

Survival Analysis of Cholera Disease in Ilorin East Local Government Area of Kwara State, Nigeria.

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ABSTRACT

This research was carried out to study the major causes of Cholera outbreak, determine whether symptoms of cholera is affected by the political wards of the local government area understudy, determine if the number of people that may likely contact cholera in future will increase or reduce and determine whether cholera is influenced by gender. Questionnaires were administered to 5,000 respondents of Ilorin East Local Government Area of kwara state in which about 4973 were retrieved from the respondents, which amount to 99.5%. Result from the descriptive statistics shows that eating contaminated food and lack of good social amenities are the major causes of cholera outbreak. The results of logistic regression analysis shows that those admitted to hospital after suspecting cholera symptoms is not influenced by the political ward of the respondents. In addition, the same analysis shows that number of patients that will be at risk in the nearest future will likely reduce while chi square analysis revealed that the rate at which people contact cholera is not dependent on gender. We thereby recommend that Health Planner should sensitize people more on the causes and prevention of cholera. Also, Drugs and other necessary amenities should be readily available before cholera outbreak in order to curtail any future outbreak of the disease

Key Word: causes, Cholera, outbreak, symptoms and Patients

I. INTRODUCTION

Survival analysis is a collection of statistical procedures for data analysis where the outcome variable of interest is time until an event occurs. Because of censoring the non-observation of the event of interest after a period of follow-up a proportion of the survival times of interest will often be unknown. The specific difficulties relating

to survival analysis arise largely from the fact that only some individuals have experienced the event and, subsequently, survival times will be unknown for a subset of the study group [2]. This phenomenon is called censoring and it may arise in the following ways: (a) a patient has not (yet) experienced the relevant outcome, such as relapse or death, by the time of the close of the study; (b) a patient is lost to follow-up during the study period; (c) a patient experiences a different event that makes further follow-up impossible. Such censored survival times underestimate the true (but unknown) time to event. Visualizing the survival process of an individual as a time-line, their event (assuming it were to occur) is beyond the end of the follow-up period. This situation is often called right censoring. Censoring can also occur if we observe the presence of a state or condition but do not know where it began. .

Cholera is a bacterial disease spread through contaminated water and food. Cholera can cause severe diarrhea, dehydration, and even death if the disease goes untreated. People living in places with unsafe drinking water, poor sanitation, and inadequate hygiene are at highest risk of cholera. Cholera is an infection of the intestines caused by the bacterium *Vibrio cholerae*. You can get cholera from drinking water or eating food containing cholera bacteria. [4]. Cholera is an acute diarrhea infection caused by consuming food or water contaminated with the bacterium *Vibrio cholerae*. It is a global public health threat and indicates inequity and lack of social and economic development. Access to safe water, basic sanitation and hygiene is essential to prevent cholera and other waterborne diseases. Most people with cholera have mild or moderate diarrhea and can be treated with oral rehydration solution (ORS).

II. LITERATURE REVIEW

Cholera caused by *Vibrio cholerae* remains endemic and recurrent in Nigeria resulting in morbidity and mortality on annual basis. *Vibrio cholerae* O1 and non-O1/O139 were reported causative agents of the disease outbreak in Nigeria and some of these strains circulating the country acquired multidrug resistance potential. Several factors including socioeconomic and environmental among other factors drive this trend [4]. Some regions in the country have been identified as hot spots most especially the north where insurgency has exacerbated outbreaks and management/control difficult. Surveillance and response to cholera outbreaks has been suboptimal which in turn has always increased the number of fatalities. Coordinated and harmonized approach involving all needed components (education, WASH, vaccination, surveillance, human capacity building and strengthening capacity of laboratories) has been advocated as a viable option to tackle the scourge [6].

Despite efforts to control cholera, the disease continues to occur as a major public health problem in many developing countries. Numerous studies over more than a century have made advances in the understanding of the disease and ways of treating patients, but the mechanism of emergence of new epidemic strains, and the ecosystem supporting regular epidemics, remain challenging to epidemiologist [1]. In Nigeria, since the first appearance of epidemic cholera in 1972, intermittent outbreaks have been occurring. The later part of 2010 was marked with severe outbreak which started from the northern part of Nigeria, spreading to the other parts and involving approximately 3,000 cases and 781 deaths [3]. Sporadic cases have also been reported. Although epidemiologic surveillance constitutes an important component of the public health response, publicly available surveillance data from Nigeria have been relatively limited to date. Based on existing relevant scientific literature on features of cholera, this paper presents a synopsis of cholera epidemiology emphasizing the situation in Nigeria [4].

Vibrio cholerae is the etiological agent of cholera, a severe diarrheal disease, which can occur as either an epidemic or sporadic disease. Cholera pandemic-causing *V. cholerae* O1 and O139 serogroups originated from the Indian subcontinent and spread globally and millions of lives are lost each year, mainly in developing and underdeveloped countries due to this disease [6]. *V. cholerae* O1 is further classified as classical and

Biotype which can produce biotype specific cholera toxin (CT). Since 1961, the current seventh pandemic El Tor strains replaced the sixth pandemic strains resulting in the classical biotype strain that produces classical CT [6]. The ongoing evolution of a typical *Vibrio cholerae* strains encoding classical CT is of global concern. Pathogenesis of *Vibrio cholerae* is a complex process that involves coordinated expression of different sets of virulence-associated genes to cause disease. We are yet to understand the complete virulence profile of *V. cholerae*, including direct and indirect expression of genes involved in its survival and stress adaptation in the host. In recent years, whole genome sequencing has paved the way for better understanding of the evolution and strain distribution, outbreak identification and pathogen surveillance for the implementation of direct infection control measures in the clinic against many infectious pathogens including *V. cholerae* [7]. This review provides a synopsis of recent studies that have contributed to the understanding of the evolution, distribution and genetics of the seventh pandemic of *Vibrio cholerae* strains.

. The objective of this narrative review is to investigate and identify factors responsible for the recurrent outbreaks of cholera in Africa and response strategies that have been employed in curbing the problem, with the view of aggregating otherwise sparing data needed for policy formulation geared towards control and eradication of the disease [1]. The continuous and recurrent outbreaks of cholera in Africa are fueled by cross-border migration, environmental reservoirs, socioeconomic factors, climate change and political instability.)

Global efforts to combat epidemic cholera outbreaks have witnessed tremendous feats over the decades. However, sporadic outbreaks in regions, particularly across African states, mask these advancements [3]. This regressive trend is frequently fueled by factors retarding efforts towards optimal environmental sanitation and personal hygiene, which include ingesting infected food, drinking contaminated waters, and engaging in unhealthy environmental practices such as indiscriminate waste and sewage disposal and poor toilet practices [5]. The ongoing efforts to achieve the Global Taskforce on Cholera Control (GTFCC) targets of a 90% reduction in cases and deaths by 2030, even in the wake of continuous outbreaks across various African regions, as reported by the World Health Organization (WHO) face a significant threat. One such effort, among others, is the AFRICHOL project, an enhanced cholera

surveillance consortium launched in Africa over a decade ago as part of the GTFCC at WHO to monitor and fast – track the GTFCCs 2030 targets. It is tasked with supporting the implementation of research-based strategies for combating cholera in Africa.

III. RESEARCH METHODOLOGY METHOD OF DATA COLLECTION

The method of data collection refers to the method used in obtaining the information required. Before acquiring the data used for this research work, the population of Ilorin East local government were sampled out by employing stratified sampling technique in which the population was grouped homogeneously by grouping them into political wards. Questionnaires were administered within these political wards and proper analysis was carried out based on the data obtained from the questionnaires.

METHOD OF DATA ANALYSIS

The statistical technique used for analyzing the data collected for this research work was CHI SQUARE (χ^2). Chi square is a non-parametric statistic, which is usually applied in a test involving nominal measurement. It is used to test the independent of two traits or correlation. It is also used to test for goodness of fit of statistics frequency, measures etc. This area of the research work deals only with the gender and contact of cholera within political wards in Ilorin East local government. The necessary computation formula is

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where O_{ij} is the observed value, E_{ij} is the expected value

To calculate expected frequencies, the sum of each row is multiplied by the sum of each column and the product divided by the grand total

$$E_{ij} = \frac{\text{row total} \times \text{column total}}{\text{grand total}}$$

The Hypothesis to be use is

H_0 : Gender is independent on the contact of cholera

H_1 : Gender is dependent on the contact of cholera

Level of significance $\alpha = 0.05$

Test statistic: $\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$

LOGISTIC REGRESSION

Logistic regression analysis is part of a category of statistical model used to analyze a dataset, which has one or more independent variable(s) that determine it outcome. The outcome is measured with a dichotomous variable (in which there are only two possible outcomes).

In logistics regression, the dependent variable is binary or dichotomous, i.e. it only contains data coded as 1 (TRUE, success, pregnant e.t.c.)

The goal of logistics regression is to find the best fitting model to describe the relationship between the dichotomous characteristics of interest of interest (dependent variable = response or outcome variable) and a set of independent (predictor or explanatory) variables.

Let X denotes the vector of predictors ($X_1, X_2, X_3, \dots, X_N$) and let the conditional probability that the outcome is denoted by the equation as: $P(Y = \frac{1}{X}) = \pi(X)$

The logistic regression model has a linear form for the logit of this probability.

$$\text{Logit} \{ \pi(X) \} = \log \left\{ \frac{\pi(X)}{1 - \pi(X)} \right\} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n$$

IV. DATA ANALYSIS

Table 1: Distribution of respondents according to their gender

Gender of the respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	2696	54.2	54.2	54.2
	Female	2017	40.6	40.6	94.8
	Bisexual	260	5.2	5.2	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

From table 1 above, male has the highest frequency of 2696 (54.2%) while female has a

frequency of 2017(40.6%) and bisexual respondents are 260(5.3%) frequency.

Table 2: Marital status of respondents

Marital Status of the respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	1614	32.5	32.5	32.5
	Married	1354	27.2	27.2	59.7
	Separated	1433	28.8	28.8	88.5
	Divorced	360	7.2	7.2	95.7
	Widow(er)	212	4.3	4.3	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

Table 2 above shows the marital status of respondents, the Single respondents constitute the highest frequency of 1614(32.5%) and married

have 1359 (27.2%) while separated, Divorced & widower has 1433(28.8%), 360 (7.2%) and 212(4.3%) frequencies respectively.

Table 3: Level of education of respondents

Level of Education of the respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No formal Education	127	2.6	2.6	2.6
	Elementary & Secondary	3066	61.7	61.7	64.3
	Post-Secondary or Tertiary	1160	23.3	23.3	87.6
	Post Graduate	620	12.4	12.4	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

From table 3 above, the education qualification of the respondents in the study area indicates that elementary & secondary qualification have the highest frequency of 3066 (61.7%),

followed by post-Secondary education or Tertiary qualification with frequency of 1160 (23.3%) while respondents without formal education has a frequency of 127(2.6%).

Table 4: Occupational status of the respondents

Occupation of the respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	1630	32.8	32.8	32.8
	Self-Employed	1138	22.9	22.9	55.7
	Government Employed	1323	26.6	26.6	82.3
	Retired	882	17.7	17.7	100.0
	Total	4985	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

From table 4 above, the occupational status of the respondents in the study area shows the area is students' populated with a frequency of

1634(32.8%), followed by Government employed on a frequency of 1327(26.6%) while Retiree constituted a frequency of 882 (17.7%).

Table 5: Distribution of respondents who had contacted cholera before

Number of respondents who had contacted cholera before					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3050	61.3	61.3	61.3
	Yes	1923	38.7	38.7	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

From table 5 above, out of the 4973 respondents only 1923 indicated that they have contacted cholera before while the remaining 3050

claimed they have not contacted the disease before, which implies that only 38.7% of the respondents have contacted cholera before.

Table 6: Distribution of respondents with cholera symptoms

What was your symptoms					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cough	458	9.2	9.2	9.3
	Nausea, vomiting, diarrhea	2626	52.8	52.8	62.0
	Fever	1889	38.0	38.0	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

Table 6 shows that most of the respondents which constituted 2626(52.8%) indicated they had Nausea, vomiting and diarrhea as cholera symptoms followed by those that had

fever with frequency of 1889 (38.0%) while those that had cough only constituted 9.3% as symptoms for cholera in the study area.

Table 7: Respondents opinion about causes of cholera

What do you think is the courses of cholera					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water	2678	53.9	53.9	53.9
	Contaminated Food	1820	36.6	36.6	90.5
	Mosquito Bite	475	9.5	9.5	100.0
	Total	4973	100.0	100.0	

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

Table 7 above shows the cause of cholera according to the respondents. The shows that, 2678 representing 53.9% of the respondents agreed that water is a major cause of cholera, 1820 (36.6%) of

the respondents signified that contaminated food causes cholera while about 475 of the respondents representing 9.5% believed mosquito bite causes cholera.

Logistic Regression

Table 8: Distribution of respondents who have contacted cholera before.

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.245	.019	329.471	1	.000	.60
Variables in the Equation							
				Score	df	Sig.	
Step 0	Variables	Which Political ward do you reside?		27.077	1	.000	
		How old are you as at your last birthday?		307.39	1	.000	

Gender	0.286	1	.624
Marital Status	44.899	1	.000
Number of Children	58.422	1	.000
What is your Level of Education?	.066	1	.894
What do you do for a living?	13.207	1	.000
What is your religious belief?	203.894	1	.000
Overall Statistics	3296.76	8	.000
	8		

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

From table 8 above, it was discovered that those that have contacted cholera before is significant, this is because $(1 - 0.600 = 0.40)$ 40% of the respondents signified they have had contacted cholera before. Also, it was discovered that those that have contacted cholera before is significant to political ward, age, marital status, number of children, religion and type of job the respondent do for living while gender and level of education are not significant

TEST OF HYPOTHESIS USING CHI-SQUARE

H_0 : Gender is independent of how people contacted cholera.

H_1 : Gender is dependent on how people contacted cholera.

$$\text{TEST STATISTIC: } X^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

CRITICAL VALUE

$$\alpha = 0.05$$

DECISION RULE: Reject H_0 if P-value < critical value (α), if otherwise do not reject.

Decision: Do not Reject H_0

Table 22: Chi-Square test of gender of respondents on how respondents contacted cholera

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.003 ^a	1	.957		
Continuity Correction ^b	.000	1	1.000		
Likelihood Ratio	.003	1	.957		
Fisher's Exact Test				1.000	.838
Linear-by-Linear Association	.003	1	.958		
N of Valid Cases	89				

Source: Survey 2025 by Alao N.A, Adeoye A.O, Aiyelabegan A.B and Ojo O. D

CONCLUSION: Since P-value (0.838) > Critical value (0.05), H_0 is not rejected and conclude that how people have been contacted cholera is independent of gender.

V. CONCLUSION

This research work was carried out to discover the rate at which cholera spread, it causes, symptoms, preventive measures and to determine if gender depend on the spread of Cholera in Ilorin East Local Government of Kwara State. The method employed to gather the data used for this study was questionnaire method. Questionnaires were administered to 5000 respondents but 4973 were returned in the process of carrying out this research. The methods of data analysis used were

data exploration, Chi-Square test and logistics regression.

Result of analysis from the frequency distribution according to level of education of respondents in the study area shows that elementary and secondary qualification have the highest frequency of 3066 (61.5%), post-Secondary education or Tertiary has a frequency of 1160 (23.3%) and respondents with no formal education have the lowest frequency of 127(2.5%). The occupational status of respondents in the study area, shows that Majority of the respondents were student with 1630(32.8%) frequency, while Government employed are 1323(26.6%), self-employed had 1138(22.9%) and Retiree have the lowest frequency, with 882 (17.7%). Furthermore, of the 4973 respondents, about 1923 indicated that

they had contacted cholera before while the remaining 3050 claimed that they have not contacted cholera disease before. This implies that only 38.7% of the respondents have contacted cholera before while 2853 of the respondents, which represent 57.4%, claimed they had taken vaccine against cholera before and majority of the respondents indicated that they had Nausea, vomiting and diarrhea as cholera symptoms followed by fever. Also, 53.8% of the respondents agreed that contaminated water, contaminated food are the major causes of cholera and the analysis revealed that most of the respondents have access to well water in their various homes.

Moreover, the results of the analysis indicates that Nausea, vomiting and diarrhea were symptoms the respondents felt the last time they contacted cholera. Also, most of the respondents claimed they got cholera from drinking contaminated water while so many of the respondents also believed drinking treated water and eating properly heated food will prevent people from having cholera.

Result of the logistic regression shows that those that have contacted cholera before is significant to political ward, age, marital status, number of children, religion and the job the respondent do for a living but is not significant to the level of education and gender. Also, it was discovered that those that have taken vaccine against cholera before is significant to political ward, age, marital status, number of children, level of education and the job the respondents do for a living but is not significant to the religious belief of the respondents and gender. Also, the result of the analysis shows that those that were ever confirmed of having cholera is significant to political ward, age, marital status, religious belief and the job the respondents do for a living but is not significant to gender, number of children and level of education of the respondents.

Also result of the analysis shows that, those who have directly or indirectly contacted patients suffering from Cholera is significant and about 24.0% of the respondents claimed they were directly or indirectly contacted patients suffering from Cholera. This shows that it is significant to political ward, age, marital status, religious belief, job the respondents do for a living, number of children and level of education of the respondents but not significant for gender.

VI. RECOMMENDATION

1. Health Planner should sensitize people more on the causes and prevention of cholera

2. Drugs and other necessary amenities should be readily available before cholera outbreak in order to curtail any future outbreak of the disease.
3. Government at federal, states and local government should endeavor to provide an environment free of Cholera.
4. All agencies involve in educating the masses on disease control should be adequately funded.
5. Government at federal, states, and local level should do more to provide good water supply in the understudy community.
6. Cholera vaccines should be administered on the populace under study as at when due.

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