78(36.4)	214
	Richer	165(42.9)	74(19.2)	146(37.9)	385
	Richest	202(38.2)	147(27.8)	180(34)	529
Total		553	257	442	1252

This study intended to find out if the standard of living had an influence on the choice of contraceptive method. The findings from the study indicated that the proportion of non-users reduced as the standard of living index improved from poorest to richest 67.8% and 30.4% respectively. To check if there exists an association between standard of living index and choice of contraceptive method the null hypothesis; choices of contraceptive methods are similar in all levels of standard of living against alternative hypothesis; the choices of contraceptive methods are not similar in all standards of living.

$$H_0 : \mu_{poorest} = \mu_{middle} = \mu_{richer} = \mu_{richest}$$

$$H_1 : \mu_{poorest} \neq \mu_{middle} \neq \mu_{richer} \neq \mu_{richest}$$

The results of the chi-square test were that $\chi^2_{0.05,4} = 48.58$ and $p\text{-value} < 0.001$. The null hypothesis was rejected and concluded that the choices of contraceptive methods were not similar in all standards of living. Similar findings from a research carried out in Zambia identified standard of living to be positively associated with the use of contraceptives. The use of contraceptives increased as the level of living standards increased mainly because of the improved ability to access and buy

various contraceptive methods without bothering their partners. [standard of living middle(AOR=1.35, $p \leq 0.005$);rich(AOR=2.04, $p \leq 0.001$);richest(AOR=1.95, $p \leq 0.034$)](lasong et al Determinants of modern contraceptives use among married women of reproductive age)

4.2.4 Choices of Contraceptive Method by Employment Status

Table 4.10. Contraceptive Choice according to Employment status

		Contraceptive Choice			Total
		Non-users N(%)	Long-term N(%)	Short-term N(%)	
Employment Status	Employed	147(49.3)	64(21.5)	87(29.2)	298
	Unemployed	406(42.6)	193(20.2)	355(37.2)	954
Total		553	257	442	1252

The choices of contraceptives methods was found to be 21.5% and 29.2% long-term and short-term methods respectively among the employed. The proportion translated to 20.2% and 37.2% respectively among the unemployed. Chisquare test was conducted to test the null hypothesis that the choices of contraceptive methods are the same between employed and unemployed married Muslim women, against alternative hypothesis the choices of contraceptive methods are not the same between the employed and unemployed women.

$$H_0 : \mu_{Employed} = \mu_{Unemployed}$$

$$H_1 : \mu_{Employed} \neq \mu_{Unemployed}$$

The results of the test are contained in the given table The chi-square test results were $\chi^2_{0.05,2} = 6.6628$ and $p - value = 0.003574$. The null hypothesis at 5% level of significance was rejected and concluded that the choices of contraceptives methods are not the same between the employed and unemployed. These findings are in line with the research carried out in Bangladesh which indicated the use of contraceptives to be 60.9% and 67.2% among the unemployed and employed women respectively, [AOR=1.319, 95% CI(1.193, 1.458)]. The proportions among the employed and unemployed using modern contraceptives being 56.5% and 51.7% respectively (Islam et al)

4.2.5 Choices of Contraceptive Method by Quality of Media Exposure

The goal of the study was to find out if the quality of media exposure had an association with the choices of contraceptive methods. The results showed the proportion of nonusers to be more than the users of contraceptives. However the proportion of short term method users was higher than long-term method users, 36.5% and 21.5% respectively among the those exposed to good quality media. The proportions were

Table 4.11. Contraceptive Choice according to quality of media exposure

		Contraceptive Choice			Total
		Non-users N(%)	Long-term N(%)	Short-term N(%)	
Quality of Media Exposure	Good	483(42)	248(21.5)	420(36.5)	1151
	Poor	70(6.3)	9(8.9)	22(21.8)	101
Total		553	257	442	1252

21.8% and 8.9% respectively among those exposed to poor media. The null hypothesis that the choices of contraceptive methods are similar between good and poor media exposure against alternative hypothesis that the choices of contraceptive methods are not similar between those exposed to good and poor media.

$$H_0 : \mu_{Good} = \mu_{Poor}$$

$$H_1 : \mu_{Good} \neq \mu_{Poor}$$

The results from the chi-square test, $\chi^2_{0.05,2} = 28.629$ and $p - value < 0.001$. The p-value is less than the 5% level of significance therefore the null hypothesis rejected and concluded choices of contraceptive methods are not the same between good and poor media exposure. Exposure to good quality media correlates positively with the use of contraceptives. With relevant information, the decisions and behaviors of the married women are influenced in a positive, better manner translating to increased contraceptive use. These findings contradict a research by [Okach et al] where exposure to media and information on family planning failed to improve contraceptive use.

4.3 Test for Significance of the predictors

Table 4.12. The odds ratio of multinomial regression model for predictors of Choice of contraceptive methods among married Muslim women

Response	variable	Estimates	odds ratio(OR)	95%CI	p value
LONG-TERM METHOD	Intercept	-2.0892	0.1238	(0.0301,0.5090)	0.0038
	Age	-0.046	0.9550	(0.9306,0.9800)	0.0916
	Education Some Primary	0.998	2.7129	(1.1059,6.6555)	0.0293
	Education Completed Primary	1.7513	5.7621	(2.3311,14.2432)	<0.001
	Education Secondary and Higher	2.8816	17.8430	(6.9829,45.5934)	<0.001
	Partner Education Some Primary	-1.2407	0.2392	(0.1048,0.7983)	0.0166
	Partner Education Completed Primary	-1.1034	0.3317	(0.1283,0.8579)	0.0228
	Partner Education Secondary and Higher	-1.1076	0.3303	(0.1267,0.8611)	0.0235
	Number of Birth	0.3162	1.3719	(1.2538,1.5010)	<0.001
	Standard of Living Index Middle	0.5657	1.7607	(0.7535,4.1142)	0.1914
	Standard of Living Index Richer	0.8829	2.4179	(1.0844,5.3913)	0.0309
	Standard of Living Index Richest	1.1679	3.2152	(1.4381,7.1883)	0.0044
	Employment Status	0.0871	1.0910	(0.7512,1.5843)	0.6474
	Quality of Media Exposure	-0.3093	0.7340	(0.3184,1.6919)	0.4679
SHORT-TERM METHOD	Intercept	-0.2417	0.7853	(0.1798,3.4307)	0.7480
	Age	-0.113	0.8931	(0.8719,0.9149)	<0.001
	Education Some Primary	-0.0436	0.9574	(0.5687,1.6117)	0.8698
	Education Completed Primary	0.2059	1.2287	(0.7154,2.1101)	0.4554
	Education Secondary and Higher	0.8402	2.3169	(1.2917,4.1555)	0.0048
	Partner Education Some Primary	1.5081	4.5182	(1.2531,16.2913)	0.0212
	Partner Education Completed Primary	1.6819	5.3756	(1.5015,19.2454)	0.0097
	Partner Education Secondary and Higher	1.5132	4.541	(1.2550,16.4314)	0.0211
	Number of Birth	0.3448	1.4117	(1.3034,1.5290)	<0.001
	Standard of Living Index Middle	0.4067	1.5018	(0.8925,2.5271)	0.1256
	Standard of Living Index Richer	0.4941	1.6391	(0.9997,2.6874)	0.0502
	Standard of Living Index Richest	0.6072	1.8352	(1.1128,3.0268)	0.0174
	Employment Status	0.2364	1.2667	(0.9159,7.7517)	0.1530
	Quality of Media Exposure	-0.5723	0.5642	(0.3139,1.0143)	0.0558

To determine if a relationship exists between the response variable "Choice of contraceptive methods" and the set of predictors age, number of births, respondent and partner education level (0=no schooling, 1=some primary, 2=completed primary, 3=secondary and higher), standard of living index (0=poorest, 1=middle, 2=richer, 3=richest), quality of media exposure (0=good, 1=poor) and employment status (1=unemployed, 0=employed), statistical significance of the fitted model is tested using the likelihood ratio test statistics. 13 predictors are used to fit the model and response variable has 3 categories (0=non-users, 1=long-term method users, 2=short-term method users). The test statistic is based on chi-square distribution with (2×13) , 26, degrees of freedom. Test for significance

of model fit;

H_0 : The null model is a significant fit

H_1 : The full model is a significant fit.

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

The p value for likelihood ratio test is 0, hence the model is a significant fit; overall there is a significant relationship between "choice of contraceptive method" and the set of predictors.

If a predictor has an overall relationship to the response variable, it might or might not be statistically significant in differentiating between pairs of categories for the multinomial logistic regression model so defined. For categorical predictors variables with multiple categories; the null hypothesis for the test is that all partial regression coefficients corresponding to dummy variable created are all zero against alternative hypothesis that at least one is significantly different from zero. Compare two model fits; a model with dummy variables for category variable and another without the dummy variables.

4.3.1 Education level

$$H_0 : \beta_{jp\text{someprimary}} = \beta_{jp\text{completedprimary}} = \beta_{jp\text{secondaryandHigher}} = 0$$

$$H_1 : \beta_{jp\text{someprimary}} \neq \beta_{jp\text{completedprimary}} \neq \beta_{jp\text{secondaryandHigher}} \neq 0$$

The likelihood ratio test statistic for model fit with dummy variables for education level is;

Table 4.13. The likelihood ratio test statistic of model fit with dummy variables for education level

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

The model fit without the dummy variables for education level is;

The difference in two likelihood ratio test statistics is $317.6282 - 243.5561 = 74.0721$ with 6 degrees of freedom. The p value for the test is <0.0001 thus education level is a significant predictor.

Table 4.14. The likelihood ratio test statistic of model fit without dummy variables for education level

Test	statistic	DF	p value
Likelihood Ratio Test	243.5561	20	p-value=<0.001

4.3.2 Partner education level

$$H_0 : \beta_{jpsomeprimary} = \beta_{jpcompletedprimary} = \beta_{jpsecondaryandHigher} = 0$$

$$H_1 : \beta_{jpsomeprimary} \neq \beta_{jpcompletedprimary} \neq \beta_{jpsecondaryandHigher} \neq 0$$

For the model fit containing the dummy variables, the likelihood ratio statistics is

Table 4.15. The likelihood ratio test statistic of model fit with dummy variables for partner education level

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

The fit for the model without the dummy variables has its likelihood ratio test equal to;

Table 4.16. The likelihood ratio test statistic of model fit without dummy variables for education level

Test	statistic	DF	p value
Likelihood Ratio Test	297.80	20	p-value=<0.001

19.8282, is the difference in likelihood ratio test statistics with 6 degrees of freedom. pvalue= 0.00297 for the test, partner education level is a significant predictor.

4.3.3 Standard of Living Index

$$H_0 : \beta_{jpmiddle} = \beta_{jpricher} = \beta_{jprichest} = 0$$

$$H_1 : \beta_{jpmiddle} \neq \beta_{jpricher} \neq \beta_{jprichest} \neq 0$$

The likelihood ratio test statistic for the model with standard of living variable;

for the model fit without the dummy variables, the likelihood ratio test statistics ;

The difference in the test statistics 13.9306 with 6 degrees of freedom. From p-value=0.03042, standard of living index is a significant predictor.

Table 4.17. The likelihood ratio test statistic of model fit with dummy variables for standard of living index

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

Table 4.18. The likelihood ratio test statistic of model fit without dummy variables for standard of living index

Test	statistic	DF	p value
Likelihood Ratio Test	303.6976	20	p-value=<0.001

4.3.4 Age

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

The likelihood ratio test statistic for a model fit having age as a predictor;

Table 4.19. The likelihood ratio test statistic of model fit with age as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

for the model fit without age as a predictor, its likelihood ratio test statistics is

Table 4.20. The likelihood ratio test statistic of model fit without age as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	217.4738	24	p-value=<0.001

The difference in likelihood ratio test is 100.1544 with 2 degrees of freedom. p-value=<0.001 thus age is significant.

4.3.5 Number of Birth

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

For "number of birth" as predictor in the model fit, the likelihood ratio test statistics ;

The likelihood ratio test for model fit without "number of birth";

Overall number of birth is a significant predictor, p-value=<0.001. The difference in likelihood ratio statistics is 98.71681 with 2 degrees of freedom.

Table 4.21. The likelihood ratio test statistic of model fit with number of births as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

Table 4.22. The likelihood ratio test statistic of model fit without number of birth as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	218.9114	24	p-value=<0.001

4.3.6 Quality of media exposure

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

For the model fit with "quality of media exposure" as a predictor, the likelihood ratio test statistics is

Table 4.23. The likelihood ratio test statistic of model fit with quality of media exposure as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

The likelihood ratio test for the model fit without "Quality of media exposure" as a predictor;

Table 4.24. The likelihood ratio test statistic of model fit without quality of media exposure as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	313.7743	24	p-value=<0.001

The difference in likelihood ratio test statistics 3.85394 with 2 degrees of freedom and p-value=0.1456 thus "Quality of media exposure" is not a significant predictor overall.

4.3.7 Employment status

$$H_0 : \beta_{jp} = 0$$

$$H_1 : \beta_{jp} \neq 0$$

For the model fit having "employment status" as a predictor, the likelihood ratio test

Table 4.25. The likelihood ratio test statistic of model fit with employment status as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	317.6282	26	p-value=<0.001

Table 4.26. The likelihood ratio test statistic of model fit without employment status as a factor

Test	statistic	DF	p value
Likelihood Ratio Test	315.5603	24	p-value=<0.001

For the model fit without "employment status" as a predictor, the likelihood ratio test statistics; Difference in likelihood ratio test statistics is 2.0679 with 2 degrees of freedom and p-value=0.3556 hence "employment status" is not a significant predictor overall.

Table 4.27. Table showing the overall significance of all the predictors 4.12

predictor	p value
Age	p-value<0.001
Wife Education	$P < 0.001$
Partner Education	0.002970
Number of Children ever Born	p-value<0.001
Employment Status	0.3556
Standard of Living Index	0.03042
Quality of Media Exposure	0.1456

overall, respondent and partner education level, age, number of births and standard of living index are significant predictors of the choices of contraceptives methods. Quality of media exposure and employment status were not significant predictors 4.27. From the bivariate analysis there existed an association between the response variable and independent variables. With multinomial logistic regression, two independent variables (employment status and quality of media exposure) were insignificant determinants as a result dropped when fitting the reduced multinomial logistic model.

4.4 Significance Test for Overall Model Fit

Table 4.28. The Reduced Multinomial Logistic regression model of the Determinants of contraceptive method among Married Muslim women in Indonesia

Response	variable	Estimates	odds ratio(OR)	95%CI	p value
LONG-TERM METHODS	Intercept	-2.1564	0.1157	(0.0309,0.4328)	0.0014
	Age	-0.0469	0.9542	(0.9299,0.9791)	0.07326
	Education Some Primary	1.0787	2.9407	(1.2298,7.0321)	0.0153
	Education Completed Primary	1.8353	6.2671	(2.6083,15.0584)	<0.001
	Education Secondary and Higher	2.9626	19.3479	(7.8030,47.9742)	<0.001
	Partner Education Some Primary	-1.2357	0.2906	0.1055,0.8005)	0.0168
	Partner Education Completed Primary	-1.0706	0.3428	(0.1331,0.8828)	0.0265
	Partner Education Secondary and Higher	-1.0755	0.3411	(0.1314,0.8855)	0.0271
	Number of Birth	0.3167	1.3726	(1.2556,1.5004)	<0.001
	Standard of Living Index Middle	0.5783	1.7829	(0.7651,4.1549)	0.1804
	Standard of Living Index Richer	0.9285	2.5307	(1.1468,5.5847)	0.0215
	Standard of Living Index Richest	1.2093	3.3513	(1.5150,7.4132)	0.0028
SHORT-TERM METHODS	Intercept	-0.2350	0.7906	(0.1912,3.2685)	0.7435
	Age	-0.1156	0.8908	(0.8697,0.9124)	<0.001
	Education Some Primary	0.0839	1.0875	(0.6578,1.7980)	0.7437
	Education Completed Primary	0.3348	1.3976	(0.8289,2.3564)	0.2091
	Education Secondary and Higher	0.9656	2.6264	(1.4916,4.6246)	0.1465
	Partner Education Some Primary	1.5140	4.5448	(1.2705,16.2573)	0.0199
	Partner Education Completed Primary	1.7480	5.7430	(1.6173,20.3931)	0.0069
	Partner Education Secondary and Higher	1.5820	4.8645	(1.3546,17.4688)	0.0153
	Number of Birth	0.3494	1.4183	(1.3103,1.5351)	<0.001
	Standard of Living Index Middle	0.3955	1.4851	(0.8861,2.4891)	0.1333
	Standard of Living Index Richer	0.5405	1.7169	(1.0530,2.7993)	0.0302
	Standard of Living Index Richest	0.6454	1.9067	(1.1636,3.1243)	0.0104

The hypothesis testing;

H_0 : The Null model is a significant fit

H_1 : The Full model is a significant fit

The likelihood ratio test for the reduced multinomial logistic regression model;

Table 4.29. Table showing Likelihood ratio test for reduced multinomial logistic regression model

Test	statistic	DF	p value
Likelihood Ratio Test	311.6392	22	p-value= \leq 0.001

4.28 shows the reduced fitted multinomial regression model containing the significant determinants of choice of contraceptive methods among married Muslim women. The test indicated the model to be statistically significant Likelihood Ratio Test Statistics

equals 311.6392 with DF=22 and p value<0.001 4.29. There is a strong evidence of statistical association between choices of contraceptive methods and woman's age,wife and partner education level,number of births and standards of living index among married Muslim women.

4.4.1 Interpretation of Coefficient Estimates

Comparing Long-term contraceptive methods over not using any contraceptive method;

Age;while holding wife and partner education,number of births and standard of living index constant. With the increase in the age of the woman by one year,a married Muslim woman is 4.58% [AOR=0.9542,95% CI(0.9299,0.9791)] less likely to use long-term contraceptives methods over not using any contraceptive method.

Wife education level;while holding age,partner education level,number of births and standard of living index constant; A woman who has had some primary education is 2.9407 [AOR=2.9407,95% CI(1.2298,7.0321)] times more likely to use long-term contraceptives over not using any contraceptive method compared to married Muslim women with no schooling. A Muslim woman who has completed primary education level is 6.2671 [AOR=6.2671,95% CI(2.6083,15.0584)] times more likely to choose long-term contraceptives over not using any contraception compared to women with no education experience. A married Muslim woman who has secondary and higher education experience is 19.3479 [AOR=19.3479,95% CI(7.8030,47.9742)] times more likely to make use of long-term contraceptives over not using any contraception compared to women with no schooling.

Partner education level;while holding age,wife education level,number of births and standard of living index; married Muslim women whose partners had some primary,completed primary and secondary and higher education were 70.94% [AOR=0.2906,95% CI(0.1055,0.8005)],65.72% [AOR=0.3428,95% CI(0.1331,0.8828)] and 65.89% [AOR=0.3411,95% CI(0.1314,0.8855)] respectively less likely to choose long-term contraceptive methods over not using any contraceptive method compared to married Muslim women whose partners had no schooling.

Number of births;while holding age,wife and partner education level and standard of living index constant; As the number of children born increases by one birth,a married Muslim woman is 37.26% [AOR=1.3726,95% CI(1.2556,1.5004)] more likely to choose long-term contraceptives over not using any contraception method.

Standard of Living Index;while holding age,wife and partner education level and number of births; A married Muslim woman with middle,richer and richest standard of living index is 78.29% [AOR=1.7829,95% CI(0.7651,4.1549)]more,2.5307 [AOR=2.5307,95% CI(1.1468,5.5847)], 3.3513 [AOR=3.3513,95% CI(1.5150,7.4132)] times more likely use long-term contraceptives over not using any contraception compared to women with poorest standard of living.

Comparing short-term contraceptive methods over not using any contraceptive method Age of the woman;while holding wife and partner education,number of births and standard of living index constant; As the age of the married Muslim woman increases by one year,the woman is 10.92% [AOR=0.8908,95% CI(0.8697,0.9124)] less likely to use short-term contraceptives over not using any contraceptives method.

Number of births; while holding age,wife and partner education and standard of living index constant; As the number of births increase by one birth,a married Muslim woman is 41.83% [AOR=1.4183,95% CI(1.3103,1.5351)] more likely to use short-term contraceptives methods over not using any contraception.

Wife education level;while holding age,number of births,partner education level and standard of living index constant; A Muslim woman who has had secondary and higher,completed primary or had some primary education is 2.6264 [AOR=2.6264,95% CI(1.4916,4.6246)] times, 39.76% [AOR=1.3976,95% CI(0.8289,2.3564)], 8.75% [AOR=1.0875,95% CI(0.6578,1.798)] respectively more likely to choose short-term contraceptive methods over not using any contraceptives compared to women with no schooling.

Partner education level;while holding age,number of births,wife education level and standard of living index constant; A married Muslim woman whose partner had some primary,completed primary and secondary or higher education level is 4.5448 [95% CI(1.2705,16.2573)], 5.7430 [95% CI(1.6173,20.3931)], 4.8645 [95% CI(1.3546,17.4688)] times respectively more likely to use short-term contraceptives over not using any contraceptives compared to Muslim women whose partner had no schooling.

Standard of living index; while holding age, wife and partner education,number of births constant; A married Muslim woman with middle,richer and richest standards of living index is 48.51% [AOR=1.4851,95% CI(0.8861,2.4891)], 71.69% [AOR=1.7169,95% CI(1.0530,2.7993)], 90.67% [AOR=1.9067,95% CI(1.1636,3.1243)] respectively more likely to use short-term contraceptive methods over not using any contraception method compared to married Muslim with poorest standard of living index

The **multinomial logistic regression model fit** for predicting the choices of contraceptive methods given the specific values for the significant predictors.

$$\ln\left(\frac{pr(\text{Long - Term Contraceptive Method})}{pr(\text{Not - Using Contraceptive})}\right) = -2.1564 - 0.0469_{Age} + 1.0787_{Education_{some\ primary}} \\ + 1.8353_{Education_{completed\ primary}} \\ + 2.9626_{Education_{secondary\ and\ higher}} - 1.2357_{partner\ education_{some\ primary}} \\ - 1.0706_{partner\ education_{completed\ primary}} \\ - 1.0755_{Education_{secondary\ and\ higher}} + 0.3167_{Number\ of\ Births} \\ + 0.5783_{Living\ Index_{Middle}} \\ + 0.9285_{Living\ Index_{Richer}} + 1.2093_{Living\ Index_{Richest}}$$

$$\begin{aligned}
\ln\left(\frac{\text{pr}(\text{Short} - \text{TermContraceptiveMethod})}{\text{pr}(\text{Not} - \text{UsingContraceptive})}\right) = & -0.2350 - 0.1156_{\text{Age}} + 0.0839_{\text{Education}_{\text{someprimary}}} \\
& + 0.3348_{\text{Education}_{\text{completedprimary}}} \\
& + 0.9656_{\text{Education}_{\text{secondaryandhigher}}} + 1.514_{\text{partnereducation}_{\text{someprimary}}} \\
& + 1.748_{\text{partnereducation}_{\text{completedprimary}}} \\
& + 1.582_{\text{Education}_{\text{secondaryandhigher}}} + 0.3494_{\text{NumberofBirths}} \\
& + 0.3955_{\text{LivingIndex}_{\text{Middle}}} \\
& + 0.5405_{\text{LivingIndex}_{\text{Richer}}} + 0.6454_{\text{LivingIndex}_{\text{Richest}}}
\end{aligned}$$

5 Chapter 5: Discussion, Conclusion and Recommendation

5.1 Introduction

This section contains the discussion of the results, conclusion and recommendation of this study.

5.2 Discussion

The motivation of this work was to establish the predictors linked with the choice of contraceptive methods among married Muslim women in Indonesia. The sociodemographic characteristic of 1252 married Muslim women indicate 44% of the respondents were non-users of contraceptives, 20% long-term method users and 35.3% were users of short-term contraceptives 4.6. The mean and standard deviation of the wife age and number of births by a woman were (32.06,8.33) and (3.34,2.44) respectively 4.1. There was a very clear relation between wife age and number of children born by a woman, it was quite linear 4.4 and were not highly correlated, correlation coefficient 0.54, $p < 0.0001$ 4.5. There was no difference in age distribution among the three choices of contraception methods, mean and standard deviation for age in the three categories was similar 32.1 and 8.33 respectively 4.4. All the categorical variables were significantly associated with the options of birth control methods among married Muslim women in the Bivariate analysis performed with a chi-square test 4.6.

There was statistical evidence of an association between the choice of contraceptive methods and the level of education among the married Muslim women $\chi^2 = 121.76$, $pvalue < 0.001$ 4.6. The proportion of non-users of contraception were 67.8%, 52.7% and 43.6% among the illiterate, some primary or completed primary education respectively. The proportions decreased as the level of education improved 4.6. Married Muslim women with secondary and higher education level were [AOR=19.3479 95% CI(7.8030,47.9742)], [AOR=2.6264, 95% CI(1.4916,4.62461)] more likely to use long-term and short-term methods respectively over not using any method compared to those with no education. These findings are similar with the results from earlier studies carried out in Ghana and Bangladesh which showed education as a significant determinant of the use of contraceptives. Illiteracy has been identified in the previous studies as a factor which has effect on the use and knowledge of various contraception. Literate women were in all likelihood to make use of contraceptive in contrast to illiterate one. This research has pointed out wife education level to be linked with the use of various contraceptive methods, a finding supported by other previous researches. The effect of woman and partner education on the use of contraception is a direct one. Through education a woman gets to comprehend the benefits of using contraceptives, the various choices of contraception and understand the ones that best suits her

immediate needs. Married women with secondary and higher education are susceptible to use short or long-term contraceptive methods. This finding is probable since education is an indicator of numerous components that influence health-seeking conduct. Compared to those with secondary and higher education level, married women with low level of education do not own the degree of contraceptive literacy needed to make upright choices about their health and are worse placed to get control of the cultural barrier to use of different contraceptive methods. Its through the same education that women get to learn the benefits of having fewer children as this leads to small manageable families, impacting the well-being of their children and their productivity positively. This paper has shown partner education to be outstandingly identified with the use of contraceptives. Women who their partner had secondary and higher education were remarkably more justifiably to use any contraceptive method compared to those who their partner had no education. There was an increase in the probability of choosing short-term methods as the partner education level improved [AOR=4.8645, 95% CI(1.3546, 17.4688)] over not using any method compared to partners with no education, a finding similar to the study conducted in Bangladesh. Partner education level may be associated with improved health consciousness that may make the wife informed of and use contraceptives. A husband take part in making decisions of the family as Indonesian way of life upholds the concept of patriarchy. Thereafter a partner with better education experience may direct the wife to use contraceptives properly.

A study conducted in Zambia indicated age of the woman to be a significant determinant of contraceptive use with the odds of using any contraceptives increasing with age as the estimates showed 15.2% in 1992 to 49% in 2014 and modern methods users 8.9% to 44.8%. Among the married married Muslim Indonesian women, age was an important determinant factor for choosing contraceptive method for use. This study has drawn findings which contradict with the earlier studies conducted, indicated that at younger age women are likely to use various contraceptive methods for birth spacing and pregnancy timing because most of the women at this age haven't received the planned number of children. As opposed to younger women, older women are less likely to use any contraceptive method mainly at this particular age they experience infrequent sex coupled with menopause onset. As the age increased by one year the odds of using long-term and short-term methods were [AOR=0.9542, 95% CI(0.9299, 0.9791)], [AOR=0.8908, 95% CI(0.8697, 0.9124)] respectively. This findings are similar to the study conducted in Nigeria which revealed women at old age to have lower use of contraceptives.

This study has shown there is no significant effect of media exposure and employment status on the prevalence and choice of contraceptives methods however previous different researches have demonstrated a strong association between media exposure, employment status and use of contraceptives. A study conducted in Bangladesh indicated employment status a significant determinant of contraception use (p value < 0.001).

It revealed the use of contraceptives to be 60.9% and 67.2% among the unemployed and employed women respectively; [AOR=1.319,95%CI(1.193,1.458)]. The proportion among the employed and unemployed using modern contraceptives being 56.5% and 51.7% respectively (*Islam et.al*). This study has identified quality of media exposure as an insignificant predictor of the choices of contraceptives, these findings are similar to a research by (*Okach et.al*) where exposure to media and information on family planning failed to improve contraceptive use.

This study supports findings from other previous researches that elucidate women with better living standards can easily access and have higher tendency to use various contraceptive methods compared with their poor counterparts. Women from richer 57.1% and richest 61.8% families were at a lower risk of getting pregnant because of being in a position to access and purchase various contraceptive methods compared to their 37.9% poor counterparts. Findings from a study conducted in Malawi revealed the existence of a strong association between standards of living index and use of contraceptives. Results from this study have shown the same findings with the odds ratio of married Muslim from the richest wealth index to use long-term and short-term contraceptive methods being [AOR=3.3513,95% CI(1.5150,7.4132)], [AOR=1.9067,95% CI(1.1636,3.1243)] respectively. Standard of living index impact a woman's ability to look for family planning services in several mechanisms, financial ability, travel to and from and accessibility of areas. In this manner, women living in poverty environment are at danger of not using contraceptives. These discovery call for awareness because 17.1% and 9.9% of the married women are in the middle and poorest category at the time for study. For the sake of enhanced usage of various contraceptive methods, concerned stakeholders need to stretch out and make possible for women living in paucity.

In regard to the number of births, this study found it was a determinant factor among the married women. Married Muslim women with children are more likely to use any contraceptive method compared to women with no children. With every addition of one child, the probability of married Muslim woman to use long-term and short-term contraceptive methods increased 37% [AOR=1.3726,95% CI(1.2556,1.5004)] and 41.83% [AOR=1.4183,95% CI(1.3103,1.5351)] times respectively. These outcomes are much the same with the discoveries of a research carried out in Ghana. As the woman continues to sire children she makes use of the various contraception to help in birth spacing as this allows enough time for the proper care and development of the child. This study has indicated that the overall prevalence of contraceptive is low 55.8% with the users of long-term, non-users and short-term methods users being 20.5%, 44.2% and 35.3% respectively. This study has shown the choice of contraceptive methods to be influenced by the woman's age, woman and partner education level, number of children born and standard of living index.

5.3 Conclusion

In closure, this research shows the use of contraceptives to be low among married Muslim women 55.8% with non-users of contraceptives, long-term and short-term method users 44.2%, 20.5% and 35.3% respectively. The reduced multinomial logistic regression model fit was significant with $p - value < 0.001$ thus there existed an association between the choice of contraceptive methods and the given set of predictors. Overall, the choice of contraceptive method was significantly influenced by wife's education, partner education level, age of the woman, number of births and standard of life. Quality of media exposure and employment status were insignificant determinants. The choices of contraceptive methods varied with the levels of education standard of living, quality of media exposure and employment status.

5.4 Recommendation

Education level, age of the woman, number of children born and standard of living index remain significant determinants of choices of contraceptive methods and use among married Muslim women in Indonesia. Family planning services offered by the concerned stakeholders should be fine-tuned with these significant determinants which will lead to increased utilization of various contraceptive methods as a result maternal health targets within sustainable development goals are realized. The findings of this study recommend that concerned stakeholders should single out certain women and make an awareness in regard to contraception. Uneducated, younger and older women, and the poor should be targeted this may have a robust impact in improving their use of contraceptives which may translate to reduced maternal mortality. The study has found factors significantly linked with the choices of contraceptive methods exclusively among married Muslim women. Further studies may be carried out to investigate the significant factors related with the use and choices of contraceptive methods among married women from other religions in the region because different denominations have different teachings and interpretation on the subject contraception this may translate to increased contraceptive use in the region. Poor women were less likely to use any contraceptive method compared to their richer and richest counterparts, there seems to be a larger gap in use and choice of contraceptive methods between the poor and rich women. The findings from this study revealed quality of media exposure and employment status to be an insignificant predictor of choices of contraceptive methods, further studies in the region may be encouraged to find out if the results obtained are accurate since they contradict the study findings from most global and national studies.

References

Ajah LO, Dim CC, Ezegwui HU, Iyoke CA, Ugwu EO(2015). Male partner involvement in female contraceptive choices in Nigeria. *Journal of Obstetrics and Gynaecology*; 35:pg 628–631

Akinrinola Bankole, Shawn Malarcher(2010). Removing Barriers to Adolescents' Access to Contraceptive Information and Services. *Studies in Family Planning*; 41:pg 117–124.

Ahmed, S., Li, Q., Liu, L., and Tsui, A. O. (2012). Maternal deaths averted by contraceptive use: an analysis of 172 countries. *The Lancet*, 380(9837),pg 111–125

Arbab AA, Bener A, Abdulmalik M(2011). Prevalence, awareness and determinants of contraceptive use in Qatari women. *East Mediterr Health J*;17:pg 11–18

Ba DM, Ssentongo P, Agbese E, et al(2019). Prevalence and predictors of contraceptive use among women of reproductive age in 17 sub-Saharan African countries: a large population-based study. *Sex Reprod Healthc*;21:pg 26–32

Baldwin SB, Solorio R, Washington DL, Yu H, Huang YC, et al(2008). Who is using emergency contraception? Awareness and use of emergency contraception among California women and teens. *Women Health Issues*; 18:pg 360-68.

Bankole A, Malarcher S(2010). Removing barriers to adolescents' access to contraceptive information and services *Stud Family Plann.* 41, 2, pg 117-124.

Barden-O'Fallon J, Speizer IS, Cáliz J, Rodriguez F(2011). Contraceptive discontinuation among Honduran women who use reversible methods. *Stud Fam Plann*;42(1):pg 11–20.

Behrman JA, Wright KQ, Grant MJ, Soler-Hampejsek E(2018);49. Trends in Modern Contraceptive Use among Young Adult Women in sub-Saharan Africa 1990 to 2014. *Studies in Family Planning*.Issue 4, pg 319–344

Blumenthal PD, Voedisch A, Gemzell-Danielsson K(2010). Strategies to prevent unintended pregnancy: increasing use of long-acting reversible contraception. *Human Reprod Update*;17(1):pg 121–37

Canning D, Schultz TP(2012). The economic consequences of reproductive health and family planning. *Lancet*;380(9837):pg 165–71.

Fikree FF, Khan A, Kadir MM, Sajan F, Rahbar MH(2001). What influences contraceptive use among young women in urban squatter settlements of Karachi, Pakistan? *International Family Planning Perspective*; 27:pg 130-36.

Frost JJ, Lindberg LD(2013). Reasons for using contraception: Perspectives of US women seeking care at specialized family planning clinics. *Journal of contraception*; 87(4):pg 465-72.

Gottschalk LB, Ortayli N(2014). Interventions to improve adolescents' contraceptive behaviors in low- and middle-income countries: A review of the evidence base. *Contraception*; 90, No. 3, pg 211–225.

Guttmacher Institute(2020). Fact Sheet:Contraceptive Use in the United States. pg 6-8

Islam MR, Thorvaldsen G(2012). Family planning knowledge and current use of contraception among the Mru indigenous women in Bangladesh: a multivariate analysis. *Journal of Contraception*; 3:pg 9-16.

Islam R, Islam AZ, Rahman M(2013). Unmet need for family planning: experience from urban and rural areas in Bangladesh. *Public Health Research*; 3(3):pg 37-42

Jain AK(1989). Fertility reduction and the quality of family planning services.*Studies in Family Planning*; 20(1):pg 1-16.

Janowitz B, Stanback J, Boyer B(2012). Task sharing in family planning.*Stud Family Plann*;41(1): pg 57-62.

Kavanaugh, M. L., Frohwirth, L., Jerman, J., Popkin, R., and Ethier, K. (2013). Long-acting reversible contraception for adolescents and young adults: patient and provider perspectives.*Journal of Pediatric and Adolescent Gynecology*, 26(2) pg 86-95

Keesbury, Jill, Monica Wanjiru, and Katherine Maina(2010)."Mainstreaming emergency contraception pills in Kenya," policy brief. Nairobi: Population Council pg 2-9.

Khan MM, Hossain ME, Hoq MN(2012). Determinants of contraception use among female adolescents in Bangladesh. *Asian Soc Sci*;8:pg 181–91.

Lwelamira J, Mnyamagola G, Msaki MM(2012). Knowledge,attitude and practice (KAP) towards modern contraceptives among married women of reproductive age in Mpwapwa district, central Tanzania. *Current Research Journal of Social Sciences*; 4(3):pg 235-45.

Monteith RS, Anderson JE, Pineda MA, Santiso R, Oberle M(1985). Contraceptive use and fertility in Guatemala. *Studies in Family Planning*; 16(5):pg 279-288.

Morbidity and Mortality Weekly Report(2015), Vital Signs:Trends in Use of Long-Acting Reversible Contraception among Teens Aged 15–19 Years Seeking Contraceptive Services: United States,2005-2013 April 10, 2015 / Vol. 64 / No. 13, pg 363-369.

Mosher WD(2016) Trends and Determinants of IUD use in the USA,2002-2012.*Hum Reprod*;31:1696-702

Muanda MF, Ndongo GP, Messina LJ, Bertrand JT(2017);19. Barriers to modern contraceptive use in rural areas in DRC. *Culture, Health and Sexuality*.pg 1011–1023

Mustafa R, Afreen U, Hashmi HA(2008). Contraceptive knowledge, attitude and practice among rural women. *Journal of the College of Physicians and Surgeons Pakistan*; 18 (9):pg 542-45.

Nketiah-Amponsah E, Arthur E, Abuosi ALB-N-A(2012). Correlates of contraceptive use among Ghanaian women of reproductive age (15–49 years). *Afri J Reprod Heal*;16:pg 154–69.

Okezie C, Ogbe AO, Okezie CR(2010). Socio-economic determinants of contraceptive use among rural women in Ikwuano local government area of Abia state, Nigeria. *Int NGO J*;5(4):pg 74–7

Oni GA, Carthy JM(1986). Use of contraceptive for birth spacing in Nigerian City. *Studies in Family Planning*; 17(4):pg 163-71.

Oye-Adeniran BA, Adewole IF, Umoh AV, Oladokun A, Ghadegesin A, Ekanem EE, et al(2006). Community-based Study of Contraceptive Behavior in Nigeria. *African Journal of Reproductive Health*; 10(2):pg 90-104.

Palamuleni ME, Adebowale AS(2014). Women empowerment and the current use of long acting and permanent contraceptive: evidence from 2010 Malawi demographic and health survey. *Malawi Med J*;26:pg 63–70.

Philliber, A. E., Hirsch, H., Mortillaro, L., Turner, R., Arons, A., and Philliber, S. (2014). Impact of years of clinical experience on perceived contraindications and barriers to the use of LARC: a survey of family planning providers. *Women's Health Issues*, 24(5), pg 503-509

Rahman MM, Akter S, Mondal MNI(2008). Contraceptive Use among Married Women in Chuadanga District, Bangladesh. *Middle East Journal of Family Medicine*; 6(2):pg 22-27.

Rahman MM, Mondal MNI, Ali MK(2011). A study on the factors affecting the use of contraception in Bangladesh. *International Research Journal of Biochemistry and Bioinformatics*; 1(7):pg 178-83.

Rizwanaty Imma Aryanty et.al(2021) Uses of contraceptive and maternal mortality in Indonesia pg 3-11

Savabi Esfahany M, Fadaei S, Yousefy A(2006). Use of combined oral contraceptives: retrospective study in Isfahan, Islamic Republic of Iran. *East Mediterr Health J*;12(3-4):pg 417-22.

Stanback J, Qureshi Z, Nutley T, Sekadde Kigonda C;lancet(1999). Checklist for ruling out pregnancy among family-planning clients in primary care;pg 354,pg 566.

Stang A, Schwingl P, Rivera R.Bull World Health Organ 2000;78(8) New contraceptive eligibility checklists for provision of combined oral contraceptives and depotmedroxyprogesterone acetate in communitybased programmes; pg 1015-23.

Starbird E, Norton M, Marcus R(2016). Investing in family planning: key to achieving the sustainable development goals. *Glob Health Sci Pract*;4(2):pg 191-210.

Securva G(2013) Long-acting reversible contraception:A practical solution to reduce unintended pregnancy.Minerva 65;271-7

Tawiah EO(1997). Factors affecting contraceptive use in Ghana. *Journal of Biosocial Science*; 29:pg 141-49.

Tiruneh FN, Chuang K-Y, Ntenda PAM, et al(2016). Factors associated with contraceptive use and intention to use contraceptives among married women in Ethiopia. *Women Health*;56:pg 1-22.

Trussell J(2004). Contraceptive failure in the United States. *Contraception*;70(2):pg 89–96

United Nations Development Program,United Nations Population Fund,World Health Organization,World Bank Special Programme on Research, Development and Research Training on Human Reproduction(2000). Task Force on Post-Ovulatory Methods of Fertility Regulation. Efficacy and side effects of immediate postcoital levonorgestrel used repeatedly for contraception.*Contraception* ; 61:pg 303-8.

Williamson LM, Parkes A, Wight D, Petticrew M, Hart GJ(2009);6. Limits to modern contraceptive use among young women in developing countries: a systematic review of qualitative research. *Reproductive Health*; pg 3.

Winikoff, B.,Sullivan, M. (1987). Assessing the Role of Family Planning in Reducing Maternal Mortality Studies in Family Planning, 18(3),pg 128

World Health Organization Department of Reproductive Health and Research (WHO/RHR) and Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs (CCP), Knowledge for Health Project. Family Planning: A Global Handbook for Providers (2018 update). Baltimore and Geneva: CCP and WHO, 2018. pg 1-72,172-380

World Health Organization(2004). Medical eligibility criteria for contraceptive use, Third edition. Geneva: World Health Organization.pg 7-16