CHOLERA PREDICTION SYSTEM

Yobe State, Nigeria

Comprehensive Analysis Report

Date Range: October 2014 - November 2024
LGAs Analyzed: 6 (Fune, Nguru, Nangere, Bade, Gujba, Machina)
Total Cases: 513
Model: Ridge Regression (R² = 0.78)

Report Generated: October 17, 2025

eHealth Africa - Disease Modelling Unit

EXECUTIVE SUMMARY

1. OVERVIEW

This report presents a comprehensive analysis of cholera cases in Yobe State, Nigeria, spanning from October 2014 to November 2024. The analysis integrates environmental factors (precipitation, temperature, vegetation indices), socio-economic indicators (wealth index, population), and historical case data to predict future cholera risk.

2. KEY FINDINGS

• Total cholera cases recorded: 513

• Number of weeks with cases: 44 out of 3156

• Most affected LGA: Fune (228 cases, 44.4%)

• Least affected LGA: Gujba (38 cases, 7.4%)

• Peak year: 2024

3. MODEL PERFORMANCE

• Best performing model: Ridge Regression

• Test accuracy (R²): 0.777 (77.7% variance explained)

• Average prediction error (RMSE): 0.72 cases per week

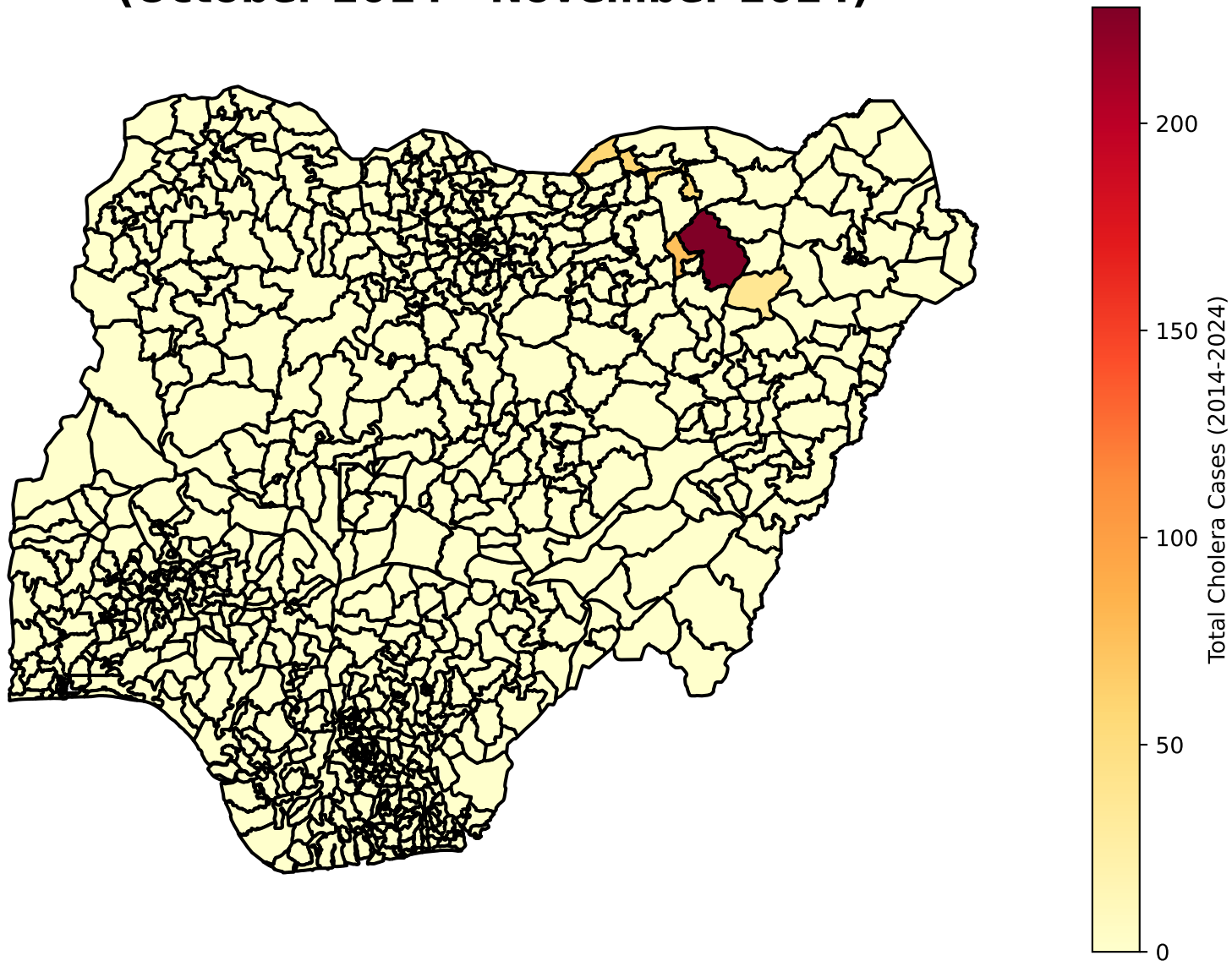• Models tested: Random Forest, Gradient Boosting, Ridge, Lasso Regression

4. FUTURE PREDICTIONS (Next 12 Weeks)

• Total predicted cases: 791

• Highest risk LGA: Fune (545 expected cases)

• Number of LGAs at high/very high risk: 3
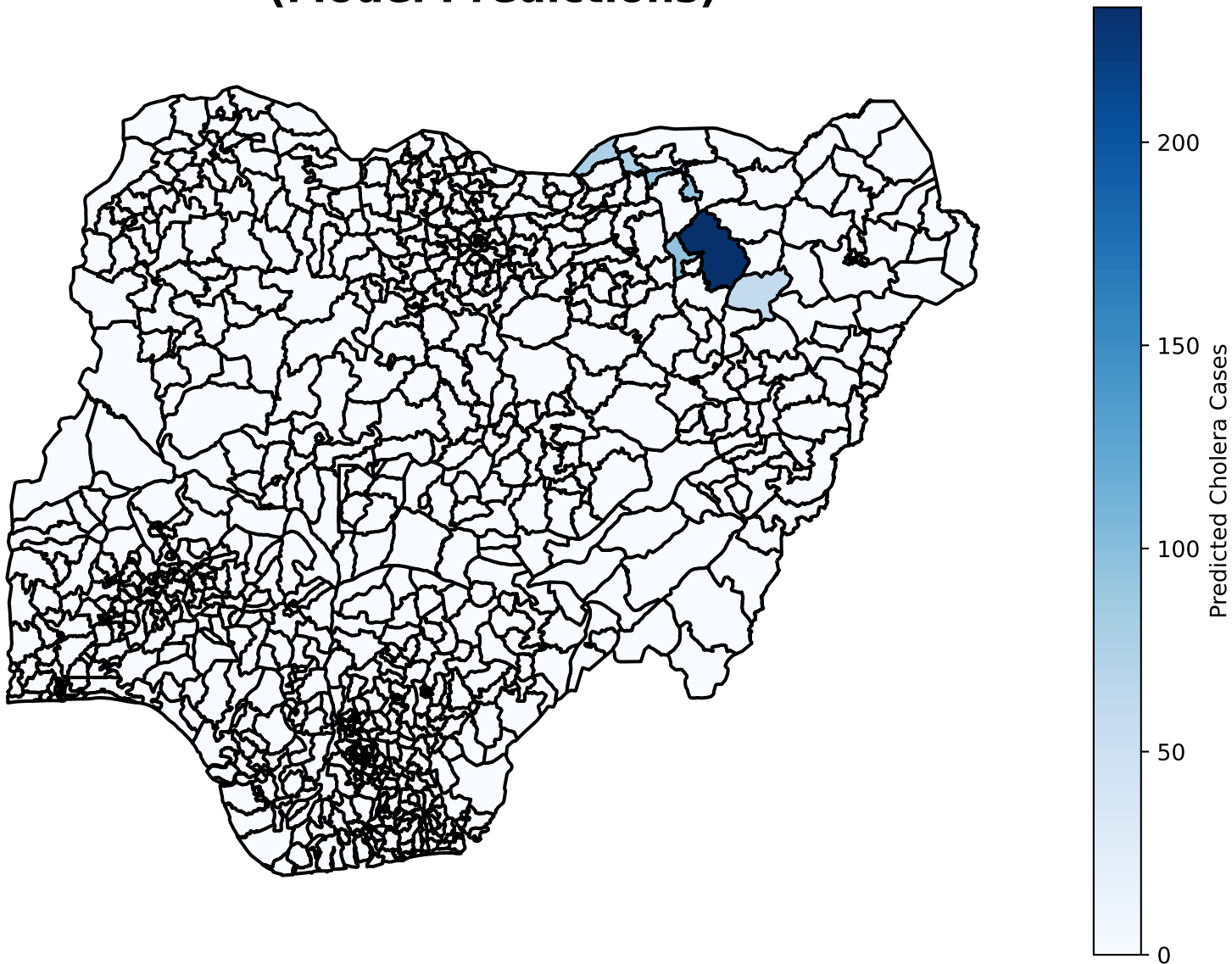
• High-risk LGAs: Fune, Nangere, Nguru

5. PRIORITY RECOMMENDATIONS

• Deploy rapid response teams to Fune, Nguru, and Nangere LGAs immediately

• Pre-position oral rehydration salts and cholera treatment kits in high-risk areas

• Intensify community health education on water, sanitation, and hygiene (WASH)

• Strengthen disease surveillance and early warning systems

• Coordinate with WASH sector to improve water quality and sanitation facilities

ACTUAL CHOLERA CASES BY LGA
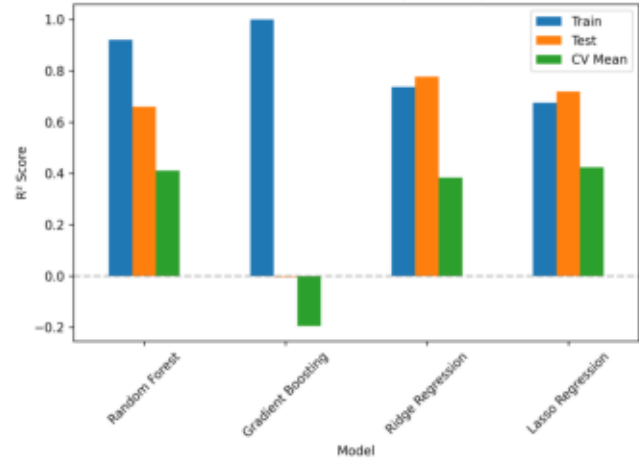## (October 2014 - November 2024)

PREDICTED CHOLERA CASES BY LGA
(Model Predictions)

Predicted Cholera Cases

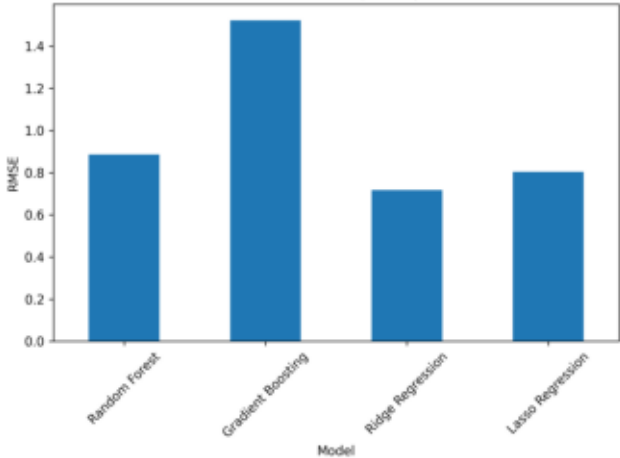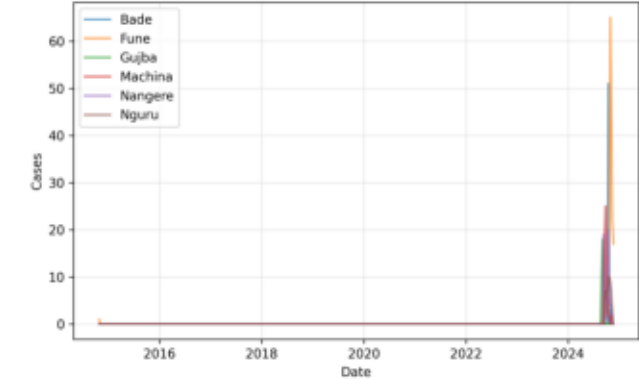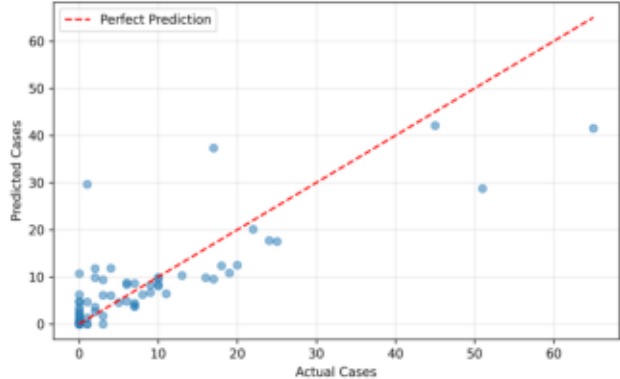# ANALYSIS CHARTS

Model Performance (R² Score)

Model Error (RMSE)

Cholera Cases Over Time by LGA

Predicted vs Actual Cases

MODEL PERFORMANCE COMPARISON

Model	Train R²	Test R²	CV R²	RMSE	MAE
Random Forest	0.921	0.660	0.411	0.886	0.119
Gradient Boosting	1.000	-0.004	-0.195	1.522	0.151
Ridge Regression	0.737	0.777	0.383	0.718	0.154
Lasso Regression	0.675	0.720	0.423	0.804	0.126

INTERPRETATION

• R² (R-squared): Proportion of variance explained by the model (higher is better, max = 1.0)

• RMSE (Root Mean Square Error): Average prediction error in cases per week (lower is better)

• MAE (Mean Absolute Error): Average absolute prediction error (lower is better)

• CV R²: Cross-validation R² score, measures generalization ability

The Ridge Regression model achieved the best test performance with an R² of 0.777, meaning it explains 77.7% of the variance in cholera cases. The model's RMSE of 0.72 indicates an average prediction error of less than 1 case per week.

FUTURE PREDICTIONS - NEXT 12 WEEKS

LGA	Total Predicted Cases	High-Risk Weeks (out of 12)
Fune	544.5	12/12
Nguru	95.9	12/12
Nangere	69.1	12/12
Bade	56.1	0/12
Machina	24.6	0/12
Gujba	0.6	0/12

NEXT WEEK PREDICTIONS (Week Starting: 2024-12-01)

Fune: 45.4 cases   **[Very High]**

Nguru: 8.0 cases   **[High]**

Nangere: 5.7 cases   **[High]**

Bade: 4.7 cases   **[Medium]**

Machina: 2.0 cases   **[Medium]**

Gujba: 0.0 cases   **[Low]**

CHOLERA CASES BY LGA AND YEAR

ga_name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Bade	0	0	0	0	0	0	0	0	0	0	55
Fune	1	0	0	0	0	0	0	0	0	0	227
Gujba	0	0	0	0	0	0	0	0	0	0	38
Machina	0	0	0	0	0	0	0	0	0	0	58
Nangere	0	0	0	0	0	0	0	0	0	0	75
Nguru	0	0	0	0	0	0	0	0	0	0	59

RECENT PREDICTIONS (Last 20 Weeks)

lga_name	week_start	case_count	predicted_cases	risk_category
Nguru	2024-11-18 00:00:00	0	3.4881794273949347	Medium
Nangere	2024-11-18 00:00:00	0	2.013894020401326	Medium
Gujba	2024-11-18 00:00:00	0	0.0	Low
Bade	2024-11-18 00:00:00	0	4.621619165283587	Medium
Machina	2024-11-18 00:00:00	0	0.1231576893809331	Low
Fune	2024-11-18 00:00:00	17	37.34197094136399	Very High
Machina	2024-11-11 00:00:00	0	2.8672999833540325	Medium
Gujba	2024-11-11 00:00:00	0	0.0766464377970426	Low
Fune	2024-11-11 00:00:00	22	20.09767046292421	Very High
Nangere	2024-11-11 00:00:00	0	0.0	Low
Bade	2024-11-11 00:00:00	0	0.0	Low
Nguru	2024-11-11 00:00:00	3	6.109010770516442	High
Machina	2024-11-04 00:00:00	2	3.6287316592413	Medium
Bade	2024-11-04 00:00:00	1	29.683221953273204	Very High
Nguru	2024-11-04 00:00:00	7	8.633006584532016	High
Gujba	2024-11-04 00:00:00	0	0.0	Low
Nangere	2024-11-04 00:00:00	4	11.86494132103867	Very High
Fune	2024-11-04 00:00:00	45	42.08905054552025	Very High
Machina	2024-10-28 00:00:00	0	4.8059658184450464	Medium
Fune	2024-10-28 00:00:00	65	41.54310110896836	Very High