

Projecting Under Five Mortality Rate for Mauritania Using an Artificial Intelligence Technique

¹Dr. Smartson. P. NYONI, ²Thabani NYONI

¹ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

²Independent Researcher & Health Economist, Harare, Zimbabwe

Abstract - This study uses annual time series data on under five mortality rate (U5MR) for Mauritania from 1960 to 2020 to predict future trends of U5MR over the period 2021 to 2030. Residuals and model evaluation statistics indicate that the applied ANN (12, 12, 1) is stable in forecasting under five mortality rate. ANN model projections revealed that U5MR will remain high throughout the out of sample period. Therefore, we encourage the government of Mauritania to address all the factors that significantly contribute to under five mortality by allocating more resources to the maternal and child health (MNCH) program.

Keywords: ANN, Forecasting, U5MR.

I. INTRODUCTION

The fight against all forms of poverty and other deprivations will never end until the entire world is free from hunger, poverty, inequalities, social injustice and human rights abuses (UN, 2016; UN, 2015). The world leaders and all stakeholders should commit resources to the fulfilment of this agenda. In addition, major global health issues must be addressed as a matter of urgency. Health issues that need attention include sexual and reproductive health, maternal and child health, adolescent health, communicable and non-communicable diseases (UN, 2020; UNICEF, 2019; WHO, 2019; UNICEF, 2018). Ensuring good health and promotion of well-being for all at all stages of life is the priority of the 3rd sustainable development goal (SDG3) (UNICEF, 2019). By 2030, all UN member states should have managed to implement strategies that are effective in bringing down neonatal and under five mortality to as low as 12 neonatal deaths per 1000 live births and 25 under five deaths per 1000 live births (WHO, 2019; Gulmezoglu *et al.* 2016).

The objective of this study is to forecast under five mortality rate for Mauritania using a machine learning algorithm. The study findings are expected to inform child health policies, planning and allocation of resources in order to end all preventable under five deaths.

II. LITERATURE REVIEW

Gage & Bauhoff (2020) assessed the impact of PBF on early neonatal health outcomes and associated health care utilization and quality in Burundi, Lesotho, Senegal, Zambia and Zimbabwe. Authors utilized data from Demographic and Health Surveys and Multiple Indicator Cluster Surveys and applied difference-in-differences analysis to estimate the effect of PBF projects supported by the World Bank on early neonatal mortality and low birth weight and concluded that PBF had no impact on early neonatal health outcomes in the five African countries studied and had limited and variable effects on the utilization and quality of neonatal health care. Aghai *et al.* (2020) determined the gender differences in neonatal mortality, stillbirths, and perinatal mortality in south Asia using the Global Network data from the Maternal Newborn Health Registry. It was noted that the risks of stillbirths, and early neonatal mortality were higher among male infants than their female counterparts. However, there was no gender difference in mortality after 7 days of age. A prospective, population-based research study was conducted by Dhaded *et al.* (2020) to investigate neonatal deaths in rural Karnataka, India for the period 2014–2018. Study staff collected demographic and health care characteristics on eligible women enrolled with neonatal outcomes obtained at delivery and day 28. Cause of neonatal mortality at day 28 was assigned by algorithm using prospectively defined variables. Study found that infants who were preterm and low-birth weight remained at highest risk for 28-day neonatal mortality in India. Masaba & Phetoe (2020) described the trends of neonatal mortality within the two sub-Saharan countries. The study concluded that in 2018, the neonatal mortality rate for Kenya was 19.6 deaths per 1000 live births. The neonatal mortality rate had fallen gradually from 35.4 deaths per 1000 live births in 1975. On the other hand, South Africa had its neonatal mortality rate fall from 27.9 deaths per 1000 live births in 1975 to 10.7 deaths per 1000 live births in 2018.

III. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modeling; will be applied in this study. The ANN is a data processing system consisting of a large number of highly interconnected processing elements in architecture inspired by the way biological nervous systems of the brain appear like. Since no explicit guidelines exist for the determination of the ANN structure, the study applies the popular ANN (12, 12, 1) model based on the hyperbolic tangent activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting annual under five mortality rate for Mauritania.

Data Issues

This study is based on annual under mortality rate in Mauritania for the period 1960 – 2020. The out-of-sample forecast covers the period 2021– 2030. All the data employed in this research paper was gathered from the World Bank online database.

IV. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	P
Observations	49 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.000848
MSE	0.326659
MAE	0.440847

Residual Analysis for the Applied Model

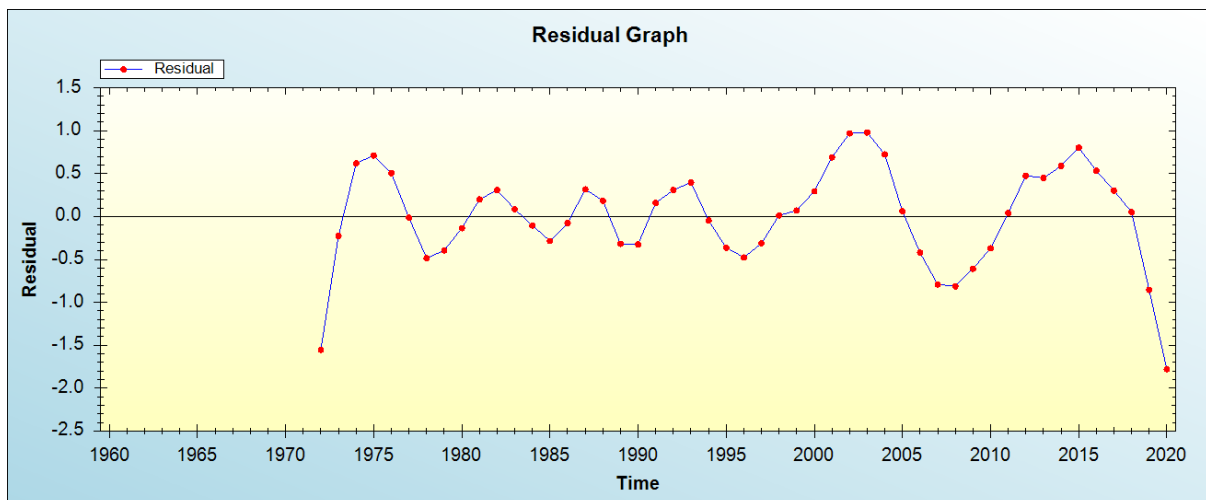


Figure 1: Residual analysis

In-sample Forecast for P

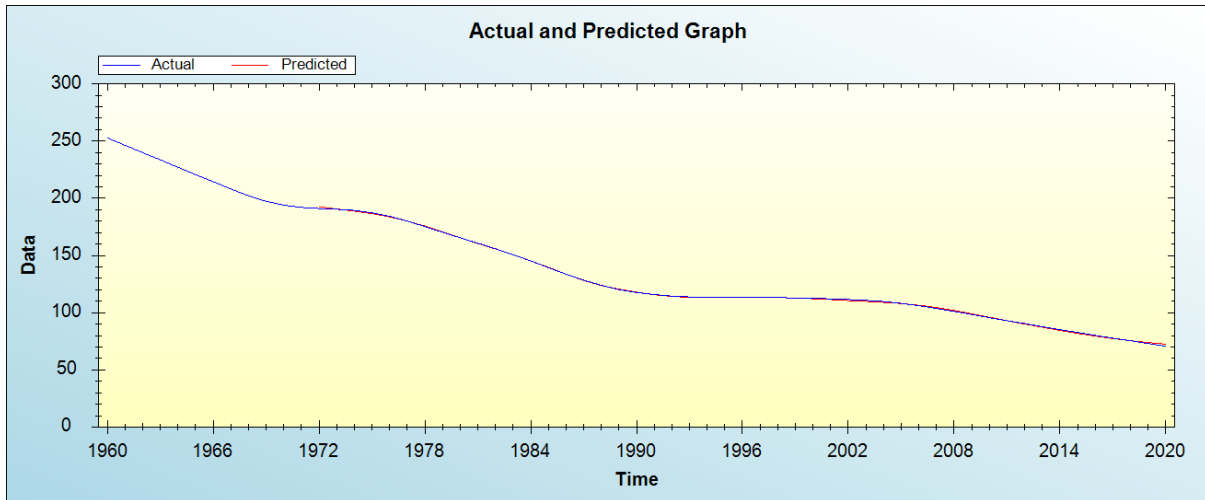


Figure 2: In-sample forecast for the P series

Out-of-Sample Forecast for P: Actual and Forecasted Graph

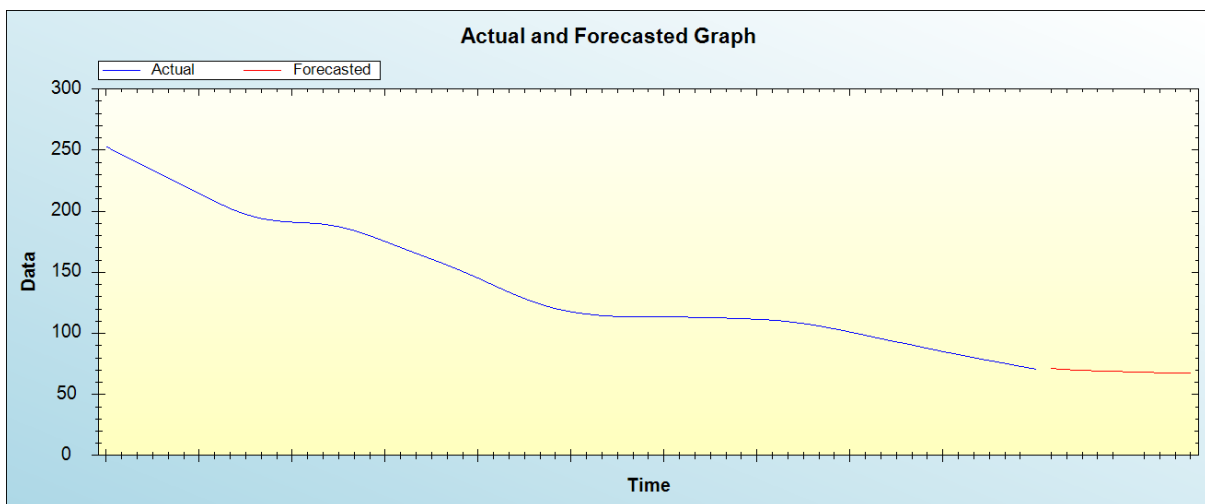


Figure 3: Out-of-sample forecast for P: actual and forecasted graph

Out-of-Sample Forecast for P: Forecasts only

Table 2: Tabulated out-of-sample forecasts

2021	71.2247
2022	70.3475
2023	69.8009
2024	69.2234
2025	68.9140
2026	68.5804
2027	68.2118
2028	67.8183
2029	67.7224
2030	67.6131

The main results of the study are shown in table 1. It is clear that the model is stable as confirmed by evaluation criterion as well as the residual plot of the model shown in figure 1. It is projected that annual U5MR will remain high throughout the out of sample period.

V. POLICY IMPLICATION & CONCLUSION

This study applied the ANN model to forecast future trends of under-five mortality rate in Mauritania and the findings revealed that U5MR will remain high throughout the out of sample period. The government of Mauritania has made significant progress in the reduction of under-five mortality. However, neonatal mortality continues to contribute a significant percentage of under five deaths, hence the government must prioritize allocating more resources to the maternal and child health program activities in order to improve the quality of antenatal, delivery and essential newborn care services.

REFERENCES

- [1] UNICEF. (2019). Levels and trends in child mortality: report 2019. Estimates developed by the UN Inter-agency Group for child mortality estimation. New York: UNICEF.
- [2] United Nations. (2015). transforming our world: The 2030 agenda for sustainable development, A/RES/70/1. New York: UN General Assembly.
- [3] UN (2020) sustainable development goals. <https://www.un.org/sustainable-development/development-agenda>
- [4] UNICEF (2018). Every Child alive. New York: UNICEF
- [5] World Health Organization (WHO) (2019). SDG 3: Ensure healthy lives and promote wellbeing for all at all ages.
- [6] Gu'Imezoglu AM., Lawrie TA., Hezelgrave N (2016). Interventions to Reduce Maternal and Newborn Morbidity and Mortality. In: Disease Control Priorities 3, 115–36.
- [7] United Nation. Transforming our world: The 2030 agenda for sustainable development 2016.

Citation of this Article:

Dr. Smartson. P. NYONI, Thabani NYONI, "Projecting Under Five Mortality Rate for Mauritania Using an Artificial Intelligence Technique" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 6, Issue 7, pp 370-373, July 2022. Article DOI <https://doi.org/10.47001/IRJIET/2022.607079>
