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FORECASTING THE NUMBER OF VERTICAL REFERRALS FOR BPJS PARTICIPANTS AT HEALTH SERVICE CENTER IN UNIVERSITAS AIRLANGGA USING ARIMA MODEL

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BPJS,
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ABSTRACT

Autoregressive Integrated Moving Average (ARIMA) is a time series forecasting method to estimate future events using past data. It can perform short-term forecasting on data with all types of data patterns, both seasonal and non-seasonal data. This study aims to report the best ARIMA for vertical referral cases in BPJS PLK Universitas Airlangga participants. This method used to analyze the number of vertical references for BPJS participants. The research method used is non-intrusive using secondary data and the sample used was the entire population of vertical point reference data for BPJS PLK UNAIR in 2020. The purposive sampling used until 266 data are found. The results of the analysis show that the ARIMA model used to estimate the number of vertical referrals participants is AR [6] or also known as ARIMA [6,0,0]. As for PLK Campus B UNAIR is ARIMA [0,1,1]. In this model, all diagnostic tests have met the assumption requirements. The results of forecasting the number of vertical referrals in PLK Campus C shows the number of vertical referrals will tend to have a constant or horizontal trend with a smaller reference value than the data in 2020. Meanwhile, the number of vertical referrals of PLK Campus B UNAIR has decreased in number compare to 2020. This forecasting has a MAPE value below 10% so the forecasting model has a very good performance in forecasting examples of vertical referrals for BPJS participants in the future. Then the results are useful for making policies to deal with future cases.

Kata Kunci:
Time Series,
ARIMA,
Rujukan Vertikal,
BPJS,
Layanan Kesehatan

ABSTRAK

Autoregressive Integrated Moving Average (ARIMA) merupakan metode peramalan time series untuk mengestimasi peristiwa yang akan datang dengan memakai data di masa lalu. Metode ARIMA dapat melakukan peramalan jangka pendek pada data dengan segala jenis pola data, baik data musiman maupun non-musiman. Penelitian ini bertujuan untuk melaporkan penentuan model terbaik peramalan ARIMA untuk kasus jumlah rujukan vertikal peserta BPJS PLK UNAIR. Sehingga metode ARIMA dapat digunakan untuk menganalisis jumlah rujukan vertikal peserta BPJS PLK UNAIR. Metode penelitian yang dipakai adalah penelitian unobstrutive dengan menggunakan data sekunder dan sampel yang digunakan berupa seluruh populasi data jumlah rujukan vertikal peserta BPJS PLK UNAIR tahun 2020. Teknik sampling yang digunakan adalah purposive sampling hingga ditemukan terdapat 266 titik data yang sesuai. Hasil analisis menunjukkan model ARIMA yang dapat digunakan untuk mengestimasi jumlah rujukan vertikal peserta BPJS PLK Kampus C UNAIR adalah AR [6] atau bisa juga disebut sebagai ARIMA [6,0,0]. Sedangkan untuk PLK Kampus B UNAIR adalah ARIMA [0,1,1]. Seluruh uji diagnostik pada model tersebut telah memenuhi syarat asumsi. Hasil peramalan jumlah rujukan vertikal di PLK C menunjukkan jumlah rujukan vertikal akan cenderung memiliki trend yang konstan atau mendatar dengan nilai jumlah rujukan lebih kecil daripada data tahun 2020. Sedangkan jumlah rujukan vertikal PLK Kampus B UNAIR mengalami penurunan jumlah rujukan daripada jumlah rujukan vertikal pada tahun 2020. Hasil peramalan ini memiliki nilai MAPE dibawah 10% mengindikasikan bahwa model peramalan memiliki kinerja yang sangat bagus dalam melakukan peramalan kasus jumlah rujukan vertikal peserta BPJS PLK UNAIR di masa yang akan datang. Kemudian hasil peramalan kasus ini bermanfaat untuk pengambilan kebijakan untuk menghadapi kasus yang akan datang.

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DISCUSSION

Forecasting is an activity of estimating future events which are then used for effective and efficient action planning (1). Forecasting methods are grouped into two types, namely objective and subjective. The objective forecasting method consists of regression (causal) and time series models. While *PERT*, analogies, survey techniques, and delphi are subjective forecasting methods (1). The selection of the forecasting method is chosen by adjusting the pattern of the case data used.

One of the two forms of objective forecasting models is the time series. This model estimates data by utilizing data in the past by paying attention to certain time variables and the function model is obtained based on the time series without being influenced by external variables (2). *Autoregressive Integrated Moving Average* or ARIMA Box-Jenkins is a time series analysis method. This method can predict non-seasonal and seasonal events. The dependent variable used in predicting an event is the data of the event in the past. While the independent variables are ignored.

Forecasting based on time series can be applied to various fields. Several studies using the ARIMA method are used for short-term electricity load forecasting, rainfall forecasting, and goods price forecasting (3–5). In addition, the ARIMA model can be used for forecasting in the health sector. Several studies in the health sector use Box-Jenkins ARIMA in forecasting: cases of coronary heart disease, dengue fever in the work area of the Mulyorejo Health Center and East Java Province (6–8).

Health service facilities are places for carrying out medical service efforts, starting from promotion efforts, preventing illness, curing disease and rehabilitation (9). Universitas Airlangga Health Care Center (PLK UNAIR) is one of the health facilities that provide primary health services located in Surabaya which carries out promotive, preventive, curative and rehabilitative efforts.

Since 1st November 2014, Universitas Airlangga Health Care Center or *Pusat Layanan Kesehatan* (PLK UNAIR) has started collaborating with the Health Social Security Agency or *Badan Penyelenggara Jaminan Sosial* (BPJS), including BPJS for Health and BPJS for Employment. This allows PLK UNAIR to provide referral services both vertically and horizontally provided by BPJS. Referrals can be made to all participants who are registered in health insurance.

Horizontal referrals are referrals carried out between health facilities at the same level. Meanwhile, referrals carried out by medical services at different levels are called vertical referrals. Referrals are made if the referral health facility is unable to meet the needs in accordance with the patient's medical condition due to limited facilities, tools and/or sources of manpower or human resources (10).

BPJS has a maximum standard for the number of BPJS participant referrals to prevent a spike in the number of referrals and minimize the handling costs that must be borne by BPJS in Advanced Health Facilities or *Fasilitas Kesehatan Tingkat Lanjut* (FKTL). The standard that BPJS uses is 15% of the number of BPJS patients who come to First Level Health Facilities or *Fasilitas Kesehatan Tingkat Pertama* (FKTP) every month (11). The implementation of vertical referrals at UNAIR PLK has a number of cases that exceed BPJS standards. PLK Campus B UNAIR had a referral number of 23.43% in 2019. Then it decreased by 0.20% to touch the figure of 23.23%. Meanwhile, PLK Campus C UNAIR has a higher number of referrals than PLK Campus B UNAIR, with a referral percentage of 31.54% in 2019 and increased to 36.18% in 2020. This number exceeds the standard set by BPJS .

The obstacle found by UNAIR PLK in the vertical referral process for BPJS participants was the lack of knowledge of BPJS participants regarding the tiered referral system. So there are still many BPJS participants who ask for referrals even though they do not meet the requirements for referral actions, causing an increase in the number of vertical referrals for BPJS participants. This is contrary to the expectation of PLK UNAIR that the number of vertical referrals for BPJS participants does not exceed the target of BPJS provisions. Forecasting will be carried out to find out the number of vertical referrals in 2021. Then the forecasting results can be used by related parties for policy determination and decision-making after knowing the results of case forecasting.

The ARIMA method can perform short-term forecasting on data with all types of data patterns, both seasonal and non-seasonal data. In addition, ARIMA can predict an event by looking at past data patterns quickly, simply, cheaply, and accurately because it only requires variable data to be predicted. Therefore, the method that can be said to be suitable for predicting the number of

vertical referrals for BPJS PLK UNAIR participants is the *Autoregressive Integrated Moving Average* method.

Therefore, this article aims to report on determining the best ARIMA forecasting model and report the results of forecasting the number of vertical referrals for BPJS participants at PLK UNAIR. It is hoped that the results of this study can help the authorities to take the right policy to prevent an increase in the number of vertical referrals for BPJS PLK UNAIR participants.

METHODS

The research used is an unobstructive research, that was where the research subject does not know that the research is being carried out related to the subject. This study does not require feedback from the subject. This study is a quantitative study using secondary data on the number of vertical referrals for BPJS PLK UNAIR participants in 2020.

The sample used is the entire population of data on the number of vertical referrals for BPJS PLK UNAIR participants in 2020. The sampling technique used is purposive sampling

Data collection was carried out during the internship process. The sample used is the total population and the sample is taken using a purposive sampling technique by taking data on the number of vertical referral patients BPJS PLK UNAIR on weekdays only. The data taken come from the P-Care PLK UNAIR website. The referral data used are only the number of BPJS participant referrals who come on weekdays while holidays are not counted. There are a total of 266 data points used. Then the data will be analyzed using time series analysis or time series with the model *Autoregressive Integrated Moving Average* (ARIMA) (p,d,q). The stages carried out are: checking the stationarity of the data, identification of temporary models, estimation of model parameters, diagnostic examinations (white noise test and residual normality test), determining the best model, and finally forecasting results (12). The variable used is the daily number of vertical referral data for BPJS Health participants at PLK UNAIR.

The analysis step is carried out to determine the best ARIMA forecasting model and report the results of forecasting the number of vertical referrals for BPJS PLK UNAIR participants. Forecasting results can be used for relevant agencies in making policies and taking appropriate actions to overcome the number of vertical referrals for BPJS Health participants at PLK UNAIR.

RESULT

Overview of the Number of Vertical Referrals for BPJS Participants

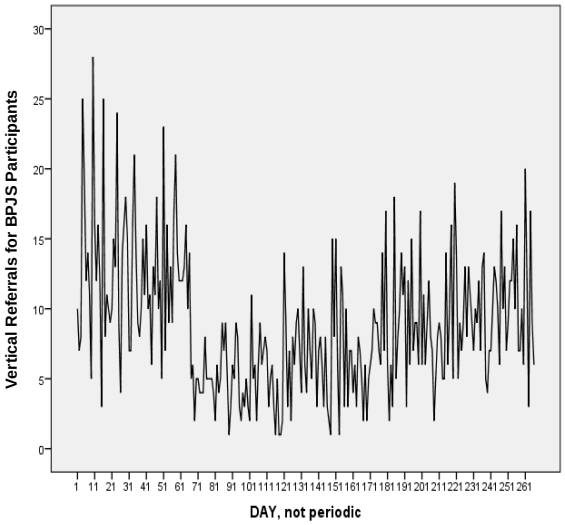

Figure 1. Sequence Chart Daily Data Number of Vertical Referrals for Participants BPJS PLK Campus C UNAIR

Based on Figure 1, it is known that during 2020, the number of vertical referral patients of BPJS PLK participants fluctuated, namely there was an increase and decrease. The highest number of vertical referral patients at PLK Campus C UNAIR occurred on 13th January 2020, with 28 patients being referred.

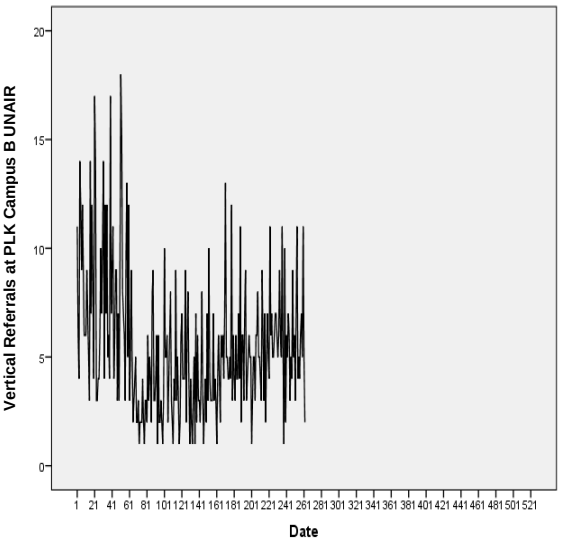

Figure 2. *Sequence Chart* Daily Data on the Number of Vertical Referrals for BPJS Participants at PLK Campus B UNAIR.

The number of vertical referrals in PLK Campus B UNAIR has increased and decreased as well. Based on Figure 2, the highest number of vertical referrals occurred on 2nd March 2020 with a total of 18 vertical referrals.

Data Stationarity Check

Stationarity can be seen from the data pattern in Figures 1 and 2. In Figure 1, there are no non-stationary data on the average or variance in the vertical reference data of BPJS participants at PLK Campus C UNAIR. The spread of data based on the average value looks constant from time to time and there is no variation in the data up and down that is too sharp. Therefore, it can be concluded that the vertical reference data for BPJS participants at PLK Campus C UNAIR are stationary in terms of mean and variance. So, the data do not need to transform or differencing.

Meanwhile, in Figure 2, it is found that there is a non-stationary average in the data on the number of vertical referrals for BPJS participants at PLK Campus B UNAIR. It can be seen that several data points are outliers or it can be said that there are data values that are too far from the average line on the graph. So that the vertical reference data for BPJS participants at PLK Campus B UNAIR must go through a differencing process.

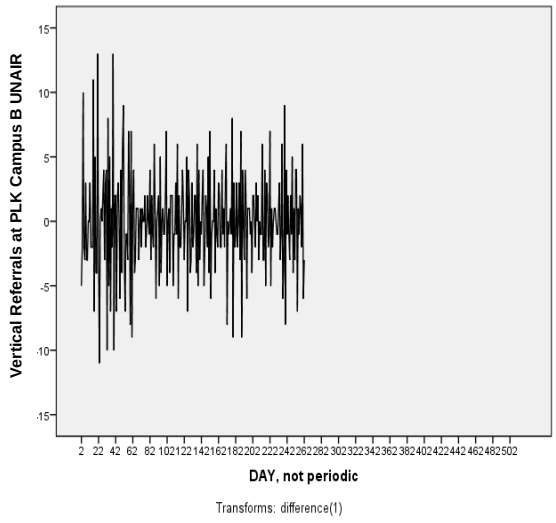

Figure 3. *Sequence Chart* Daily Data on the Number of Referrals for BPJS PLK Campus B UNAIR after the Differencing Process.

Figure 3 shows the daily data plot of the number of BPJS PLK referrals at Campus B UNAIR after going through the differencing process. The data plots have shown stationary in the mean and variance. After the data stationarity is met, the next step is to identify a temporary model.

Temporary Model Identification

After the data are stationary, the next step is to determine the ARIMA model. Model identification by determining a temporary model on the data is done by looking at the *Autocorrelation Function* (ACF) and *Parcial Autocorrelation Function* (PACF) graphic patterns. From the ACF and PACF graphs, it can be concluded that the ACF pattern in the number of vertical referrals for BPJS PLK Campus C UNAIR participants forms a sinusoidal wave that is not very clear. While the PACF pattern in Figure 5 has bars up to Lag 6. After comparing the MAE and MAPE values to several models, it can be concluded that the alleged provisional model is AR [6] or can also be referred to as ARIMA [6,0,0]. on the ACF and PACF graphs, the ACF plot of the number of vertical referrals for BPJS PLK Campus B UNAIR participants shows that there are bars on Lag 1, the PACF plot forms an exponential shrinking pattern and the data have gone through the differencing process.

Model Parameter Estimation

After the provisional model is obtained, namely ARIMA [6,0,0], the next step is to determine the estimated value of the significant model parameters. Based on the parameter estimation results in the vertical referral data of BPJS PLK Campus C UNAIR patients, it can be seen that the constant value shows a significance of 0.000, which means that the constant value is significant to 5% alpha. The AR parameter values at Lag 2, 5 and 6 have a significant value to 5% alpha. Estimate values at: AR Lag 2 = 0.146, AR Lag 5 = 0.224, and AR Lag 6 = 0.381. Then the parameter estimation conditions have been met.

While the vertical reference data for BPJS PLK Campus B UNAIR patients, the estimated constant parameter values and the MA parameter estimates on Lag1 have a significant value of 5% alpha. The estimate value for constant is -0.012 and for MA Lag 1 is 0.909. So, the parameter estimation has been fulfilled.

Diagnostic Test Examination

Several tests that can be done in the diagnostic test step of the model are the residual normality test and the white noise test. The results of the residual normality test on the vertical

reference data of BPJS PLK Campus C UNAIR participants showed a *p value* of 0.141. This value is greater when compared to alpha 0.05. Then H0 is accepted, meaning that the residuals are normally distributed.

Meanwhile, the vertical reference data for BPJS PLK Campus B UNAIR participants showed a *p value* of 0.069. This value is greater when compared to alpha 0.05. This shows that H0 is accepted, which means that the residuals are normally distributed.

Table 1.ARIMA White Noise Test [6,0,0] on Vertical Reference Data for BPJS PLK Participants at Campus C UNAIR

Model	Ljung Box Q		
	Statistics	DF	Sig
ARIMA [6.0,0]	10,019	15	0.819

The second suitability test is the white noise test. Based on the results, the significance of the Ljung-Box Q vertical reference data for BPJS PLK Campus C UNAIR participants is 0.819. This value is greater than 5% alpha, so H0 is accepted. This means that this value has met the white noise requirements.

Table 2. ARIMA White Noise Test [0,1,1] on Vertical Reference Data for BPJS PLK Participants at Campus B UNAIR

Model	Ljung Box Q		
	Statistics	DF	Sig
ARIMA [0,1,1]	14,854	17	0.606

Based on Table 2, the significance value of Ljung-Box Q for the vertical reference data for BPJS PLK Campus B UNAIR participants is 0.606, where the value is greater than the alpha value of 0.05, so H0 is accepted. So it can be said that the residual is white noise. Overall, both ARIMA models for PLK Campus C UNAIR and PLK Campus B UNAIR have met the requirements for diagnostic testing. So it can be concluded that the model is feasible to use.

Using the Best Model for Forecasting

After the model has met the assumptions in the diagnostic test, it is possible to obtain the most suitable model. The forecasting equation that will be used to project the number of vertical referrals for BPJS participants in 2021 at the PLK Campus C UNAIR, with the ARIMA model equation [6,0,0], that is:

$$Yt = 9.113 + 0.147\ Y_{t-2} + 0.224\ Y_{t-5} + 0.381\ Y_{t-6} + e_t$$

While the equation for estimating the number of vertical referrals for BPJS participants in 2021 at the PLK Campus B UNAIR, with the ARIMA model equation [0,1,1] is:

$$Yt = -0.012 + e_t - 0.909\ e_{t-1}$$

Forecasting Results of Vertical Referral Data for BPJS Participants

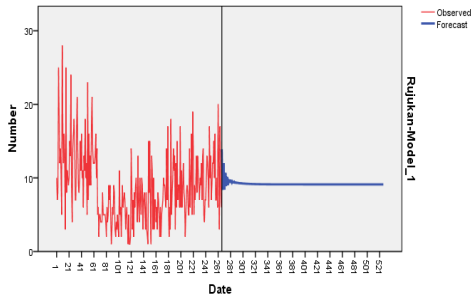

Figure 4. Forecasting Results for 2021 PLK Campus C UNAIR.

The red line in Figure 4 shows the actual daily data of BPJS participants' vertical referrals, while the blue line is the result of forecasting the daily vertical referral data of BPJS Health participants. The figure shows that the results of forecasting vertical referral data for PLK Campus C UNAIR in 2021 tend to have a constant or horizontal trend with a smaller number of referrals than data in 2020 by which, at the beginning of the year on the 2nd of January 2021 PLK Campus C UNAIR will have around 14 patients. BPJS Health referrals, after that, will increase and decrease around numbers 8, 9, 10, 11, and 12 on 3rd January 2021 to 22nd January 2021. Then the graph is horizontal, which means the number of vertical referrals for BPJS Health participants will be constant at number 9 in 23rd January 2021 to 30th December 2021.

The red line in Figure 5 is the actual daily data on the number of vertical referrals of PLK Campus B UNAIR, while the blue line is the result of forecasting. Forecasting results show that the number of vertical referrals for BPJS participants in 2021 will experience a decrease in the number of referrals compared to the number of vertical referrals in 2020, by which, at the beginning of the year on the 2nd of January 2021, PLK Campus C UNAIR will have around 6 vertical referrals until 13th January 2021, after

that it will experience a decrease in the number of referrals to five vertical referrals and continue to decline to number 3 on 30th December 2021.

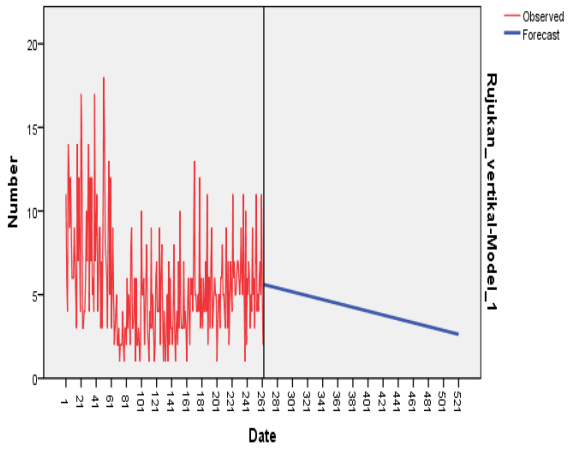

Figure 5. Forecasting Results for 2021 PLK Campus B UNAIR

Then, based on the results of the analysis, the vertical reference data for PLK Campus C UNAIR obtained MAPE values of 3.212% and MAE 61,372, meaning that if you do forecasting, there will be absolute errors of 3,212 and 61.372. Meanwhile, for PLK Campus B UNAIR, the MAPE value is 2.293% and MAE 61.032, meaning that if you do forecasting, there is an error percentage of 2.293% and an absolute error of 61.032.

DISCUSSION

Overview of the Number of Vertical Referrals for BPJS Participants at PLK UNIVERSITAS AIRLANGGA in 2020

During 2020, there was an increase and decrease in the number of vertical referral patients for BPJS participants at PLK UNAIR. The highest number of vertical referral patients at PLK Campus C UNAIR occurred on January 13, 2020, with 28 patients being referred. Meanwhile, the highest number of vertical referrals occurred on 2nd March 2020, with a total of 18 vertical referrals. One of the reasons for the high number of vertical referrals at the beginning of 2020 could be due to the absence of news of COVID-19 cases entering East Java. Then, when COVID-19 cases began to enter East Java, the number of vertical referrals continued to decline until the end of the year.

One of the reasons for the high number of vertical referrals at the beginning of 2020 could be due to the absence of news of COVID-19 cases entering East Java. Then, when COVID-19 cases began to enter East Java, the number of vertical referrals continued to decline until the end of the year. This can be due to the fact that many people are afraid to go to health services during a pandemic (13). People are afraid of getting infected with COVID-19 in healthcare facilities.

Case Forecasting

The first stage in the case forecasting process is checking the stationarity of the data. Stationarity can be seen from data patterns or by displaying sequence chart data. Datas, are said to be stationary if the fluctuations in the data are around the average value and the variance or increase and decrease in the data does not have a wide enough difference. Stationarity of the data in the mean can be detected by looking at the data plot. If there is a trend or the distribution of data is not around the average value, then the data are not stationary in the average. While the non-stationarity in the variance can be seen by looking at the value of the data variation (1). If the data are not stationary in the variance, then the data need to be transformed. The differencing process is carried out when the dataare not stationary in the mean.

Figure 1 shows that the distribution of data based on the average value looks constant and there is no too sharp variation in the data up and down. Therefore, it can be concluded that the vertical reference data for BPJS participants at PLK Campus C UNAIR are stationary in average and variance. Thus, the data do not require a transform or difference. Meanwhile, it is found that there is a non-stationary average in the data on the number of vertical referrals for BPJS participants at PLK Campus B UNAIR in Figure 2. It can be seen that several data points are outliers or it can be said that there are data values that are too far from the average line on the graph. So that the vertical reference data for BPJS participants at PLK Campus B UNAIR must go through a differencing process. Figure 3 is a daily data plot of the number of BPJS PLK Campus B UNAIR referrals after making a difference. The figure has shown that the data have been stationary in the mean and variance.

After the stationarity of the data is met, the second step is to identify the temporary ARIMA model. To determine the non-seasonal d value, if the differencing was not carried out in the previous stage then d=0. However, if the data

are stationary after doing non-seasonal 1 differencing then d=1, and so on. If it only contains *Autoregressive* (AR) and differencing processes, it can be represented by ARIMA (p, d, 0). If it only contains *Moving Average* (MA) and differencing it can be denoted by ARIMA (0, d, q). Non-seasonal p and q values were determined by looking at the pattern of ACF and PACF before differencing (12).

The identification of the temporary model is carried out by looking at the ACF and PACF chart patterns. Based on the ACF and PACF graphs, it can be concluded that the ACF pattern in the number of vertical referrals for BPJS PLK Campus C UNAIR participants forms a sinusoidal wave that is not very clear. While the PACF pattern in Figure 5 has bars up to Lag 6. After comparing the MAE and MAPE values to several models, it can be concluded that the alleged provisional model is AR [6] or can also be referred to as ARIMA [6,0,0]. on the ACF and PACF graphs, the ACF plot of the number of vertical referrals for BPJS PLK Campus B UNAIR participants shows that there are bars on Lag 1, the PACF plot forms an exponentially shrinking pattern and the data have gone through a differencing process, then the provisional model estimate is ARIMA [0,1,1].

The third stage after the provisional model is obtained is to determine the estimated value of significant model parameters, namely the magnitude of the Autoregressive coefficient (φ) and the Moving Average coefficient (θ), so that the complete model equation can be formulated. Autoregressive coefficient values (φ) and Moving Average coefficients (θ) which are taken to form the equation, are coefficients that have a significance value less than 0.05 or can be said to be significant to 5% alpha.

Based on the parameter estimation results in the vertical referral data of BPJS PLK Campus C UNAIR patients, it can be seen that the constant value shows a significance of 0.000, which means that the constant value is significant to 5% alpha. AR parameter values at Lag 2, 5 and 6 have a significant value to 5% alpha. Estimated values are: AR Lag 2 = 0.146, AR Lag 5 = 0.224, and AR Lag 6 = 0.381. Then the parameter estimation conditions have been met. Meanwhile, in the vertical reference data for BPJS PLK Campus B UNAIR patients, the estimated constant parameter value and the MA parameter estimation value on Lag1 have a significance value of 5% alpha. The estimate value for constant is -0.012 and for MA Lag 1 is 0.909. So, the parameter estimation has been fulfilled.

The fourth step is the examination of diagnostic tests to prove the model is good to use or not. There are several model suitability tests that can be carried out, including the residual normality test and the white noise test.

Residual normality test is used to determine the assumption test of normal distribution error (14). The residual normality test was carried out using the Kolmogorov-Smirnov statistical test with the hypothesis that the test was a normally distributed residual (H0 was accepted). The results of the residual normality test on the vertical reference data for BPJS PLK Campus C UNAIR participants showed a *p value* of 0.141. This value is greater when compared to alpha 0.05. Then H0 is accepted, meaning that the residuals are normally distributed.

Meanwhile, the vertical reference data for BPJS PLK Campus B UNAIR participants showed a *p value* of 0.069. This value is greater when compared to alpha 0.05. This shows that H0 is accepted, which means that the residuals are normally distributed.

The second suitability test is the white noise test, which is one of the test methods used to determine whether the residuals are independent and homogeneous from the residuals (homogeneous variance). If the error value is random, then a model is said to be good, where the process shows no serial correlation (no autocorrelation) or is independent of each other, in other words that the residual no longer has a certain pattern or is random (means = 0 and variance = constant) (15). The way to see white noise is by using one of the two test statistics, namely the Q Box–Pierce test and the Ljung-Box test statistic (16). The Box-Jenkins model is said to be good if the residuals have met the white noise test (H0 is accepted).

Based on the results of the white noise test, the significance of the Ljung-Box Q vertical reference data for BPJS PLK Campus C UNAIR participants is 0.819. This value is greater than 5% alpha, so H0 is accepted. This means that this value has met the white noise requirements. Table 2 shows the significance value of Ljung-Box Q of the vertical reference data for BPJS PLK Campus B UNAIR participants is 0.606, where the value is greater than the alpha value of 0.05, so H0 is accepted. So it can be said that the residual is white noise. Overall, the two ARIMA models for PLK Campus C UNAIR and PLK Campus B UNAIR have met the diagnostic testing

requirements. So it can be concluded that the model is feasible to use.

After the model has met the assumptions in the diagnostic test, the last stage in forecasting using the ARIMA method is forecasting with the equations that have been obtained and have met the feasibility test. The forecasting equation that will be used to project the number of vertical referrals for BPJS participants in 2021 at the Health Service Center Campus C UNAIR, with the ARIMA model equation [6,0,0], that is:

$$Yt = 9.113 + 0.147\ Yt\text{-}2 + 0.224\ Yt\text{-}5 + 0.381\ Yt\text{-}6 + et$$

While the equation for estimating the number of vertical referrals for BPJS participants in 2021 at the Airlangga University Campus B Health Service Center, with the ARIMA model equation [0,1,1], that is:

$$Yt = -0.012 + et - 0.909\ et\text{-}1$$

The results of forecasting vertical referral data for PLK Campus C UNAIR in 2021 tend to have a constant or flat trend with a smaller number of referrals than data in 2020, by which at the beginning of the year of 2nd January 2021, PLK Campus C UNAIR will have around 14 BPJS referral patients and will increase and decrease around numbers 8, 9, 10, 11, and 12 on 3rd January 2021 to 22nd January 2021. Then the graph is horizontal, which means the number of vertical referrals for BPJS Health participants will be constant at number 9 on ladder 23 at January 2021 to 30th December 2021.

Meanwhile, the forecasting results for PLK Campus B UNAIR showed that the number of vertical referrals for BPJS participants in 2021 had decreased in the number of referrals compared to the number of vertical referrals in 2020, by which at the beginning of the year that was on 2nd January 2021, PLK Campus B UNAIR will have around 6 vertical referrals until 13th January 2021, after that there will be a decrease in the number of vertical referrals to five and continue to decline to number 3 on 30th December 2021. Forecasting result also have an upper and lower limit which indicates that the forecast may miss several numbers around the limits.

Then, the forecasting results are evaluated using the accuracy measures Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE). The smaller the MAPE value, the closer the estimated value is to the actual value, or, in other words, the method that has been chosen is the best method (17). A method has very good performance if the MAPE value is below 10%, and has good performance if the value is between 10% and 20% (18).

Based on the results of the analysis, the vertical reference data for PLK Campus C UNAIR obtained MAPE values of 3.212% and MAE 61,372, meaning that, if you do forecasting, there will be absolute errors of 3.212% and 61.372. Meanwhile, for PLK Campus B UNAIR, the MAPE value is 2.293% and MAE is 61.032, meaning that, if you do forecasting, there is an error percentage of 2.293% and an absolute error of 61.032. The MAPE and MAE values in both data are below 10%, indicating that the forecasting results have a very good performance.

Recommendation

The obstacle found by UNAIR PLK in the vertical referral process for BPJS participants was the lack of knowledge of BPJS participants regarding the tiered referral system. So there are still BPJS participants who ask for referrals even though they do not meet the requirements to be referred. PLK UNAIR has conducted education regarding the proper flow of the tiered referral system to overcome this problem. However, there is a need for broad education to the general public regarding the appropriate referral system. Therefore, it is recommended for the BPJS to make educational efforts about the tiered referral system to the general public. Especially through various media that are in great demand by the wider community so that the dissemination of information can reach all levels of society.

CONCLUSIONS AND SUGGESTIONS

Conclusion

The ARIMA model that can be used to predict the number of vertical referrals for BPJS PLK Campus C UNAIR participants is AR [6] or can also be referred to as ARIMA [6,0,0] with the following equation:

$$Yt = 9.113 + 0.147\ Yt\text{-}2 + 0.224\ Yt\text{-}5 + 0.381\ Yt\text{-}6 + et$$

While the ARIMA model that is suitable for vertical referrals for BPJS PLK Campus B UNAIR participants is ARIMA [0,1,1] with the following equation:

$$Yt = -0.012 + et - 0.909et\text{-}1$$

Suggestion

There needs to be broad education to the general public about the right referral system through various media that are of interest to the wider community so that the dissemination of information can reach all levels of society without exception.

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