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TREND ANALYSIS OF EARLY MARRIAGE CASES IN SOUTH SULAWESI USING VECTOR AUTOREGRESSIVE FOR STUNTING SOLUTION

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Abstract

The purpose of this study is to use the VAR model to predict and project the number of early marriage cases in South Sulawesi for the upcoming year. The data used in this analysis comes from the Dinas Pemberdayaan, Perlindungan Perempuan dan Anak, and the Pengadilan Tinggi Agama Makassar, covering the period from January 2017 to September 2024. The results indicate that the VAR(2) model is the best choice according to the AIC for determining the optimal lag length. To examine the relationships between variables, a Granger causality test was conducted for each district and city. The findings reveal significant causal relationships in most districts, suggesting that changes in one district can influence early marriage trends in others. The MAE method was used to calculate the prediction error. Some regions, such as Sengkang, Pangkajene, and Pare-Pare, showed an increasing trend in the projected number of early marriage cases from October 2024 to September 2025. In contrast, Barru and Masamba experienced a decline in these cases. Reducing early marriages could help lower rates of stunting, as early marriage is often linked to maternal and child health issues as well as malnutrition. These findings are valuable for developing effective policies aimed at reducing early marriage and its associated consequences for the people of South Sulawesi.

Keywords: Early Marriage, Time Series, VAR.

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1. INTRODUCTION

Forecasting combines elements of both art and science to predict future events by analyzing historical data. This process employs mathematical models to project future outcomes [1]. The primary advantage of forecasting is that it provides insights into potential future scenarios, allowing for better preparation against undesirable events. While forecasting cannot completely predict actual occurrences, the mathematical models used can be structured to minimize forecasting errors. These errors are typically assessed using measures such as mean absolute error (MAE), mean absolute percentage error (MAPE), root mean square absolute percentage error (RMSAPE), among others.

Time series analysis is a method used to evaluate how historical data impacts future data in order to generate forecasting results. For this method to be effective, the data must be collected at consistent intervals, such as daily, monthly, or yearly. Time series analysis can be applied to either univariate data, which involves a single variable, or multivariate data, which involves multiple variables. One drawback of univariate time series analysis is that it does not take into account the influence of other variables that may significantly affect the outcome, as it only focuses on one variable and its historical data. On the other hand, multivariate time series analysis allows for the exploration of dynamic relationships between multiple variables and enables simultaneous forecasting of data [2].

In this study, the multivariate time series model we will apply is the Vector Autoregressive (VAR) model. The VAR method functions as a forecasting technique that utilizes time series data to model and forecast multiple variables simultaneously. It is an extension of the Autoregressive Model (AR), which creates a vector in which the variables interact with one another.

The advantages of the VAR method include: (1) the model's simplicity, as it does not require a distinction between endogenous and exogenous variables; (2) easy estimation of the VAR model, which can be performed using the least squares method; and (3) the forecasting outcomes are generally more accurate than those produced by more complex simultaneous models [3].The VAR model is particularly suitable for analyzing the number of early marriage cases in South Sulawesi due to its ability to identify cause-and-effect relationships between variables within a system.

Early marriage is a significant social phenomenon that affects the social, economic, and welfare development of communities. South Sulawesi, a province in Indonesia, faces this issue as well. According to the Office of Empowerment, Protection of Women and Children, Population Control, and Family Planning [4], South Sulawesi ranks 14th in Indonesia for the highest rate of early marriage, with a rate of 9.23%. Within the province, four districts report the highest numbers of early marriages: Sidrap (402 cases), Soppeng (158 cases), Barru (74 cases), and Enrekang (70 cases) in 2023, according to the Annual Data from the Makassar Religious High Court [5].

Marrying before reaching the ideal age can have various negative impacts, particularly for women. Research conducted by Plan Indonesia in collaboration with the Center for Population and Policy Studies (PSKK) at UGM in 2011 on "Early Marriage Practices in Indonesia" revealed that women who marry at a young age face a higher risk of dangerous pregnancies and mental health issues, such as stress.

Additionally, they are more vulnerable to domestic violence due to the unstable emotions and psychological conditions of their partners [6].

One significant health issue associated with early marriage is the increased risk of pregnancy and childbirth complications, which can ultimately lead to maternal death. Women who marry at a young age are more likely to experience risky pregnancies, which may result in stunting or hindered child development [7]. Stunting is a chronic nutritional problem caused by inadequate nutritional intake over an extended period, adversely affecting a child's growth, resulting in shorter height compared to age standards [8]. According to data from the Indonesian Nutrition Status Survey (SSGI) released by the Ministry of Health, the prevalence of stunting among children under five in South Sulawesi reached 27.2% in 2022. This province ranks 10th in terms of the highest stunting prevalence in Indonesia [9].

The connection between early marriage and stunting presents an opportunity to explore the complex dynamics that influence children's health. Therefore, this study aims to model the cases of early marriage as a potential solution to the stunting issue in South Sulawesi, using the Vector Autoregressive (VAR) approach.

The findings of this study are intended to provide a foundation for creating more targeted and effective policies to address public health issues in South Sulawesi. It emphasizes the importance of preventing early marriage as a primary strategy to reduce stunting rates.

2. RESEARCH METHODS

2.1 Data Source

This study employs a quantitative research approach. The data utilized consists of time series data, specifically focusing on the number of early marriage cases in South Sulawesi. This data is categorized by districts and cities, covering the period from January 2017 to September 2017. sourced from Dinas Pemberdayaan, Perlindungan Perempuan dan Anak, Pengendalian Penduduk, dan Keluarga Berencana (DP3AP2KB) Sulawesi Selatan dan Pengadilan Tinggi Agama Sulawesi Selatan.

2.2 Variables used

The variable used in this study is the number of cases of early marriage (Y_t) in each district or city.

2.3 Model Vektor Autoregressive

The Vector Autoregressive (VAR) method is an analytical technique used to analyze time series data. This data is organized based on consistent time intervals, whether daily, weekly, monthly, quarterly, or annually [10].

In the Vector Autoregression (VAR) approach, there is no distinction between endogenous and exogenous variables. Endogenous variables are those whose values are determined by the model itself. While they are not identical, these endogenous variables resemble dependent variables in regression analysis, as their values can be established once the values of the independent variables are known. In contrast, exogenous variables are determined outside the model and are typically viewed as equivalent to independent variables [11]. It is important to note that all variables in a VAR model must be stationary; if they are not, they need to be transformed before analysis [12].

The Vector Autoregressive (VAR) model combines multiple Autoregressive (AR) models into a vector form, where the variables influence each other. Specifically, VAR(1) refers to a Vector Autoregressive model of order 1, indicating that each variable is influenced solely by the lag value of other variables from one previous time period [13].

P-order Vector Autoregressive Model [14].

$$\boldsymbol{Y_t} = \boldsymbol{\alpha} + \emptyset_1 \boldsymbol{Y_{t-1}} + \emptyset_2 \boldsymbol{Y_{t-2}} + \ldots\ldots + \emptyset_p \boldsymbol{Y_{t-p}} + \boldsymbol{\varepsilon_t} \tag{1}$$

To effectively forecast using historical data, it is important to evaluate the suitability of various methods for a specific dataset. Among the common techniques for measuring forecasting errors is the Mean Absolute Error (MAE). The MAE is a widely used metric to assess the accuracy of a prediction model. It calculates the average absolute difference between the predicted values and the actual values. The formula for calculating the MAE is as follows [15].

$$\boldsymbol{MAE} = \sum_{i=1}^{n} \frac{|y_i - \hat{y}_i|}{n} \tag{2}$$

Where :

y_i : actual data

$\hat{y}_i$: forecasting value

n : Number of data

2.4 Analysis Steps

The steps of analysis that will be used in this study are as follows:

1. Data description to outline the trend in early marriage cases in South Sulawesi from January 2017 to September 2024.
2. Analysis of Data Using the Vector Autoregressive (VAR) Method

The steps involved in analyzing a Vector Autoregressive (VAR) model are as follows:

a) To check the data's stationarity, conduct a root-root test using the Augmented Dickey-Fuller (ADF) method. If the P-value is less than 0.05, the data is considered stationary.
b) Conduct testing for optimal lag by utilizing the Akaike Information Criterion (AIC) to create the best model.
c) The next stage conducts the Granger Causality test to assess the effect between two variables.
d) Perform parameter estimation using the Vector Autoregression (VAR) model.
e) Check the results of the error calculation on the accuracy of the error rate using **Equation 2**.
f) Please provide the results of the modeling on the number of early marriage cases.

3. RESULTS AND DISCUSSION

Conduct data analysis using the Vector Autoregressive (VAR) method, specifically:

3.1 Testing for Stationarity in Averages Using the Augmented Dickey-Fuller (ADF) Test

The first step in analyzing data with Vector Autoregression is to check the data for stationarity using the Augmented Dickey-Fuller test. Data is considered stationary if the p-value is less than 0.05. The results of the stationarity test are:

Table 1. Results of the Augmented Dickey-Fuller (ADF) Test

District	P-Value	Description	District	P-Value	Description
Makassar	0,044	Stationary	Enrekang	0,447	Non-stationary
Sengkang	0,309	Non-stationary	Sidrap	0,620	Non-stationary
Watampone	0,01	Stationary	Makale	0,021	Stationary
Pangkajene	0,239	Non-stationary	Maros	0,363	Non-stationary
Jeneponto	0,018	Stationary	Watangsoppeng	0,734	Non-stationary
Takalar	0,01	Stationary	Bulukumba	0,353	Non-stationary
Barru	0,192	Non-stationary	Palopo	0,01	Stationary
Sungguminasa	0,01	Stationary	Selayar	0,016	Stationary
Bantaeng	0,01	Stationary	Masamba	0,01	Stationary
Sinjai	0,347	Non-stationary	Belopa	0,472	Non-stationary
Pare-Pare	0,525	Non-stationary	Malili	0,908	Non-stationary
Pinrang	0,767	Non-stationary			

Source : Open Source Software R

Table 1, shows that several districts and cities are non-stationary, as the p-value is greater than 0.05. Therefore, differencing is required to make the data stationary.

3.2 Optimum Lag Testing

Table 2. Optimal Lag Determined by the Minimum AIC Value

Lag	AIC	HQ	SC
1	-66,579	-60,435	**-51,349**
2	-69,241	-57,208	**-39,415**

Source : Open Source Software R

According to **Table 2**, lag 2 has the lowest AIC value. The Akaike Information Criterion (AIC) is commonly used in model selection because it balances model fit and complexity. Therefore, the model with the lowest AIC is regarded as the best choice.

3.3 Parameter Estimation Testing

The simplified equation model derived from the VAR(2) parameter estimation based on the Regency or City is:

1) Makassar

   Y_1= 4,169+0,075$Y_{16(t-1)}$-0,268$Y_{16(t-2)}$

   Multiple R-Squared: 0,6899

2) Sengkang

   Y_2= 6,776+0,913$Y_{2(t-1)}$-0,231$Y_{2(t-1)}$-1,525$Y_{5(t-1)}$-0,188$Y_{5(t-1)}$+1,647$Y_{11(t-1)}$-2,734$Y_{11(t-2)}$

   Multiple R-Squared: 0,9002

3) Watampone

   Y_3= 4,563-0,097$Y_{11(t-1)}$-1,243$Y_{11(t-2)}$-5,921$Y_{20(t-1)}$-6,258$Y_{20(t-2)}$+0,023$Y_{21(t-1)}$+1,013$Y_{21(t-2)}$

   Multiple R-Squared: 0,7694

4) Pangkajene

   Y_4= 0,028+0,841$Y_{11(t-1)}$-0,256$Y_{11(t-2)}$-0,438$Y_{19(t-1)}$-0,912$Y_{19(t-2)}$

   Multiple R-Squared: 0,8071

5) Jeneponto

   Y_5= -0,863+0,261$Y_{4(t-1)}$+0,278$Y_{4(t-2)}$-0,173$Y_{19(t-1)}$-0,761$Y_{19(t-2)}$

   Multiple R-Squared: 0,7935

6) Takalar

   Y_6= 0,163+0,252$Y_{6(t-1)}$-0,442$Y_{6(t-2)}$-0,029$Y_{7(t-1)}$+0,079$Y_{7(t-2)}$+0,088$Y_{11(t-1)}$+$Y_{19(t-1)}$-0,031$Y_{13(t-1)}$-0,128$Y_{13(t-2)}$+0,052$Y_{16(t-1)}$-0,084$Y_{16(t-2)}$+0,100$Y_{21(t-1)}$-0,109$Y_{21(t-2)}$

   Multiple R-Squared: 0,7653

7) Barru

   Y_7= 1,358+0,429$Y_{11(t-1)}$-0,402$Y_{11(t-2)}$-0,026$Y_{16(t-1)}$-0,230$Y_{16(t-2)}$

   Multiple R-Squared: 0,659

8) Sungguminasa

   Y_8= 2,523+1,231$Y_{1(t-1)}$-0,302$Y_{1(t-2)}$+0,577$Y_{7(t-1)}$ 0,188$Y_{7(t-2)}$+0,261$Y_{8(t-1)}$+0,595$Y_{8(t-2)}$

   Multiple R-Squared: 0,6819

9) Bantaeng

   Y_9= 0,776+0,177$Y_{1(t-1)}$-0,233$Y_{1(t-2)}$+0,056$Y_{11(t-1)}$-0,244$Y_{11(t-2)}$

Multiple R-Squared: 0,5674

10) Sinjai

Y_{10}= 5,969+0,345$Y_{2(t-1)}$-0,107$Y_{2(t-2)}$-0,012$Y_{3(t-1)}$-0,407$Y_{3(t-2)}$+0,485$Y_{4(t-1)}$+0,334$Y_{4(t-2)}$+0,022$Y_{21(t-1)}$+0,947$Y_{21(t-2)}$+1,752$Y_{22(t-1)}$ -0,001$Y_{22(t-2)}$

Multiple R-Squared: 0,8536

11) Pare – Pare

Y_{11}= 0,615-0,110$Y_{10(t-1)}$+0,144$Y_{10(t-2)}$-0,526$Y_{15(t-1)}$+0,484$Y_{15(t-2)}$

Multiple R-Squared: 0,7819

12) Pinrang

Y_{12}= 1,244+0,494$Y_{2(t-1)}$-0,104$Y_{2(t-2)}$+0,249$Y_{4(t-1)}$+1,520$Y_{4(t-2)}$+0,850$Y_{7(t-1)}$-0,485$Y_{7(t-2)}$+0,305$Y_{11(t-1)}$-1,378$Y_{11(t-2)}$-0,446$Y_{16(t-1)}$0,576$Y_{16(t-2)}$+0,225$Y_{17(t-1)}$-0,323$Y_{17(t-2)}$+0,226$Y_{19(t-1)}$+1,337$Y_{19(t-2)}$-1,544$Y_{22(t-2)}$ +0,417$Y_{22(t-1)}$

Multiple R-Squared: 0,9149

13) Enrekang

Y_{13}= 4,161+0,145$Y_{4(t-1)}$+0,463$Y_{4(t-2)}$+-0,466$Y_{16(t-1)}$-0,259$Y_{16(t-2)}$

Multiple R-Squared: 0,6887

14) Sidrap

Y_{14}= 1,313+0,600$Y_{2(t-1)}$-0,169$Y_{2(t-2)}$+1,859$Y_{9(t-1)}$-0,305$Y_{9(t-2)}$+1,477$Y_{11(t-1)}$-1,714$Y_{12(t-2)}$

Multiple R-Squared: 0,8384

15) Makale

Y_{15}= 0,847+-0,081$Y_{2(t-1)}$-0,006$Y_{2(t-2)}$+-0,016$Y_{4(t-1)}$-0,131$Y_{4(t-2)}$+0,255$Y_{6(t-1)}$-0,580$Y_{6(t-2)}$+0,185$Y_{10(t-1)}$ $-$0,110$Y_{10(t-2)}$+0,200$Y_{11(t-1)}$+0,073$Y_{11(t-2)}$+0,099 $Y_{12(t-1)}$+0,046$Y_{12(t-2)}$-0,087$Y_{13(t-2)}$-0,178$Y_{13(t-1)}$

Multiple R-Squared: 0,752

16) Maros

Y_{16}= 0,470+0,243$Y_{2(t-1)}$-0,169$Y_{2(t-2)}$+0,315$Y_{4(t-1)}$-0,446$Y_{4(t-2)}$+0,459$Y_{7(t-1)}$-0,027$Y_{7(t-2)}$+0,495$Y_{11(t-1)}$-1,136$Y_{11(t-2)}$+1,881$Y_{15(t-1)}$-0,247$Y_{15(t-2)}$+0,209$Y_{23(t-1)}$+ 0,788$Y_{23(t-2)}$

Multiple R-Squared: 0,8792

17) Soppeng

Y_7= 1,435+0,043$Y_{4(t-1)}$-0,912$Y_{4(t-2)}$+0,922$Y_{7(t-1)}$-0,427$Y_{7(t-2)}$

Multiple R-Squared: 0,774

18) Bulukumba

Y_{18}= 2,572+0,830$Y_{6(t-1)}$+1,588$Y_{6(t-2)}$-0,256$Y_{10(t-1)}$-0,061$Y_{10(t-2)}$+0,217$Y_{17(t-1)}$-0,143$Y_{17(t-2)}$

Multiple R-Squared: 0.8505

19) Palopo

Y_{19}= 1,426-0,108$Y_{2(t-1)}$-0,036$Y_{2(t-2)}$-0,098$Y_{13(t-1)}$-0,260$Y_{13(t-2)}$-0,281$Y_{18(t-1)}$+0,047$Y_{18(t-2)}$

Multiple R-Squared: 0.7215

20) Selayar

Y_{20}= 0,482+0,025$Y_{3(t-1)}$-0,001$Y_{3(t-2)}$+0,002$Y_{4(t-1)}$-0,064$Y_{4(t-2)}$+0,039$Y_{10(t-1)}$-0,028$Y_{10(t-2)}$-0,035$Y_{18(t-1)}$-0,071$Y_{18(t-2)}$

Multiple R-Squared: 0.6804

21) Masamba

Y_{21}= 0,371+0,448$Y_{7(t-1)}$-0,174$Y_{7(t-2)}$+0,200$Y_{8(t-1)}$-0,001$Y_{8(t-2)}$-0,267$Y_{13(t-1)}$-0,240$Y_{13(t-2)}$-0,129$Y_{17(t-1)}$-0,152$Y_{17(t-2)}$+0,321$Y_{18(t-1)}$-0,121$Y_{18(t-2)}$

Multiple R-Squared: 0.8254

22) Belopa

Y_{22}= 0,182+0,114$Y_{2(t-1)}$-0,097$Y_{2(t-2)}$+0,133$Y_{3(t-1)}$-0,032$Y_{3(t-2)}$+0,295$Y_{11(t-1)}$-0,123$Y_{11(t-2)}$-0,215$Y_{16(t-1)}$-0,104$Y_{16(t-2)}$+0,0

Multiple R-Squared: 0.7886

23) Malili

Y_{23}= 1,448+0,191$Y_{2(t-1)}$-0,083$Y_{2(t-2)}$-0,007$Y_{4(t-1)}$-0,456$Y_{7(t-2)}$

Multiple R-Squared: 0.7652

The VAR(2) model was utilized to analyze the number of early marriage cases in various districts and cities in South Sulawesi. This model predicts the number of early marriage cases based on previous time series data, and the Multiple R-Squared value indicates how effectively the model explains the variation in the data. In most areas, such as Pinrang and Sengkang, the high R-Squared values (above 0.9) suggest that the VAR(2) model effectively captures trends in early marriage. However, in some regions, such as Bantaeng and Barru, the lower R-Squared values indicate that the model is less effective in explaining the variations in early marriage data.

3.4 Calculation of Error Rate and Accuracy

Table 3. Results of Mean Absolute Error (MAE) Values

District	MAE	District	MAE
Makassar	0,916	Enrekang	4,603
Sengkang	3,099	Sidenreng	4,650
Watampone	1,538	Makale	0,833
Pangkajene	0,730	Maros	0,666
Jeneponto	1,166	Soppeng	2,514
Takalar	0,999	Bulukumba	1,919
Bantaeng	4,090	Palopo	1,135
Barru	1,595	Selayar	0,999
Sungguminasa	1,234	Masamba	1,521
Sinjai	2,865	Belopa	0,916
Pare-pare	3,833	Malili	1,500
Pinrang	2,623		

Source : Open Source Software R

3.5 Forecasting

Based on the estimation results obtained during the process of forecasting early marriage cases in South Sulawesi for the year from October 2024 to September 2025, the predicted outcomes by Regency/City are as follows:

Table 4. Predicted Number of Early Marriage Cases in South Sulawesi

	District	Ok-24	Nov-24	Des-24	Jan-25	Feb-25	Mar-25	Apr-25	Mei-25	Jun-25	Jul-25	Aug-25	Sep-25
1	Makassar	4	6	4	5	5	4	5	5	5	5	5	4
2	Sengkang	12	9	10	12	13	14	15	17	18	20	22	23
3	Watampone	5	6	4	7	6	7	6	6	7	7	7	7
4	Pangkajene	2	3	2	2	3	3	3	5	5	5	6	7
5	Jeneponto	1	1	1	1	1	1	1	4	4	4	4	4
6	Takalar	1	2	1	2	2	2	2	2	2	2	2	2
7	Barru	16	5	7	7	6	5	5	5	5	5	5	6
8	Sungguminasa	2	2	3	3	3	3	3	4	5	5	5	5
9	Bantaeng	3	2	3	3	3	3	3	3	3	3	3	3
10	Sinjai	10	6	5	7	6	5	6	7	6	7	8	8
11	Pare-Pare	4	4	4	4	5	4	4	4	5	5	6	6
12	Pinrang	8	4	3	5	6	6	8	8	9	11	11	12
13	Enrekang	3	3	3	7	4	5	5	5	6	6	6	6

14	Sidrap	42	16	18	21	19	16	19	18	19	21	21	22
15	Makale	2	2	2	2	2	2	2	2	2	2	2	2
16	Maros	3	3	2	3	3	4	4	5	5	6	6	6
17	Soppeng	12	12	7	12	8	8	9	10	10	11	11	12
18	Bulukumba	5	7	5	9	8	7	8	8	8	8	8	8
19	Palopo	4	3	4	5	3	3	4	4	3	4	3	3
20	Selayar	2	2	2	2	2	2	2	2	2	2	2	2
21	Masamba	12	7	5	6	6	5	5	5	5	6	6	6
22	Belopa	3	3	4	4	2	2	2	2	2	2	2	2
23	Malili	4	5	3	5	3	3	3	3	4	4	4	4

Source : Open Source Software R

According to **Table 4**, the prediction analysis for early marriage cases in South Sulawesi covers a one-year period from October 2024 to September 2025. The analysis reveals 23 prediction results for each district and city in the region. The data indicates that some areas are expected to see an increase in early marriages, while others may experience a decrease or remain stable.

Notably, Sengkang is projected to see a rise in cases, increasing from 12 to 23. Pangkajene is also expected to increase, going from 2 to 7 cases. Pare-Pare will likely see an uptick from 4 to 6 cases, and Pinrang may rise from 8 to 12 cases. Additionally, although Watangsoppeng and Sidrap initially show a decline, they are expected to experience an increase in early marriage cases in subsequent months. Barru and Masamba are categorized as regions with a downward trend in case numbers. In Barru, the number of cases decreased from 16 to 6, while in Masamba, it fell from 12 to 6. Several other regions displayed stable patterns, showing little or no significant changes over the prediction period. For instance, Makale maintained a steady count of 2 cases per month, as did Selayar, which also had no change from 2 cases. Areas like Jeneponto and Takalar experienced slight increases but eventually stabilized. Meanwhile, Belopa and Malili had small fluctuations, lacking any clear upward or downward trend.

Overall, Sengkang and Pangkajene saw the most significant increases, while Barru and Masamba exhibited a downward trend in early marriage cases. Other regions, such as Makale and Selayar, remained stable throughout the prediction period..

Based on the data presented in **Table 4**, the predicted number of early marriage cases in South Sulawesi for the period of 2024-2025 indicates a significant issue that requires attention. The table reveals that certain districts, such as Sidrap and Sengkang, have notably high rates of early marriage. For instance, it is projected that Sidrap will experience a dramatic increase, reaching 42 cases by October 2024, although there will be variations throughout that year. Similarly, Sengkang is expected to see a steady rise in early marriages, with a projected 23 cases by September 2025. These statistics clearly illustrate that early marriage is not only a common social phenomenon but also a structural problem that can impact the economic and social development of communities, particularly in densely populated areas like Sidrap and Sengkang.

Early marriage can negatively impact both maternal and child health, so it is important for local governments and all stakeholders to closely address this issue. Early marriage affects the lives of young couples and is also linked to maternal and child health challenges, particularly in relation to stunting caused by malnutrition.

Young women are often not fully prepared to conceive and give birth, which heightens the risk of health complications such as premature birth and low birth weight (LBW). Additionally, children born to mothers who marry early are more likely to experience long-term health issues, primarily due to inadequate access to nutritious food and medical care.

Early marriage is often linked to a lack of education and poor economic conditions for families. Many young mothers who marry early tend to leave school prematurely, which hinders their access to proper healthcare and nutrition. Economic factors play a crucial role as well; families that marry young are typically in worse financial situations. As a result of their limited resources, they struggle to provide adequate nutrition for pregnant women and their children. This leads to issues such as malnutrition and stunting in young children.

Reducing the number of early marriages is essential to prevent an increase in stunting in South Sulawesi and to promote maternal and child health. Lowering the incidence of early marriages can also decrease the risk of pregnancies at inappropriate ages, allowing young mothers more time to complete their education and better prepare their children for the future.

It is essential to implement a comprehensive and integrated strategy to address both stunting and early marriage. This strategy should include improved education on reproductive health for adolescents, economic empowerment for women in areas with high rates of early marriage, and enhanced access to quality health services, particularly for pregnant women and children, to promote proper nutritional development.It is essential to implement a comprehensive and integrated strategy to address both stunting and early marriage. This strategy should include improved education on reproductive health for adolescents, economic empowerment for women in areas with high rates of early marriage, and enhanced access to quality health services, particularly for pregnant women and children, to promote proper nutritional development.

A more assertive government is necessary to combat early marriage. Addressing early marriage and stunting can be more effective through the implementation of stronger policies in education, health, and law enforcement, along with active participation from communities and local governments. By improving the quality of life for mothers and children, these actions will also positively impact the long-term socio-economic development of South Sulawesi, creating a healthier and more educated generation that is prepared to tackle future challenges.

4. CONCLUSIONS

Based on the results of research on the number of cases of early marriage in South Sulawesi, the VAR2 model is obtained based on the lowest AIC value. So that the equation model formed from the VAR(2) parameter estimation based on the Regency / City is 23 equation models. The prediction of early marriage cases in South Sulawesi from October 2024 to September 2025 indicates a varied trend across different districts and cities. Areas such as Sengkang, Pangkajene, Pare-Pare, Pinrang, Watangsoppeng, and Sidrap are projected to experience an increase in cases. In contrast, Makale and Selayar are expected to remain stable with no significant changes. Notably, Sengkang and Pangkajene are anticipated to see the largest increases, while Barru and Masamba are showing a downward trend in early marriage cases. The predicted number of early marriage cases in South Sulawesi presents a significant challenge that needs to be addressed. Certain districts, such as Sidrap and Sengkang, exhibit high rates of early marriage. One critical strategy to reduce stunting is to decrease the prevalence of early marriages, as these have a direct impact on the health of mothers and children, leading to malnutrition and stunted growth. Therefore, it is essential to implement comprehensive measures to tackle both stunting and early marriage in South Sulawesi. These measures should include economic empowerment, improved access to health services, and better law enforcement.

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