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Research

Prevalence and Determinants of Cholera Outbreak and Personal Hygiene Among Adults.

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Abstract: Cholera remains a major public health concern affecting high risk population. During a cholera outbreak, it is essential to reduce transmission and minimize new infections. The miasma theory, host-agent-environment model and eco social theory were utilized for this study. This study analyzes the prevalence and determinants of cholera among adults in selected states in Nigeria from 2020 to 2024 utilizing Time series using least square regression to predict and forecast and correlation analysis to identify the relationship between suspected cases of cholera and Total death cases. Data was sourced from the Nigerian centre for disease control (NCDC) encompassing reported cholera cases and deaths from 2020 to 2024. The study employed a secondary and quantitative data to elucidate the relationship between cholera prevalence and personal hygiene. The results from forecasting shows that the severity of the disease has generally been reducing while correlation analysis shows there is strong positive relationship between total suspected cases and death cases in year 2020 with (r=0.87), year 2022 with (r=0.95), a weak positive correlation with (r=0.32) in 2023 and a very strong positive correlation with (r=0.98) in 2024. These results underscore the critical need for comprehensive public health interventions focusing on improving water quality, sanitation and hygiene (WASH) pratices. The study recommends the implementation of targeted educational programs to promote personal hygiene and advocates for continuous surveillance and data collection to monitor cholera trends and inform policy decisions.
The results show that number of suspected cases and deaths over the years shows a corresponding decrease. This means that cholera infection can be contained in Nigeria.

Keywords: Cholera, Prevalence, Epidemiology, Outbreak, Risk factors.

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1.0 INTRODUCTION

Cholera remains a persistent global health issue, primarily affecting regions where access to clean and safe water and sanitation is limited. This acute diarrheal disease caused by vibrio cholera (v.cholera), Robert Koch,(1880) can lead to severe dehydration, vomiting and death if untreated, Despite advances in medical sciences, cholera outbreak continue to impact millions of individuals. The prevalence of cholera is often linked to a combination of environmental, social and personal hygiene practices of individuals.

Historically known as a “disease of poverty”, cholera predominantly affects low income communities, where the infrastructure for safe, clean water and sanitation is often lacking. It is endemic and seasonal in nature, occurring mostly during rainy season. The organism normally lives and thrives in aquatic environment, people acquire its infection by consuming contaminated water, seafood or other foods. Infection can spread rapidly particularly in areas where human waste is untreated.

In Nigeria, the first series of cholera outbreak was reported between 1970 to 1990. Despite this long experience with cholera, an understanding of the epidemiology of the disease aiding its persistence in outbreak is still lacking. The federal ministry of health reported 37289 cases and 1434 deaths between January and October 2010 while a total of 22797 cases of cholera with 728 deaths and case fatality rate of 3.2% was recorded in 2011. Cholera is usually transmitted Feco-orally through contaminated water and food and remains a risk in many countries.

New outbreaks can occur sporadically in any part of the country where water supply, food hygiene and sanitation are inadequate. Mild and asymptomatic cholera accounts for 80% of cases with incubation periods ranging from two hours to five days. Preventing cholera from entering a community is impossible, however, early detection and confirmation followed by appropriate response can prevent the spread within the community. Individuals who are at highest risk of this disease include children and adults. There have been extensive attempts to contain this disease in Nigeria and all over the world at large.

Cholera constitute a great medical, social and economic problems in Nigeria, apart from the affliction it causes and poses to health and life. Cholera has the capability of high transmissibility through consumption of infected food and water, substantial fatal death and also the ability to cause huge economic and social disruption in the nation.

Since the inception of cholera outbreak in Nigeria, there has been extensive attempts to better contain the disease in Nigeria and all over the world. The timely filling of these knowledge and safety precautions gaps is necessary to keep oneself safe and away from this disease and to enhance control strategies. To achieve the purpose of this studies, the aim and objectives of this research is: to investigate the prevalence of cholera outbreaks and to identify key determinants that contribute to its spread with a specific focus on personal hygiene practices among adults, to predict the number of suspected cholera cases, to forecast number of suspected cases and deaths associated with cholera and to determine the type and the strength of relationship that exists between suspected cases and deaths.

Taylor, (2015) reviewed multiple cross sectional studies that examined hygiene promotion during a cholera outbreak. One study suggested that the public health messages, regarding hygiene were effective and promoted appropriate behaviour changes. Another study reported large percentages of people receiving the health messages with a majority employing at least one prevention method. There are two oral cholera vaccines prequalified by the WHO, Dukoral and Shancol. Both vaccines killed whole cell v.cholerae. In addition, shancol contains v.cholerae 0139 whereas Dukoral contains the recombinant cholera toxin B subunit. Both vaccines have a good and efficacy profile. The vaccines have an estimated 60 to 85% protection rate for a life span of 2 to 3 years.

The WHO has recommended vaccine use since 2010; however, public health use has been limited due to questions about feasibility, acceptability, cost and resources. Luquero, (2013). Between 2012 and 2014, a case control study within Haiti was conducted to determine the field of effectiveness of the oral inactivated bivalent whole cell vaccine. This vaccine was found to be effective in protecting against cholera infections for up to 24 hours after vaccination. Ivers, (2015).

Individuals living in remote areas are particularly susceptible to cholera due to awareness and weak integrated disease and response (IDSR) system within their communities. Although Nigeria adopted IDSR as its public health surveillance strategy in 2021, its effectiveness varies significantly across different states.

The poor functionality of this surveillance system has hindered effective outbreak responses in Nigeria. This gap in active community based surveillance, directly and indirectly threatens the achievement of the three strategic axes of the global cholera roadmap which aims to end cholera worldwide by 2030. The Nigerian health authorities must implement the global cholera roadmap, as recommended by the Global Taskforce on

cholera control(GTFCC) to reduce cholera deaths by 90% in the country. This requires strengthening both natural and local health surveillance systems and enhancing cholera streams, which include health facility based surveillance, community based surveillance should routinely detect suspected cholera cases.

There are several reasons for cholera cases to remain unreported, when symptoms are mild, health advice may not be sought after by patients. Mild cases may not be tested for v.cholerae due to symptoms being undistinguishable from other causes. In addition, there are several surveillance and reporting limitations such as limited health care, stigma and fear, inadequate surveillance system.

Penrose, (2010), A researcher in Dr Congo researched on Cholera transmission in the republic of Congo (DRC). A time series based least square regression analysis was deemed appropriate for this study to determine the relationship that exists between Cholera and prevalence variable such as hygiene awareness, water access and sanitation in the republic of Congo and evaluating the ability of the model to forecast the magnitude of Cholera. Least square regression highlighted the impact of these factors in reducing or increasing Cholera cases

Pearson's correlation test examined the possibility of a linear relationship between Cholera and other variables and revealed a significant correlation between Cholera cases and sanitation, water and hygiene practices with coefficients of 0.233, -0.176 and -0.243 respectively. However, these values are below the threshold of 0.05, indicating a weak relationship or association. Penrose, (2010); Stolzfus, (2014).

The outcome of the study is predicted to considerably lowering the rate of cholera in spreads, addressing both the prevalence and behavioral factors, this research has the potential to provide actionable recommendation ultimately reducing cholera outbreaks and improving health outcomes. This research continues to reducing morbidity and mortality associated with the disease, enhancing personal hygiene and environmental sanitation practices as emphasized in this study directly correlates with improved health outcomes and overall quality of life for affected populations. The scope of the research work is within the data gotten from the Nigeria center for disease control (NCDC) which covers January to September 2024 and the previous available years within a given selected states in Nigeria.

METHODOLOGY

Population can be defined as the total number of persons in a particular area. It can also be defined as the totality of all cases which possess a set of well-defined

characteristics. It is the entire group of items which the researcher wishes to study. This project will examine and analyse the data on the suspected cases and deaths cases of individuals of cholera from 2020 to 2024 using Nigeria as the case study. Population of the study consists of all the persons that fall under the umbrella of those reported to have cholera in Nigeria. Some states were selected from the 36 states in Nigeria including the FCT for sampling and a judgmental sampling method was employed by getting data from Nigeria Center for Disease Control (NCDC) within the specific states that experience the outbreak of Chlorea over the given years in Nigeria. The research method used for this study to determine the analysis of the prevalence and determinants of cholera among adults in Nigeria are deductive statistics and inductive statistics; deductive statistics such as percentages, frequency tables, bar chart, line graph were use to describe the phenomenon while, inductive statistics applies linear regression analysis and correlation analysis from which conclusion are drawn. Linear regression model using least square method is used for predicting and forecasting future cares, helps identify trends and patterns in data such as the suspected cares and disease prevalence overtime. It is also useful for contributing meaningful insights for public health officials to design and implement effective prevention strategies for cholera outbreaks and to significantly contain cholera outbreaks in Nigeria.

Regression analysis is a statistical device that estimates or predicts the unknown values of one variable from the unknown values of another variable. There are two types of variable in regression analysis:

Independent variable

Dependent variable

The variable whose value is influenced or to be predicted is called dependent variable. A dependent variable is what happens as a result of the independent variable. The variable which influences the value or is used for prediction is called independent variables.

$Y = a + bt$

$$a = \frac{y}{n} - \frac{b\Sigma t}{n}$$

$$b = \frac{n\Sigma Xt - \Sigma Xt\Sigma Yt}{n\Sigma Xt^2 - (\Sigma Xt)^2}$$

Derivation of regression analysis formula

$Y = a + by$

Least square estimate

$Y = a + \beta xi + Ni$

ΣNi

Y = a + βxi + Ni

Ni = Yi - a - βxi

$\Sigma Ni^2 = \Sigma(Yi - a - \beta Xi)$

$$\frac{\delta Ni^2}{\delta a} = 2\Sigma(Yi - a - \beta Xi)$$ ------- i

$$\frac{\delta \Sigma Ni^2}{\delta \beta} = -2Xi\Sigma(Yi - a - \beta)$$

$$\frac{\delta \Sigma Ni^2}{\delta a} = 0$$

$$\frac{\delta \Sigma Ni^2}{\delta \beta} = 0$$ ------- (ii)

$-2\Sigma(Yi - a - \beta Xi^2) = 0$

$\Sigma(Yi - a - \beta Xi) = 0$

$\Sigma Xi(Yi - a - \beta Xi) = 0$ -------- (iii)

From (iii)

$\Sigma Yi - na - \beta \Sigma Xi = 0$

$$\frac{na}{n} = \frac{\Sigma Yi}{n} - \frac{\beta 2Xi}{n}$$

$A = y - \beta X$ --------- (iv)

From equation (iv)

$\Sigma Xi(Yi - a - \beta Xi) = 0$

$\Sigma XiYi - aXi - \beta \Sigma Xi^2 = 0$ -------- (v)

From equation (v)

$$a = \frac{\Sigma Yi}{n} - \frac{\beta \Sigma Xi}{n}$$

$$\Sigma XiYi - \Sigma Xi\left(\frac{\Sigma Yi}{n} + \frac{\beta Xi}{n}\right) - \beta \Sigma Xi^2 = 0$$

$$\Sigma XiYi - \frac{\Sigma Xi \Sigma Yi}{n} + \frac{\beta(\Sigma Yi)^2}{n} - \beta \Sigma X^2 \; \Sigma XiYi - \frac{\Sigma Xi \Sigma Yi}{n} + \frac{\beta(\Sigma Yi)^2}{n} - \beta \Sigma X^2 = 0$$

Multiply through by n

$n\Sigma XiYi - \Sigma xi\Sigma Yi + \beta(\Sigma Xi)^2 - n\beta \Sigma Xi^2 = 0$

$n\Sigma XiYi - \Sigma xi\Sigma Yi = n^2$

$\Sigma Xi^2 - \beta(\Sigma X)^2$

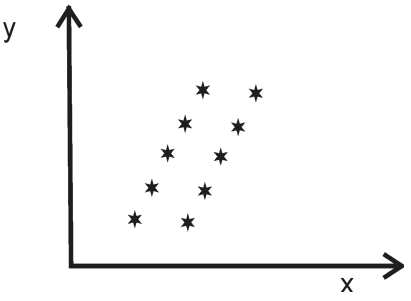
$$\frac{n\Sigma XiYi - \Sigma XiYi}{n\Sigma Xi^2 - (\Sigma Xi)^2} = \frac{\beta(n\Sigma Xi^2 - (\Sigma X)^2}{n\Sigma Xi^2 - (\Sigma Xi)^2}$$

$$B = \frac{n\Sigma XiYi - \Sigma Xi\Sigma Yi}{n\Sigma Xi^2 - (\Sigma Xi)^2}$$

Correlation analysis is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. There are four types of correlation analysis.

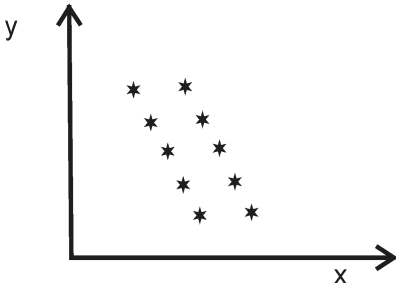
- Positive correlation
- Negative correlation
- Zero correlation
- Perfect positive correlation

Positive Correlation: This is a direct linear relationship that exist in bivariate data (x and y) such that an increase in x has a corresponding increase in Y



0<r<1

Negative Correlation: A negative correlation between two variables means that the variables more in opposite directions. An increase in one variable leads to a decrease in the other variable and a decrease in one variable leads to an increase in the other variable.



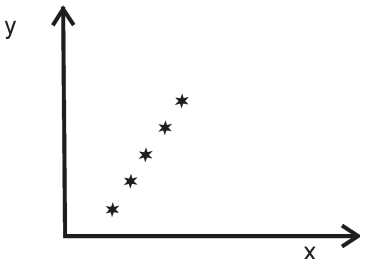
-1<r<0

Zero Correlation: When all the points in a scatter plots are in such a way that a linear line cannot be fixed. We say that there is a zero relationship between the two variables

r = 0

Perfect Positive Correlation: When all the points on a scatter plot fall on a straight line, we say there is a perfect positive or negative correlation between x and y.

r = 1



$$r = \frac{(n\Sigma xy)-(\Sigma x)(\Sigma y)}{\sqrt{n\Sigma x^2-(\Sigma x)^2 . n\Sigma y^2-(\Sigma y)^2}}$$

ΣX is the sum of all X values

ΣY is the sum of all Y values

ΣXY is the sum of the product of X and Y values

ΣX^2 is the sum of the squares of X values

X is the mean of X = ΣX/n

Y is the mean of Y = ΣY/n

Cor(X, Y) = 1/n Σ(Xi – X)(Yi – Y) = (ΣXY – nXY)/n

Cor(X, Y) = 1/n (ΣXY – ΣXΣY)/n

$$Var(X) = \frac{1}{n}\Sigma(Xi - X)^2 = \frac{\Sigma X^2 - nX^2}{n}$$

$$Var(Y) = \frac{1}{n}\Sigma(Yi - Y)^2 = \frac{\Sigma Y^2 - nY^2}{n}$$

$$r = \frac{Cor\,(X,Y)}{\sqrt{Var\,(x)Var\,(y)}}$$

$$r = \frac{1}{n}(\Sigma XY - \frac{\Sigma X \Sigma Y}{n})$$

$$\frac{n(\Sigma XY)-(\Sigma X)(\Sigma Y)}{\sqrt{\frac{1}{n}(\Sigma X^2 - \frac{\Sigma X^2}{n}) . \frac{1}{n}(\Sigma Y^2 - \frac{\Sigma Y^2}{n}}}$$

$$r = \frac{n(\Sigma XY)-(\Sigma X)(\Sigma Y)}{\sqrt{(n\Sigma X^2 - (\Sigma X)^2 . n\Sigma Y^2 - (\Sigma Y)^2}}$$

The magnitude of the correlation coefficient (r) indicates the strength of the relationship

r < 0.5 indicates a weak positive relationship between variables

r > 0.5 indicates a strong positive relationship between variables

r < -0.5 indicates a weak negative relationship between variables

r > -0.5 indicates a strong negative relationship between variables.

RESULTS AND DISCUSSION

The results examines the prevalence and determinants of cholera outbreaks and personal hygiene among adults within selected states in Nigeria. The findings are structured to provide a clear understanding of the relationships between key variables and their impact on public health. To ensure clarity and ease of interpretation, results are presented using tables and charts, also time series analysis were used to predict the trend of cholera outbreak based on the information soured using a secondary source of data collection.

Table 1: Descriptive Statistics for Cases and Total Deaths in 2020

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Cases with Diarrhea	8	380	20	400	158.13	45.118	127.614
Cases with Vomiting	8	332	18	350	139.75	39.059	110.475
Cases with Dehydration	8	285	15	300	124.38	33.878	95.821
Total Suspected Cases	8	997	53	1050	422.25	118.025	333.825
Total Deaths	8	13	2	15	7.38	1.558	4.406
Valid N (list-wise)	8						

From the table above the mean number of suspected cases was 422.25, with diarrhea, vomiting, and dehydration being the major symptoms. The mean number of deaths was 7.38, indicating relatively low mortality compared to later years. A high standard deviation suggests variations in case distribution.

Table 2: Correlation Between Total Suspected Cases and Total Deaths in 2020

H_0: There is no significant correlation between the number of suspected cases and total deaths.

H_1 : There is a significant correlation between the number of suspected cases and total deaths.

Decision rule: Reject H_0, accept H_1 → Higher case numbers are significantly associated with increased deaths.

Correlations

		Total Suspected Cases	Total Deaths
Total Suspected Cases	Pearson Correlation	1	.947**
	Sig. (2-tailed)		.000
	N	8	8
Total Deaths	Pearson Correlation	.947**	1
	Sig. (2-tailed)	.000	
	N	8	8

Conclusion: Given a Pearson correlation value of 0.947 which indicate 95% strongly positive association between suspected cases and deaths of Patients with Cholera diseases..

Table 3: Descriptive Statistics for Cases and Total Deaths in 2021

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Suspected cases with diarrhea	8	10300	1700	12000	5250.00	1296.148	3666.061
Suspected cases with vomiting	8	8600	1400	10000	4450.00	1083.480	3064.544
Suspected cases with dehydration	8	8400	1100	9500	4012.50	1036.553	2931.814
Total Suspected cases	8	27300	4200	31500	13712.50	3414.017	9656.299
Total Deaths	8	160	90	250	160.00	21.213	60.000
Valid N (list-wise)	8						

The table above shows highest reported cases mean is given as (13,712.50) and deaths mean is given as (160.00) compared to other years. Major symptoms: diarrhea, vomiting, and dehydration. Significant variability in the number of cases across different periods.

Table 4: Correlation Between Total Suspected Cases and Total Deaths in 2021

H$_0$: No significant correlation between suspected cases and deaths.

H_1: A significant correlation exists between suspected cases and deaths.

Decision rule: reject H_0 if $p > 0.05$ otherwise do not reject.

Correlations

		Total Suspected cases	Total Deaths
Total Suspected cases	Pearson Correlation	1	.870**
	Sig. (2-tailed)		.005
	N	8	8
Total Deaths	Pearson Correlation	.870**	1
	Sig. (2-tailed)	.005	
	N	8	8

Conclusion: given the Pearson correlation value to be 0.870 (p = 0.005) we conclude that there is a very Strong positive association between suspected cases and death with the state considered in the given data whereby, implied that increased in suspected cases led to more deaths.

Table 5: Descriptive Statistics for Cases and Total Deaths in 2022

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Suspected Cases With Diarrhea	9	550	1400	940.22	288.419
Suspected Cases With Vomiting	9	400	2158	884.22	529.188
Suspected Cases With Dehydration	9	380	2000	792.22	490.326
Total Suspected Cases	9	1330	5170	2616.67	1185.211
Total Deaths	9	10	280	64.78	84.624
Valid N (listwise)	9				

From the table above there is decline in suspected cases (mean = 2,616.67) and deaths (mean = 64.78) compared to 2021. Significant standard deviation, indicating variability in the number of cases across the year.

Table 6: Correlation Between Total Suspected Cases and Total Deaths in 2022

H_0: No significant correlation between suspected cases and deaths.

H_1: A significant correlation exists between suspected cases and deaths.

Decision rule: reject H_0 if $p > 0.05$ otherwise do not reject.

Correlations

		Total Suspected Cases	Total Deaths
Total Suspected Cases	Pearson Correlation	1	.945**
	Sig. (2-tailed)		.000
	N	9	9
Total Deaths	Pearson Correlation	.945**	1
	Sig. (2-tailed)	.000	
	N	9	9

Conclusion: The Pearson correlation value is given as 0.945 (p = 0.000), this indicate a very Strong positive association between the suspected cases and death of cholera patients, this indicate that deaths increased with the rise in cases.

Table 7: Descriptive Statistics for Cases and Total Deaths in 2023

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Suspected cases with diarrhea	13	1480	20	1500	4321	332.38	131.985	475.877
Suspected cases with vomiting	13	1280	20	1300	2855	219.62	94.269	339.893

cases with dehydration	13	2098	10	2108	3661	281.62	155.244	559.738
Total Suspected cases	13	4833	75	4908	10837	833.62	364.660	1314.802
Total deaths	13	20	3	23	126	9.69	1.546	5.574
Valid N (listwise)	13							

From the table above further reduction in cases (mean = 833.62) and deaths (mean = 9.69). Suggests better disease management or immunity development. Standard deviation shows continued fluctuations, though at a lower scale than previous years.

Table 8: Correlation Between Total Suspected Cases and Total Deaths in 2023

H_0: No significant correlation between suspected cases and deaths.

H_1: A significant correlation exists between suspected cases and deaths.

Decision rule: reject H_0 if $p > 0.05$ otherwise do not reject.

Correlations

		Total Suspected cases	Total deaths
Total Suspected cases	Pearson Correlation	1	.323
	Sig. (2-tailed)		.282
	N	13	13
Total deaths	Pearson Correlation	.323	1
	Sig. (2-tailed)	.282	
	N	13	13

Conclusion: the Pearson correlation value is given as 0.323 (p = 0.282), his shows there is a Weak association between the total suspected cases and death in the year 2023, this not statistically significant (p > 0.05).

Table 9: Descriptive Statistics for Cases and Total Deaths in 2024

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Suspected Cases With Diarrhea	10	899	1	900	1796	179.60	88.805	280.825
Suspected Cases With Vomiting	10	800	0	800	2045	204.50	82.491	260.858
Suspected Cases With Dehydration	10	899	1	900	1796	179.60	88.805	280.825
Cases with Tachycardia	10	1100	0	1100	2350	235.00	107.437	339.747
Cases with Fever	10	500	0	500	1245	124.50	51.091	161.563
Total Suspected Cases	10	4498	2	4500	10762	1076.20	459.968	1454.546
Total Deaths	10	131	0	131	349	34.90	13.046	41.254
Valid N (listwise)	10							

The table above shows an increase in cases (mean = 1,076.20) and deaths (mean = 34.90) compared to 2023. New symptoms: Tachycardia and fever, possibly leading to higher mortality. Rising trend suggests a resurgence of the disease.

Table 10: Correlation Between Total Suspected Cases and Total Deaths in 2024

H_0: No significant correlation between suspected cases and deaths.

H_1: A significant correlation exists between suspected cases and deaths.

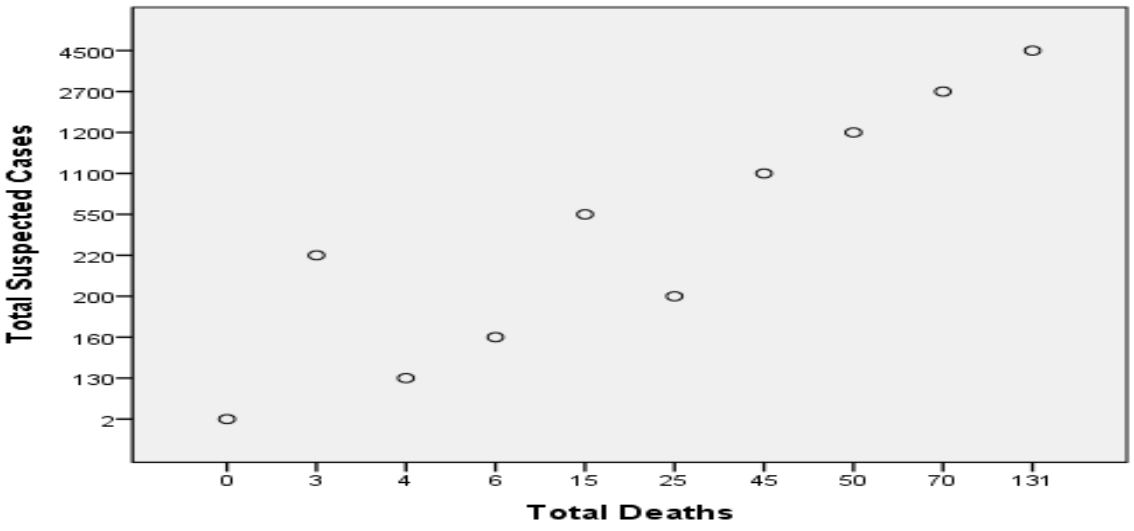
Decision rule: reject H_0 if $p > 0.05$ otherwise do not reject

Correlations

		Total Suspected Cases	Total Deaths
Total Suspected Cases	Pearson Correlation	1	.977**
	Sig. (2-tailed)		.000
	N	10	10
Total Deaths	Pearson Correlation	.977**	1
	Sig. (2-tailed)	.000	
	N	10	10

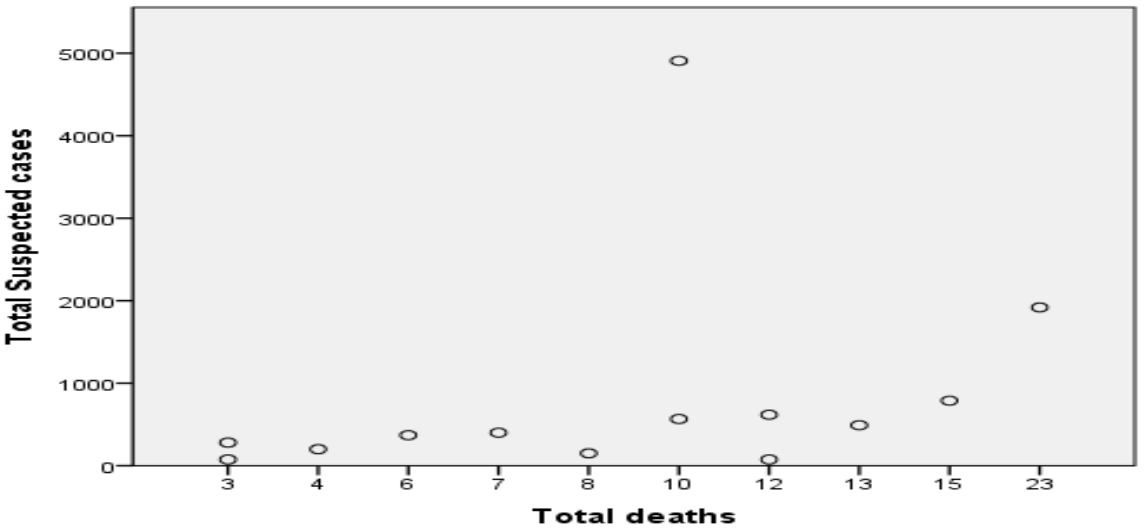
Conclusion: The Pearson correlation is given as 0.977 (p = 0.000), this indicate a very strong association between Total suspect rate and death in Cholera patients in year 2024 hereby, indicating that new symptoms may have contributed to higher deaths.

Figure 1: Distribution of Total Suspected Cases and Total Deaths in 2024



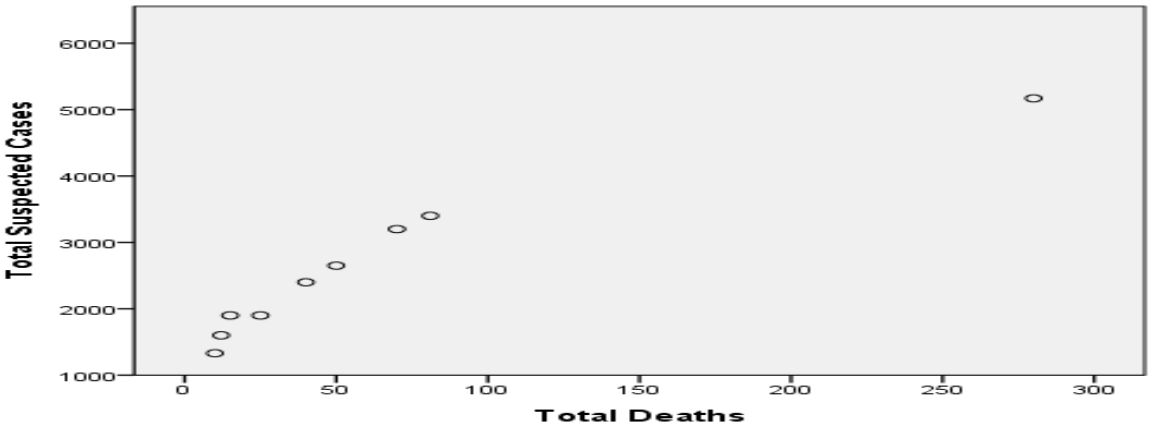
From the figure above, increase in total suspected cases (up to 4,500), with 349 recorded deaths. New symptoms (tachycardia and fever) appear, potentially contributing to higher mortality. Indicates a resurgence of the disease after previous declines.

Figure 2: Distribution of Total Suspected Cases and Total Deaths in 2023



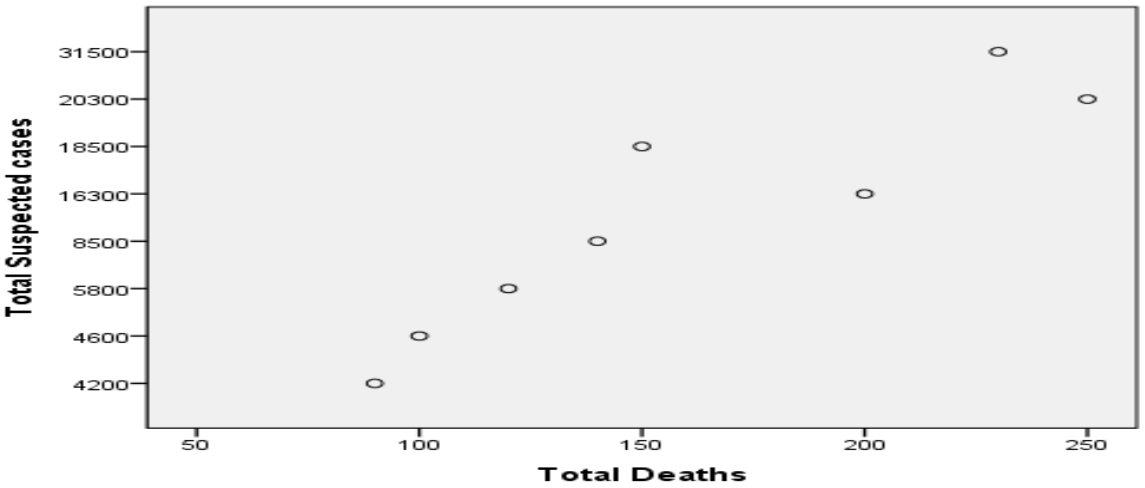
The figure above shows significant decline in cases (833.62 average) and deaths (9.69 average) compared to 2022. Suggests better disease management but not complete eradication.

Figure 3: Distribution of Total Suspected Cases and Total Deaths in 2022



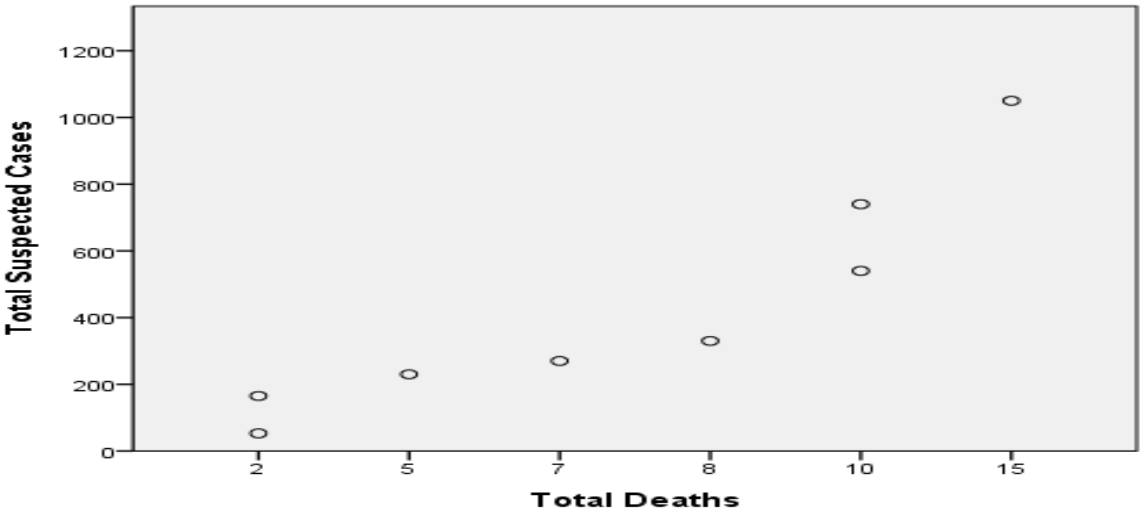
The figure above, shows moderate decline in cases (mean = 2,616.67) and deaths (64.78 average) compared to 2021. Indicates partial success in controlling the outbreak but with ongoing risks.

Figure 4: Distribution of Total Suspected Cases and Total Deaths in 2021



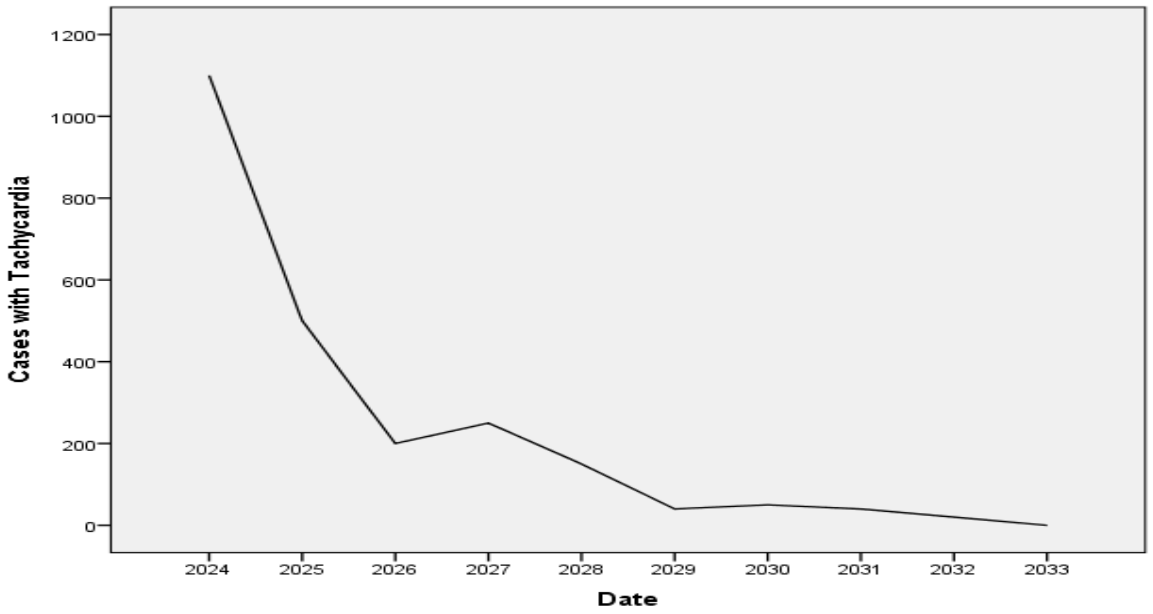
The figure above, shows peak outbreak year with the highest number of cases (mean = 13,712.50) and deaths (160.00). Reflects a severe crisis requiring immediate intervention.

Figure 5: Distribution of Total Suspected Cases and Total Deaths in 2020



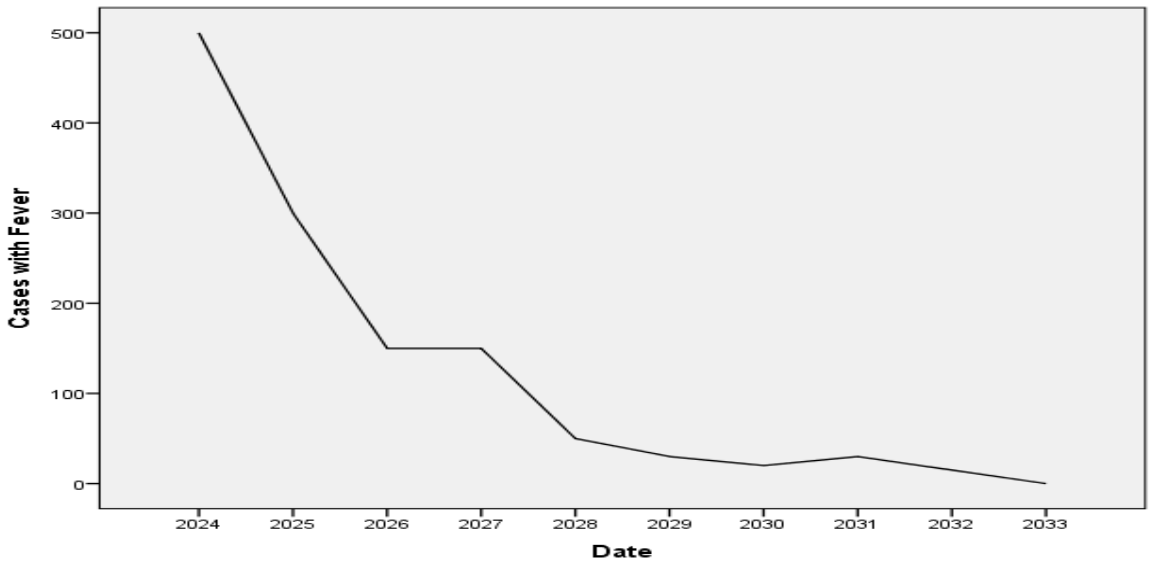
From the figure above, lowest number of cases and deaths compared to later years (mean = 422.25 cases, 7.38 deaths). Represents the initial phase of the outbreak before its peak in 2021.

Figure 6: Time Series Analysis of Cases with Tachycardia (2024-2033)



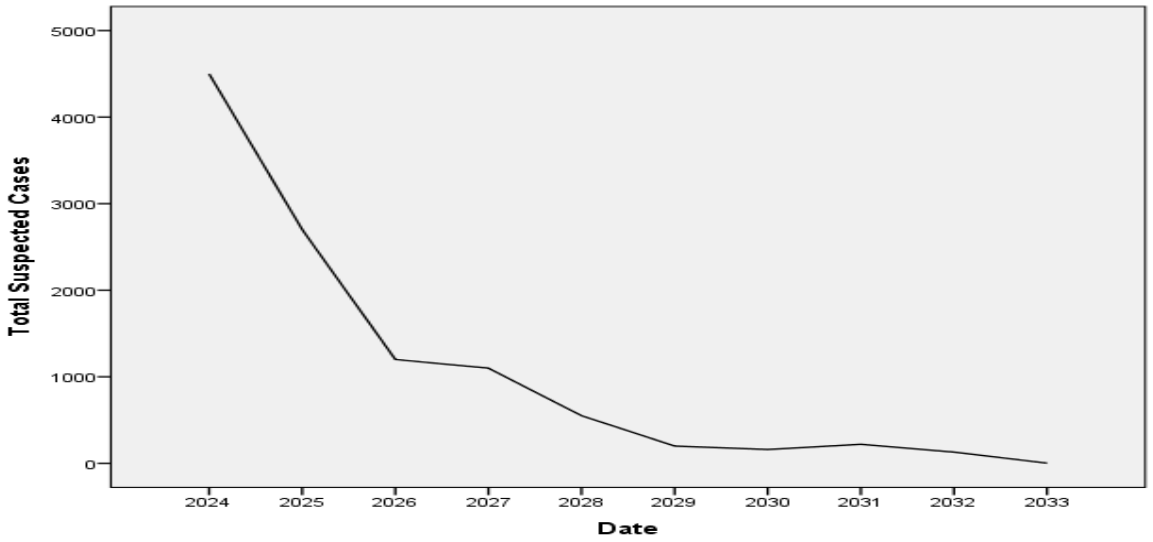
The figure shows an increasing trend in tachycardia cases, suggesting worsening health outcomes.

Figure 7: Time Series Analysis of Cases with Fever (2024-2033)



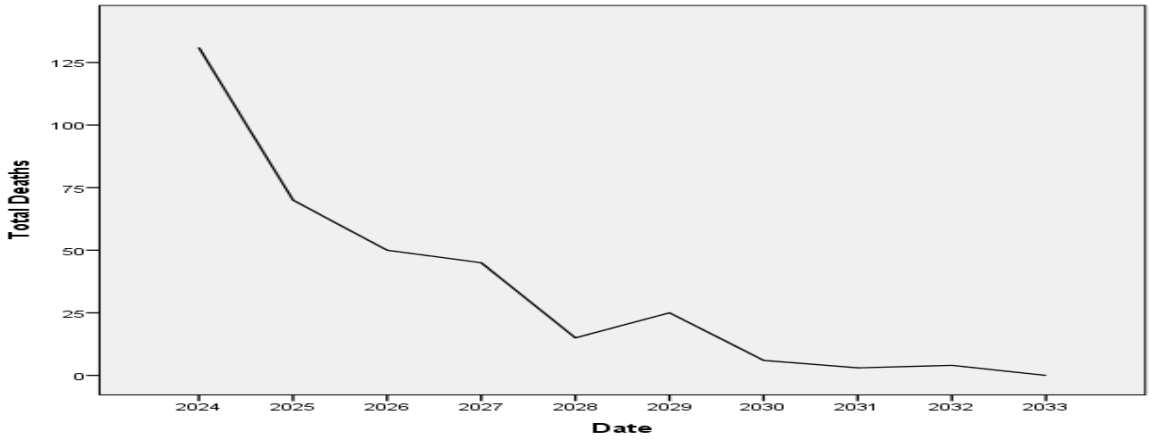
The chart above depicts gradual rise in fever cases, which may indicate a more severe disease pattern.

Figure 8: Time Series Analysis of Total Suspected Cases (2024-2033)



The figure above, depicts fluctuations but overall upward trend, suggesting disease control measures may need improvement.

Figure 9: Time Series Analysis of Total Deaths (2024-2033)



From the figure above, expected increase in mortality, particularly after 2028, highlighting the need for interventions.

Summary of Findings

From the time series analysis trend, the number of suspected cases of cholera is expected to decrease in 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032 and 2033. Also number of death cases. Also least square method used to forecast death cases shows the

number of death cases to decline in 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032 and 2033.

The Correlation analysis shows that there is a strong positive relationship between total number of cholera cases recorded and the total death rate in the number of selected state in Nigeria which data were available during the course of this research work. In the year 2020 there is a very strong association with (r=0.95), same cases with year 2021 with (r=0.87), year 2022 with (r=0.95), and a weak positive association with (r=0.32) in 2023 and a very strong association with (0.98) in 2024.

The findings indicate that for every state represented in Nigeria, cholera disease has been adequately contained and the outbreak needs to be managed for further spread among the citizens.

The correlation analysis from the data analyzed shows that number of suspected cases and death over the years shows a corresponding decrease and correlation analysis shows positive relationship between suspected cases and death cases. The analysis indicated that there is a strong relationship between individuals who are suspected to have contacted cholera diseases and the total number of death of the given. There was high rate of cholera outbreak in year 2024al due to the addition symptoms of the outbreak.

Conclusion

From the results above, it was established that the number of suspected cases and death cases has reduced in the forecasted years. This means that cholera has reduced, thereby the outbreak of cholera should be managed by the government and individual in the community so has to avoid the continuous spread of the diseases in the community and this will help to minimize the mortality rate of the morbidity. The epidemiological implication of this finding is that Cholera can be effectively contained in Nigeria. This shows that over the year based on the forecast, cholera can be managed and can be eradicated in the years to come if the necessary measures are put in place to avoid its continuous outbreak.

References

1. Ali M. (2012): The global burden of cholera. Bulletin of the World Health Organization. Springer Berlin.
2. Chadwick.E.(1984): Report on the sanitary conditions of the laboring population. Edinburgh, Scotland: Edinburgh university press.
3. Chad.C.H.(2013): Historical epidemiology of the second cholera pandemic: Relevance to present day disease pandemics. Journal pone.

4. Daniel.P.D.(2017): Dr John snow and reverend whitehead: retrieved from http://www.cholera and the Thames.co.uk/cholera-in-london/cholera-in-soho/.

5. Eisenberg.J.N.S.(2007): Integrating disease control strategies. Balancing water, sanitation and hygienic diarrheal disease burden. Research and practice journal.

6. Gundry.S.(2004): A systematic review of the health outcomes to household water quality in developing countries. Journal of water and health

7. Heale.R.(2017): Validity and reliability in quantitative studies.Evidence based nursing journal

8. Hopkins.N.S(1926): The school of Hygiene and public health of the John Hopkins university, Baltimore, USA. British medical journal.

9. Ivers,L.C.(2015): Effectiveness of reactive oral cholera vaccination in rural Haiti. A case control study and bias-indicator analysis. The lancet Global health.

10. Karamanou.M.(2012): From miasmas to germs; a historical approach to theories of infectious disease transmission. Le infezioni stona della medicina.

11. Kellam.S.G(1999): Core elements of developmental epidemiologically based prevention research. American journal of community psychology.

12. Luquero.F.J(2013): First outbreak response using oral cholera vaccine in Africa. Vaccine coverage,acceptability And surveillance of adverse events,Guinea. 2012.plos.doi:http://dx.doi.org/110.137/journal.pritd.0002465

13. NCDC (2020): Cholera surveillance and number of cases. Www.ncdc.gov.ng

14. Pizzi.R.A(2023): Apostles of cleanliness. England. Asc publications

15. Pollitizer.R.(2004): A study of cholera. Bulletin of the World Health Organization.

16. Porta.M.(2014): A dictionary of epidemiology (6.ed international epidemiological association).Oxford, N.Y. Oxford university press

17. Snow.J.(1856): Cholera and the water supply in the south districts of London in 1854. Journal of public health and sanitary review.

18. Susser.M.(1998): Does risk factor epidemiology put epidemiology at risk? Peering into the future. Journal of epidemiological community health.

19. Vanderslice.J.(1993): All coil forms are not created equal- A comparison of the effects of water source and in-house water contamination on infantile diarrheal disease. Water Resource Research.

20. Zuckerman.J.N.(2007): The true burden and risk of cholera: implications for prevention and control. The lancet infectious diseases.7(8).521530.doi:http://dx.doi.org.ezp.waldenlibrary.org/10.1016/s1473-3099(07)7013-x.