Jurnal Info Kesehatan
Vol. 22, No. 3, September 2024, pp. 595-608
P-ISSN 0216-504X, E-ISSN 2620-536X
DOI: *10.31965/infokes.Vol22.Iss3.1213*
Journal homepage: *https://jurnal.poltekkeskupang.ac.id/index.php/infokes*

RESEARCH Open Access

The Influence of Women's Empowerment on The Preference for Contraceptive Methods in Indonesia: A Multinomial Logistic Regression Modelling

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Received: 7 June 2023 Revised: 3 October 2023 Accepted: 21 March 2024

Abstract

The concept of women's empowerment encompasses enabling women to take control of their own lives, independently make choices, and fulfill their complete capabilities. Numerous research studies examined the correlation between the empowerment of women and their reproductive health. In Indonesia, female labor force participation is relatively low. As a result, research on the influence of empowering women on contraceptive method preference in Indonesia makes sense. This research aims to find the multinomial logistic regression model in choosing contraceptive methods for married women in Indonesia and to identify the women's empowerment traits that most impact contraceptive method choice. For this study, the researchers utilized secondary data obtained from the 2017 Indonesian Demographic and Health Survey (IDHS). The participants consisted of women between the ages of 15 and 49 who were married. The total number of respondents sampled was 49,216. Variables that significantly affect contraceptive method use include the respondent's current employment, the respondent has bank account or other financial institution accounts, the cumulative count of offspring previously born and beating justified if the wife argues with her husband. The analysis is obtained using the multinomial logistic regression test, independency, multicollinearity, and parameter test, and the selection is made by considering either the smallest value of Akaike's information criterion or the option that achieves the highest level of accuracy. Findings highlight four significant variables: Firstly, employed women are more likely to use contraceptives than the unemployed. Secondly, access to banking services correlates with a higher likelihood of contraceptive use. Thirdly, women with more children tend to prefer long-acting reversible contraceptives. Lastly, endorsement of spousal violence justifiability is linked to conventional contraceptive selection. These results emphasize the roles of employment, financial access, family size, and gender-based violence perceptions in shaping contraceptive choices in Indonesia. Model 3 emerges as the most accurate predictor of preferences after eliminating six variables based on rigorous testing and multicollinearity considerations. These findings underscore the importance of addressing economic empowerment and gender-related issues in Indonesian reproductive health programs and policies. Such a comprehensive approach can enhance women's autonomy, enabling them to make crucial life choices and ultimately improving their overall well-being.

Keywords: Contraceptive Method, Multinomial Logistic Regression Model, Women Empowerment.

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1. INTRODUCTION

Page and Czuba (1999) define women's empowerment as enabling women to govern their lives, make independent decisions, and actualize their full potential. Education, healthcare, economic opportunities, political engagement, and social rights must be available to women. Women's empowerment seeks to reduce gender inequality and discrimination while promoting gender equality by facilitating women's full participation in all societal sectors (James, 2022).

In Indonesia, participation of women in the labor force is relatively low, at approximately 51% in 2021, and has remained unchanged for more than two decades despite alterations to the economy's structure, advances in education, declining rates of early marriage, and declining fertility (Cameron et al., 2019; Dommaraju & Tan, 2024). In addition, the gender gap in workforce involvement is notably significant within the region, with an approximate rate of 30% (The World Bank, 2023).

Numerous studies have investigated the connection between the empowerment of women and their reproductive health. As an illustration, a report from the United Nations Population Fund investigated significant issues concerning reproductive health and rights that have an impact on women at various stages of their lives, such as early life opportunities, education, marriage, family, violence, and aging (UNFPA, 2000). A systematic review of the attributes used to assess the level of women's empowerment gains in the context of sexual and reproductive health revealed that the most frequently measured domains of women's empowerment included factors encompassed liberation from coercion, the capacity to make decisions, effective communication with a partner, the freedom to choose, personal control, autonomy, and the skill to negotiate (Vizheh et al., 2021). Additional research discovered a correlation between the empowerment of women and reduced fertility rates, longer gaps between births, and a decrease in unintended pregnancies (Upadhyay et al., 2014).

Contrary to the majority of Southeast Asian nations, Indonesia has a lower contraceptive prevalence. In 2017, the prevalence rate of contraceptive use among married women in Indonesia stood at 64% for all contraceptive methods, whereas the CPR for Southeast Asia was 74% in 2019 (The World Bank, 2021). The discrepancy was notably greater for present usage of long-acting and permanent methods (LAPM), which are known for their higher effectiveness and cost-efficiency compared to short-term methods (Aryanty et al., 2021). This low contraceptive utilization may hinder Indonesia's efforts to achieve the Sustainable Development Goals for reproductive health and gender equality, as it increases the likelihood of unintended pregnancies, maternal mortality, and poor infant health outcomes (United Nations, 2022; Women, 2022; World Health Organization, 2021).

Information on women's empowerment and the usage of contraceptives was gathered as part of the 2017 Indonesia Demographic and Health Survey (IDHS), providing an excellent opportunity to investigate the link in the context of Indonesia (USAID, 2017). Financial, sociocultural, interpersonal, constitutional, involved in politics, and psychological empowerment aspects may all impact women's reproductive health (Vizheh et al., 2021). This study will apply multinomial logistic regression to examine the correlation between women's empowerment and the utilization of contraceptives. Multinomial logistic regression is an expanded linear model that calculates the likelihood of the m categories of a qualitative dependent variable Y by considering a set of explanatory factors X. The natural logarithm of the probability (log-odds) ratio for the k-th class of Y vs. a reference category is estimated using a linear predictor function in this model (Carpita et al., 2013). As a dependent variable, this study used three kinds of contraceptive methods: current contraceptive method user, LAPM contraceptive method user, and non-contraceptive user. The reasons for doing this research were to (1) find the multinomial logistic regression model in choosing contraceptive methods for married women in Indonesia and to (2) identify the women's empowerment traits that most impact contraceptive method choice.

2. RESEARCH METHOD

The Indonesian Demographic and Health Survey (IDHS) from 2017 is the source of the secondary data that is used in this study. All of the respondents are married women, and their ages range from 15 to 49. The number of respondents sampled is 49,216. Following descriptive analysis, the data will be analyzed using multinomial logistic regression to determine the optimal model. Before modeling, it is necessary to carry out either an association or an independence test in order to establish whether or not each independent variable is connected to the dependent variable. In the experiments that were carried out, the Chi-Square Analysis was used. (McHugh, 2013). The subsequent step is data separation. Training data and test data are the two subsets that result from data splitting. The training data are utilised to train the model, while the test data are utilised to evaluate it. The commonly used data division ratio is to divide the data into two parts: training data comprising up to 80% of all data and test data comprising up to 20% of all data (Draelos, 2019). Then, modeling using multinomial regression was performed. A model suitability test is a type of hypothesis test that evaluates the degree to which a statistical model corresponds to a given data set. (Penn State, 2023), and a simultaneous test is a type of hypothesis test that compares multiple parameters in a regression model to specific values (Erhardt, 2013), and the degree to which a statistical model corresponds to a set of observations is determined by a goodness of fit test (Scribbr, 2022). Then, proceed with the finest model selection.

Table 1. The research variables used and their references

Variable Indicator	Description	Category	References
Y	Current contraceptive method	Not Using Contraceptive Short-Acting Contraceptive Method Long-Acting Contraceptive and Permanent Method (LAPM)	(Amo-Adjei et al., 2019; Hardiani et al., 2020; Orwa et al., 2022; Ugaz et al., 2016)
X1	Highest educational level	No Education Primary Secondary Higher	(Gayatri, 2022; Pazol et al., 2015)
X2	Respondent currently working	No Yes	(Credé et al., 2012; Melka et al., 2015)
X3	Has an account in a bank or other financial institution	No Yes	(Roy & Patro, 2022)
X4	Total children ever born	0 - 2 3 - 5 6 or more	(Orwa et al., 2022)
X5	Owns land alone or jointly	Does not own Alone only Jointly only Both alone and jointly	(Behrman, 2017)
X6	Individual or combined homeowner	Does not own Alone only Jointly only	(Allendorf, 2007; Gaddis et al., 2022;

		Both alone and jointly	Tibaijuka et al., 2017)
X7	Beating is justifiable if the wife and spouse dispute	No Yes Don't know	(Khan & Mofizul Islam, 2018)
X8	If the wife leaves the house without informing her spouse, she is entitled to be beaten.	No Yes Don't know	(Khan & Mofizul Islam, 2018)
X9	Frequency of watching television	Not at all Less than once a week At least once a week	(Westoff, 2001)
X10	Newspaper and magazine perusing frequency	Not at all Less than once a week At least once a week	(Westoff, 2001)

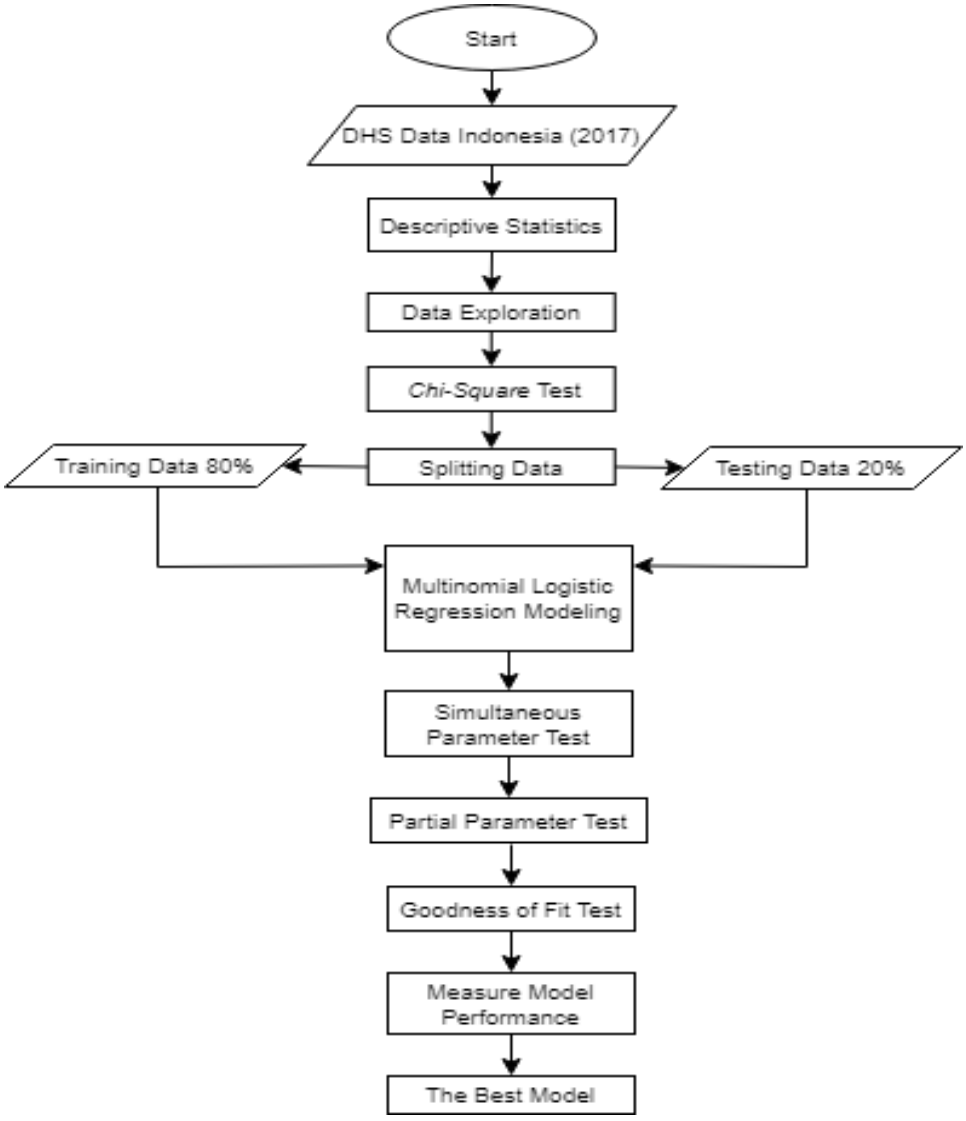

Figure 1. The stages of the research

Multinomial logistic regression is a statistical technique that extends logistic regression to categorical variables with more than two levels (Carpita et al., 2013). It is a useful technique

for analyzing multiclass classification problems in which the response variable can fall into multiple possible categories (Tan & Bellec, 2023). Multinomial logistic regression estimates the log odds of each category relative to a reference category, which is typically the most common or the last category. The model employs the maximum likelihood method to fit a set of binary logistic regressions for each category and implies that the observations are independent and have the same distribution. Multinomial logistic regression has several advantages over other methods, including the ability to manage nominal and ordinal response variables, robustness to non-normality and heteroscedasticity of the errors, and simplicity of interpretation and implementation. Nonetheless, it has limitations, such as requiring a large sample size, presuming predictor and category independence, and being sensitive to multicollinearity and outliers. (El-Habil, 2012; Hashimoto et al., 2020)

Given a set of predictor variables, it is used to model the probability of each possible outcome of the dependent variable (Efendi & Ramadhan, 2018).

The following is an example of the formula that may be written for multinomial logistic regression:

$$P(Y = j|X) = \frac{e^{\beta_{0j}+\beta_{1j}X_1+\cdots+\beta_{pj}X_p}}{1 + \sum_{k=1}^{J-1} e^{\beta_{0k}+\beta_{1k}X_1+\cdots+\beta_{pk}X_p}}$$

where $j = 1,2, \ldots, J-1$ are the categories of the dependent variable, $X = (X_1, X_2, \ldots, X_p)$ are the independent variables, and $\beta_{0j}, \beta_{1j}, \ldots, \beta_{pj}$ are the coefficients to be estimated (García-Portugués, 2023). The last category $j = J$ is the reference category and its probability is:

$$P(Y = J|X) = \frac{1}{1 + \sum_{k=1}^{J-1} e^{\beta_{0k}+\beta_{1k}X_1+\cdots+\beta_{pk}X_p}}$$

The coefficients can be interpreted as the log odds of choosing category j over category *J*, provided that there is a rise of one unit in the relevant independent variable (Penn State, 2023).

There are three potential outcomes for the dependent variable in a trichotomous logistic regression, a type of logistic regression. Three logit functions are subdivided from Y (Zhu & Fang, 2016). The predictor variables in a logistic regression can be categorical, numerical, or ordinal, however, depending on the software used, transformations or coding schemes may be necessary (Gwen, 2015).

The logistic model compares the likelihood of an event happening to the chance of the event not occurring on a logarithmic scale. The logistic regression models used are as follows:

$$Ln\ (P\ /\ 1 - p)\ =\ \beta_0\ +\ \beta_1 X_1\ +\ \beta_2 X_2\ +\ \beta_3 X_3 + \ \ldots\ +\ \beta_{10} X_{10}$$

where *Ln* is the natural logarithm and *P* is the probability of the respondent selecting the type of contraceptive method.

The following methods of data analysis are used while using multinomial logistic regression:

Maximum likelihood is a viable technique for estimating parameters, specifically it is used to estimate the logit model when the response variable is a qualitative scale. It seeks to obtain a classification model (Qudratullah, 2011). The maximum likelihood function is:

$$l(\beta) = \prod \pi_{0.}(x_i)^{y0i}\, \pi_{1.}(x_i)^{y1i}\, \pi_{2.}(x_i)^{y2i}, \text{ with } \sum i.j = 1 \qquad (1)$$

if so, the log function is a likelihood:

$$l(\beta) = \sum y_{1ig1}\,(x_i) + y_{2ig2.}(x_i) - \ln.(1 + e.^{g1(x_i)} + e.^{g2(x_i)}) \qquad (2)$$

Through the utilization of a hypothesis test, assess the importance of parameters along side the test statistic G or the likelihood ratio.

H_0: $\beta_1 = \beta_1 = \ldots = \beta_p = 0$

H_a: there is a minimum of one $\beta_j \neq 0$, with $j = 1,2,3,.., p$

Hence, test statistics $G = -2ln\left[\frac{L_0}{L_a}\right]$

In this context, L_0 denotes the likelihood when there are no independent variables, while L_a represents the likelihood when independent variables are present. $G > x^2_{(df, a)}$ or p-value < α were the requirements for rejecting H_0 as the null hypothesis.

Consequently, a partial test employing a Wald test and a hypothesis

$H_0: \beta_j = 0$

$H_a: \beta_j \neq 0$, with $j = 1, 2, 3, \ldots, p$

Test criteria for rejecting H_0 were $W > x^2_{(df, \alpha)}$ or p-value < α.

Next, the classification's precision must be calculated. The Apparent Error Rate (APER), which quantifies classification error, is used as a standard for comparing various classification methods. Following the analysis, the results are interpreted and conclusions are derived.

3. RESULTS AND DISCUSSION

The findings are based on an examination of data from the 2017 Indonesian Demographic and Health Survey, which was conducted on 49,216 married women between the ages of 15 and 49. Using multinomial logistic regression, the use of contraceptive methods was classified as follows: Non-Contraceptive Method Users (0), Short-Acting Contraceptive Method Users (1), and Long-Acting Contraceptive Method Users (2) are detailed in Table 2 below.

Table 2. Dependent variable descriptive statistics

Category	N	Percentages
Not Using Contraceptive	28,366	57.64%
Short-Acting Contraceptive Method	16,322	33.16%
Long-Acting Contraceptive and Permanent Method (LAPM)	4,528	9.20%

The findings of the descriptive analysis regarding the distribution of contraceptive methods used, considering the independent factors, are also presented in Table 3.

Table 3. The proportion of contraceptive methods utilized based on independent variables

Variable	Category	Current Contraceptive Method			Total (%)
		Not Using Contraceptive (%)	Short Acting Contraceptive Method (%)	Long-Acting and Permanent Contraceptive Method (%)	
Highest educational level	No Education	69.8	23.3	6.9	100
	Primary	45.1	44.3	10.6	100
	Secondary	58.8	32.5	8.6	100
	Higher	69.6	21.2	9.2	100
Respondent currently working	No	60.8	31.5	7.7	100
	Yes	54.9	34.6	10.5	100
Has an account in a bank or other financial institution	No	56.8	35	8.2	100
	Yes	59	30.2	10.8	100

Total children ever born	0 - 2	66.1	28.2	5.8	100
	3 - 5	33.9	48	18.1	100
	6 or more	53.1	29.7	17.2	100
Owns land alone or jointly	Does not own	63.9	28.6	7.6	100
	Alone only	48.5	39.7	11.8	100
	Jointly only	41.6	45.2	13.3	100
	Both alone and jointly	39.9	45.5	14.7	100
Individual or combined homeowner	Does not own	72	22.6	5.4	100
	Alone only	46.5	40.7	12.8	100
	Jointly only	41.1	45.7	13.2	100
	Both alone and jointly	41.3	44.6	14.1	100
Beating is justifiable if the wife and spouse dispute	No	56.9	33.8	9.4	100
	Yes	62.3	29.1	8.6	100
	Don't know	76.8	18.9	4.3	100
If the wife leaves the house without informing her spouse, she is entitled to be beaten	No	57.2	33.3	9.5	100
	Yes	57.5	34	8.5	100
	Don't know	79.1	16.6	4.3	100
Frequency of watching television	Not at all	64	27.2	8.9	100
	Less than once a week	64.9	27.2	7.8	100
	At least once a week	56.1	34.4	9.4	100
Newspaper and magazine perusing frequency	Not at all	53.1	37.3	9.6	100
	Less than once a week	62.3	29.5	8.2	100
	At least once a week	64.7	24.9	10.3	100

To determine whether or not each independent variable is related to the dependent variable in question, an association test must first be conducted. If the p-value is below 0.05, it indicates a significant correlation between the independent and dependent variables. All the results from these tests are presented in Table 4.

Table 4. Chi-square value, degrees of freedom, and p-value of association test results between independent and dependent variables (contraceptive method type).

Independent Variable	**Chi-square value**	**Degrees of freedom**	***P-value***	**Explanation**
X1	1.50E+03	6	0.000	significant
X2	214.7311	2	0.000	significant

X3	172.9504	2	0.000	significant
X4	4.30E+03	4	0.000	significant
X5	1.80E+03	6	0.000	significant
X6	4.40E+03	6	0.000	significant
X7	193.2954	4	0.000	significant
X8	172.7246	4	0.000	significant
X9	220.7897	4	0.000	significant
X10	563.4004	4	0.000	significant

All independent variables have significant results, so they can be included in the model, as indicated by the Chi-square test for association.

The data was separated into two portions, with 80% (39,374 observations) serving as training data and 20% (9,842 observations) serving as testing data. 13,058 respondents used short-term contraceptive methods, 3,623 respondents used long-term contraceptive methods, and the remaining respondents did not use any contraceptive method.

The first stage of this analysis involves parameter estimation. Maximum likelihood is the technique used to estimate parameters. The following are the multinomial logistic regression models derived from the data:

Table 5. Multinomial Logistic Regression Model with Estimated Beta Parameters

Outcome	**Model Equation**
Short-acting	$-2.466246 + 1.0604205X_{1} + 0.8777065X_{1.2} + 0.4077558X_{1.3} + 0.07597136X_{2.1} + (-0.006698947)X_{3.1} + 0.8034334X_{4.1} + (-0.2295113)X_{4.2} + 0.16469257X_{5.1} + 0.2576877X_{5.2} + 0.3232909X_{5.3} + 0.6624479X_{6.1} + 0.9076546X_{6.2} + 0.8572474X_{6.3} + (-0.4295599)X_{7.1} + (-0.5186410)X_{7.8} + 0.02907216\ X_{8.1} + (-0.6536242)X_{8.8} + 0.2530513X_{9.1} + 0.5852642X_{9.2} + (-0.2478894)X_{10.1} + (-0.32135278)X_{10.2}$
Long-acting	$-4.160019 + 0.9226893X_{1} + 0.9476823X_{12} + 0.8668599X_{13} + 0.14850372X_{21} + 0.242123825X_{31} + 1.4867638X_{4.1} + 0.9685709X_{4.2} + 0.07539328X_{5.1} + 0.2019620X_{5.2} + 0.3059393X_{5.3} + 0.7614356X_{6.1} + 0.9243671X_{6.2} + 0.9554464X_{6.3} + (-0.2019081)X_{7.1} + (-0.5312874)X_{7.8} + -0.09151486X_{8.1} + (-0.7558995)X_{8.8} + 0.1662635X_{9.1} + 0.4115364X_{9.2} + (-0.2127186)X_{10.1} + (-0.08075873)X_{10.2}$

By analyzing the coefficient values of the parameter β as presented in Table 5, two functions are derived for the multinomial logit model. In this model, the variable Y represents the type of contraceptive method used, while the explanatory variables X1, X2, X3, X4, X5, X6, X7, X8, X9, and X10 correspond to the highest level of education, current employment status of the respondent, possession of a bank account or financial institution, number of children ever born, land ownership, house ownership, justification for physical violence in case of argument with the spouse, justification for physical violence if the wife goes out without informing the husband, frequency of watching television, and frequency of reading newspapers or magazines, respectively.

Table 6. Multicollinearity Test

	GVIF	**Df**	**GVIF^(1/(2*Df))**
X1	132.158885	3	2.256919
X2	2.613126	1	1.616517
X3	2.188419	1	1.47933

X4	2.321173	2	1.234317
X5	4.969072	3	1.306309
X6	7.476194	3	1.398342
X7	1.664873	2	1.135914
X8	2.009338	2	1.190593
X9	32.894166	2	2.394858
X10	2.460344	2	1.252417

Upon examining the analysis results, it is observed that there are four variables with a GVIF value exceeding 4, as indicated in Table 6, thus there is an indication of significant collinearity. Then the variables X1 (highest educational level), X5 (owns land alone and jointly), X6 (owns house alone or jointly), and X9 (frequency of watching television) are excluded from the model.

After removing four variables from the results of the multicollinearity test, the Simultaneous Test was conducted utilizing the second model. The objective of this Simultaneous Test is to ascertain the significance of the explanatory variable's influence on the selection of contraceptive method.

Table 7. Simultaneous Test

Model	#Df	LogLik	Df	Chisq	Pr(>Chisq)
1	22	-33497			
2	2	-35561	20	4128.7	< 2.2e-16 ***

Table 7 shows that the G value is 4128.7 and the P value is 2.2e-16, where the P value is 0.05, indicating that H0 is rejected. It may be inferred that the factors have an explanatory impact on the choice of contraceptive method.

After examining the test results displayed in Table 8, it was observed that the variables X8 and X10 were deemed statistically insignificant. As a result, these variables were eliminated from the model.

Table 8. Partial Test

Contraceptive Method		Wald	Sig.	Exp(B)	Information
Short-Acting	Intercept	-30.89355	0	-0.6901545	significant
	X21. Yes	6.95412	3.55E-12	0.1623067	significant
	X31. Yes	-4.282153	1.85E-05	-0.1064127	significant
	X41. 3-5	43.52826	0	1.156599	significant
	X42. 6 or more	2.28052	0.02257687	0.1585507	significant
	X71. Yes	-8.526032	0	-0.4478368	significant
	X78. Don't Know	-5.257048	1.46E-07	-0.5405438	significant
	X81. Yes	2.325803	0.02002906	0.06840515	significant
	X88. Don't Know	-5.856035	4.74E-09	-0.6964467	significant
	X101. Less Than Once A Week	-13.087182	0.00E+00	-0.3289011	significant

	X102. At Least Once A Week	-12.447088	0	-0.50206001	significant
Long Acting	Intercept	-62.24214	0	-2.5328383	significant
	X21. Yes	6.055314	1.40E-09	0.2329102	significant
	X31. Yes	6.779128	1.21E-11	0.2677963	significant
	X41. 3-5	45.23528	0	1.784906	significant
	X42. 6 or more	14.53625	0	1.2706014	significant
	X71. Yes	-2.665878	0.007678763	-0.2225248	significant
	X78. Don't Know	-3.007951	2.63E-03	-0.5516749	significant
	X81. Yes	-1.364916	0.17227955	-0.06690977	not significant
	X88. Don't Know	-3.686357	2.274869e-04	-0.8007519	significant
	X101. Less Than Once A Week	-5.371077	7.83E-08	-0.2232355	significant
	X102. At Least Once A Week	-1.492763	0.1354992	-0.09036896	not significant

Based on the results obtained from Hosmer and Lemeshow's goodness-of-fit test, the p-value is found to be below 0.05. This suggests that the model fits the data well and supports the implementation of the multinomial logit model.

Table 9. Hosmer and Lemeshow Test (Multinomial Model)

Step	**Chi-Square**	**Degrees of Freedom**	**p-Value**
1	91.754	10	2.44E-15

Three models' accuracy and AIC values are compared in Table 10.

Table 10. Model Accuracy and AIC Comparison

Model	**Accuracy**	**AIC**
1	0.6145092	64669.94
2	0.6074985	67037.12
3	0.6091242	67346.83

Model 1 has the highest accuracy (61.45%) and the lowest AIC (64669.94) among the three models, implying that it performs the best. Models 2 and 3 have marginally lower accuracy values (60.75% and 60.9%) and higher AIC values (67037.12 and 67346.83, respectively) than Model 1. However, based on the test parameters and multicollinearity, the optimal model eliminates six variables. Based on these results, Model 3 appears to be the most accurate and best-fitting model.

Ten factors were examined for their impact on respondents' choice of the contraceptive method using multinomial logistic regression, and only four were found to be significant: respondents' current employment status, the presence of a bank or other financial institution account, respondents' total number of children, and respondents' belief that husbands are justified in hitting wives during arguments.

The findings of this study indicate that employed women had a higher likelihood of using contraceptive methods compared to unemployed women. These results align with a previously

published report from the National Family and Health Survey. (Zaidi, 2022). Additionally, the research revealed that women who possessed bank accounts had a higher tendency to use contraceptive methods compared to those who did not have bank accounts. These findings suggest that economic factors, such as employment and access to financial services, may play a role in influencing women's choices regarding contraception (D'Souza et al., 2022; Gammage et al., 2020).

Earlier studies have demonstrated a positive association between women who believed that husbands were justified in using physical violence during disagreements and their inclination to opt for conventional methods of contraception, such as withdrawal and rhythm, than those who did not (Khan & Mofizul Islam, 2018; Ogunjuyigbe et al., 2005). This study suggests that women's choices regarding contraception are influenced by their perceptions of gender-based violence. Consistent with prior research, the results of this study demonstrate that women or couples who have a higher number of children or have achieved their desired family size are more inclined to opt for long-acting reversible contraceptive methods (LARCs), which offer greater effectiveness and convenience.

4. CONCLUSION

Using multinomial logistic regression on ten independent variables that influence contraceptive method use, four variables were found to have a significant effect: the respondent is currently employed, has a bank account or other financial institution account, the cumulative count of children previously born and the husband's perceived justification for physical violence in marital conflicts. The analysis of contraceptive method classifications using multinomial logistic regression strongly indicates that Model 3 emerges as the most precise and best-fitting model. To enhance the quality of future research outcomes, it is recommended that additional investigations explore other variables associated with women's empowerment, which can influence contraceptive method usage in Indonesia. Future researchers can investigate the impact of the level of education among women, their independence in making decisions, mobility, social support, exposure to mass media, as well as additional women's empowerment attributes that may influence their contraceptive choices. Furthermore, upcoming researchers can examine the evolving trends in contraceptive usage and indicators of women's empowerment by utilizing more recent data outlets, like the soon-to-be-published 2022 Indonesia Demographic and Health Survey. This will enable a comprehensive analysis of the subject matter over time.

REFERENCES

Allendorf, K. (2007). Do Women's Land Rights Promote Empowerment and Child Health in Nepal? *World Development*, *35*(11), 1975-1988. https://doi.org/10.1016/j.worlddev.2006.12.005

Amo-Adjei, J., Mutua, M., Mukiira, C., Mutombo, N., Athero, S., Ezeh, A., & Izugbara, C. (2019). Fertility intentions and the adoption of long-acting and permanent contraception (LAPM) among women: Evidence from Western Kenya. *BMC Women's Health*, *19*, *26*. https://doi.org/10.1186/s12905-019-0716-3

Aryanty, R. I., Romadlona, N. A., Besral, B., Panggabean, E. D. P., Utomo, B., Makalew, R., & Magnani, R. J. (2021). Contraceptive use and maternal mortality in Indonesia: a community-level ecological analysis. *Reproductive Health*, *18*, *42*. https://doi.org/10.1186/s12978-020-01022-6

Behrman, J. A. (2017). Women's land ownership and participation in decision-making about reproductive health in Malawi. *Population and Environment*, *38*, 327–344. https://doi.org/10.1007/s11111-017-0272-4

Cameron, L., Suarez, D. C., & Rowell, W. (2019). Female Labour Force Participation in Indonesia: Why Has it Stalled? *Bulletin of Indonesian Economic Studies*, *55*(2), 157-192. https://doi.org/10.1080/00074918.2018.1530727

Carpita, M., Sandri, M., Simonetto, A., & Zuccolotto, P. (2013). Football Mining with R. In *Data Mining Applications with R*. 397-433. https://doi.org/10.1016/B978-0-12-411511-8.00015-3

Credé, S., Hoke, T., Constant, D., Green, M. S., Moodley, J., & Harries, J. (2012). Factors impacting knowledge and use of long acting and permanent contraceptive methods by postpartum HIV positive and negative women in Cape Town, South Africa: A cross-sectional study. *BMC Public Health*, *12*,*197*. https://doi.org/10.1186/1471-2458-12-197

Dommaraju, P., & Tan, J. (2024). Going against global marriage trends: the declining age at first marriage in Indonesia. *Asian Population Studies*, 20(2), 144-164. https://doi.org/10.1080/17441730.2023.2193488

Draelos, R. (2019). *Best Use of Train/Val/Test Splits, with Tips for Medical Data*. Glassbox Medicine. Retrieved from: https://glassboxmedicine.com/2019/09/15/best-use-of-train-val-test-splits-with-tips-for-medical-data/

D'Souza, P., Bailey, J. V., Stephenson, J., & Oliver, S. (2022). Factors influencing contraception choice and use globally: a synthesis of systematic reviews. The European *Journal of Contraception & Reproductive Health Care*, 27(5), 364-372. https://doi.org/10.1080/13625187.2022.2096215

Efendi, A., & Ramadhan, H. W. (2018). Parameter estimation of multinomial logistic regression model using least absolute shrinkage and selection operator (LASSO). *AIP Conference Proceedings*, *2021*. https://doi.org/10.1063/1.5062766

El-Habil, A. M. (2012). An application on multinomial logistic regression model. *Pakistan Journal of Statistics and Operation Research*, *8*(2), 271-291. https://doi.org/10.18187/pjsor.v8i2.234

Erhardt, E. (2013). *R lm simultaneous parameter tests. Cross Validated.* Cross Validated. Retrieved from: https://stats.stackexchange.com/questions/50284/r-lm-simultaneous-parameter-tests

Gaddis, I., Lahoti, R., & Swaminathan, H. (2022). Women's legal rights and gender gaps in property ownership in developing countries. *Population and Development Review*, 48(2), 331-377. https://doi.org/10.1111/padr.12493

Gammage, S., Joshi, S., & Rodgers, Y. V. D. M. (2020). The intersections of women's economic and reproductive empowerment. *Feminist Economics*, 26(1), 1-22. https://doi.org/10.1080/13545701.2019.1674451

García-Portugués. (2023). *Notes for Predictive Modeling*. Retrieved from: https://bookdown.org/chua/ber642_advanced_regression/multinomial-logistic-regression.html

Gayatri, M. (2022). The use of long-acting and permanent contraceptive methods (LAPMs) among women who have completed childbearing in Indonesia: does informed choice matter?. *The European Journal of Contraception & Reproductive Health Care*, 27(1), 28-33. https://doi.org/10.1080/13625187.2021.2008347

Gwen. (2015). *Type of predictors for logistic regression*. Cross Validated. Gwen. Retrieved from: https://stats.stackexchange.com/questions/149056/type-of-predictors-for-logistic-regression

Hardiani, H., Hastuti, D., Islakhiyah, I., & Junaidi, J. (2020). Determinants of Long-Acting and Permanent Methods (LAPMS) of contraception use in Jambi Province, Indonesia. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah*, 8(4), 353-368. https://doi.org/10.22437/ppd.v8i4.10701

Hashimoto, E. M., Ortega, E. M. M., Cordeiro, G. M., Suzuki, A. K., & Kattan, M. W. (2020). The multinomial logistic regression model for predicting the discharge status after liver

transplantation: estimation and diagnostics analysis. *Journal of Applied Statistics*, *47*(12), 2159–2177. https://doi.org/10.1080/02664763.2019.1706725

James, D. (2022). Women Empowerment: A Literature Review. *Acta Scientific Women's Health*, 4 (7), 60-64. https://doi.org/10.31080/aswh.2022.04.0377

Khan, M. N., & Islam, M. M. (2018). Women's attitude towards wife-beating and its relationship with reproductive healthcare seeking behavior: A countrywide population survey in Bangladesh. *PloS one*, 13(6), e0198833. https://doi.org/10.1371/journal.pone.0198833

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia medica*, 23(2), 143-149. https://doi.org/10.11613/BM.2013.018

Melka, A. S., Tekelab, T., & Wirtu, D. (2015). Determinants of long acting and permanent contraceptive methods utilization among married women of reproductive age groups in western Ethiopia: A cross-sectional study. *Pan African Medical Journal*, *21,246*. https://doi.org/10.11604/pamj.2015.21.246.5835

Ogunjuyigbe, P. O., Akinlo, A., & Ebigbola, J. A. (2005). Violence against women: an examination of men's attitudes and perceptions about wife beating and contraceptive use. *Journal of Asian and African Studies*, 40(3), 219-229. https://doi.org/10.1177/0021909605055070

Orwa, J., Gatimu, S. M., Ngugi, A., Agwanda, A., & Temmerman, M. (2022). Factors associated with use of long-acting reversible and permanent contraceptives among married women in rural Kenya: A community-based cross-sectional study in Kisii and Kilifi counties. *PloS one*, 17(10), e0275575. https://doi.org/10.1371/journal.pone.0275575

Page, N., & Czuba, C. E. (1999). Empowerment: What is it. *Journal of extension*, 37(5), 1-5.

Pazol, K., Zapata, L. B., Tregear, S. J., Mautone-Smith, N., & Gavin, L. E. (2015). Impact of contraceptive education on contraceptive knowledge and decision making: a systematic review. *American journal of preventive medicine*, 49(2), S46-S56. https://doi.org/10.1016/j.amepre.2015.03.031

Penn State. (2023). *Analysis of Discrete Data*. Penn State.

Roy, P., & Patro, B. (2022). Financial inclusion of women and gender gap in access to finance: A systematic literature review. *Vision*, 26(3), 282-299. https://doi.org/10.1177/09722629221104205

Scribbr. (2022). *Chi-Square Goodness of Fit Test | Formula, Guide & Examples*. Scribbr. Retrieved from: https://www.scribbr.com/statistics/chi-square-goodness-of-fit/

Tan, K., & Bellec, P. C. (2023). Multinomial logistic regression: Asymptotic normality on null covariates in high-dimensions. *Advances in Neural Information Processing Systems*, 36. Retrieved from: https://proceedings.neurips.cc/paper_files/paper/2023/hash/e0ac27bf3327c9cb99cc5f548db4f73a-Abstract-Conference.html

The World Bank. (2021). *Contraceptive prevalence, any method (% of married women ages 15-49) - Indonesia*. The World Bank. Retrieved from: https://data.worldbank.org/indicator/SP.DYN.CONU.ZS?locations=ID

The World Bank. (2023). *The World Bank's Gender Data Portal*. The World Bank. Retrieved from: https://genderdata.worldbank.org/

Tibaijuka, L., Odongo, R., Welikhe, E., Mukisa, W., Kugonza, L., Busingye, I., ... & Bajunirwe, F. (2017). Factors influencing use of long-acting versus short-acting contraceptive methods among reproductive-age women in a resource-limited setting. *BMC women's health*, 17, 1-13. https://doi.org/10.1186/s12905-017-0382-2

Ugaz, J., Banke, K., Rahaim, S., Chowdhury, W., & Williams, J. (2016). Private providers' knowledge, attitudes and misconceptions related to long-acting and permanent

contraceptive methods: a case study in Bangladesh. *Contraception*, 94(5), 505-511. https://doi.org/10.1016/j.contraception.2016.06.004

UNFPA. (2000). *Women's empowerment and reproductive health: Links throughout the life cycle*. UNFPA. Retrieved from: https://www.unfpa.org/publications/womens-empowerment-and-reproductive-health

United Nations. (2022). *Goal 5: Achieve gender equality and empower all women and girls*. United Nations. Retrieved from: https://www.un.org/sustainabledevelopment/gender-equality/

Upadhyay, U. D., Gipson, J. D., Withers, M., Lewis, S., Ciaraldi, E. J., Fraser, A., ... & Prata, N. (2014). Women's empowerment and fertility: a review of the literature. *Social science & medicine*, 115, 111-120. https://doi.org/10.1016/j.socscimed.2014.06.014

USAID. (2017). *Indonesia: Standard DHS, 2017*. USAID. Retrieved from: https://dhsprogram.com/methodology/survey/survey-display-522.cfm

Vizheh, M., Muhidin, S., Behboodi Moghadam, Z., & Zareiyan, A. (2021). Women empowerment in reproductive health: a systematic review of measurement properties. *BMC Women's Health*, 21, 1-13. https://doi.org/10.1186/s12905-021-01566-0

Westoff. (2001). *Mass media and reproductive behavior in Africa. Demographic and Health Surveys Analytical Reports No. 2*. Calverton, Maryland: ORC Macro. Retrieved from: https://dhsprogram.com/pubs/pdf/AR2/AR2.pdf

Women, U. (2022). *Progress on the Sustainable Development Goals: The gender snapshot 2022*. https://www.unwomen.org/en/digital-library/publications/2022/09/progress-on-the-sustainable-development-goals-the-gender-snapshot-2022

World Health Organization. (2021). *The future we expect: women's health and gender equality*. World Health Organization. Retrieved from: https://www.who.int/news/item/28-06-2021-the-future-we-expect-women-s-health-and-gender-equality

Zaidi, T. (2022). *Working women are more likely to use modern contraception, shows NFHS-5 findings*. Retrieved from: https://www.businesstoday.in/latest/story/working-women-are-more-likely-to-use-modern-contraception-shows-nfhs-5-findings-332650-2022-05-06

Zhu, Y., & Fang, J. (2016). Logistic regression–based trichotomous classification tree and its application in medical diagnosis. *Medical Decision Making*, 36(8), 973-989. https://doi.org/10.1177/0272989X1561865