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A Kernel Logistic Regression Approach to Understanding the "*Banyak Anak Banyak Rezeki*" Stigma

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ABSTRACT

Indonesia, the world's 4th largest country with a population of 270 million in 2020, faces many challenges due to rapid population growth, including biodiversity loss and increased consumption of natural resources. One of the cultural factors underlying the high rate of population growth is the perception of "*Banyak Anak Banyak Rezeki*" that develops in the community. This study aims to identify and model the factors that influence the "*Banyak Anak Banyak Rezeki*" stigma and find solutions to overcome this problem. The research method used was quantitative, with a sample of 384 people in South Sulawesi, consisting of Bugis, Makassar, Toraja, and Mandar tribes. The variables studied include religiosity, tradition, number of children, and cognitive dissonance. The analysis techniques used were logistic regression (LR) and kernel logistic regression (KLR). The results showed that religiosity, number of children, and cognitive dissonance had a significant effect on the "*Banyak Anak Banyak Rezeki*" stigma. The accuracy of the LR model reached 87.01% and increased to 93.51% after using KLR.

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A. INTRODUCTION

Indonesia has the 4th largest population in the world, currently at 270 million people, an increase of around 12.2% in 10 years. The very rapid increase in population is the main cause of the loss of biodiversity and various resources needed for life on earth (Akhirul et al., 2020). The increase in consumption and production that occurs in Indonesia impacts the rate of deforestation, excessive use of land, food, water, air, fossil fuels, and minerals, as well as waste from consumption, such as air and water pollution, toxic materials, and greenhouse gases. and the reduction in forest area from initially 144 million hectares in 2016 to 120 million hectares in 2021, slowly displacing other species (Cafaro et al., 2022).

In terms of health, COVID-19 has exposed the weaknesses of the health service system in Indonesia and the lack of coordination between governments in dealing with the health crisis. Indonesia is the country with the second highest number of deaths in Asia,

with 161,916 cases, and the highest in ASEAN, where the root of the problem identified is human overpopulation (Darmawan, 2023). The Indonesian government, through the Family Planning (KB) program, has made efforts to control the number of births and the ideal birth age interval to achieve quality family formation (Dewi, 2016), but challenges still exist in overcoming the cultural and social stigma associated with the number of children. In South Sulawesi Province, population growth is one of the significant factors influencing open unemployment (Wahab, 2022), which is currently 4.33 and is one of the highest on the island of Sulawesi (Badan Pusat Statistik Sulawesi, 2023).

Factors that are thought to influence population growth in Indonesia based on theory are a misinterpretation of religiosity from society, traditions, and culture, as well as cognitive dissonance, which causes the perception of "*Banyak Anak Banyak Rezeki*" to become entrenched in Indonesia. The stigma "*Banyak Anak Banyak Rezeki*" is oriented towards the belief that a child is considered a form of investment that is expected to help financially and be responsible for the needs of their parents. This makes children considered an investment, and the perception develops that if many children have a lot of good fortune (Dewi, 2016). As a result, children will become the sandwich generation and carry out two or more roles that must be carried out simultaneously. Hence, role conflicts in individuals have many negative impacts on their personal lives and the achievement of social functioning. 48% of Indonesian people are the sandwich generation, and almost half of them are 20-29 years old (Al-Aamri et al., 2020).

The novelty in this research involves the cognitive dissonance variable in the stigma classification model "*Banyak Anak Banyak Rezeki*." This variable refers to the incompatibility of beliefs or knowledge with the actions taken so that it influences decisions, one of which is controlling the birth rate of children in the family (Astika & Dwirandra, 2018). Apart from that, another novelty from this research is the development of the Logistic Regression (LR) model into Kernel Logistic Regression (KLR), where this method can provide higher accuracy, can handle overfitting when the data is highly dimensional, and can provide significant variable information to the model (Al-Aamri et al., 2020).

B. RESEARCH METHOD

1. Research Procedures

The stages in this research are as follows:

- Conducting literature review to study theories and previous research related to Logistic Regression (LR), Kernel Logistic Regression (KLR), and the factors associated with the stigma "*Banyak Anak Banyak Rezeki.*"
- The instruments were reviewed by psychology and education experts to ensure that the instruments were valid and appropriate for measuring the concepts of religiosity and cognitive dissonance.
- Data was collected online from people in South Sulawesi from diverse religious and ethnic backgrounds, including Bugis, Makassar, Mandar, and Toraja, who already have children.
- Measuring the validity and reliability of data to ensure that the collected data was consistent and accurately measured the variables according to objectives.
- Conducting independence tests to ensure that the independent variables had no significant multicollinearity, meaning that each independent variable stands alone in influencing the dependent variable

The binary logistic regression model can be written as follows (Nusinovici et al., 2020):

$$[\pi(x_i)] = \frac{\exp(x_i\beta)}{1+\exp(x_i\beta)}$$

This KLR model is formed by adding kernel functions to the LR model. The KLR model can be written (Annas et al., 2022):

$$\log[\pi(k_i)] = \sum_{j=1}^{n} a_j K((x_i),(x_j)) = k_i\alpha \quad (1)$$

k_i is the kernel element in the i-th row of the kernel matrix $K((xi),(xj))$ $\boldsymbol{K((x_i),(x_j))}$, with the kernel function commonly used is the radial basis function kernel (RBF Kernel). The RBF function of this kernel is as follows:

$$\begin{aligned}\mathbf{K} &= e^{-\frac{1}{2\sigma}\left((x_i-x_j)^T(x_i-x_j)\right)}\\ &= e - yxi - xj2\end{aligned}$$

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- The model, trained on training data, then the tested using test data to evaluate its performance in classifying the "*Banyak Anak Banyak Rezeki*" stigma.
- Perform simultaneous testing to see the combined effect of all independent variables on the dependent variable. After that a partial test was carried out to assess the individual influence of each independent variable on the dependent variable.
- Analyze the goodness-of-fit measures of the model using various measures, such as the -2 Log Likelihood, Nagelkerke R^2 (coefficient of determination), and Hosmer-Lemeshow Test, to evaluate how well the model fits the data.
- Based on the results of the parameter estimation, an analysis was conducted to determine which variables or factors significantly influence the "*Banyak Anak Banyak Rezeki*" stigma.
- Conclusions were drawn from the model testing results and the analysis of significant factors. An interpretation of the influence of these factors on the research stigma was also provided.

2. Data and Variables

In general, the respondents of this research are people in South Sulawesi who already have children, come from one of the ethnic groups of South Sulawesi, namely Bugis, Makassar, Mandar, and Toraja, and have different religious backgrounds.

Table 1. The variables used in this research are as follows

Variable	Indicator	Scale	Operational Definition
"*Banyak Anak Banyak Rezeki*" stigma (Y)	Have the belief that having many children will bring good fortune	0: No 1: Yes	The belief that having many children brings blessings or prosperity is measured through a closed-ended question ("Yes" or "No") such as, "Do you believe that having many children brings blessings/prosperity.?" Each indicator of religiosity will be measured using a Likert scale (1-5) based on respondents' self-reported confidence, worship frequency, personal religious experiences, understanding of religious teachings, and perceived consequences of following religious guidelines
Religiosity (X_1)	1. Confidence 2. Worship Practices 3. Experience 4. Religious Knowledge 5. Consequence (Hatibie & Priyambodo, 2020)	Continuous	Each indicator of religiosity will be measured using a Likert scale (1-5) based on respondents' self-reported confidence, worship frequency, personal religious experiences, understanding of religious teachings, and perceived consequences of following religious guidelines
Tradition (X_2)	Have the habit of following the traditions of their ancestors	0: No 1: Yes	
The number of children (X_3)	The current number of children still alive.	Continuous	
Cognitive Dissonance (X_4)	A misalignment between a person's beliefs, values, or thoughts drives individuals to seek consistency in their behavior. 1. Emotional 2. Wisdom 3. Concern over the deal (Marikyan et al., 2023)	Continuous	

C. RESULT AND DISCUSSION

1. Validity and Reliability Test

The research instrument, which consists of 37 questions, is tested using correlation techniques. If the correlation coefficient is $\geq R_{table}$, the item in question is considered valid, as shown in Table 2 below.

Table 2. Validity test

Variables	Item	R	R-Table	Information
Religiosity	X1.1	0,704		Valid
	⋮	⋮		⋮
	X1.18	0,907	0,329	Valid
Cognitive Dissonance	X3.1	0,872		Valid
	⋮	⋮		⋮
	X3.19	0,865		Valid

After carrying out the validity test, the next step is a reliability test using Cronbach's alpha coefficient. If Cronbach's alpha coefficient shows a number ≥ 0.6, it can be concluded that the instrument is declared reliable, so it is said to be suitable for research, as in Table 3 below.

Table 3. Reliability test

Variables	Cronbach's Alpha	Information
Religiosity	0,927	Reliable
Cognitive Dissonance	0,894	Reliable

2. Descriptive Analysis

a. Religiosity

The religiosity variable was measured involving five dimensions (Hagevi, 2014), namely beliefs, worship practices, experiences, religious knowledge, and consequences from 384 respondents from various ethnicities and religions. The researchers observed that religious participation among the younger generation was strongly associated with more positive attitudes toward marriage and having children. Meanwhile, individuals who rarely participate in religious activities tend to delay the time they become parents because of other controlling factors (Sprocha & Tisliar, 2019). Information was obtained from the data collection results, which can be seen in Table 4.

Table 4. Religiosity Descriptive

Dimensions of Religiosity	Responses					Average
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Confidence	219 (28,52%)	161 (20,96%)	23 (2,99%)	221 (28,78%)	144 (18,75%)	4,39
Worship Practices	233 (20,23%)	392 (34,03%)	103 (8,94%)	247 (21,44%)	177 (15,36%)	4,13
Experience	444 (23,13%)	531 (27,66%)	151 (7,86%)	540 (28,13%)	254 (13,23%)	4,17
Religious Knowledge	283 (18,42%)	352 (22,92%)	164 (10,68%)	457 (29,75%)	280 (18,23%)	4,16
Consequence	269 (17,51%)	365 (23,76%)	144 (9,38%)	459 (29,88%)	299 (19,47%)	4,16

In Table 4, the belief dimension shows the highest number of answers in the disagree category, with 221 respondents indicating several doubts or disagreements with the proposed religious beliefs. This indicates a difference of opinion or a lack of deep understanding of religious beliefs. In the dimension of worship practices, the majority of respondents agreed with 392 respondents, indicating that many practice worship according to the teachings of their religion so that the practice of worship remains important and accepted in the respondents' religious life. The experience dimension showed the most answers in the disagree category with 540 respondents, meaning many people have religious experiences that do not match their religious expectations or teachings, resulting in dissatisfaction or incompatibility. In the dimension of religious knowledge, the distribution of agree and disagree answers was almost the same, indicating that some respondents felt they had good knowledge. In contrast, others felt they did not understand religious teachings. On the consequences dimension, many respondents chose to disagree, indicating negative perceptions of the impact of religiosity and disbelief in the significant benefits of religious life. However, the average value of all dimensions shows that the respondents' perceptions are very high, namely >4.

b. Cognitive Dissonance

This variable was measured using three aspects (Khraim, 2020), namely, Emotional, Wisdom, and Concern over the deal (worry after making a decision) from 384 respondents from various ethnicities and religions. An example of cognitive dissonance that is often found is when someone feels that having many children will bring a lot of fortune but, on the one hand, realizes that currently, the main root cause of the many problems with the quality of human resources throughout the world is because the population is too large. The following results were obtained based on the data collection results.

Table 5. Cognitive Dissonance Descriptive

Dimensions of Cognitive Dissonance	Responses					Average
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Emotional	260 (11,28%)	539 (23,39%)	349 (15,15%)	840 (36,46%)	316 (13,72%)	3,76
Wisdom	464 (20,14%)	743 (32,25%)	388 (16,84%)	555 (24,09%)	154 (6,68%)	3,06
Concern Over the Deal	423 (15,74%)	718 (26,71%)	394 (14,66%)	888 (33,04%)	265 (9,86%)	3,10

In Table 5 above, most respondents in the emotional dimension chose not to agree, indicating that 840 respondents emotionally do not support this stigma. Despite the predominant disagreement, emotional support for the "*Banyak Anak Banyak Rezeki*" stigma remains significant and must be taken into account in further analysis and decision-making regarding this issue. Then for the wisdom dimension, the majority of respondents chose to agree; this shows that 743 respondents, in terms of knowledge and wisdom, agreed with the stigma, which means that most respondents saw the stigma "*Banyak Anak Banyak Rezeki*" as something wise and worthy of support based on the knowledge and wisdom that they have. Furthermore, in the concern over the deal dimension, the majority of respondents chose not to agree, indicating significant concern about the stigma of "*Banyak Anak Banyak Rezeki*." This reflects changes in social views and may indicate a shift in values regarding having many children. This imbalance may reflect cognitive dissonance, where their emotional beliefs may conflict with their knowledge or principles regarding the stigma. Overall, the average score for all dimensions shows a value of >3, meaning that all respondents' perceptions of all dimensions are high.

3. Logistic Regression

a. Parameter Significance Test

The parameter significance test is carried out to determine whether the parameter estimates obtained significantly affect the model simultaneously and partially. Simultaneous tests are carried out to determine the significance of parameters to the model simultaneously or as a whole, as in Table 6 below.

Table 6. Simultaneous Test

G Test Statistic	Db	P-Value
211,030	4	0,000

Based on Table 6 above, it can be seen that the p-value is <0.05, so it was decided to reject H_0. It can be concluded that with a real level of 5%, at least one predictor variable simultaneously influences the response variable. Next, a partial parameter significance test was carried out, as in Table 7 below.

Table 7. Partial Test

Variables	Wald	P-Value
Religiosity	9,492	0,002
Tradition (Yes)	1,432	0,231
Number of children	25,983	0,000
Cognitive Dissonance	60,252	0,000
Constant	67,525	0,000

In Table 7, the p-value for three of the four variables is less than the alpha value of 0.05, so it can be concluded that with

a real level of 5%, three variables, namely religiosity, number of children, and cognitive dissonance, significantly affect the response variable.

The results for the religiosity variable are in line with the Wardhana (2017) findings which states that religiosity plays an important role in attitudes toward family planning. The belief that children are a "blessing from God" often leads to the rejection of contraceptive methods. Since the New Order, the government's family planning program has been difficult to accept because it conflicts with society's values. Abdi et al. (2020) found that religiosity hinders the adoption of birth control policies due to misunderstandings about religious teachings and a lack of capability in fertility decisions. Her research also shows that sociocultural factors influence contraceptive use, with religious leaders often spreading inaccurate information or opposing contraception.

For the number of children variable, the findings of Dewi (2016) are in line with this research which states that people with many children believe that having many children brings more fortune, based on cultural experience and family traditions. Children are considered assets expected to help with household work or the family economy.

Meanwhile, for the cognitive dissonance variable, the Samsi et al. (2023) findings are in line with this research, which states that many people still do not understand the benefits and objectives of family planning programs. Lack of accurate information causes confusion and distrust of government programs. Cognitive dissonance occurs when people face new information that conflicts with existing beliefs, resulting in rejection or resistance. Research by Cahyarini et al. (2021) shows that perceptions of contraception are shaped by knowledge of myths, fears, and misinformation from the surrounding environment, even though they are aware of the importance of using contraception.

b. Binary Logistic Regression Modeling

After carrying out simultaneous and partial parameter significance tests, the next step is to model binary logistic regression according to the coefficient values in Table 8 below.

Table 8. Coefficient Value of Variables

Variables	Coefficient (B)
Religiosity	0,064
Number of children	0,672
Cognitive Dissonance	0,537
Constant	-40,319

Based on Table 8 above, the binary logistic regression model formed can be seen in model Equation (2) below.

$$\pi(x) = \frac{\exp\left(-40,319 + 0,064 \text{ Religiusitas} + 0,672 \text{ Jumlah } anak + 0,537 \text{ Disonansi kognitif}\right)}{1 + \exp\left(-40,319 + 0,064 \text{ Religiusitas} + 0,672 \text{ Jumlah anak} + 0,537 \text{ Disonansi kognitif}\right)} \tag{2}$$

c. Model Fit Test

The model suitability test was conducted to evaluate the binary logistic regression model that had been formed, using the Hosmer and Lemeshow Goodness of Fit test as in Table 9 below.

Table 9. Hosmer and Lemeshow Test

Variables	Coefficient (B)
Religiosity	0,064
Number of children	0,672
Cognitive Dissonance	0,537
Constant	-40,319

From Table 9 above, it can be seen that the coefficient value of the Hosmer and Lemeshow Test is $5.659 \leq x^2_{(a,\, v)}$, so it can be concluded that the model formed is suitable for classification.

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d. Classification Accuracy

The following are the results of the accuracy of the classification of the "*Banyak Anak Banyak Rezeki*" stigma in South Sulawesi, which can be seen in Table 10 below.

Table 10. Confusion Matrix

		Prediction		Percentage (%)
		No	Yes	
Actual	No	139	25	84,8
	Yes	26	117	81,8
Accuracy				83,4

Based on Table 10 above, it can be concluded that the classification accuracy obtained is 83.4% and is included in the good category for classifying the stigma of "*Banyak Anak Banyak Rezeki*" in South Sulawesi using logistic regression analysis. The model obtained will be used to predict testing data to see the performance of the model Equation (1) that has been obtained. The results can be seen in Table 11.

Table 11. Accuracy

	Training Data	Testing Data
Accuracy	83,4	87,01

e. Kernel Logistic Regression

The performance of the LR model for classifying the stigma "*Banyak Anak Banyak Rezeki*" is in the good category. This can be seen from the results of data testing accuracy, which is 87.01%. According to Martín-Baos et al. (2021), the performance resulting from LR can be optimized using a machine learning method, namely KLR. KLR is a form of regularized LR by adding a kernel function to the model. This analysis uses the RBF kernel function.

The classification analysis with KLR is based on the LR results involving significant predictors in the previous model, namely number of children, religiosity, and cognitive dissonance so that the classification model with KLR gets optimum results. Optimization of this classification model is based on the accuracy values obtained from data testing modeling as seen in Table 12 below.

Table 12. Table of accuracy of KLR on Testing Data

Threshold Value	Accuracy
$\lambda = 0,01$ and $\gamma = 0,001$	92.21%
$\lambda = 0,01$ and $\gamma = 0,03$	92.21%
$\lambda = 0,01$ and $\gamma = 0,18$	93.51%
$\lambda = 0,001$ and $\gamma = 0,08$	90.91%
$\lambda = 0,001$ and $\gamma = 0,017$	89.61%

Table 12 above is five examples of accuracy results in data modeling using KLR based on significantly influential factors. The highest accuracy results were obtained when using λ and γ of 0.18 and 0.01 respectively with an accuracy value of 93.51%. This accuracy is the optimum result of the iteration process using λ between 0.001 to 0.01 and γ between 0.01 to 0.210.

Based on the results in Table 12, it can be said that the use of KLR in optimizing the accuracy of classification modeling with LR on the "*Banyak Anak Banyak Rezeki*" stigma data has been successful. This is shown by the accuracy value which previously was only 87.01% and was in the good category, after using KLR it increased by 6.5% to 93.51% and changed to the excellent classification category.

D. CONCLUSION AND SUGGESTION

This study aims to analyze the factors that influence the stigma of "*Banyak Anak Banyak Rezeki*" using kernel logistic regression modeling. The four variables analyzed are religiosity, tradition, cognitive dissonance, and number of children. Religiosity has a significant influence on the stigma of "*Banyak Anak Banyak Rezeki*". Individuals with higher levels of religiosity tend to support the view that having many children is a blessing. This shows that religious values are important in shaping these societal views.

Tradition does not show a significant influence on the stigma of "*Banyak Anak Banyak Rezeki*." This suggests that although tradition may support this view, its influence is not strong enough compared to other factors in the model used. In contrast to tradition, cognitive dissonance has a significant influence on the stigma of "*Banyak Anak Banyak Rezeki*". Individuals who experience a discrepancy between their beliefs and the reality they face are more likely to have strong views regarding this stigma. Cognitive dissonance can strengthen or weaken their beliefs depending on how they adjust or resolve it. Lastly, the number of children an individual has also had a significant influence on the stigma of " *Banyak Anak Banyak Rezeki*." Those with more children tend to support this view more than those with fewer children. This may be related to their direct experiences and how they view children as a blessing in their lives.

Overall, this study shows that religiosity, cognitive dissonance, and the number of children are significant factors affecting the "*Banyak Anak Banyak Rezeki*" stigma. At the same time, tradition has no significant effect on the model used. In addition, in terms of model optimization, modeling using KLR is proven to increase the accuracy of the LR model. In contrast, previously, the LR model had an accuracy of 87.01%, increasing to 93.51%. These findings can be used to design more effective interventions to address this stigma through an approach that considers the significant factors that have been identified. To overcome this stigma, targeted educational programs can help individuals align their beliefs about the number of children and financial stability. In addition, engaging religious institutions to promote inclusive family planning messages can reduce stigma. Policy initiatives, such as financial assistance and parenting resources, are critical to supporting families of all sizes while encouraging community dialogue that celebrates diverse family structures can increase acceptance.

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AUTHOR CONTIBUTION

All authors contributed to this manuscript, from exploring ideas to writing this article.

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COMPETING INTEREST

The authors declare that they have no competing interests.

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