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ANALYZING GENITAL ULCER DISEASE CASES IN MALES AND FEMALES AT GWERU DISTRICT HOSPITAL

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ABSTRACT

In this study, ANN models were applied in analyzing Genital Ulcer Disease (GUD) cases, that is, for males (GUDM) and females (GUDF) at Gweru District Hospital (GDH). The employed data covers the period January 2010 to December 2019 and the out-of-sample period ranges over the period January 2020 to December 2021. The residuals and forecast evaluation criteria of the applied models indicate that the models are quite adequate in predicting GUDM and GUDF incidence in Gweru urban district over the out-of-sample period. The results of the study basically indicate that GUDM cases are always more than GUDF cases and this has been projected to persist into the out-of-sample period. In order to prevent and control GUD incidence in the urban district of Gweru, a 2-fold policy recommendation has been put forward.

Keyword: - ANN, Forecasting, Genital Ulcer Disease (GUD)

INTRODUCTION

Genital Ulcer Disease (GUD) is a serious public health threat, especially in developing countries such as Zimbabwe. The causes of GUD are either infectious (for example, syphilis, chancroid, genital herpes simplex virus [HSV] etc) or noninfectious (for example, fixed drug eruption, sexual trauma etc). In the case of Zimbabwe, Mungati et al (2018) argue that the most common cause of GUD is herpes simplex virus. The basic diagnosis of GUD is hinged on history and physical examination while further GUD diagnosis need to be supported by laboratory findings (Roett et al., 2012). Patients diagnosed as having GUD in Zimbabwe

receive a combination of antimicrobials to treat syphilis, chancroid, lymphogranuloma venereum and genital herpes (Nyoni & Nyoni, 2020). Given the fact that GUD is a major risk factor in the transmission of HIV (Phiri et al., 2013; Mungati et al., 2018; Kilmarx et al., 2018), its appropriate management has become a public health priority (Kularatne et al., 2018) and in this regard, the modeling and forecasting of GUD cases in order to inform policy has become inevitably instructive (Nyoni & Nyoni, 2020).

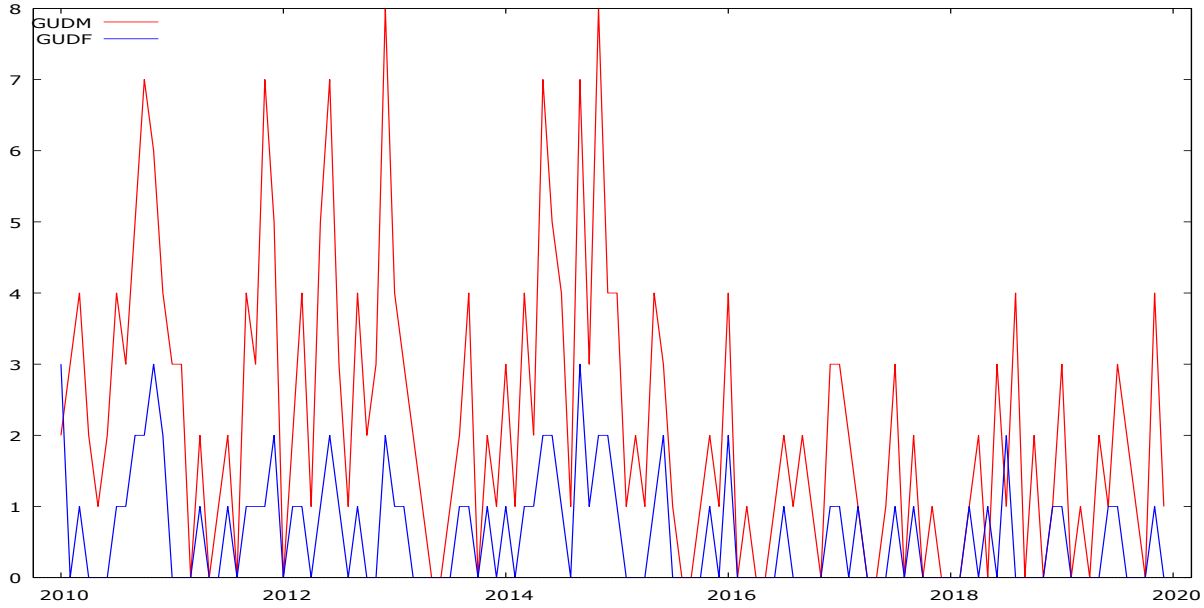

Figure 1: GUDM and GUDF cases at GDH

As shown in figure 1 above, most GUD cases have been confirmed in males than females. This could be attributed to differences in health seeking behavior in the sense that men usually do not seek health services in time and often delay in seeking health related help. This indicates that there is for sexual behavior change in Gweru urban district, especially for men.

OBJECTIVES OF THE STUDY

i. To analyze GUDM and GUDF cases at GDH over the period January 2010 to December 2019.
ii. To forecast GUDM and GUDF cases at GDH over the period January 2020 to December 2021.
iii. To determine whether GUDM and GUDF cases at GDH are increasing or decreasing over the period January 2020 to December 2021.

RELATED STUDIES

In Malawi, Phiri et al. (2013) examined the etiology of GUD and its relation with HIV infection and found out that HSV type 2 ulcers were highly prevalent and strongly associated with HIV. In South Africa, Kularatne et al. (2018) investigated trend in the prevalence of GUD and revealed that HSV is the leading cause of GUD in South Africa. In a Zimbabwean study, Mungati et al. (2018) assessed the etiology of GUD and found out that HSV was the main cause of GUD. In another Zimbabwean study, Nyoni & Nyoni (2020) analyzed GUD cases in Chitungwiza urban district and revealed that more GUD cases are being confirmed in male than female patients and this trend will persist into the future.

Many researchers (Phiri et al., 2013; Kularatne et al., 2018; Mungati et al., 2018) have examined the etiology of GUD and overwhelmingly agreed that GUD is mainly caused by HSV. Only one paper (i.e Nyoni & Nyoni, 2020) models and forecasts GUD cases in Zimbabwe. The current study is motivated by Nyoni & Nyoni (2020) and seeks to empirically refute or confirm the results revealed by Nyoni & Nyoni (2020). This will go a long way in helping policy makers generalize the policy prescriptions for the fight against GUD in different places in the country, for example, if the results of this study become consistent with Nyoni & Nyoni (2020), it may imply the need for similar policy actions to be implemented in both Chitungwiza urban district and Gweru urban district. This could lead to possible generalization of results in many similar places around the country, or simply generalizing results for the whole country, pending further empirical examination.

METHODOLOGY

Following Nyoni & Nyoni (2020), the study applies the Artificial Neural Network (ANN) approach in modeling and forecasting GUD cases for GDH. Guided by Fischer & Gopal (1994), who argue that no strict rules 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.

DATA ISSUES

The data used in this study, that is, GUDM and GUDF series covers the period January 2010 to December 2019 and was recorded for young adults aged 16 – 49 years who presented with

GUD at GDH over the study period. All the data was taken from the Health Information Department at GDH.

FINDINGS OF THE STUDY

DESCRIPTIVE STATISTICS

Table 1: Descriptive statistics

Variable	Mean	Median	Minimum	Maximum
GUDM	2.1833	2.0000	0.0000	8.0000
GUDF	0.61667	0.0000	0.0000	3.0000
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
GUDM	1.9617	0.89851	0.98962	0.58869
GUDF	0.77982	1.2646	1.1029	0.54352
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
GUDM	0.0000	7.0000	2.0000	0
GUDF	0.0000	2.0000	1.0000	0

From table 1 above, it is clear that most GUD cases have been confirmed in males than females at GDH. For example, the average GUDM cases over the study period is 2 cases per month while the average GUDF cases over the same period is approximately 1 case per month. The maximum for GUDM is 8 cases while the maximum for GUDF is 3.

Table 2: ANN model summary – GUDM

Variable	GUDM
Observations	108 (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	0.135896
MSE	0.364792
MAE	0.465727

Table 2 shows the main results of the ANN model describing GUDM.

In-sample Forecast – GUDM

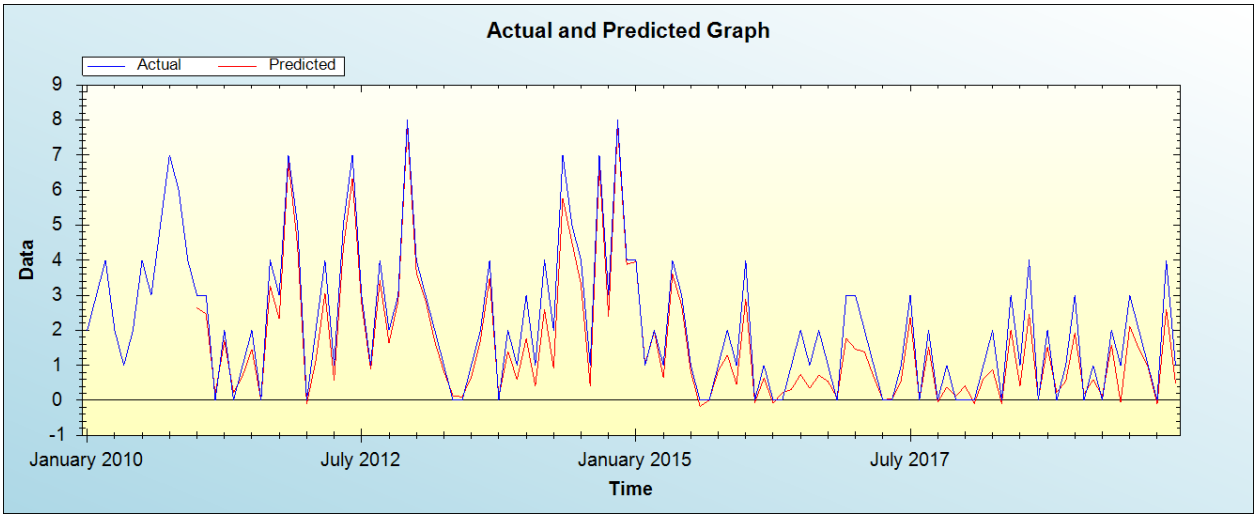

Figure 2: In-sample forecast – GUDM

Figure 2 shows the in-sample forecast of the ANN model for GUDM.

Out-of-Sample Forecast – GUDM: Actual and Forecasted Graph

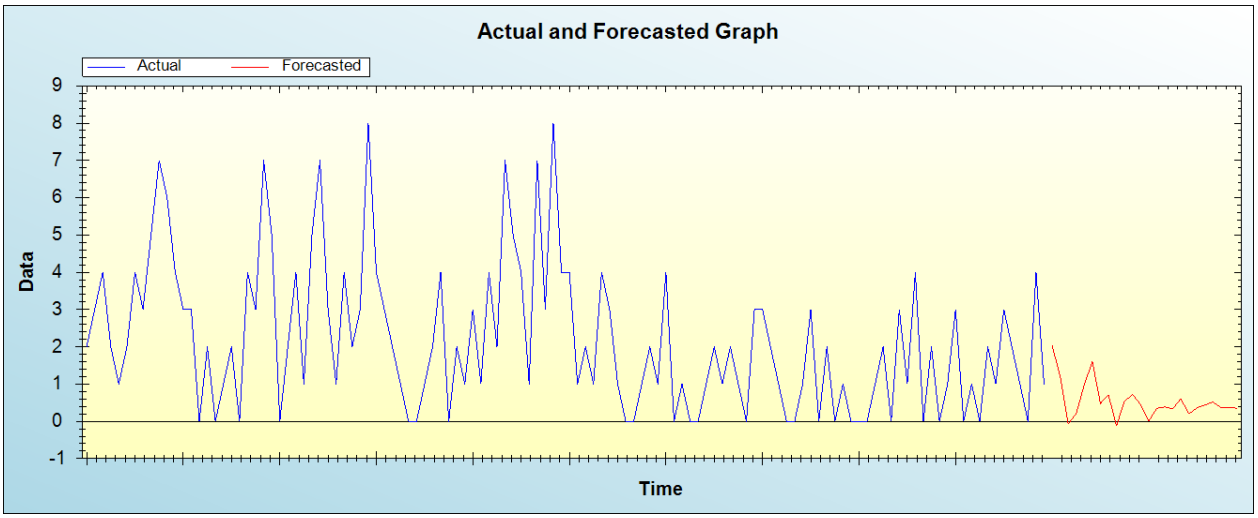

Figure 3: Out-of-sample forecast – GUDM: actual and forecasted graph

Figure 3 shows the out-of-sample forecasts for the GUDM series; the same is also tabulated in table 3 and graphed in figure 4 below.

Out-of-Sample Forecast – GUDM: Forecasts only

Table 3: Out-of-sample forecast – GUDM: forecasts only

Month/Year	Predicted GUDM
January 2020	2.0361
February 2020	1.2088
March 2020	-0.0779

April 2020	0.2189
May 2020	0.9811
June 2020	1.6055
July 2020	0.4782
August 2020	0.7128
September 2020	-0.1222
October 2020	0.5419
November 2020	0.7199
December 2020	0.4543
January 2021	0.0079
February 2021	0.3480
March 2021	0.3830
April 2021	0.3390
May 2021	0.6067
June 2021	0.2003
July 2021	0.3640
August 2021	0.4373
September 2021	0.5176
October 2021	0.3624
November 2021	0.3741
December 2021	0.3501

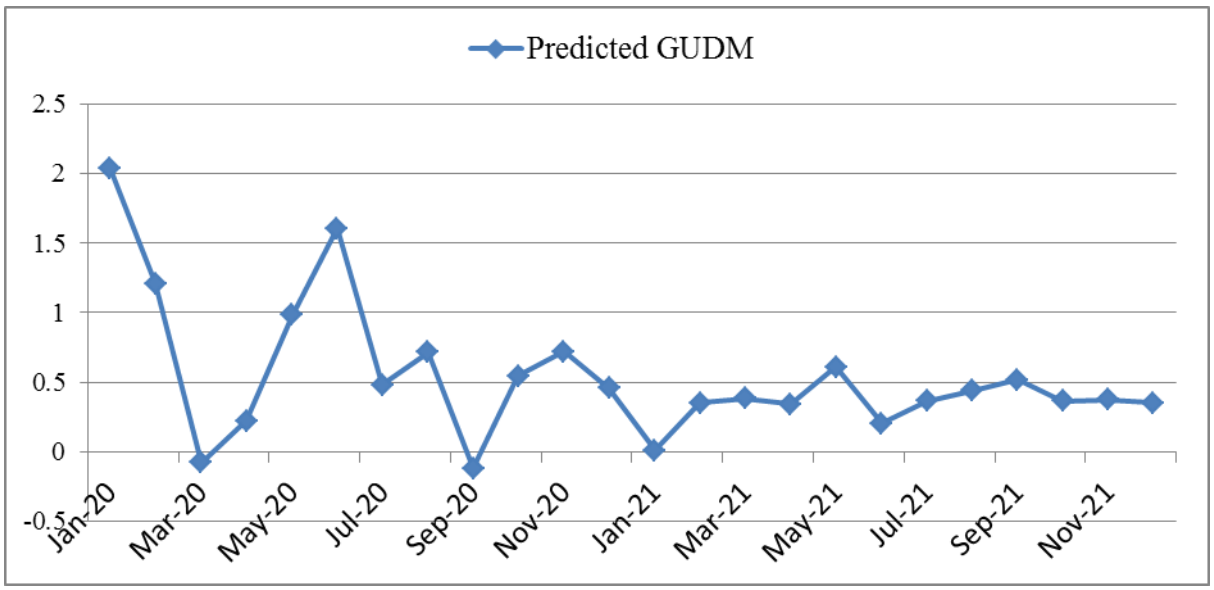

Figure 4: Graphical presentation – GUDM: out-of-sample forecasts only

Table 4: ANN model summary – GUDF

Variable	GUDF
Observations	108 (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	0.188258
MSE	0.098448
MAE	0.215192

Table 4 shows the main results of the ANN model describing GUDF.

In-sample Forecast – GUDF

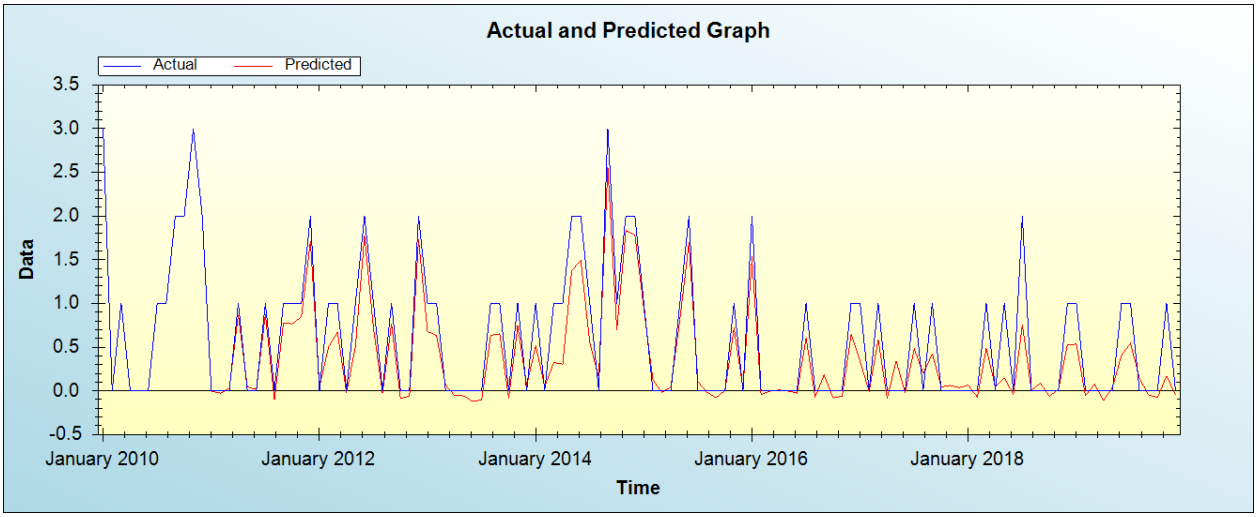

Figure 5: In-sample forecast – GUDF

Figure 5 shows the in-sample forecast of the ANN model for GUDF.

Out-of-Sample Forecast – GUDF: Actual and Forecasted Graph

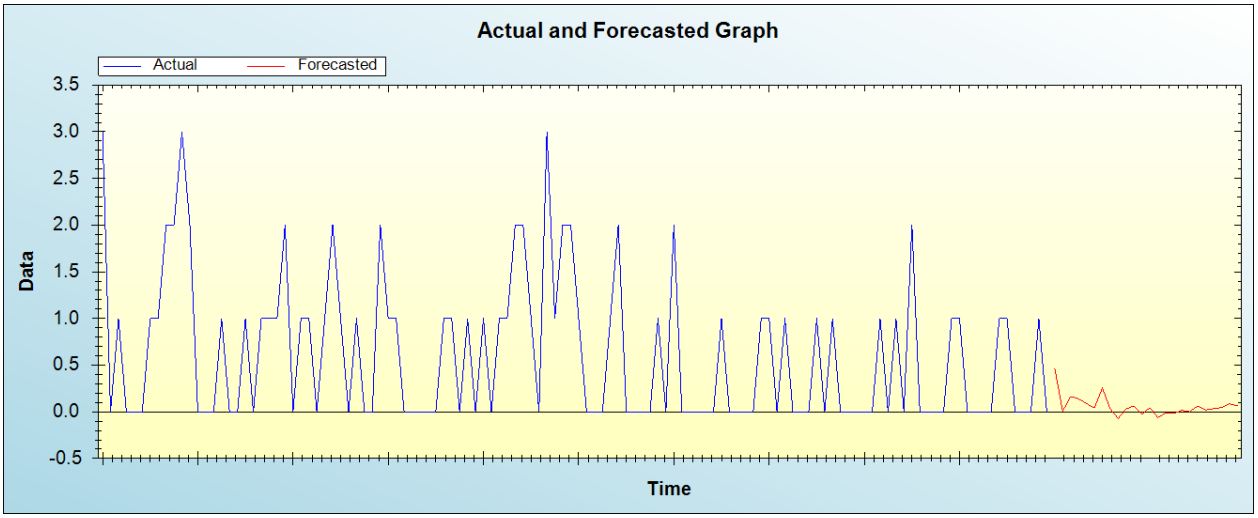

Figure 6: Out-of-sample forecast – GUDF: actual and forecasted graph

Figure 6 shows the out-of-sample forecasts for the GUDF series; the same is also tabulated in table 5 and graphed in figure 7 below.

Out-of-Sample Forecast – GUDF: Forecasts only

Table 5: Out-of-sample forecast – GUDF: forecasts only

Month/Year	Predicted GUDF
January 2020	0.4643
February 2020	0.0058
March 2020	0.1636
April 2020	0.1405
May 2020	0.0875
June 2020	0.0407
July 2020	0.2580
August 2020	0.0304
September 2020	-0.0725
October 2020	0.0302
November 2020	0.0646
December 2020	-0.0233
January 2021	0.0447
February 2021	-0.0624
March 2021	-0.0111
April 2021	-0.0177
May 2021	0.0149
June 2021	0.0018
July 2021	0.0616

August 2021	0.0184
September 2021	0.0336
October 2021	0.0454
November 2021	0.0845
December 2021	0.0663

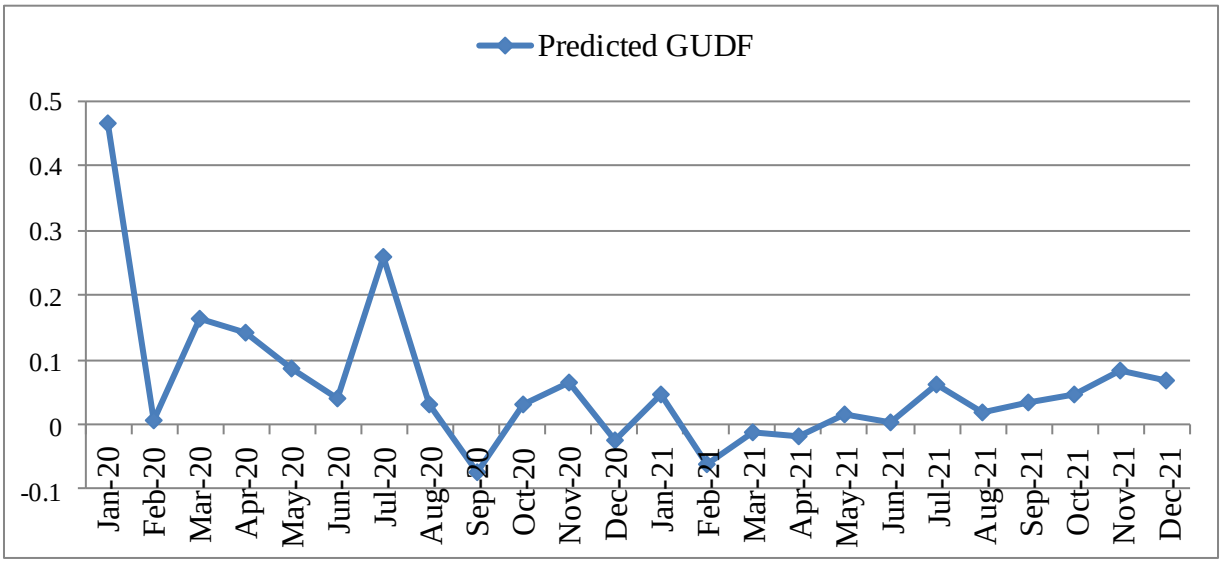

Figure 7: Graphical presentation – GUDF: out-of-sample forecasts only

Predicted GUDM and GUDF on a Single Graph

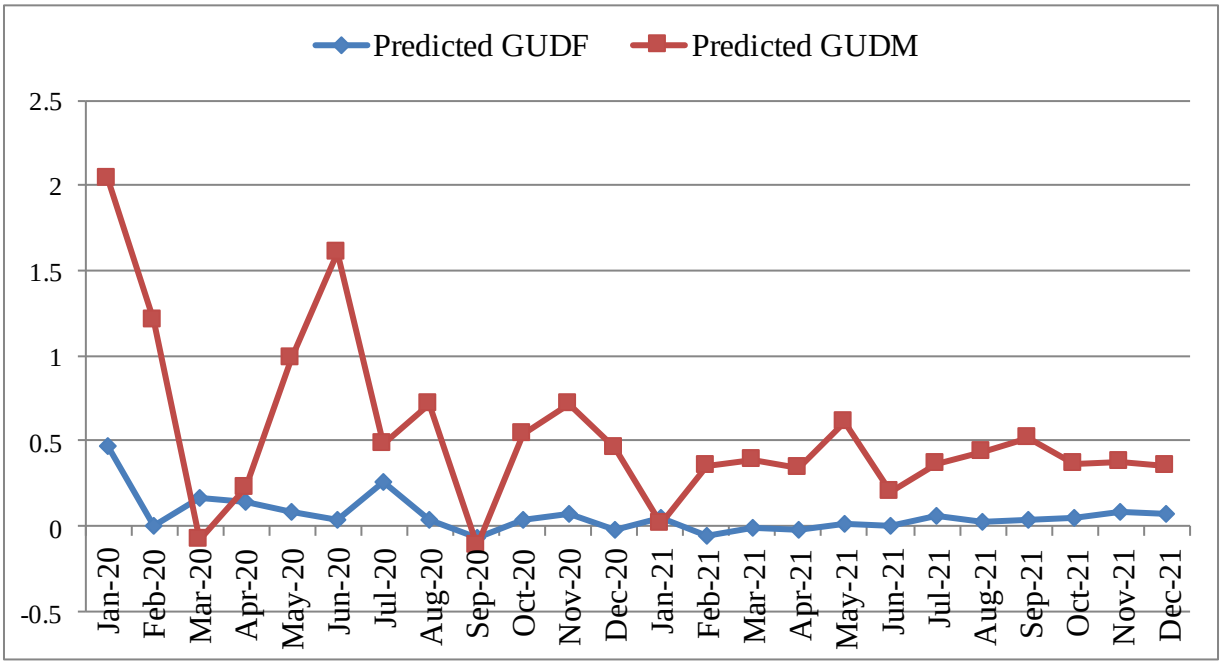

Figure 8: Predicted GUDM and GUDF on a single graph

Figure 8 shows the projected GUDM and GUDF cases over the period January 2020 to December 2021. Worthy to note is that both predicted GUDM and GUDF cases are declining. It is also clear that GUDM cases have been projected to remain higher than GUDF cases, confirming the need for sexual behavior change programmes in Gweru urban district, especially for men. The results of this study are consistent with Nyoni & Nyoni (2020).

Residual Analysis and Forecast Evaluation for the ANNs

Residual Analysis for GUDM

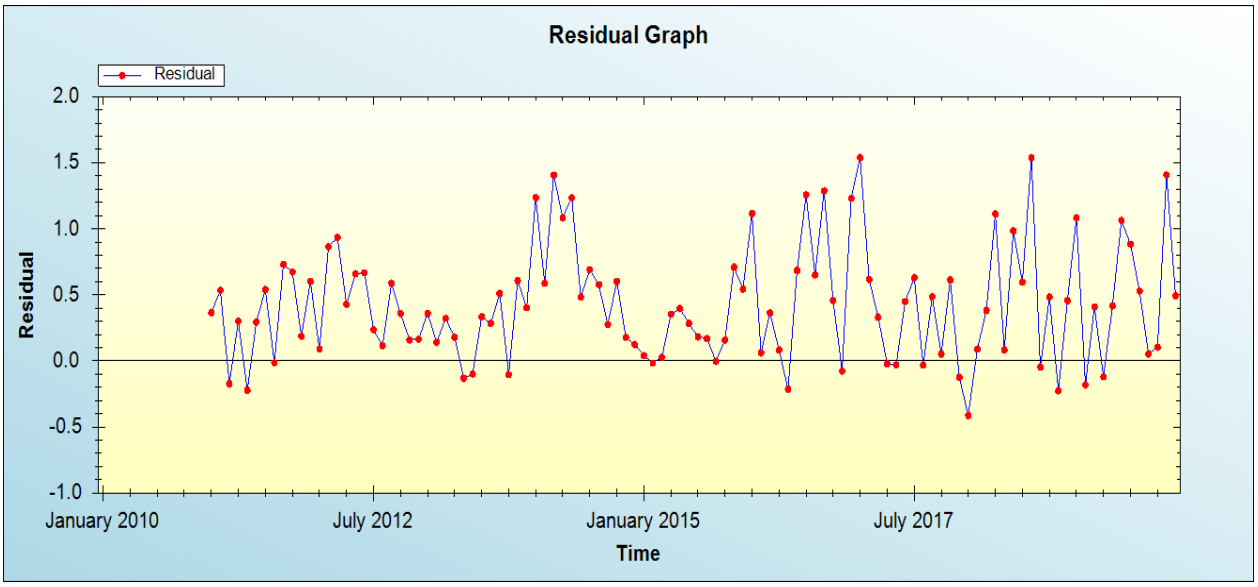

Figure 9: Residual analysis for GUDM

Residual Analysis for GUDF

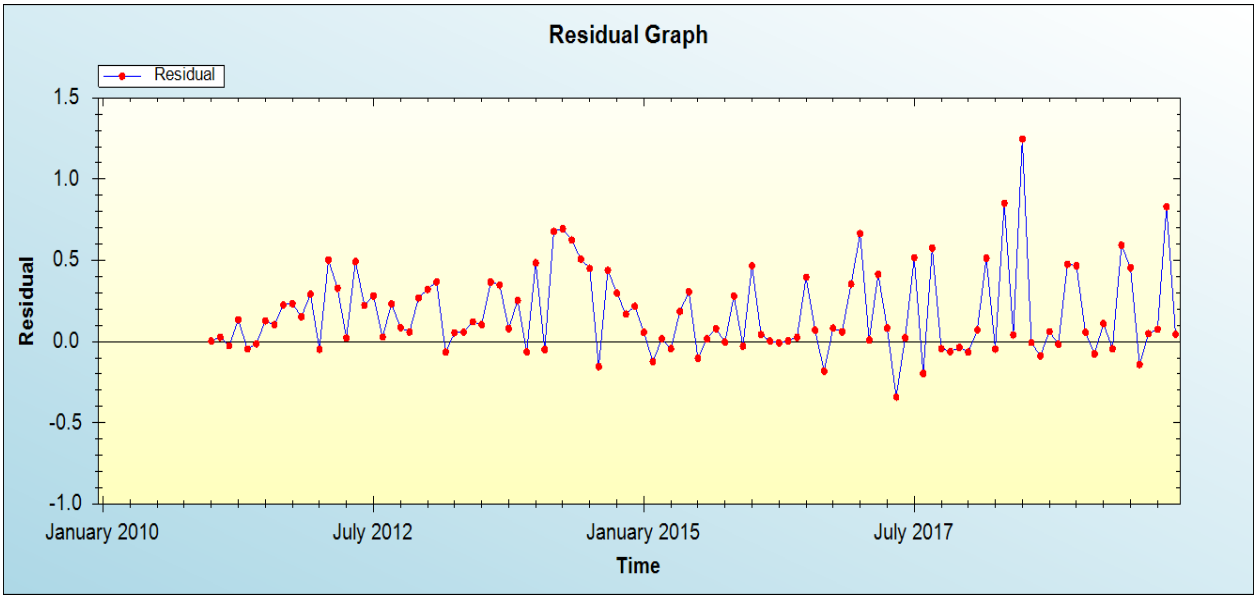

Figure 10: Residual analysis for GUDF

Forecast Evaluation Statistics for Both GUDM and GUDF ANNs

Table 6: Forecast evaluation statistics

Evaluation Statistic	GUDM ANN	GUDF ANN
Error	0.135896	0.188258
MSE	0.364792	0.098448
MAE	0.465727	0.215192

Figure 9 and 10 show stable residuals, which are as close to 0 as possible; indicating the suitability of the estimated models. Table 6 shows the forecast evaluation criteria: in both instances, the Error, MSE and MAE are quite small, indicating the reliability of the forecasts.

CONCLUSION & RECOMMENDATIONS

This paper examined GUD cases for GDH over the period January 2010 – December 2019. The applied ANN models indicate a general decline in GUD cases at GDH but also confirm the common knowledge that men have a poor healthcare seeking behavior as their GUD cases seem to be always more than those of females. Even though, the projected decline in overall GUD cases imply a possible win in the fight against GUD, it paramount to consider the following policy directions in order to complement the existing policy frameworks:

i. GDH should see to it that they intensify sexual behavior change programmes as well as general sexual health education programmes in its catchment area, especially at Gweru urban district. Special emphasis should be put on STI prevention, detection and treatment.
ii. GDH should also scale-up its voluntary medical male circumcision (VMMC) programmes.

REFERENCES

[1] Fischer, M. M., & Gopal, S. (1994). Artificial Neural Networks: A New Approach to Modeling Interregional Telecommunication Flows, Journal of Regional Science, 34 (4): 503 – 527.

[2] Kilmarx, P. H., et al. (2018). HIV Infection in Patients With Sexually Transmitted Infections in Zimbabwe – Results From the Zimbabwe STI Etiology Study, PLoS ONE, 13 (6): 1 – 10.

[3] Kularatne, R. S., et al. (2018). Trends in the Relative Prevalence of Genital Ulcer Disease Pathogens and Association With HIV Infection in Johannesburg, South Africa, 2007-2015, PLoS ONE, 13 (4): 1 – 13.

[4] Mungati, M., et al. (2018). The Etiology of Genital Ulcer Disease and Coinfections With Chlamydia Trachomatis and Neisseria Gonorrhoeae in Zimbabwe: Results From the Zimbabwe STI Etiology Study, Sexually Transmitted Diseases, 45 (1): 61 – 68.

[5] Nyoni, S. P., & Nyoni, T. (2020). Genital Ulcer Disease in Chitungwiza Urban District in Zimbabwe: Latest Insights From Artificial Neural Networks, International Journal of Research and Development, 5 (2): 222 – 233.

[6] Phiri, S., et al. (2013). Etiology of Genital Ulcer Disease and Association With HIV Infection in Malawi, Sexually Transmitted Diseases, 40 (12): 923 – 928.

[7] Roett, M. A., et al. (2012). Diagnosis and Management of Genital Ulcers, American Family Physician, 85 (3): 254 – 262.