COMPARISON OF SELECTED RAPID DIAGNOSTIC KITS AND STOOL CULTURE IN CHOLERA DIAGNOSIS AMONG PATIENTS PRESENTING WITH DIARRHOEA SYMPTOMS ATTENDING NAIROBI WOMENS HOSPITAL (ADAMS)

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(Medical Laboratory Science)

JOMO KENYATTA UNIVERSITY

OF

AGRICULTURE AND TECHNOLOGY

2023

Comparison of Selected Rapid Diagnostic Kits and Stool Culture in Cholera Diagnosis among Patients Presenting with Diarrhoea Symptoms Attending Nairobi Womens Hospital (Adams)

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A Thesiss Submitted in Partial Fulfillment of the Requirements for the Degree of Masterof Science in Medical Laboratory Science of the Jomo Kenyatta University of Agriculture and Technology

2023

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

Signature……Date……

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This thesis has been submitted for examination with our approval as the University supervisors

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DEDICATION

I dedicate this work to the entire Muraya family for their unwavering support in the entire season of study. Special dedication to Alex and Allan.

ACKNOWLEDGMENTS

I wish to sincerely appreciate the following institutions for their material and technical support: Jomo Kenyatta University of Agriculture and Technology and The Nairobi Women's Hospital. My sincere gratitude goes to Dr. Perpetua Ndungu, Dr Alex Wamachi and Dr. Jessica Wesonga for their professional guidance and assistance during the entire writing of this work. My appreciation also goes to Mr. Evans Kiptanui (Kenya Medical Research Institute) for offering reference and data analysis software that made the process convenient and accurate. I am so grateful to Gelas Moli (Laboratory Technologist In-charge) who helped in participant's recruitment, specimen collection, analysis and documentation. Special regards to Dr. Munyoki Nyamai who assisted in Quality assurance and data cleaning during the entire research period. To all study participants who gave consent and took part in this entire period of study. I am forever grateful. You made the study a success.

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ABBREVIATIONS AND ACRONYMS

APW	Alkaline Peptone Water.
HEH	Human to Environment
HH	Human to Human transmission
JKUAT	Jomo Kenyatta University of Agriculture and Technology.
NWH	Nairobi Women's Hospital.
PPE	Personal Protective Equipment.
RDT	Rapid Diagnostic Kits
SPSS	Statistical Package for the Social Sciences
TCBS	Thiosulfate Citrate Bile Salts.
TSI	Tripple Sugar Iron
VT	Vector transmission
V.CHOLERAE	*Vibrio Cholerae*
W/V	Water per volume
WHO	World Health Organization

OPERATIONAL DEFINITION OF KEY TERMS

Cross reactivity Is the reactivity of the observed agent initiating the response outside of the expected primary response.

Diagnosis It is the process where you determine what has caused a particular disease for a patient in question by taking laboratory tests, physical examination, interviewing the patient, understanding the causes of the observed signs, patient record assessment and differential elimination of comparable possible causes.

Rapid diagnostic test (RDT) A diagnostic technique performed rapidly and easily in initial or emergency clinical screening and for use in clinical facilities with restrained resources. They enable provision of diagnostic services at various points-of-care. They provide same-day outcomes inside two hours, commonly in about 20 minutes.

Reproducibility Refers to the ability to replicate an entire experiment or study, either by the same researcher or by someone else working independently.

Sensitivity The positive outcomes out of the individuals with the disease. At the end of the day, an exceptionally sensitive test is one that can distinguish patients with an illness from those without. When a test picks out all patients with a particular sickness, it is 100% sensitive. It is very unlikely that any clinical test is 100% sensitive. A test with 90% sensitivity will distinguish 90% of patients who have the infection yet will miss 10% of patients who are infected.

Specificity This is the extent to which a test recognizes patients who do not have the disease. This helps identify absence of disease. . A test that has 100% specificity will distinguish 100% of patients who

do not have the disease. A test that is 90% specific will distinguish 90% of patients who are not infected.

ABSTRACT

Cholera is an acute watery diarrhoea disease caused mainly by Vibrio Cholerae O1 and less commonly by Vibrio Cholerae O139. Cholera can lead to severe disease and death if untreated. It is transmitted through faecal oral contamination and is thus predominantly associated with lack of safe drinking water, improper sanitation and personal hygiene. Cholera is an important public health concern in many parts of America, Asia and Africa. Globally 3-5 million cases and over 100,000 deaths occur annually due to cholera. This study evaluated the performance of three selected rapid diagnostic kits against stool culture as a gold standard in cholera diagnosis among patients, presenting with diarrhoea symptoms attending The Nairobi Womens Hospital (Adams). In order to achieve these objectives, the study adopted a descriptive cross-sectional method which provided data on the participant's demographic characteristics and distribution. Performance of the selected rapid diagnostic kits results was compared against stool culture which was used as the reference standard. Kits were Boson, Bioline and Star Diagnostics. Same samples were inoculated in Triple Sugar Iron media for culture analysis. The sample size determination was calculated using Mittal formula (2015) formula with a confidence interval of 95% and a margin error of 5% which gave 293 participants. Data obtained was presented using tables and graphs. Statistical tools applied for data analysis included frequencies, percentages, Pearson Chi-square, ROC curve and Kappa tests. Project approval was obtained and principles of ethics observed throughout the study. The kits used in the study i.e. Boson, Bioline and Star Diagnostics had sensitivity of 87.1% 82.5% and 76.6% respectively. In addition, they achieved a specificity of 96.6%, 95.5% and 93.8 % respectively. The three achieved a substantial level of agreement on Kappa Test (> 0.60).Achieving the recommended cut-off values of 75% sensitivity and 93.6% specificity. Boson was the most sensitive kit as compared to Star Diagnostic kit which was least sensitive. In terms of specificity, Boson also performed better than the three while Star Diagnostic was the least specific. This qualifies the selected Rapid Diagnostic Kits used in this study Ideal for testing. In this regard therefore, since the selected Rapid Diagnostic Tests for Vibrio Cholera are available in the market should be validated and recommended for screening as well as diagnostic purposes.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Cholera is an acute enteric diarrhea disease, resulting from colonization of small intestines by *Cholerae* bacteria. It is characterized by a sudden onset of profuse painless watery diarrhoea, occasional vomiting, rapid dehydration, acidosis and circulatory collapse. Cholera is an ancient disease, and its exact origins remain unknown. It is still a standout among the most dreaded contamination illnesses in general well being, particularly in those nations where clean drinking water is not accessible to the neighbourhood individuals (Duchene *et al*., 2020).

Cholera infections has since been eliminated in countries such as Europe and the United States unlike in Southeast Asia, Sub-Saharan Africa and lately mark able outbreak in Haiti, Where sporadic infections have been confirmed(Cambaza *et al*., 2019*).*

In Africa, there are an estimated 120,000 deaths each year attributed to cholera outbreaks, with the numbers increasing yearly with majority cases being children. Generally, there is a generous under reporting of cases; this indicates that the real problem is even worse (Cambaza *et al*., 2019*)*

Cholera infection is associated with various clinical manifestations such as, gastroenteritis, septicaemia, muscle cramping and weakness due to loss of potassium and calcium. (Duchene *et al*., 2020). When *V. cholerae* is ingested, it produces enterotoxins (poisons that demonstration in the gastrointestinal tract) whose activities on the mucosal epithelium are in charge of general indications of cholera.(Duchene *et al*., 2020).

Kenya health authorities continue to report elevated cholera activity with an additional 1,409 suspected cases reported nationwide bringing the total case count to 2,959 by October 2019. Most cases have been reported in Garissa County (654 suspected cases), followed by Nairobi (384 suspected cases), Machakos (231

suspected cases), and Kiambu (164 suspected cases) counties and least 55 cholera-associated deaths have been reported same period.

1.2 Statement of the Problem

Cholera remains one of the most infectious disease when proper sanitation and proper hygiene is not observed. In Kenya especially in informal settlement, poor drainage system, high population and overcrowding pose risk of infections. Cholera infections has an incubation period within hours to five days. Left untreated, can be fatal within hours (Duchene *et al.,* 2019). Isolation and identification of Vibrio cholerae serogroup O1 or O139 by culture of a stool specimen remains the gold standard. Media of choice is Cary Blair - ideal for transport, and the selective thiosulfate–citrate–bile salts agar (TCBS) - ideal for isolation and identification. Culture method takes 72 hours, within this isolation period may lead to high infection rate, thus high mortality rate. A total of 68 522 clinically suspected cases of cholera and 2641 deaths were reported (overall case-fatality rate [CFR], 3.9%), affecting all regions of the country (Jinadu, 2018). There is need to regularize, validate and recommend the available rapid testing kits with an aim to shorten the testing period. Lack of comparative data of RDTs performance across diverse geographical regions, and inclusion of RDTs that had positive or negative readings for *V. cholera* O139 in cholera diagnosis is a gap that need to be addressed. An updated synthesis of the accuracy of cholera RDTs is needed to assist clinicians and the global public health community to grasp a thorough picture of current cholera speedy diagnosis (Mason *et al.,* 2018).

In the event of a cholera outbreak, panic and fear reigns among the patients who test positive through laboratory diagnosis. This result to unnecessary hospitalization of cases that are positive for vibrio but require confirmation as pathogenic thus need for specificity (Mason, 2018). There is little data available in Kenya on recommended quick cholera diagnosis to match stool culture test to isolate cholera infection. When Timely Screening , detection and diagnosis is not prioritized, Kenyan population might be at a greater risk of infections as Vibrio Cholera infections is one of the notifiable communicable waterborne diseases in Kenya (George, 2016).

1.3 Justification

This study fills a crucial research gap since the available rapid kits are not in the governance policy. Performance of the selected rapid diagnostics kits as compared to stool culture for screening and diagnosis of V*ibrio cholera* infections shall provide critical literature for future reference by various stakeholders such as health care providers, researchers, academicians, students, and the community. From the findings of this research, the policy makers would be able to formulate appropriate algorithms for diagnosis, treatment and management of *Vibrios cholera* infections. This will involve mobilization of resources at both national and county levels. In many of health facilities, rapid diagnostic testing has been widely used as a method for diagnosis of cholera. However, stool culture remains the recommended gold standard for diagnosis of cholera although it takes not less than 72 hours for a preliminary report. Cholera being an emergency disease of public health concern, a faster and reliable method is required for diagnosis of pathogenic cholera. Comparing cholera isolation using different rapid diagnostic tests and stool culture test will improve accurate and timely cholera diagnosis.

1.4 Objectives

1.4.1 Broad Objective

Comparison of Selected rapid diagnostic kits and stool culture in cholera diagnosis among patients presenting with diarrhoea symptoms attending Nairobi Womens Hospital (Adams Branch).

1.4.2 Specific Objectives

1. To determine the prevalence of *Cholera Vibrio* among the patients attending Nairobi Women's Hospital Adams branch.
2. To assess the performance of Selected Cholera diagnostic kits in diagnosis of *Vibrio Cholera* in relation to stool culture as the gold standard.

3. To determine the Sensitivity and Specificity of Selected rapid diagnostics kits in cholera diagnosis among patients attending Nairobi women's hospital Adam's branch.

1.5 Research question

1. How do the selected Cholera rapid diagnostic kits compare with stool culture, which is the gold standard in diagnosis of *Vibrio Cholera*?
2. Which is most recommended on the selected cholera rapid diagnostic kit in diagnosis of *Vibrio Cholerae* in terms of specificity and sensitivity*?*
3. What is the prevalence of *Vibrio cholera* among the patients attending Nairobi Women's Hospital?

1.6 Null hypothesis.

H_{O1}: There is no relationship among different rapid diagnostic tests for diagnosis of *Vibrio Cholera* infections.

H_{O2}: Rapid diagnostic tests for *Vibrio cholera* does not agree with stool culture test in diagnosis of *Vibrio cholera* among Patients attending Nairobi Womens Hospital (Adams Branch)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Cholera is an acute, highly transmissible, intestinal infection caused by toxigenic bacteria *Vibrio cholerae* O1 and O139. In its severe form, cholera is characterized by a sudden onset of acute voluminous watery diarrhoea that can rapidly lead to dehydration and death if left untreated (Elimian, 2019).

It has been estimated that 1.3 to 4 million cholera cases and 21 000 to 143 000 deaths occur every year worldwide (*Ali et al.,* 2015).Within the year 2015, Africa accounted 40% of all cholera cases reported to the WHO (compared with 93% to 98% between 2001 and 2009), Asia reported 38% and the Americas 21% (principally Haiti, the Dominican Republic and Cuba) (Ali *et al.,* 2015).

The reduced proportion of African cases since 2010 is a consequence of the dramatic appearance of cholera in the Caribbean region in that year. From the onset of the outbreak in October 2010 until the end of 2016, almost 800 000 cases and over 9400 deaths have been reported (UNICEF, 2013). Latin America was hit with several large epidemics in the 1990's (Ali *et al*., 2015).

According to a survey conducted in East Africa on the plagues brought about by cholera, the study noted that the refugee camps are the most affected and they considered the refugee camps as risk factor for the spread of cholera (Saidi *et al*., 2014).

The refugee camp of Kakuma had established that 418 patients were treated and discharged while four succumbed to cholera outbreak. Out of these cases, 83% were refugees from other countries while 17% were of Kenyan origin and mostly the cases were within Kakuma. (Saidi *et al*., 2014).

2.2 Outbreak investigations in Kenya

Reports in Kenya indicated that in December 2017, an aggregate of 3967 affirmed and likely cases including 76 deaths (case casualty rate = 1.9%) were accounted for by the Ministry of Health to WHO, of the cases announced, 596 were laboratory confirmed with 20 of 47 areas (43%) in Kenya having detailed cases. By the beginning of November 2017, seven regions kept on having dynamic cholera episodes (Embu, Garissa, Kirinyaga, Mombasa, Nairobi, Turkana, and Wajir). This raised an alarm and made researchers to engage more on cholera research in Kenya (Githuka., *et al* 2017).

One of the mark able cholera outbreak was detected during a wedding festival in October 2019, within the month, 155 cholera cases were recorded in Nairobi County alone. Health and education authorities were on high alert in at least 17 of 47 counties. A number of schools closed temporarily due to fears of spread, Particular concerns surround Nairobi's informal settlements which is clustered generally large populations, lack of proper sanitation services and reliable sewage management, As a result, such regions face elevated risk of various contagious diseases. (Mallory *et al.,* 2020).

In a study conducted in Lake Victoria by Shapiro it was established that, lake is potential for the spread of V. *cholera* (Shapiro *et al*., 1999). The researcher directed a case-control concentrate to investigate hazard components related cholera incidents particularly in Nyanza province and western part of Kenya in June 1997 to March 1998. (Shapiro *et al*., 1999). It was established that Omwenga and Daud, in (2020) did a study on the cases of cholera in Kenya and five cases of cholera were established. Out of these cases, four of them occurred along the highways while one of them happened in Kakuma refugee camp. The researcher went further to establish whether the cholera cases witnessed were associated with the locality. During the research 990 cases of Cholera suspected were recorded which included 25 deaths. Out of these cases 51% comprised of the youths and children. The cases were not comparable in relation to sex. All the cases of cholera were serotype Inaba and they could be compared because of inheritance (Shannon *et al.,* 2019).

2.3 Transmission

The cholera bacteria is transmitted/spread through ingestion of food, water and contacts contaminated with feces of infected person. This occurs more often in underdeveloped countries, lacking proper water supplies and sewage disposal. It is characterized by profuse watery diarrhea and vomiting leading to dehydration and eventually fatal within the first hours of onset. The disease can be endemic, epidemic or pandemic if interventions is not carried out when the first case is reported.
According to WHO cholera is one of endemic and pandemic prone diseases in the world (Baker *et al.,* 2018). It was noted in the study that areas where drinking water was not treated and where people used to put in large mouth compartments, the areas were considered as risk areas and people were more susceptible to cholera. In addition, in areas where people ate food outside their household they were at a higher risk of contracting cholera. The researchers stated that cholera could be spread through transportation of people from one place to another. Mohamed *et al.,* (2012), WHO suggests legitimate and convenient case management that involves treatment of all suspected cholera cases.

The main prevention methods include improved water access, appropriate sanitation, appropriate management of waste, as well as upgraded cleanliness and food handling behaviours. WHO does not prescribe any limitation on movement and exchange to Kenya dependent on the data accessible on the present episode (Moskvitina *et al.,* 2020). The study of disease transmission of cholera for Kenya in 2017, described the constant transmission of cholera being influenced refugee influx in Kenya and social occasioned gatherings.

Persistent transmission in the above represents around 70% of the total cases with most of cases originating from the capital City Nairobi (Mengel et *al.,* 2014). Transmission in refugee settings happened mostly inside Garissa and Turkana regions, representing around 23% of the total reported cases. The two areas have huge refugee camps, in particular Dadaab and Kakuma refugee camps. Displaced people in these camps originate from nations right now encountering complex crises and huge cholera episodes. Most of the cases (7%) happened in establishments and

during social occasions, where various individuals are perceived as the point source (Githuka *et al.,* 2017). The nation encounters cholera outbreaks each year; however, enormous repeating scourges happen roughly every five to seven years and keep going for a few years. (Kigen *et al.,* 2020).

2.4 Clinical Manifestations

When a patient is infected with *V. cholera*, he or she is susceptible to other chronic diseases, which range from asymptomatic colonization of the intestines to serious diarrhoea. During early period of infection, the patient may suffer from stomach distress and regurgitating. Different individual may suffer from serious illness, but all have the same symptoms related to cholera. The patients may not suffer from fever, as it is not associated with cholera. The clinical indications of cholera brought about by *V. cholerae* O1 versus O139 are indistinguishable (Mercer, 2014). Most people infected with *V. cholerae* do not develop any symptoms, although the bacteria are present in their faeces for 1-10 days after infection and are shed back into the environment, potentially infecting other people. Among people who develop symptoms, the majority have mild or moderate symptoms, while a minority develop acute watery diarrhoea with severe dehydration. This can lead to death if left untreated.

2.5 Incubation Period

After infection, incubation period for cholera is usually between hours to five days but the hatch time may differ depending on the individual defence mechanism, which may even extent to three to five days. Mild instances of cholera may be confused with normal diarrhoea depending on the intellectual level, but a significant loss of body fluids and electrolyte may be a clear indication of the disease from a clinical perspective. Early period of illness may show faecal matter, which have issues of bile within them. However, later infection of cholera may result into a watery stool with pieces of mucus which also has a scent like that of a fish (Azman *et al.,* 2013).

The diarrhoea that results from cholera may not be painful when there is no tenesmus. In adults, the rate of stool excretion may be 11 times for every hour

particularly in the most extremes cases of cholera. For confirmed cases, the rate of discharging stool ranges between 10-20 cubic centimetres for every hour. This rate of liquid discharge is not witnessed in other cases of diarrhoea ailment. In addition, due to various reasons the diarrhoea in youths is different in cholera patients, the diarrhoea in cholera patients has an atomic number of eleven, which contain a large amount of potassium and bicarbonate (Heidary *et al.,* 2018).

2.6 Mortality

The mortality rate for untreated cases of cholera is 5- 70%. Proper mediation in cholera treatment may reduce mortality rate by 0.5 percent. In regions with high cholera mortality, children are highly affected. Albeit prior investigations had alluded that, there is great risk of mortality in pregnant women who are cholera infected (Torre *et al.,* 2016). Cholera is a potential reason for any instance of diarrhoea with or without vomiting, particularly in patients who create fast and serious volume depletion. While a wide range of microbial pathogens can prompt volume-draining diarrhoea in children, *V. cholerae* is the essential ethology in grown-ups with such an introduction. World Health Organization indicated that , cholera ought to be consistently in suspicion once a patient is five years and above, established by excreting volumes of water from intense diarrhoea which is watery even in a region where the disease cholera is not prevalent (Torre *et al.,* 2016). In endemic regions, cholera ought to be suspected in patients two years or more established with serious intense watery diarrhoea.

2.7 Preventing of transmission of the disease

Clean water and proper sanitation system are critical to averting cholera infection. However, these can be hard to accomplish in some constrained settings. An expected 760 million individuals need to clean water access sources and are in this way in danger for waterborne ailments, for example, cholera. Breastfeeding of young infants in endemic settings ensures there is not infections against cholera and other enteric diseases. Moreover, separating water through a safe material before drinking has been shown to be a compelling factor in anticipating *V. cholerae* disease obtained from surface water sources. Travellers ought to pursue the general precautionary

measures for the aversion of infection when traveling to places with the cholera outbreak. This includes avoiding food from the street, avoiding drinking tap water, half-cooked fish as well as raw vegetables. To make water safe it can be treated by use of iodine of chlorine, or through water filtration or water bubbling (Mekhlafi, 2018).

2.7.1 Vaccination

Explosive spread of cholera in African countries has led to promotion of vaccination as the best approach alongside the active monitoring efforts for management of cholera. The first vaccine against cholera was whole cell-based injectable vaccine whose application was limited by poor efficacy, side effects and the injectable mode of administration (Torre, 2016). It was replaced by a variety of oral killed whole cell vaccines. One of the most successful WHO approved cholera vaccine is Dukoral oral vaccine. It elicits immunological responses with both anti-bacterial serum vibriocidal activity and anti-toxin (Kang *et al.*, 2013). The vaccine provides up to three years of protection to recipients of its two doses. It has the advantage of providing up to 85 % protective efficacy and population that is not vaccinated can benefit from herd immunity in regions of high vaccine coverage. Nonetheless, mass administration of the vaccine is prohibited by its high cost and requirement of two doses for optimum efficacy (Kurk *et al.*, 2015).

Research is in the pipeline to develop alternative affordable completely cell-based vaccines administered orally. Orochol, a live attenuated single dose vaccine developed from classical *V. cholerae* 0569B is such an alternative. It expresses an immunologically active B-subunit and has been reported to provide 79 % protective efficacy (Ferreras *et al.*, 2018). However, it has inadequate use because of the safety concerns. Another vaccine in the realm of accreditation by WHO is an oral killed whole cell vaccine known as shancol. It is cheap to produce since it is not developed from recombinant B-subunit of the bacteria and has demonstrated 66 % efficacy over a period of 10 months (Torre, 2016). Clinical trials have shown success of this vaccine and therefore it is hopeful that it will be available for mass vaccination programs prevalent regions. The limitation for its application is the liquid

formulation that translates into specialized transport that is costly and its two-dose regimen (Kurk *et al.,* 2015).

The priority approach for prevention of cholera is improvement of sanitation, hygiene and provision of safe drinking water. In developed world cholera has been controlled by maintaining high standard of hygiene and sanitation. In developing world cholera prevalence is high due to poor sanitation and hygiene. Significant longterm investments are required for hygiene, sanitation and clean water supply (Torre, 2016). Another aspect for controlling of cholera is early planning and proper implementation of vaccination programs. This would enable capture cholera outbreaks at low infection rates in epidemic suffering regions and consequently control its native endemic reservoir regions (Ferreras *et al.,* 2018).

2.7 Risk Factors Associated with *V.Cholera*

P*a*tients with O blood type have increased susceptibility to severe cholera infection. Gastric acid acts as an important barrier against cholera infection. A decrease in gastric acidity due to pre-existing pathology or concurrent use of H2 receptor blockers or proton pump inhibitors increases susceptibility to infection. Food also acts as an acid buffer and facilitates the passage of vibrio's through the stomach (Sakib *et al.,* 2018). Introduction of vibrios into the intestinal tract stimulates both a local and systemic immune response. This provides natural immunity which is limited in duration (from 6 months to several years) depending on the individual immune response. Oral cholera vaccine induces immunity in the same manner (Sakib *et al.,* 2018). In endemic areas, attack rates in infants and children are higher compared to other age groups as they have not yet developed the immunity that comes with repeated exposure. Where cholera occurs infrequently or is unknown, all age groups are equally susceptible (Moskvitina *et al.,* 2020)

2.8 Cholera Diagnosis

Laboratory testing of cholera patients may uncover hypokalaemia, hypernatremia or hypernatremia (despite the fact that cholera is frequently connected with isometric lack of hydration), hypocalcaemia, and acidosis. Renal disappointment with intense

rounded necrosis may happen as pee yield diminishes. In children, exhaustion of glycogen stores and lacking gluconeogenesis can prompt manifestations of extreme hypoglycaemia or even trance state (Shittu *et al.*, 2016).

Pneumonia has also been depicted as a never-ending co- dreariness among children with cholera, possibly from desire eating and has been related with mortality. Blood stream attack by the life form is uncommon. Fever is additionally rare, so the nearness of a raised temperature should incite thought of a simultaneous disease or complexity. "Cholera sicca" is a bizarre type of the sickness wherein liquid aggregates in the intestinal lumen; circulatory breakdown and death can happen without diarrhea. (Kahwaji *et al.,* 2018). Generally, there are no long-term complexities of cholera when it is suitably treated. However, as different reasons for youth diarrheal disease, cholera may add to the improvement of constant enteropathy and lack of healthy sustenance in children.

2.8.1 Laboratory Diagnosis

Cholera is caused be a Gram-negative bacterium, found naturally in blackish or salty waters. It consists of various species that are either pathogenic or non-pathogenic. Only cholera toxigenic strains of *V. cholerae* cause cholera. *V. cholerae* has more than 200 serological groups distinguished, of these only *V. cholerae* O1 and O139 cause cholera epidemics in humans (Brenzinger *.et al.,* 2019).

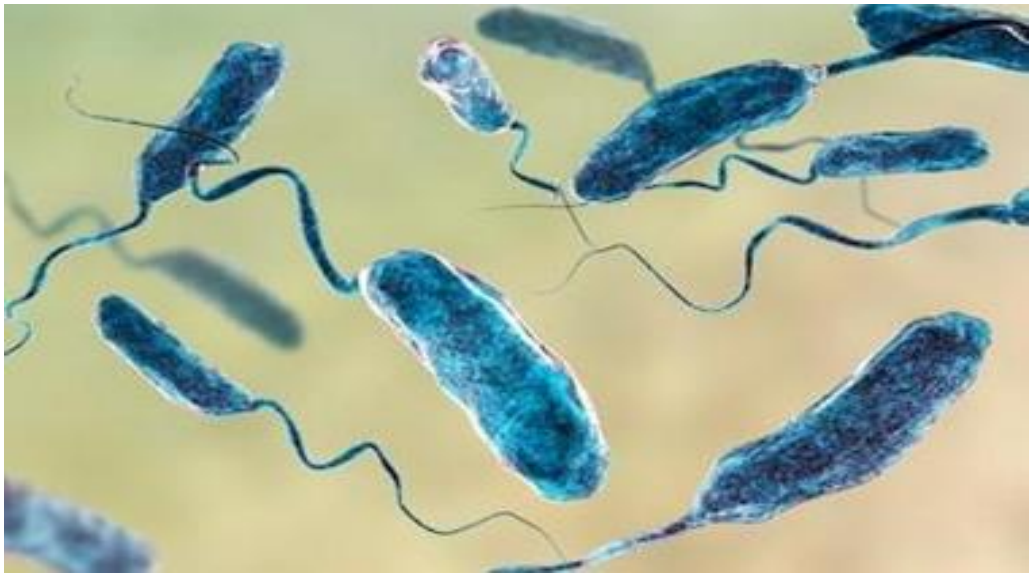

Figure 2.1: *V.Cholerae* bacterium.

Source: Traore *et al.*, 2018.

Bacterium *Vibrio cholerae* is a Gram negative, curved rod-shaped, motile, non-invasive bacterium. It produces a toxin which is responsible for the voluminous diarrhoea characteristic of the illness. *Vibrio cholerae* can survive one to two weeks in water, several days in moist alkaline food at ambient temperature, and longer when the food is refrigerated or frozen. (Epidemiological update, 2013). On the other hand, *Vibrio cholerae* does not tolerate acid or dry conditions. Boiling water assures complete killing. Chlorine is effective against *Vibrio cholerae* under the following conditions: turbidity is sufficiently low, contact time is respected, and free residual chlorine level is achieved and maintained (UNICEF, 2013)

In laboratory diagnosis, Isolation and identification of Vibrio cholerae serogroup O1 or O139 by culture of a stool specimen remains the gold standard. Cary Blair media is ideal for transport, and the selective thiosulfate–citrate–bile salts agar (TCBS) is ideal for isolation and identification.

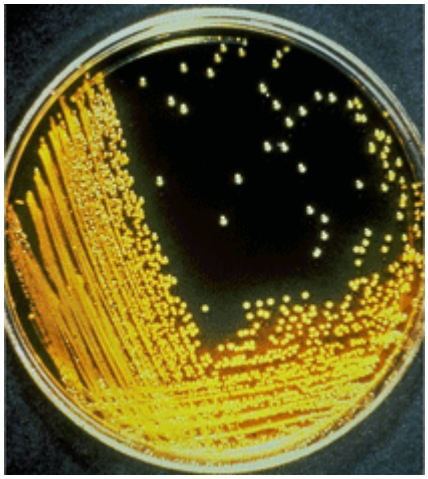

Figure 2.2: Vibrio cholerae growing on thiosulphate citrate bile salt sucrose (TCBS) agar plates

Rapid tests such as stool dipsticks or dark field microscopy can support the diagnosis in settings where stool culture is not readily available Cholera is an extremely virulent disease that can cause severe acute watery diarrhoea. It takes between hours and 5 days for a person to show symptoms after ingesting contaminated food or water. Cholera affects both children and adults and can kill within hours if untreated.

2.8.2 Rapid diagnostic tests in Cholera Diagnosis

Laboratory cultures, Isolation and identification tests usually take 2 to 7 days for an organism to be identified from sampling, inoculation, incubation to the identification, and susceptibility testing. Therefore, rapid diagnostic tests are easy to use and its test duration requires 10 minutes to 2 hours only, they are also inexpensive and require less time and labor.

Intensive training or professional workers to use the rapid test kit is not required as it has a simple procedure that can be followed easily

2.8.3 Principle of Rapid Diagnostic Kits

In preventing and spread of epidemic cholera, rapid diagnostic tests (RDTs) are used in screening suspected stool specimens, water/food samples. Several RDTs

developed recently are considered as investigative tools in confirming cholera cases, as the culture techniques are difficult to establish and/or maintain.

RDT is a qualitative and semi-quantitative – Vitro diagnostic medical device that works on the basis of immunochromatographic action like lateral flow or agglutination that forms the antigen-antibody complexes with the specific antigen of the pathogen from the given sample.

Dipstick, microfluidics, and cassette formats are often used with a sample on the test card along with certain reagents that provide a result within half an hour.

While performing the tests, the staff should wear appropriate personal protective equipment

2.8.4 Testing Procedure

Reagent test volume of 5 ml should be put in a test tube and should be well labelled with patient identifier. The reagent bottle should be assessed to ensure the solution is not turbid nor discoursed,If one confirms unsatisfactory the reagents should be discarded.
The prepared stool sample should be transfeered and analysed as per the manaufacturers instructions,The dipstick should be confirmed its submerged in processed sample

As per the selected commercial available testing rapid kit,The dipstick should be placed with indicated arrors facing downward in the mixer prepared and left for 15-30minutes followed by results interpretation.

All materials used within the procedure should be discarded in bags labelled Biohazard as they pose risk of infections.

2.8.5 Results Interpretation

Table 2.1: Result interpretation

Interpretation*	**Pinkish red band observed**		
	O1	**O139**	**Control**
A. *Vibrio cholerae* O139 detected	–	+	+
B. *Vibrio cholerae* O1 detected	+	–	+
C. *Vibrio cholerae* O1 and O139 detected	+	+	+
D. *Vibrio cholerae* O1 and O139 not detected	–	–	+
E. Invalid results	+ or –	+ or –	–

Control band must appear for the result to be considered valid.

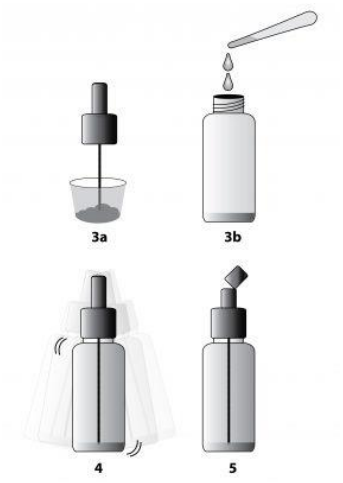

Figure 2.3: Schematic View of Dipstick

Figure 2.4: Schematic Results interprattation; (Source Centres forDisease control and Prevention)

2.9 Cholera diagnosis Recommendation

Global Task force on cholera control (GTFCC) recommends that cholera Rapid Diagnostic tests (RDTs) should be at least 90% sensitive and 85% specific.

Although several cholera RDTs have been developed, on-field performance of many of these RDTs is limited, some of them have suboptimal performance and much study have not been carried on undermining their use for individual patient diagnosis as well as quick treatment intervention, thus need for more research (Am J Trop 2013)

CHAPTER THREE

METHODOLOGY

3.1 Study site

The study area was Nairobi Woman's Hospital, The clientele demographic is of low to middle socio-economic class. The Hospital is within Nairobi County that is approximately 698 square kilometer in an area and has a population of approximately 3,138,369. The samples were collected from Nairobi Women's Hospital, Adams branch. This is a private medical facility providing medical services to low- and middle-income population in Kenya. The Hospital has a 300-bed capacity for both male and female wards, having enough beds in the Maternity, Medical, Paediatrics and surgical wards. The hospital also serves over 1000 out patients per day servicing patients mostly in civil servants, teachers, police and other groups due to its accessibility.

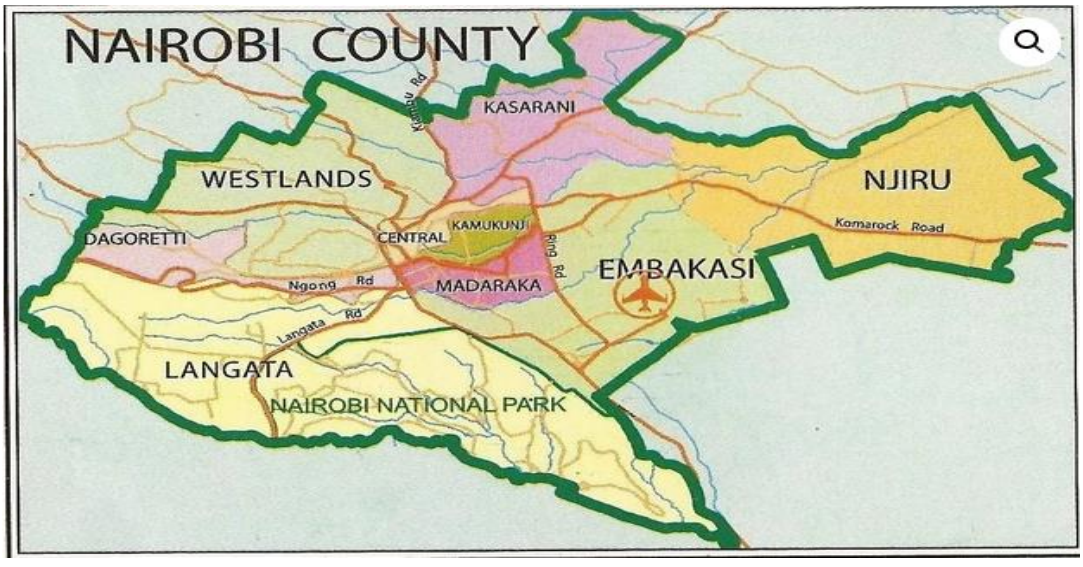

Figure 3.1: Nairobi County Map

Figure 3.2: Nairobi Womens Hospital (Adams) Location

3.2 Study Design

The study applied descriptive cross-sectional methods .The recuited individual voluntarily enrolled in the study at the Nairobi Women's Hospital Adams Branch during the period of study. Within the stipulated period,the recuited individauls were categorised as per the line listing characteristics and all relevant data was gathered.

3.3 Target population

The study population were patients attending Nairobi Women's Hospital Adams Branch with diarrhoea symptoms.

3.3.1 Inclusion criteria

The study Included Patients who gave consent to the study, had diarrhoea symptoms, visited Nairobi Womens Hospital for the clinical assessment and not on antibiotics.

3.3.2 Exclusion criteria

The study excluded patients who never gave consent to the study, those who came for diagnosis of other infections in the Hospital.

3.3.4 Study variables

Three rapid diagnostic kits results finding compared with gold standards in respect to patients demographics including locality, Age, level of Education and religion.

3.3.5 Dependent variables

The stool results were determined by the outcome of the test which is done using the rapid diagnostic kits and confirmed by culture results either positive or negative for *Vibrio Cholerae.*

3.3.6 Independent variable

These were participant's characteristic profiles that were purposely analysed to assess their influence on the *Vibrio Cholerae*. They included demographics characteristics which are age, religion and education level.

3.4 Sampling Techniques and Illustrations

Purposive sampling method was used in this study. The protocol that was used in the sampling design entailed recruiting the participants from the outpatient and the inpatient departments. The recruitment was voluntary after understanding the components of the study and signing an informed consent form. There after a coded questionnaire was administered for the purpose of demographic information presentation.

3.4.1 Sample size determination

Formula for comparing proportions was used (Mittal, 2015)

$$n = \frac{\left[Z_{\frac{\alpha}{2}}\sqrt{2 \times \bar{P}(1-\bar{P})} + Z_{\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\right]^2}{(P_1 - P_2)^2}$$

Where.

P is the average of P_1 and P_2 and Zα, Zβ are the standard, normal Z values corresponding to α and β (the probability of type I and type II errors respectively). We considered 95% confidence and 80% power.

$$n = \frac{(1.96 \times \sqrt{2 \times 0.75 \times 0.25} + 0.84 \times \sqrt{0.70 \times 0.30 + 0.80 \times 0.20})^2}{(0.10)^2}$$

$$= 293$$

The estimated sample size was 293.

3.4.2 Recruitment

All patients presenting with symptoms of cholera were eligible for enrollment. Before enrollment, nurse or medical practitioner in the presence of principal investigator offered Counseling. Detailed information on the research purpose, procedure, expectations, benefits and risks was clearly explained to eligible participants. The research assistant administered the consent before enrolling participants to the study.

3.4.3 Questionnaire and consent administration

A questionnaire was administered, and client were allowed reading through. Instructions were given on how the sample will be collected, importance of Personal Protective Equipment's (PPEs) and reasons for the study. Gloves were provided to prevent infections during specimen collection. Consent form was then administered

to those consenting to participate, in the case of critically ill patient the guardian or the one accompanying the patient was requested to give the consent. A study sample was indicated with unique patient identifier number which was different from the one initially used for hospital patients, Laboratory records were analyzed per line listing format and specimens tracked in laboratory for the study.

3.5 Sampe collection and Analysis

For inpatients, a sterile bucket for collecting stool excrement from patients were distinctly labelled and placed under individual beds. For the outpatients, a labelled stool specimen was given to the client with clear instructions on specimen collection instructions. Gloves were provided to prevent infections during specimen collection. A loopful of stool sample was aseptically collected into sterile containers free of chlorine. The collected contents were transported immediately to the laboratory for culture. Bacterial viability was determined using filter paper discs, which were dipped into non-chlorinated stool samples and transferred into sterile well labelled micro tubes each containing two to three drops of 0.9% w/v normal saline solution.

3.5.1 Laboratory analysis

All samples collected were submitted to both culture and the selected Rapid diagnostic testing for *V. cholerae* .Three types of Rapid diagnostic tests for *V. cholerae* detection were availed in the laboratory. Namely Kits Boson, Bioline and Star Diagnostic. All samples were subjected to the three RDTs and the results tabulated in an excel sheet. Rapid diagnostic testing for *V. cholerae* relies upon characterization of lipopolysaccharide antigens namely, O1 and O139 in stool samples**.** The detection of *V. cholerae* in stool samples was performed as per the manufacturer's instructions. A loopful of fresh stool sample was introduced into a commercial test buffer kit provided. The homogenized sample were homogenized and thereafter four drops was dispensed into a sterile well labelled test tube. A dipstick was placed in the test tube and left undisturbed for 15-20 minutes before results interpretation.

A positive test was indicated by presence of either 2 or 3 bands based on the identified *V. cholerae* zero-group that is O1 or O139. A negative test result was indicated by appearance of only one control band (control). The interpretations of the results was done by the help of the results template that accompany the commercial test kit

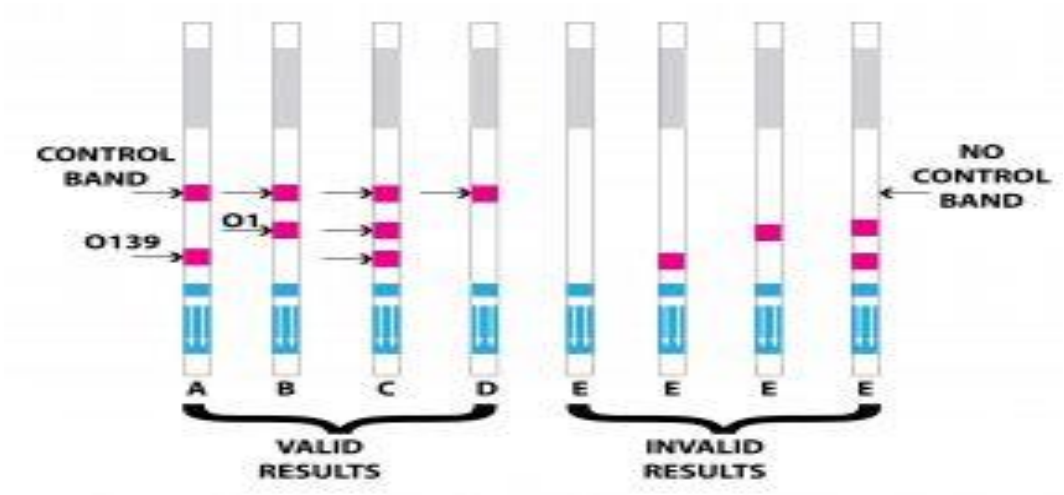

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Figure 3.3: Schematic Interpretation of Results

3.5.2 Stool culture for V. *cholerae.*

The collected samples were inoculated and incubated in Thiosulphate Citrate Bile Salts Sucrose for an overnight at 35-37^{0}c. The colonies for *Vibrio cholerae* are yellow and 2-3 mm in diameter. The obtained culture growth was subjected to biochemical tests to detect *Vibrio Cholerae 01* and *0139*

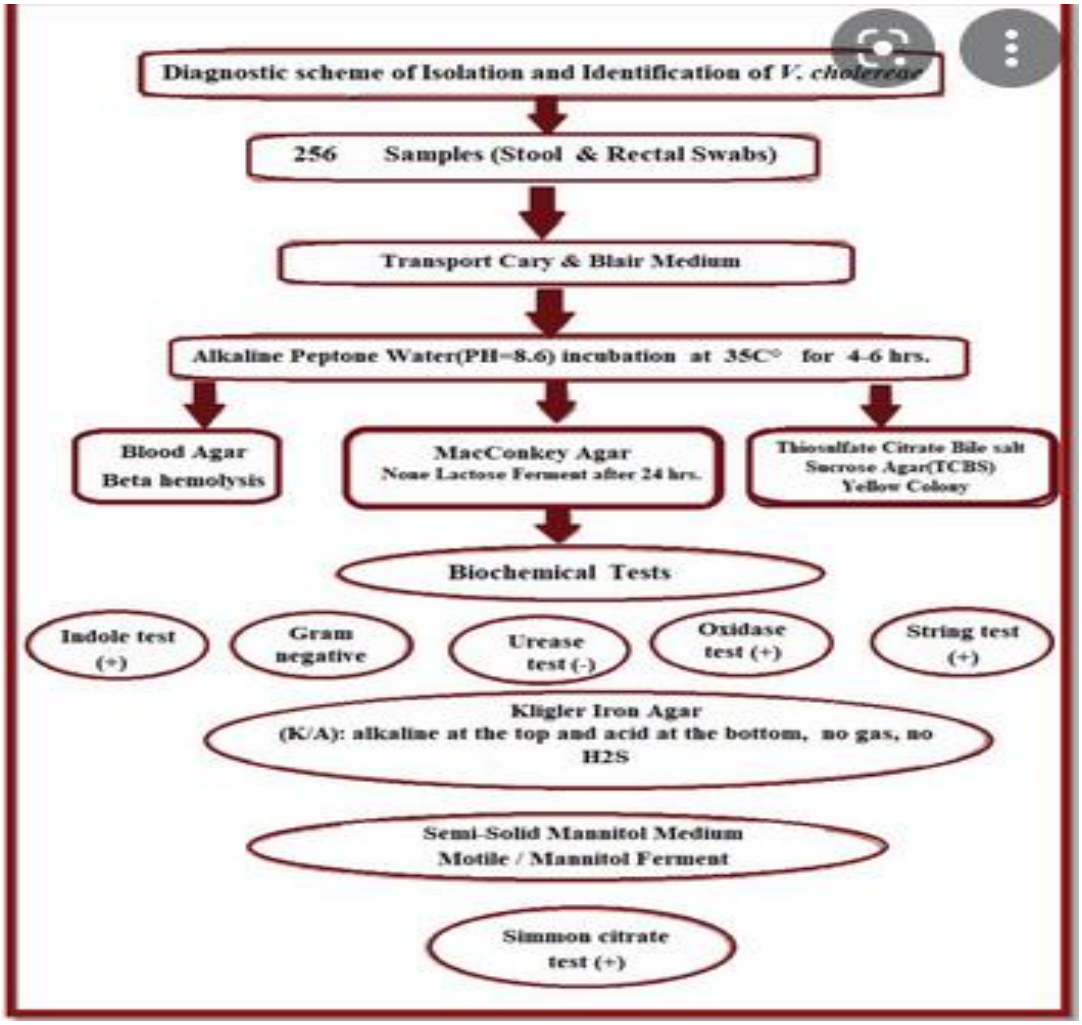

Figure 3.4: Flow diagram of identication of *Vibrio Cholerae.*

Source: Dash *et al.*, 2013

Table 3.1: Biochemical Tests for identification of *Vibrio cholera*

		Growth in broth:		Tests				
		With no NaCl added	1% NaCl	Oxidase	Nitrate Nitrite	Arginine dihydrolase	Lysine decarboxylase	Ornithine decarboxylase
Group & Species								
1	*V. cholerae*	+	+	+	+	-	+	+
	V. mimicus	+	+	+	+	-	+	+
2	*V. metschnikovii*	-	+	-	-	V	V	-
3	*V. cincinn-atiensis*	-	+	+	+	-	V	-
4	*V. hollisae*	-	+	+	+	-	-	-
5	*V. damsela*	-	+	+	+	+	V	-
	V. fluvialis	-	+	+	+	+	-	-
	V. furnissi	-	+	+	+	+	-	-
6	*V. alginolyticus*	-	+	+	+	-	+	V
	V. para-haemolyticus	-	+	+	+	-	+	+
	V. vulnificus	-	+	+	+	-	+	V
	V. carchariae	-	+	+	+	-	+	-

Source: Mahon *et al.*, 2018

3.6 Data Processing and analysis

An initial survey of the study was conducted at the Nairobi Women's Hospital (Hurlingham). It provided both preventive and curative services. The main objective of the survey was to administer the questionnaire to pilot subjects in exactly the same way as it was to be administered in the main study, asking the subjects for feedback to identify ambiguities and difficult questions, record the time taken to complete the questionnaire and decide whether it is reasonable, discard all unnecessary, difficult or ambiguous questions, assess whether each question gives an adequate range of responses, establish that replies can be interpreted in terms of the information that is required, check that all questions are answered, re-word or re-scale any questions that are not answered as expected, shorten, revise and, if possible, pilot again. The

pilot survey also sought to establish the number of patients who seek health services and their specific needs, so that projection on adequacy of sample size acquisition would enable meaningful interpretation of data from enrolled study subjects within the stipulated data collection period as captured in the work plan and budgetary needs.

3.6.1 Quality assurance

Recruitment to the study followed laid down protocols and strictly adhered to the inclusion and exclusion criteria. The reagents used were sourced from accredited suppliers that are licenced by Kenya Medical Laboratory Technicians and Technologist Board (KMLTTB). The reagents were prepared according to the manufacturer's instructions. The Rapid Diagnostic Tests(RDTs) and the Culture reports were performed as per the standard operating Procedures (SOPs) and guidelines to analysis while the control samples were included after every 20^{th} specimen. This was also shared with an external Technologist to validate the results as part of quality assurance (external). The controls for the RDT both positive and negative were conducted before a new batch was used.

3.6.2 Data management and statistical analysis

The questionnaires were kept in a cupboard under a key and lock. A sticker labelled "private and confidential for research use only" was mounted on the Cupboard. The tabulated results were saved in a personal computer and, a copy was stored in a CD and secured with a password. The same information was stored in a flash disk as a backup and kept out of the working area. The data obtained which included the Laboratory analysis and sociodemographic characteristics were double entered into Microsoft Excel sheet, cleaned, and validated.

Data analysis was conducted using the IBM SPSS version 20.0 (IBM Corp, Armonk, NY, USA). ROC To write in full curve was used to calculate Specificity, sensitivity and predictive values of results. Odds ratios to check on which parameters were estimated at a 95% confidence interval. In all the statistical tests calculated, one tailed format will be applied and a P value of less than 0.05 is considered as

significant. The data was presented using tables in form of percentages and absolute numbers.

The findings of this study was presented in JKUAT School of Biomedical Sciences, KNH, Nairobi women's Hospital Research committee, publications in peer review journals and in Scientific seminars and conferences.

CHAPTER FOUR

RESULTS

4.1 Participants characteristics

A total of 240 patients were considered in the study against our targeted sample of 293 patients. This is after cleaning the raw data and found some missing data in 53 participants. This achieved an acceptable sample size of 82%. Majority of the respondents were aged 31-40 years 74 (31%), less than 21 years (29%), 21-30 years 65 (29%) and 50 years and above 32 (13%). In terms of the religion, majority were Christians 172 (72%), Muslims 44 (18%) and other religions 24 (10%). Most of the respondents attained post-secondary education 72 (30%). The results are presented in table 4.1

Table 4.1: Demographic information

Demographic Information	Frequency (n)	Percentage (%)
Age Groups		
Less than 21	69	29
21-30 years	65	29
31-40 years	74	31
50 years +	32	13
Total	240	100
Religion		
Muslim	44	18
Christian	172	72
Others	24	10
Total	240	100
Level of Education		
Primary	48	20
Secondary	72	30
No formal education	43	18
Post-secondary education	77	32
Total	**240**	**100**

Data presented are characteristics of the findings in terms of frequency (n) and the proportion of the frequency in percentage (%).

4.2 Distribution of the test outcomes.

When using stool culture as the gold standard, negative tests were 172 (96.6%), 169 (95.5%), and 165 (93.8%) for Boson, Bioline and start diagnostics respectively. For the positive tests, 6 (3.4%), 8 (4.6%) , 11 (6.4 %) in Boson, Bioline and star diagnostics respectively.

Table 4.2: Distribution of the test against the gold standard

		Boson Diagnostic(A)			**Bioline Diagnostic(B)**			**Star Diagnostic(C)**		
		Neg	Pos		Neg	Pos		Neg	Pos	
Culture (Gold Standard)	Neg	172	8	180	169	11	180	165	15	180
	Pos	6	54	60	8	52	60	11	49	60
	Total	178	62	240	177	63	240	176	64	240

Data presented are characteristics of the findings in terms of the numbers in each outcomes in each Rapid Diagnostic kit.

4.3 Performance of the Rapid Diagnostic Tests compared to stools Culture.

The researcher analyzed the performance of the RDTs against stool culture as the gold standard. The obtained results for the three RDTs were Boson 87.1%, Bioline 82.5% and Star Diagnostics 76.61% in relation to theirs Sensitivity. In terms of the specificity, Boson 96.6 %, Bioline 95.5% and Star Diagnostics 81.7%. Boson emerged the best RDT for *Vibrio Cholerae* while Star Diagnostic was the least performing RDT

Table 4.3: Performance of the Rapid Diagnostic Tests compared to stool Culture

Test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Kappa test	Chi-square test
Boson Diagnostic	87.1	96.6	90.0	95.6	0.846	0.000
Bioline Diagnostic	82.5	95.5	86.7	93.9	0.792	0.000
Star Diagnostic	76.6	93.8	81.7	91.7	0.717	0.000

Data presented as percentage (%) of subjects. Statistical comparisons were performed using the Kappa tests at a cut-off point of 95% confidence interval.

4.4 Receiver Operating Curve

The study variables were computed and graphically obtained a ROC curve to help calculate specificity and sensitivity of the Rapid Diagnostic Tests against the gold Standard. The findings are shown in Figure 4.1

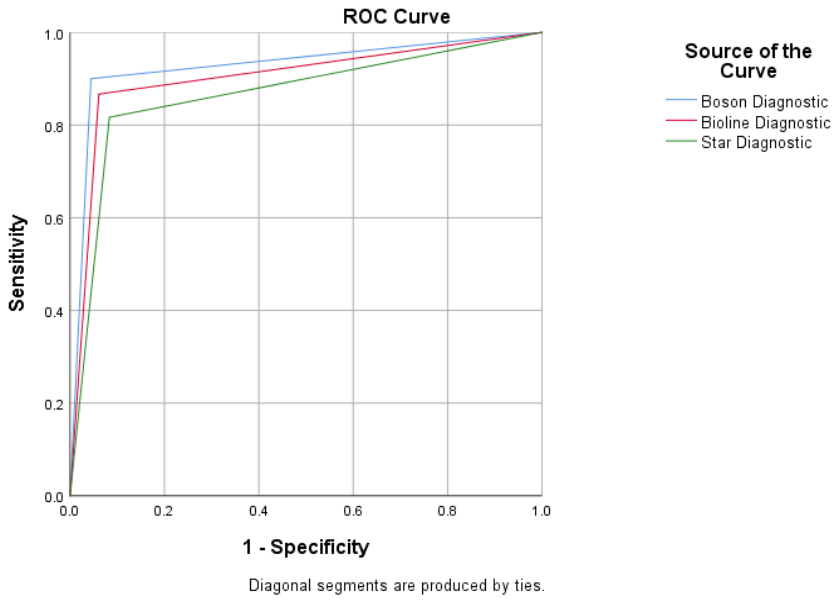

Figure 4.1: ROC Curve for Sensitivity and Specificity Results

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

Discussion of this study includes the association of various study participant's characteristics with Cholera outcomes from different rapid diagnostics kits. It has also included the consideration of the performance of different diagnostic kits versus the stool culture which was the gold standard. The study reported a prevalence of *vibrio cholerae* in the study to be 27 % of the total study population. This was obtained from the stool culture because it was the gold standard. Majority of the participants were aged between 21-40 years while minority was 50 years and above. Christians were the most represented religion with 72%. Most of the participants had attended education level of post-secondary 32%. The findings of this study were higher in prevalence than a previous study done in Western Kenya region and East Pokot County (George, 2016) which had a prevalence rate of 20%. This lower prevalence of the Western study was likely because of the collaboration of health sectors and stakeholders in implementing treatment, control and prevention interventions. Treatment centres were set up in cholera epicentres, potable water and water treatment commodities like aqua tabs were provided, hand washing equipment and soap was made available at the community level, a comprehensive cholera risk communication strategy was initiated and extra health staff were deployed to the community hospitals. The other reason that might have caused this high prevalence is the selection method of the participants. The current study used symptomatic cases while the previous study used even non-asymptomatic case. This study also agreed with a study done in Haiti that demonstrated people who lack knowledge about cholera may not be able to apply promotive, preventive and health control measures and thus remain at greater risk of contracting cholera (Grandesso, 2014).

Cholera remains a substantial health burden in Asia and Africa particularly in resource poor settings. The standard procedures to identify the etiological organism *V. cholerae* are isolation from microbiological culture from stool as well as

Polymerase Chain Reaction (PCR). Both the processes are highly lab oriented, labor extensive, time consuming, and expensive. In an effort to control for outbreaks and epidemics; an effective, convenient, quick and relatively less expensive detection method is imperative, without compromising the sensitivity and specificity that exists at present (Islam *et al.*, 2019). The objective of this component of the study was to evaluate the effectiveness of selected rapid diagnostic test (RDT) for cholera diagnosis. Several selected Rapid diagnostic kits were evaluated on their performance. The included Boson, Bioline and Star Diagnostics. Their obtained sensitivity was 87.1,82.5 and 76.6 respectively. In addition, they achieved a specificity of 96.6,95.5 and 93.8 respectively. All the RDTs gave a substantial level of agreement on Kappa Test (> 0.60). The sensitivity and specificity of the rapid test kits used in this study performed well according to Global taskforce for cholera (WHO, 2016), they can be used as screening tests. The results of the RDTs in this study were better compared to another study done Haiti (Grandesso, 2104) which showed a low sensitivity and sensitivity of 72% and 77 % respectively in different rapid diagnostic kits. The difference in the two studies can be attributed to the sample size used. The previous study used a bigger sample size that the current study. Although a study done in Sierra Leone had almost similar findings. The similarity is attributed to the timing of the study, the target population applied, the methodology used and the choice of study sample size (Nguyen et *al.*, 2014)

The Kappa test which measured the agreement of the gold standard which was the stool culture versus the rapid diagnostic kits when calculated, a p value of than 0.846, 0.792 and 0.717 was achieved for Boson, Bioline and Star Diagnostic respectively which indicated a perfect agreement between the studied rapid diagnostics test and the gold standard. This shows though stool culture is a good diagnostic test, the importance of rapid diagnostic kits in Cholera as a screening test cannot be underestimated. The reasons attributed to the good performance of rapid diagnostic tests against the gold standard in this study included: Strict adherence to guidelines in exclusion and exclusion criteria, keen adherence to the set guidelines on sufficient specimen collection, reasonable sample size, good response rate from the participants and experienced and competent personnel.

5.2 Conclusion

The findings in this study have shown that majority of the persons affected by cholera are aged between 31-40 years. Rapid diagnostic for cholera which includes Boson, Star and Bioline performed well against the gold standard which was in this study stool for culture. Boson was the most sensitive RDT as compared to Star Diagnostic RDT which was least sensitive. In terms of specificity, Boson also performed better than all the used diagnostic kits while Star Diagnostic was the least specific. This qualifies all the RDTs used in this study good for screening purposes.

5.3 Recommendations

1. A study to be done to understand the relationship between age and *Vibrio Cholera* virulence.
2. The Cholera RDTs in the market to be validated before use.
3. A population-based study to be done to assess the country's cholera burden.
4. Public health officers to educate public on cholera infections.
5. Rapid diagnostics to be licensed and approved for use in cholera screening.

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APPENDICES

Appendix I: Consent Form

Informed consent form

My name is Mary Muraya. I am a Masters student from JKUAT. I am conducting a study on Comparison of stool culture test and rapid diagnosis test kits in cholera diagnosis in Nairobi Women's Hospital Adams. The information will be used by the Ministry of Health to improve access and quality for diagnosis, treatment, management preventions of Cholera infections.

Procedures to be followed

Outpatient-Participants in this study will require to collect a stool sample aseptically.

A clean screw-top container shall be provided labelled with your Details; Name, Age, Gender, Date of collection

Other steps to follow**:**

• place something in the toilet to catch the poo, such as a potty or an empty plastic fod container, or spread clean newspaper or plastic wrap over the rim of the toilet
• make sure the poo doesn't touch the inside of the toilet
• use the spoon or spatula that comes with the container to collect the poo, then screw the lid shut
• Aim to fill around a third of it – that's about the size of a walnut if you're using your own container
• put anything you used to collect the poo in a plastic bag, tie it up and put it the bin
• wash your hands thoroughly with soap and warm running water

Collected specimens will be taken for the tests being conducted in the study. I will record the information from you in a questionnaire.

You have the right to refuse participation in this study. You will get the same care and medical treatment whether you agree to join the study or not and your decision will not change the care you will receive from the clinic today or that you will get from any other clinic at any other time.

You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive from this clinic or any other organization now or in the future.

For inpatients/Bedridden

Clean bucket shall be put under the bed, or a clean bedpan to be placed under the patient

Using a tongue blade, we transfer into a properly labelled container

For rectal swab, the swabs shall be inserted 2-3cm through the rectal sphincter, rotate gently then remove, the swab is then transferred to the container

Confidentiality

The interviews and examinations will be conducted in a private setting within the clinic. Your name will not be recorded on the questionnaire. The questionnaires will be kept in a locked cabinet for safe keeping by the principle investigator. Everything will be kept private.

Contact Information

If you have any questions concerning the study, fell free to contact JKUAT through Dr. Perpetua Ndungu on 0722864455 (Tel), Dr. Jessica Wesonga on 0723958983 and Dr Alex Wamachi on 0717340420

Participant's Statement

The above information regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time. I understand that I will get the same care and medical treatment whether I decide to leave the study or not and my decision will not change the care I will receive from the clinic today or that I will get from any other clinic at any other time.

Signature/Thumb ……..…

Date…….....

Investigator's statement

I, the undersigned, have explained to the volunteer in a language she understands the procedures to be followed in the study and the risks and benefits involved.

Name of Interviewer…….

Signature...……. Date…….....

Appendix II: Data CollectionTool

Study questionnaire:

Instructions: Please give all information required. Please tick as appropriate in the spaces provided and fill in the correct responses where necessary

INTERVIEW DATE……	
QUESTIONAIRRE NUMBER……	STUDY CODE NUMBER……

SECTION A: DEMOGRAPHIC CHARACTERISTICS

Age in complete years	
Religion	
Level of education	No formal education Primary education Secondary education Post-secondary

SECTION B: RAPID DIAGNOSTIC RESULTS.

Boson	
Bioline	
Star Diagnostics	
MUAC	

SECTION C: CULTURE REPORT

Appendix III: KNH/UON Ethical Approval

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel (254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
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Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
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Ref: KNH-ERC/A/251

10th August 2020

Mary Muraya
Reg. No.HSB 331/3268/2016
Dept.of Medical Laboratory Sciences
College of Health Sciences (CoHES)
J.K.U.A.T

Dear Mary

RESEARCH PROPOSAL – COMPARISON BETWEEN STOOL CULTURE TEST AND RAPID DIAGNOSIS TEST KITS IN CHOLERA DIAGNOSIS IN NAIROBI WOMEN'S HOSPITAL ADAMS BRANCH (P911/11/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and approved your above research proposal. The approval period is 10th August 2020 – 9th August 2021.

This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 90 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website http://www.erc.uonbi.ac.ke

Yours sincerely,

PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
Supervisors: Dr. Perpetua Ndungu(J..K.U.A.T), Dr. Jessica Wesonga(J.K.U.A.T)

Appendix IV: Published Manuscript

November 2021 EAST AFRICAN MEDICAL JOURNAL 4325

East African Medical Journal Vol. 98 No. 11 November 2021

THE PERFORMANCE OF RAPID DIAGNOSTIC KITS IN CHOLERA DIAGNOSIS AMONG

PATIENTS PRESENTING WITH DIARRHOEA SYMPTOMS ATTENDING THE NAIROBI WOMENS

HOSPITAL (ADAMS)

Mary Muraya, Department of Medical Laboratory Sciences, Jomo Kenyatta University of Agriculture

and Technology, P.O. Box 62 000 – 00200 Nairobi, Kenya, Perpetua Ndungu, Department of Medical

Laboratory Sciences, Jomo Kenyatta University of Agriculture and Technology, P.O. Box 62 000 – 00200

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Box 43844-00100, Nairobi, Kenya.

Corresponding author: Mary Muraya, Department of Medical Laboratory Sciences, Jomo Kenyatta

University of Agriculture and Technology, P.O. Box 62 000 – 00200 Nairobi, Kenya. Email:mnmuraya@gmail.com

THE PERFORMANCE OF RAPID DIAGNOSTIC KITS IN CHOLERA DIAGNOSIS AMONG PATIENTS PRESENTING WITH DIARRHOEA SYMPTOMS ATTENDING THE NAIROBI WOMENS HOSPITAL (ADAMS)

M. Muraya, P. Ndungu, A. Wamachi and M. Nyamai

ABSTRACT

Background: Cholera is an acute watery diarrhea disease caused mainly by Vibrio Cholera O1 and less commonly by Vibrio Cholera O139. It remains a global threat to public health thus importance to early detection. Stool is the ideal sample for the infection detection in both Rapid diagnostics and Stool culture.

Objective: To evaluate the performance of rapid diagnostic kits in cholera diagnosis among patients presenting with diarrhea symptoms attending Nairobi Women's Hospital.

Material and Methods: This was across-sectional descriptive study. It involved participants who visited the Hospital during the study period with diarrhea symptom of clinical presentation. Data and study outcome were screened, pooled and entered in the SPSS for analysis.

Result: The sample size determination was calculated using Mittal formula (2015) formula with a confidence interval of 95% and a margin error of 5% which

gave 293 participants. The findings in this study have shown that majority of the persons affected by cholera are aged between 31-40 years. Boson, Bioline and Star Diagnostics were the selected Rapid diagnostic kits for the study. Obtained sensitivity was 87.1%, 82.5% and 76.6% respectively with specificity of 96.6%, 95.5% and 93.8% respectively. All achieved substantial level of agreement on Kappa Test (> 0.60).

Conclusion: The Rapid Diagnostic kits in study are recommended for screening as well as diagnostic purposes.

Appendix (v) Nairobi Womens Hospital Authorization Letter.

The Nairobi Women's Hospital
With passion we deliver healthcare

LETTER OF AUTHORIZATION FOR CONDUCTING PROPOSED STUDY

The department of research, quality and standards of the Nairobi women's hospital is keen to collaboration in your study comparison of rapid diagnostic kits and stool culture in cholera diagnosis among patients presenting with diarrhea attending Nairobi women's hospital (Adams).

Note is taken of the letter of approval by Kenyatta National Hospital-University of Nairobi Research and Ethics Committee dated 10th August 2020.

You are hereby authorized to proceed with the study and urged to share the findings with the department with the department of research, Quality and standards of the Nairobi Women's Hospital.

Sincerely

15/10/2020

Dr Peter Igogo
Chief medical services
The Nairobi womens Hospital

CC; Quality and standards chair
Nairobi womens Hospiatl