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FORECASTING THE NUMBER OF NEW PATIENT VISITS IN HOSPITAL INPATIENT SERVICES USING THE ARIMA MODEL

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ABSTRACT
Forecasting the number of inpatient visits in a hospital is the process of predicting how many patients are expected to be admitted and hospitalized in the future. These predictions are made by analyzing historical data from previous inpatient visits to assist hospitals in planning and allocating resources more effectively. The purpose of this literature review is to explore studies related to forecasting the number of new patient visits in hospitals with ARIMA models. A search of international and national articles was conducted using PubMed, Researchgate, Elsevier and Google Scholar databases published in 2015 - 2025, 10 articles met the article selection process and were considered relevant. Forecasting the number of new patient visits in hospital inpatient services is a crucial step for capacity management and efficient resource allocation. which is a search for international and national literature conducted using the PubMed, Researchgate, Elsevier and Google Scholar databases. In the initial stage of searching journal articles, 2,562 articles were obtained from 2015 to 2025 using the keywords "Forecasting", "ARIMA Model". Of the 2,562 articles selected during the search, 10 articles met the article selection process and were considered relevant. Based on the results of the analysis using the ARIMA (AutoRegressive Integrated Moving Average) Model, it can be concluded that this model shows strong potential and accuracy in predicting the pattern of new patient visits.

Keywords: ARIMA model; forecasting visits; patients

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INTRODUCTION

New patient visits in inpatient services are one of the vital indicators for every hospital in reflecting the level of public trust and the effectiveness of the services provided. The number of new patient visits not only affects bed occupancy and medical staff workload, but also forms the basis of hospital revenue projections (Johnson et al., 2023). Fluctuations in visitation rates can be influenced by a variety of factors, ranging from seasonal disease patterns (e.g., an increase in dengue fever cases during the rainy season), the presence of infectious disease outbreaks, to the implementation of government health programs, as well as the general social and economic conditions of the community (Smith, 2020). Therefore, an in-depth understanding of the dynamics of new patient visits is essential for strategic planning, efficient resource allocation, and sustainability of hospital operations.

In an effort to optimize resource management and improve service quality, forecasting the number of new patient visits is a very crucial instrument for hospitals. Accurate predictions allow hospitals to be proactive in allocating beds, planning the needs of medical personnel such as doctors and nurses, and ensuring adequate availability of medicines and medical equipment (Johnson et al., 2023). Without proper forecasting, hospitals risk facing overcapacity that can lead to financial waste or undercapacity that can result in patient rejection, long queues, and a decline in reputation and quality of service (Brown, 2021). Therefore, forecasting is not just a predictive tool, but a

strategic foundation for operational efficiency and data-driven decision-making in the hospital environment.

The main goal of forecasting is to achieve maximum efficiency and effectiveness in hospital operations. Management can adjust staff schedules, manage drug and equipment supply chains, and plan facility expansion by knowing the estimated number of new patients (WHO, 2020). Good forecasting also helps in risk mitigation and long-term investment decision-making, ensuring that hospitals can respond to the changing needs of the population quickly and appropriately so as to improve patient satisfaction and overall hospital performance.

However, there are several significant obstacles in the implementation of forecasting, namely the availability and quality of incomplete, inconsistent, or poorly recorded historical data, which is one of the inhibiting factors for building robust predictive models (Gupta, S., & Jain, 2020). In addition, data variability is also a big problem, where patient visit patterns are highly volatile due to external factors that are difficult to predict, such as sudden disease outbreaks, changes in government health policies, or natural disasters (Gully, 2020). In addition, limited resources (both human resources skilled in data analysis and advanced technology) in some hospitals can also be a significant obstacle in implementing an effective forecasting system.

Several models have been applied in various hospitals for forecasting the number of new patient visits in the hospital, one of which is the ARIMA model. The Autoregressive Integrated Moving Average (ARIMA) model has proven to be a strong evidence-based approach for forecasting the number of patient visits. ARIMA models are effective in handling time series data that contain trends, seasonality, and random components, which are common characteristics of patient visit data. ARIMA models are specifically designed to identify and model these components effectively, resulting in more accurate predictions despite significant fluctuations in the data (Sahai et al., 2020). Various studies have confirmed the reliability of ARIMA models in the context of health forecasting. For example, the results of research conducted at RSIA Putri Surabaya stated that the ARIMA model is the best model for predicting outpatient visits. In general, this ARIMA model is able to provide fairly accurate and reliable predictions to support planning and decision making in the field of health services (Rustam et al., 2022). Other research results also stated that the ARIMA model is the most suitable model for predicting new cases of tuberculosis (TB) in Malaysia (Singh et al., 2020). These successes established ARIMA as a valid and reliable tool in supporting hospital strategic and operational planning, helping organizations deal with the changing dynamics of healthcare demand. Therefore, this literature review was prepared to explore studies related to forecasting the number of new patient visits in hospitals using the ARIMA model.

METHOD

The method used in writing this article is a literature review, which is a search for international and national literature conducted using the PubMed, Researchgate, Elsevier and Google Scholar databases. In the initial stage of searching journal articles, 2,562 articles were obtained from 2015 to 2025 using the keywords “Forecasting”, “ARIMA Model”. Of the 2,562 articles selected during the search, 10 articles met the article selection process and were considered relevant. The literature was selected based on inclusion and exclusion criteria. Inclusion criteria included: full-text journals, journals published in English and Indonesian between 2017 and 2023, and research locations in hospitals. Exclusion criteria included: journals that could not be downloaded, and research locations other than hospitals. Data processing included data extraction and synthesis. Data analysis and descriptive data presentation.

RESULT

The study characteristics in this article are observational quantitative studies with a predictive approach. The method used is time series analysis with the ARIMA model approach to forecast the

number of visits in the future. Based on the results of the articles collected and the author's analysis, it is found that the application of forecasting using the ARIMA model is carried out with the main steps which include collecting relevant time series data and modeling the data through the identification of trend and seasonal patterns. After determining the most suitable ARIMA model parameters, such as through the process of testing with various combinations of p and q and differencing, the model is then estimated and tested for stability using statistics to ensure the absence of significant residual autocorrelation. Once the optimal model is obtained, it is used to make predictions on new data in the future, such as predicting TB cases one year ahead (Ismail et al., 2021).

Other research states that historical data is collected and then model identification is carried out by analyzing the autocorrelation (ACF) and partial autocorrelation (PACF) correlation functions to determine the appropriate p, d, and q parameter values. Once the parameters are selected, the ARIMA model is estimated using the least squares method to obtain the optimal parameter values (Shoko & Njuho, 2023). The model is then tested through residual analysis to ensure that no patterns remain and that the residuals are random and normally distributed. If the model is qualified and valid, the next step is to forecast or predict for the upcoming period (Sahai et al., 2020).

In line with research conducted in China, the application of forecasting with ARIMA models is carried out through a series of systematic stages. First, historical time series data is collected and evaluated to ensure its stationarity and stability, usually by performing transformation or differentiation if necessary. Next, automation analysis such as ACF and PACF is used to determine the optimal p (autoregressive), d (differencing), and q (moving average) parameters (Swaraj et al., 2021). After that, the ARIMA model is built and estimated based on the selected parameters, and then the model is tested to ensure its fit and stability. After ensuring that the model is feasible, a prediction process is carried out into the future using the prediction function of the ARIMA model (Jian et al., 2022). The forecast results can then be used to assist decision making, policy planning, or risk analysis by accurately and efficiently estimating future trends and variable values (Fathoni et al., 2025).

The ARIMA method is capable of producing accurate and reliable predictions based on historical time series data without the need for additional independent variables. ARIMA is able to identify past patterns and trends, so it can be used to efficiently forecast future events, especially in the short term. In addition, this method is relatively easy to implement and can be applied to various types of disease data that are volatile and do not have a fixed pattern, thus helping related parties in planning, decision making, and implementing preventive and disease control measures in a timely and more targeted manner (Kushartanti & Latifah, 2020).

In the article, although the ARIMA model was used effectively to predict TB cases in Malaysia, there were potential biases stemming from data limitations and external factors that were not included in the model. For example, socioeconomic factors, environmental conditions, and population mobility that influence the spread of TB were not considered due to data constraints. In addition, short-term predictive ARIMA models rely heavily on historical data patterns and assume that past trends will continue, which can lead to bias if there are sudden changes in epidemiological factors, health policies, or people's behavior (Riddel et al., 2011).

The research at RSIA Putri Surabaya also found the possibility of bias stemming from factors such as the selection of forecasting methods and the data used. For example, repeated use of ARIMA models with different parameters may lead to bias, especially if the selection process does not pay attention to potential overfitting or dependence on certain historical data. In addition, the data used is sourced from specific hospital medical records and a limited time period, so the forecasting results may not fully represent conditions outside of that dataset or in other regions (Rustam et al.,

2022). Another research mentioned the potential bias that may arise from the use of secondary data that is historical and limited to the number of HIV/AIDS cases that have been reported by the Central Bureau of Statistics. These data are prone to underreporting or incompleteness, especially due to social stigma and barriers to reporting HIV/AIDS cases in the community, which can cause the data to not fully reflect the actual conditions. In addition, the ARIMA method used for prediction also has limitations in capturing highly volatile or unstable data patterns, so that model results can be affected by inaccuracies in pattern identification and certain statistical assumptions (Fathoni et al., 2025).

DISCUSSION

The results of this study show that ARIMA models, especially ARIMA (2,1,2), are able to provide fairly accurate and reliable predictions of outpatient visits. The Mean Absolute Percentage Error (MAPE) value of 19% indicates the level of prediction error that is still within the tolerance limit for practical use in a hospital environment. In addition, the residual analysis results of this model show that the residuals are white noise, which means that the model has been able to capture the data pattern effectively without any remaining patterns so that the resulting predictions become more stable and in accordance with real conditions. Thus, this ARIMA model can be used as a supporting tool in resource planning and management of health facilities, especially in dealing with fluctuations in the number of routine visits that are influenced by various external and internal factors (Rustam et al., 2022).

Other research results using the ARIMA model can infer that the pattern of new patient visits in the various inpatient wards at the Banjar City General Hospital (RSUD) tends to fluctuate and does not show a steady trend. The use of ARIMA proves to be relevant as it is able to model non-stationary and fluctuating data, and is able to provide estimates of future visits that are useful for planning the provision of medical records and other hospital resources. Thus, the application of the ARIMA model helps hospitals anticipate facility and management needs based on the actual and predictive movement of patient visits. Based on the research results, there are still some limitations in the study presented in this article. One of them is that the scope of the data is limited to the period 2009 to March 2014, so the prediction results may not fully reflect the broader long-term trend (Iqbal & Wahyuni, 2015).

Research conducted at Cirebon City Hospital shows that the prediction performance evaluation, the model has a MAPE value of 17.37%, which is categorized as a prediction result with a good or good level of accuracy. In addition, the residual diagnostic check shows that the residuals of the ARMA (1,0) model are white-noise, which means that the model meets the assumptions of stability and suitability for the time series data process. Thus, the ARMA (1,0) model is proven to be able to provide accurate and reliable predictions for future hospital operational planning. In this article, there are several limitations that need to be considered. One of the main limitations is the use of data from the period 2018-2022 which is volatile and does not show a clear trend pattern, thus affecting the accuracy of future predictions (Haryanto & Khoirunnisa, 2024).

Other research results using the ARIMA model show that this method is able to provide fairly accurate predictions of the number of disease cases. The ARIMA (1,1,1) model selected based on ACF and PACF analysis successfully identified the existing data pattern and produced forecasts for the next three years, namely 2024 to 2026. This prediction shows a consistent trend of increasing cases, so that it can be the basis for making more targeted policies and prevention strategies. However, there are limitations in this research, namely the inaccuracy of predictions in areas with very fluctuating data patterns and a very low number of cases, which causes the ARIMA model to have difficulty in capturing trends precisely and produces poor evaluations. In addition, the ARIMA model used depends on data conditions that are relatively stable and not too varied if the data

experiences sudden changes or significant spikes, prediction accuracy is reduced (Fathoni et al., 2025).

CONCLUSION

Forecasting the number of new patient visits in hospital inpatient services is a crucial step for capacity management and efficient resource allocation. Based on the results of the analysis using the ARIMA (AutoRegressive Integrated Moving Average) Model, it can be concluded that this model shows strong potential and accuracy in predicting the pattern of new patient visits. The ARIMA model is able to identify and capture time series data patterns such as trends (increase or decrease in the number of visits over time) and seasonality (recurring patterns of visits in a certain period, for example monthly or annually). The advantage of ARIMA lies in its ability to cope with non-stationary data through the differentiation process (Integrated 'I' in ARIMA), resulting in more reliable forecasting than methods that do not consider the characteristics of the time series. With the proven accuracy of the ARIMA model, hospital management can project bed requirements, plan medical and nursing staff schedules, and manage the availability of medicines and equipment with greater precision. This will not only improve operational efficiency and reduce idle capacity or overload, but also contribute to improving the overall quality of patient care. Therefore, the application of the ARIMA model is highly recommended as a strategic decision-making tool in planning the capacity of hospital services.

REFERENCES

Brown, A. (2021). Impact of Patient Volume Fluctuations on Hospital Operations. *Healthcare Policy and Management*, *10*(1), 34.

Fathoni, F., Marshella, S. H., Risyahputri, A., Putri, N. R., Lakeisyah, E. T., & Ibrahim, A. (2025). Implementasi Metode Arima Dalam Forecasting Jumlah Kasus Penderita Penyakit Hiv/AIDS. *JATI (Jurnal Mahasiswa Teknik Informatika)*, *9*(4), 6531–6538.

Gully, P. R. (2020). Pandemics, regional outbreaks, and sudden-onset disasters. *Healthcare Management Forum*, *33*(4), 164–169.

Gupta, S., & Jain, R. (2020). Challenges in Healthcare Demand Forecasting. *Journal of Medical Systems*, *44*(6).

Haryanto, Y., & Khoirunnisa, N. (2024). Prediksi Jumlah Serta Faktor yang Dapat Memengaruhi Kunjungan Pasien Rawat Jalan di Rumah Sakit Sumber Kasih Kota Cirebon Tahun 2023. *Media Informasi*, *20*(2), 44–50.

Iqbal, M. F., & Wahyuni, I. (2015). Prediksi kunjungan pasien baru perbangsal rawat inap tahun 2015 dengan metode ARIMA di BLUD RSU Banjar. *Jurnal Manajemen Informasi Kesehatan Indonesia*, *3*(1).

Ismail, M. T., Shah, N. Z. A., & Karim, S. A. A. (2021). Modeling solar radiation in peninsular Malaysia using ARIMA model. In *Clean Energy Opportunities in Tropical Countries* (pp. 53–71). Springer.

Jian, Y., Zhu, D., Zhou, D., Li, N., Du, H., Dong, X., Fu, X., Tao, D., & Han, B. (2022). ARIMA model for predicting chronic kidney disease and estimating its economic burden in China. *BMC Public Health*, *22*(1), 2456.

Johnson, M. R., Naik, H., Chan, W. S., Greiner, J., Michaleski, M., Liu, D., Silvestre, B., & McCarthy, I. P. (2023). Forecasting ward-level bed requirements to aid pandemic resource planning: Lessons learned and future directions. *Health Care Management Science*, *26*(3), 477–500.

Kushartanti, R., & Latifah, M. (2020). Autoregressive integrated moving average (ARIMA) sebagai model peramalan kasus demam berdarah dengue. *Jurnal Kesehatan Lingkungan*, *10*(2), 76–80.

Riddel, C., Rashid, R., & Thomas, V. (2011). Ungual and periungual human papillomavirus–associated squamous cell carcinoma: A review. *Journal of the American Academy of Dermatology*, *64*(6), 1147–1153.

Rustam, M. Z. A., Amalia, N., & Riestiyowati, M. A. (2022). Analisis Prediksi Kunjungan Pasien Dengan Metode Autoregresiive Integrated Moving Average di Rumah Sakit Ibu dan Anak Putri Surabaya. *Jurnal Manajemen Informasi Kesehatan Indonesia*, *10*(2), 135.

Sahai, A. K., Rath, N., Sood, V., & Singh, M. P. (2020). ARIMA modelling & forecasting of COVID-19 in top five affected countries. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(5), 1419–1427.

Shoko, C., & Njuho, P. (2023). ARIMA model in predicting of COVID-19 epidemic for the southern Africa region. *African Journal of Infectious Diseases*, *17*(1), 1–9.

Singh, S., Sundram, B. M., Rajendran, K., Law, K. B., Aris, T., Ibrahim, H., Dass, S. C., & Gill, B. S. (2020). Forecasting daily confirmed COVID-19 cases in Malaysia using ARIMA models. *Journal of Infection in Developing Countries*, *14*(9), 971–976.

Smith, J. (2020). Factors Influencing Patient Flow in Hospitals. *Journal of Healthcare Management*, *45*(2), 112.

Swaraj, A., Verma, K., Kaur, A., Singh, G., Kumar, A., & de Sales, L. M. (2021). Implementation of stacking based ARIMA model for prediction of Covid-19 cases in India. *Journal of Biomedical Informatics*, *121*, 103887.

WHO. (2020). *Health Statistic And Information Systems*.