The Epidemiological Aspect of Cholera Epidemic in Babylon Province in 2022

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Abstract: Background: Cholera is an acute watery diarrheal infection caused by, the Vibrio cholera which is a motile, Gram-negative, comma-shaped, bacteria that enter the humans gastro intestinal tract (GIT) by drinking or eating a contaminated water or food. There are Two serogroups of V. cholerae that cause pandemic, O1 and O139. V. cholerae O1 is further subdivided into two biotypes, classical and El Tor. The Case Fatality rate is the proportion of cholera cases who die to all cases diagnosed with the cholera disease within a specified time.

Objective: To study the distribution of Cholera cases and its relation to the socio demographic variable of the affected patients and to describe the case fatality rate

Patients and methods: This study is A descriptive cross-sectional study has been conducted at the public health department/ communicable diseases control Section, for the period from 1st of February 2023 to the end of July 2023. All confirmed cholera cases was included in the study(369) Collected data was entered and analyzed, using statistical package for social science program (SPSS software version 26).

Results: A total of 1224 suspected cholera cases but their culture to vibrio cholera were negative so excluded from this study, A total 369 cholera patients were selected in our study, the ages of respondents ranged between 1 to 90 years with a mean age 37.7 ± 20.464. the majority (38.8%) of the sample were 45 years old and over. 53.1% of the patients were female; and 60.4% lives in urban area. 41.7% of the total population on study were house wife and only 3% were civil servant. the majority of cases in the center of Babylon. most cases were diagnosed in autumn season. 85.37% of the cases was diagnosed in the hospital. The outcome of cholera cases as 98.92% improved and 1.08% unfortunately die so the case fatality risk (CFR) was 1.08%.

Conclusion: A multifaceted preventive plans are urgently required to be developed by The government to cope this problem including a Combined strategies of 1-Repairing the damaged infrastructures that result from subsequent wars as: Establish a good sewage system, Rehabilitation and maintenance of water supply systems and establishing water supply network to areas don't have it, to ensure clean and safe water supply to the people's houses. 2-immediate notification surveillance, 3- Increase Health education program and distributed to all cultures population by social media, TV, Decision makers and clergy about the causes of the diseases, the ways of transmission, improving personal hygiene as proper way for hand-washing, and encourage breastfeeding and 4- the implementation of oral cholera vaccines (OCVs) during epidemic. Further researches are needs to identify the other causes of high attack and mortality rates.

Keywords: Vibrio cholera, case fatality risk, surveillance.

1. INTRODUCTION

1.1 Epidemiology denotes the investigation of health outcomes in specific groups at a certain point in time, as well as the frequency, pattern, causes, and risk factors of health-related states. [1.] Descriptive epidemiology looks for the population, outcome, time and place, while Analytic epidemiology look for the causes of the outcome. [2]

Endemic: The habitual existence of a disease within a given area. [2]

Epidemic: The rise of the frequency of a disease above the expected rate. [2]

Pandemic: It means A worldwide epidemic. [2]

Case fatality rate (CFR): The ratio of deceased cholera cases to the overall number of cholera cases—both alive and dead—is calculated. [3]

Cholera is an acute watery diarrheal infection brought on by the Gram-negative, motile Vibrio cholera bacteria., comma-shaped, bacteria that enter the humans gastro intestinal tract(GIT) by eating a contaminated water or food.[4,5] mostly the infection acquired from drinking unsafe water. [6]

1.2 The history and geographical distribution of cholera

Vibrio had already been described Italian physician Fillippo Pacine (1812–1883) developed the theory of miasma as the origin of cholera in Florence in 1854, but other experts disregarded his findings. Thereafter, Robert Koch was describe The etiology of cholera at 1883, when he was investigate Twelve people were admitted to hospitals in Greece, Germany, and Egypt.. [7,8] Cholera originated in Bangladesh because of the country's frequent storms and floods, which make maintaining hygiene difficult. The cholera spreads to neighboring nations by means of carriers.[7] The cholera extended beyond the endemic area in (the Brahmaputra and Ganges delta in eastern Pakistan and India) from 1817 to1923 in six pandemics, and spread along the trade routes to most of the world then After, With the exception of a single, isolated outbreak in Egypt in 1947, cholera remained largely limited to the endemic areas and neighboring countries of Southeast Asia. the seventh pandemic began in 1961 with an emphasis in Indonesia and by 1963 had expanded to Korea, China (Taiwan), and the Philippines in the north. West Pakistan, Afghanistan, Iran, the southern USSR, and Iraq were all included in the westward expansion that started in 1964.. [9] Since 1966, cholera has been regarded as an endemic illness in our nation, Iraq. [10] Between 1966 and 1999, there were multiple episodes of severe watery diarrhea, including cholera. In the early years, Iraq also experienced seven further cases of acute watery diarrhea, including cholera (2003, 2007/2008, 2012, 2015, 2017 and 2022).. [11] There had been 560cases of cholera in 2001 and 718cases in 2002.[12] In 2007 Iraq reported 4667 cases.[13] 2,810 cholera cases were reported in Iraq in 2015, with 675 cases coming from Babylon province (Vibrio cholerae 01 Inaba). In contrast, an epidemic in 2017 resulted in 675 cases. Baghdad-Alresafa accounted for 109 (63.75 percent) of the cholera cases, with Babylon accounting for 34 cases (19.88 percent) [6.5]

1.3 The PANDEMICS and Endemic of CHOLERA 3.1

A serious public health issue, cholera is a sign of underdeveloped social structures. [4,5,8] The term pandemic means the spread of a disease globally, the first cholera pandemics, started in 1817and began in the Ganges delta, and pandemics that followed broke out in 1829, 1852, 1863, 1881, 1889, and 1961., The Americas was invaded in 1991[7,8]so The problem is international because it threatens the nearby countries and others countries of the world, also elimination of International cooperation is necessary for the endemic foci to succeed.. [9] If an area had a confirmed cholera cases over the past 3 years it was endemic, Cholera is endemic in sub-Saharan Africa Latin and Central America, and Asia (e.g., India, Bangladesh, Indonesia, Vietnam, Pakistan, Thailand, Iraq and Nepal). The epidemic of cholera can occur in endemic and non-endemic areas relying on environmental conditions. [14]

1.4 The biotypes of V. cholera that cause the pandemics

O1 and O139 are the two serogroups of V. cholerae that trigger pandemics. Two biotypes of V. cholerae O1 are further distinguished: classical and El Tor.. The knowledge of these biotype is

important because it must be differentiated from local bacterial because certain types of cholera that are not pandemic cholera are present. [8]

The pandemic 1st–6th 1817–1923, was caused by the classical O1 biotype However, the O139 biotype was accountable for the eighth pandemic (Bengal) and the El Tor biotype for the seventh pandemic (1961). (1992) [7,8, 11]

Following the dramatic epidemics in 1992 and 1993, V. cholerae biotype O139 was identified less frequently. Currently, all instances of cholera are caused by the biotype O1 El Tor, whereas O139 is rarely isolated.. [8]

1.5 The risk factors for cholera outbreaks and epidemics

During London's 1854 cholera outbreak, John Snow (1813–1858) discovered that the peoples drinking water from the a special public water pump were infected while other people's drinking a water from another public water pump were not; now, cholera outbreaks are connected to wars and natural disasters, because the major destruction to the infrastructure of the country, and refugee camps because the poor hygienic conditions. cholera epidemics are unlikely to happen In countries with high level of hygiene, safe drinking water, well-sewered houses and free from natural disasters or war or refugee camps.[7] Therefore, the following were the primary risk factors for cholera outbreaks: poverty, overcrowding, poor water and sanitation, aging, low socioeconomic status, lack of breastfeeding, and recurrent droughts or flooding. (depth and water temperature, rainfall that was shown to be related with the cholera toxin-producing bacteria). Other host risk factors that influence human susceptibility to cholera infection as human with O blood group (this relevance is apply to the El Tor biotype only), Gastric hypoacidity, Host diet and nutritional status, artificial fed infants, patients with Retinol deficiency, and HIV infection. it was noted that substantial Vaccinations against cholera have demonstrated protection. and patient who had cholera was protected for at least three years from other cholera infection[8]

1.6 Transmission

V. cholera is a natural resident of the aquatic environment, especially brackish waters, coastal waters and estuarine. Food and contaminated liquids are the fecal-oral route of transmission for cholera.. Epidemic of cholera frequently occurs close to water ways when the conditions are suitable for the bacteria growth [8] The incubation period of V. cholera might range from 12 h to 5 days[14]. V. cholera is excreted in the stool of people who have cholera infection. Patients who are asymptomatic may only expel the bacteria in their stool for a day, but those who are symptomatic may do so for 1-2 weeks following the sickness.. [8] direct transmission from one person to another during epidemics, is rarely documented. [6]

1.7 Case Fatality rate

It is the proportion of cholera cases who die to all cases diagnosed with the cholera disease within a specified time. It represent The risk of death[15,16],it is estimated by dividing the number of deaths associated with the disease in a population by the number of cases of that disease within a specified time period so it is measure The probability of death among cases diagnosed with a disease and it is often used to determine the disease severity. [15]The number of human killed by cholera all over the world is about 21,000–143,000 person each year as estimated by WHO, but this represents only 5%–10% of the true numbers because the fear of the countries on trade and tourism from the unfavorable effect[10]

Yet, in the Near East, the case fatality risk still higher than usual during recent outbreaks in spite of our knowledge on the disease and what we do to control it, this may be due to the epidemic sizes the larger the epidemic, the worse the outcomes. [17]

1.8 Clinical presentation and diagnosis

Most people are asymptomatic or have mild to moderate symptoms, similar to other causes of watery diarrhea and treated with only oral rehydration fluid [18]

While 10% have severe symptoms[19]which include (Profuse watery diarrhea (rice-water stools without blood), Nausea and vomiting, Irritability, Thirst, and, Muscle cramps because electrolyte loss. Fever is absent.[18,19] Signs and symptoms of dehydration are parallel to volume depletion and divided into two categories: 1- no dehydration (fluid deficit measured at less than 5% of bodyweight), and 2- moderate (SOME) dehydration (fluid deficit assessed at between 5 and 10% of bodyweight). shadowed eyes, Skin pinching and thirsty Returns gradually, and three, severe dehydration (defined as an estimated fluid deficit greater than 10% of body weight) corresponds to thirst, sunken eyes, loss of tears, skin pinch Goes back very slowly[20,21],other signs are thready pulse or low volume, hypotension, low fontanelle (in a newborn), reduced consciousness, or possibly a coma as a result of serious electrolyte imbalances (such as hyponatraemia and hypoglycaemia), oliguria or anuria due to the possibility of severe renal damage from hypovolemia and hypotension resulting in acute tubular necrosis.. Patients may present with tachypnea due to Acidosis and misdiagnose as pneumonia, so they should be reassessed 1–2 h after adequate rehydration to exclude pneumonia. Cholera in pregnancy may result in fetal death.[18, 20]

The diagnosis of cholera is usually clinical[18] and confirmed by isolation and identification of V. cholerae serotype by culturing a stool sample. Cary Blair media is used for transport the stool sample to the laboratory. in regions with no laboratory tests, the Crystal® VC dipstick rapid test can be useful but it is not ideal. [19] Serum electrolytes and blood glucose levels may be helpful for individuals experiencing severe symptoms, such as convulsions, anuria disorientation, or an ileus.. [18]

1.9 Management

If a person older than two years old experiences acute watery diarrhea that lasts for less than 48 hours and is accompanied by dehydration, they should be treated for cholera. Whether or not to throw up. [18]

The mainstay of management is early rehydration ; oral rehydration solution alone for Patients with (no) or (some) dehydration if they are conscious and able to take fluids by mouth. Reassessment of hydration status every 1–2 h to ensure that hydration is getting better in individuals who may be dehydrated to some extent. It is recommended to continue breastfeeding newborns and young children. [18]

Severe dehydration patients need to have an intravenous fluid bolus immediately, administered over three hours at a rate of 1/3 per minute for the first thirty minutes (double the duration in children less than 1 year and in those with malnutrition). Although normal saline containing 5–10 mmol/L of potassium can also be utilized, ringers lactate is typically the preferred fluid. It is best to begin oral rehydration concurrently. When potassium is scarce, the potassium-containing ORS will partially make up for it. Further intravenous fluids are typically not needed once the intravenous fluid bolus has finished..

If you have access to sterile water and ingredients, you can make ORS at home. Some conventional drinks work well too. Patients with substantial co-morbidities could require specialized treatment regimens. Antibiotics prescribed for patients with moderate to severe dehydration might shorten the length of illness, minimize fluid loss, and potentially reduce vibrio excretion by one to two days. A single dose of an antibiotic is typically adequate as soon as the vomiting stops; if the dose is remitted, it should be repeated. The most widely used medication in the world is still doxycycline, however since drug resistance is widespread, local sensitivities should be considered when choosing an antibiotic if these are not available. It is advised to take azithromycin in a single dose of 1 g for adults and 20 mg/kg for children. It is now advised to use ciprofloxacin once a day for three days. All children between the ages of six months and five years should receive 20 mg of zinc per day for ten days, as this lowers the risk of death and additional diarrhea episodes. If cholera is treated properly for dehydration, recovery is quick and fatality is quite low.. [18]

1.10 Prevention and control

Cholera infections can be controlled and reduce deaths by A combination of a multifaceted approach which are surveillance, access to oral cholera vaccinations, treatment, social mobilization, sanitation and hygiene, and clean water [4, 8]

Research indicates that acquired immunity following cholera infection and immunization can last up to three years. Serogroup and biotype specific immunity so the patient with O139 cholera infection had immunity to subsequent O139 individuals with El Tor cholera showed immunity against subsequent El Tor infections for a period of three years (El Tor Inaba offered defense against Ogawa serotypes as well as El Tor Inaba, but Ogawa serotype was exclusive to itself.). [11]

2. PATIENTS AND METHODS

2.1. Study design:

A cross-sectional descriptive research.

2.2. Study setting:

The research was carried out at the department of public health. / communicable diseases control Section in Al-Hillah City which represent CDC of Babylon

2.3. Time of the study:

The study was carried out between February 1st, 2023, and July 31st, 2023. A period of six months has been used for data collecting.

2.4 Ethical and administrative Approval:

The Department of Training and Development Center at the Ministry of Health in Iraq provided ethical approval for the conduct of the study (Appendix 1). Oral consent was obtained over the phone from each patient or their family after a brief description of the study's goals.

2.5. Sample size:

All confirmed cholera cases were included in the study

2.6. Study sample:

Patients whose recorded in and his /her diagnosis by laboratory culture were eligible to participate in this study.

Inclusion criteria:

1) Patients confirmed by culture vibrio cholera

2) Patients who agreed and consented to participate in the study

Exclusion criteria

➢ Patients clinically suspected cholera but not confirmed by culture of vibrio cholera

2.7. Data collection tool (Questionnaire form):

A special investigation form (Appendix 2) prepared by the Center for Communicable Disease Control / Iraqi Ministry of Health

2.8. Methods of data collection and sampling methods:

For each patient, a separate case investigation form has been filled in by the distract or hospital personnel through direct interview with the patient himself., and the missed information was completed by asking the patient or his family by phone. These 369 patients agreed to participate in the study in which the aim of the study was explained for them.

2.9. Statistical analysis:

The statistical package for social science (SPSS software version 26) was used to enter and analyze the collected data. The results were displayed as figures, tables, frequencies, percentages, and cross tabulations.

To investigate any relationships between the variables, the Chi-square (X2) test was employed. When the P-value was less than 0.05, it was deemed that the link was statistically significant.

3. RESULTS

In all, 369 cholera patients were chosen for our study; respondents' ages varied from 1 to 90 years old, with a mean age of 37.7 ± 20.464. Table (3.1) presents the characteristics of the study population. It reveals that 38.8% of the sample was composed of individuals aged 45 and above. Of the patients, 53.1 percent were female and 60.4% reside in an urban region. Just 3% of the study's entire population worked as civil servants, while 41.7 percent of participants were housewives.

Table (3.1) Distribution of cholera cases according to socio-economic status.

	Variable	Frequency	Percent
Age group	Less than 5years	10	2.7
	5-9 years	12	3.3
	10-14years	21	5.7
	15-24	81	22
	25-34	52	14.1
	35-45	50	13.6
	More than45years	143	**38.8**
	Total	369	100.0
Gender	Male	173	46.9
	Female	196	53.1
	Total	369	100.0
Residence	Urban	223	60.4
	Rural	146	39.6
	Total	369	100.0
Occupation	Government employee	11	3.0
	Unskilled	118	32
	Jobless	31	8.4
	Housewife	154	41.7
	student	55	14.9
	Total	369	100.0

Table (3.2): Distribution of cholera cases according to primary health care Districts.

District	Frequency	Percent	Population no	Attack rate per 100,000population
1st Hillah	**193**	**52.3**	**491,357**	**39.2**
2nd Hillah	**129**	**35.0**	**428,659**	**30**
Al-Musayiab	5	1.4	399,383	1.2
Al-Mahawil	14	3.8	247,692	5.6
Al-Hashimiyah	18	4.9	571,533	3.1
kotha	10	2.7	149,832	6.6
Total	369	100.0	2,288,456	16.1

Figure (3.1) shows the distribution of cholera cases according to time of diagnosis it clarified that most cases were diagnosed in autumn season.

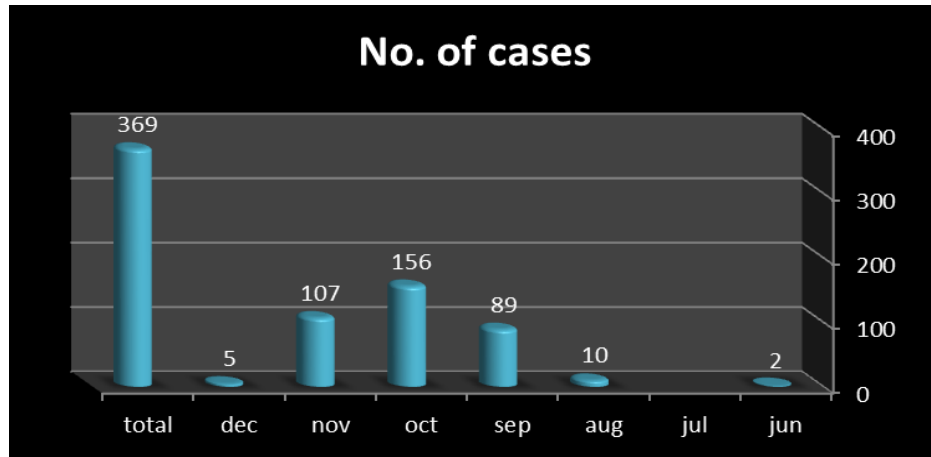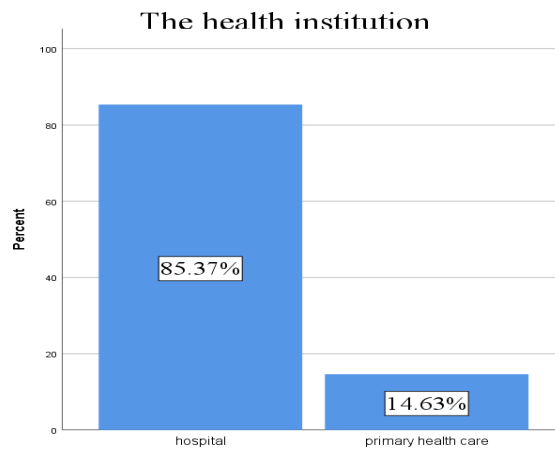**Figure (3.2) shows the percentage of cholera cases diagnosed according to health care**

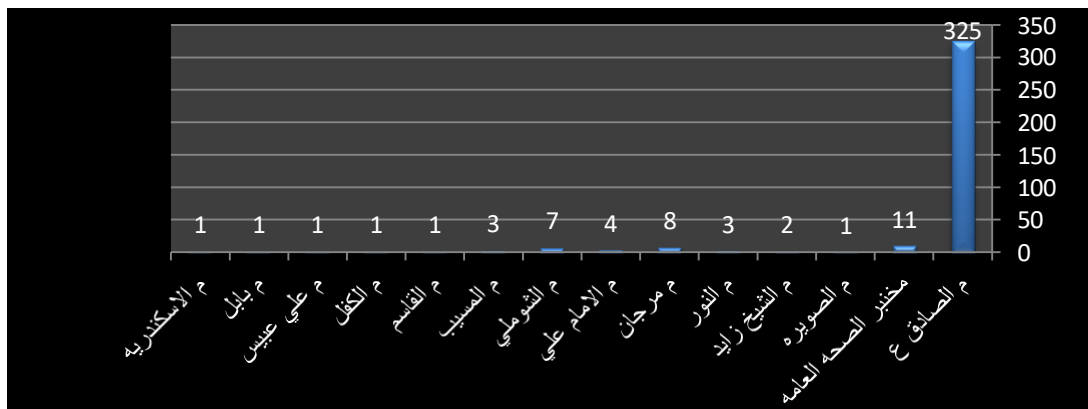**Figure (3.3) shows the number of cholera cases diagnosed by hospitals.**

Table (3.3): the signs and symptoms of cholera cases during this outbreak

Sign and symptom	diarrhoer	Fever	Rice Watery stool	Blood in stool	Vomiting	Dehydration	Other(abdominal colic, muscle cramp)	Antibiotic Treatment
Frequency from total	298	6	71	0	59	288	50	97
Percent from total	**80**	1.6	**19.2**	0	16.0	**78.0**	13.6	26.3

Table (3.4): show that the no. of cases that required hospitalization, distributed according to district. (31.71% hospitalize vs 68.29% treated as outpatient)

District	hospitalization	out patient	Total
1st Hillah	50	143	193
2nd Hillah	45	84	129
Al-Musayiab	2	3	5
Al-Mahawil	7	7	14
Al-Hashimiyah	4	14	18
kotha	9	1	10
Total	**117**	**252**	369

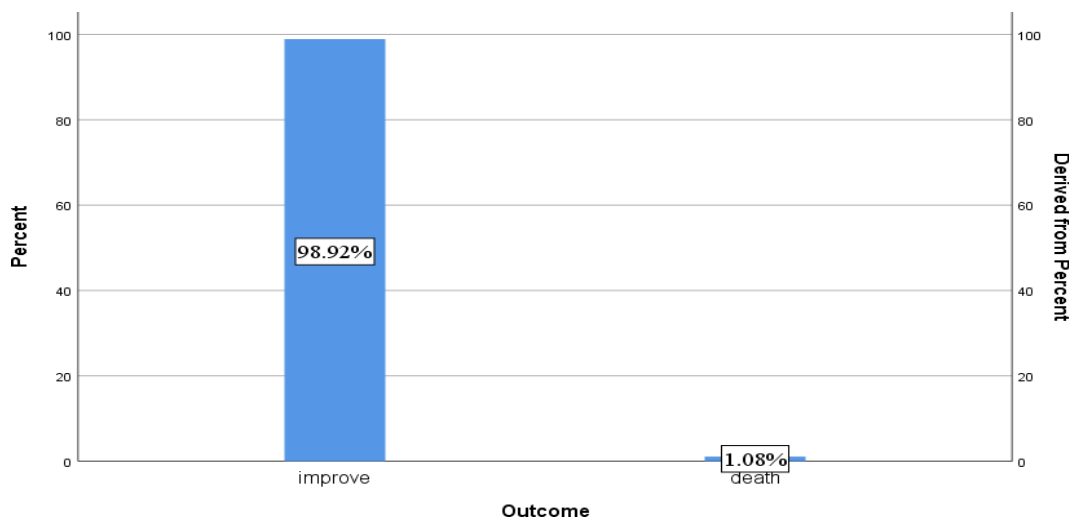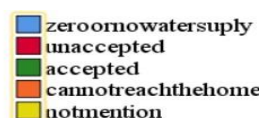**Figure (3.4) shows the percentage of cholera cases outcome.**

Table (3.5): show that the outcome of cases that distributed according to district.

District	Improve	Death	Total
1st Hillah	193	0	193
2nd Hillah	127	2	129
Al-Musayiab	5	0	5
Al-Mahawil	14	0	14
Al-Hashimiyah	18	0	18
kotha	8	2	10
Total	365	4	369

Figure (3.5) shows the chlorine percentage in the water of the patient home
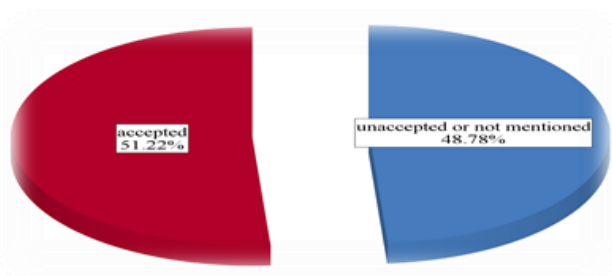
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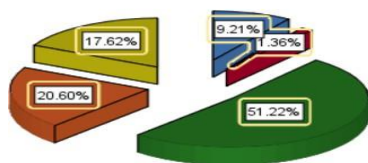
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Table (3.6): show the chlorine percentage in the water of patients house that distributed according to district.

District	accepted	unaccepted or not mentioned		Percent of accepted chlorine in patient s water houses
1st Hillah	113	80	193	**58.5**
2nd Hillah	74	55	129	**57.3**
Al-Musayiab	1	4	5	20
Al-Mahawil	0	14	14	0
Al-Hashimiyah	1	17	18	5.5
kotha	0	10	10	0
Total	189	180	369	

Table (3.7): show the relationship between the chlorine percentage in the water of patients house, the no. of hospitalized patients and the outcome of cases.

Chlorine Percentage	Hospitalization	Out Patient	Total	Improve	Death	Total
accepted	**55**	134	189	188	**1**	**189**
unaccepted or not mentioned	**62**	118	180	177	**3**	**180**
Total	117	252	369	365	4	369
P value	**0.270**			**0.292**		

Discussion

Since 1966, cholera has been endemic in Iraq. [22], Iraq faced several outbreaks of cholera, most recently in 2015 and 2017 [23] .

Cholera cases have been reported in the majority of the governorates in 2022, with 3708 reported cholera cases and 25 death in our country Iraq. Kirkuk, Baghdad al Resafa, Erbil, Sulaymaniyah and Babylon are the most affected governorates .

In our province Babylon A total of 1224 suspected cholera cases but their culture to vibrio cholera were negative so excluded from this study and A total of 369 cholera patients whose diagnosis was confirmed by culture, The first confirmed case in Babylon was diagnosed on 18 Jun 2022 in alrashayid village (rural village in the north of Babylon, that follow kotha district) and the diagnosis was confirm by central laboratory of public health directorate of Iraqi ministry of health which reveal that the sample was Vibrio cholerae 01, serotype Ogawa, biotype El Tor. tetracycline, erythromycin, ciprofloxacin, and chloramphenicol-sensitive strain that is ampicillin- and trimethoprim-sulfamethoxazole-resistant. on December 11, 2022, the final case. The mean age of the patients was 37.7 ± 20.464, with ages ranging from 1 to 90 years old. Table (3.1) displays the study population's characteristics, indicating that the majority (38.8%) of the sample were 45 years old and over against this result other studies done in Al-Muthanna and Babylon province study[5,24]. The majority of

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patients were female(53.1%)similar result with other several studies done in our country Iraq [5, 6, 10] this could be due to their work at home, caring for family members, patients and dealing with contaminated water ; Another study conducted in Babylon province at 2015 found no significant difference between males and females[24] ; The majority of patients (60.4%) lives in urban area. similar result from dayala province[25] This could be brought on by poorly maintained urban infrastructure, a malfunctioning sewage system, a lack of safe drinking water, and a history of war. ; 41.7% of the total population on study were house wife and only 3% were civil servant.

Regarding the Distribution of cholera cases according to primary health care Districts as presented in Table (3.2) which showed that the majority of cases in the center of Babylon (1st Hillah district 52.3% and the 2nd Hillah district 35.0%) and the minority of cases in the periphery of our province 12.7%, so The attack rate (a defined area's cholera case rate divided by its projected population and multiplied by 100,000 [3]) was highest in the center of Babylon 1st and 2nd Hillah district 39 and 30 respectively and lowest in the south of Babylon, Al-Hashimiyah,3.1 while the north Babylon distributed as : Al-Musayiab 1.2 ; Al-Mahawil, ; 5.6, Kotha, ; 6.6. this may be due to missing the diagnosis by hospitals laboratories in periphery of Babylon because most of diarrheal diseases (about 95 %) were tested for cholera according to epidemiological weekly reports from surveillance section of communicable disease control center-Iraqi MOH. Or could be because taking antibiotics by patients before stool cultures for vibrio cholera so the samples appeared false negative.

The vibrio cholera proliferate when water temperatures exceed 20°C [26]Figure (3.1) clarified that most cases were diagnosed in autumn season specially on October and 12 cases in summer season and disappeared in 19 December of the same year, similar result in Al Muthanna province [5] However, a 2015 study conducted in our province by Malik revealed that the majority of cholera cases peaked in September and vanished in December of the same year. [24], this finding could be due to the role of environment (weather) on the distribution of cases.

the WHO declaration that during epidemics,50%of the cases can be managed outside hospital with ORS with or without antibiotics[13]

in the conducted study demonstrates that 85.37% of the cases was diagnosed in the hospital (most of them(325 of all patients) diagnosed in the laboratory of Al-Sadiq teaching hospital),while the minority of patients 14.63% was sent by carry Blair medium from primary health care as shown in Figures (3.2)(3.3) this possibly because the sever cases only visit the hospital, because of dehydration or repeated vomiting while moderate cases visit primary health care and most of the mild cases treated by other health care personnel and didn't visit the primary health care so this will result in underestimate to size of epidemic this fact also shown in Table (3.3)which demonstrate 78% of patient was dehydrated and Table (3.4)which show 31.71% of patients was hospitalized, similar result in other study in Baghdad[13]

Figure (3.4) and table (3.5) show the outcome of cholera cases as 98.92% improved and 1.08% unfortunately die so the case fatality risk(CFR) was 1.08%; which is less than CFR in other study in Baghdad[13] ;two Patients in 2nd Hillah distract and two patients in kotha district was die So the case fatality risk in 2nd Hillah district was 1.5% and 20% in Kotha district which are higher than that considered tolerable by WHO (not exceedin1%)[13] theses result could be due to missing the correct diagnosis or don't examine stool of a lot of patient with mild –moderate diseases as table (3.4) shows in kotha distract there were only 10 patients 9 of them were hospitalized as we saied previously the only sever cases visit hospital. Regarding percent of chlorine in water Figure (3.5) shows 51.2% accepted chlorine level in the water of the patient home and 48.78% either unaccepted or not mentions(chlorine level was zero in 9.2%, unaccepted level in1.4%, did not mention in investigation form in 17.6% and the Rapid response team could not reach the home of patients in 20.6% because the wrong address given by patients). Table (3.6): show the accepted chlorine percentage in the water of patients house as: (the highest(58.5%) in1st Hillah distract, (57.3%) in2nd Hillah distract,(20%) in Al-Musayiab distract,(5.5%) in Al-Hashimiyah distract and (zero) accepted level in Al-Mahawil and kotha distracts; despite the highest chlorine level in water in the center of Babylon it also represent the highest attack rate this possibly because the damage to sewage in the center of Babylon or due to bacteria resist to chlorine, or infection transmitted by other rout as contaminated

food, on the other hand the lowest acceptable level of chlorine in other distract because most of them lives in rural area and have no Water supply network. Regarding the relationship between the chlorine percentage in the water of patients house and the No. of hospitalized patients and the outcome of caseTable (3.7): show there is no significant relationship between the chlorine percentage in the water of patients house, the No. of hospitalized patients (p value=0.27) and the outcome of cases(P value=0.292) but it is show that the higher No. of patient who were hospitalized or dead in those who had unaccepted or not mention chlorine percent in their house and vice versa, this may reflect the severity of the disease and the higher dose of organism in patient with lower chlorine percent in the water supply them.

Conclusion

Despite the cholera is an ancient disease, The incidence of cholera infection is still high in Babylon, and the majority of cases in the center of our province and in spite of the wide our knowledge about transmission and management of the diseases, the case fatality risk(CFR) is higher than tolerable level determined by WHO specially in 2nd Hillah and Kotha districts. The higher incidence of cases were in, adult age group, females, Housewife, live in Urban area

A multifaceted preventive plans are urgently required to be developed by The government to cope this problem including a Combined strategies of 1-Repairing the damaged infrastructures that result from subsequent wars as: Establish a good sewage system, Rehabilitation and maintenance of water supply systems and establishing water supply network to areas don't have it, to ensure clean and safe water supply to the people's houses, because The limitation of water supply let the people depend upon wells and tankers which is non-chlorinated water. 2-immediate notification surveillance, 3-Increase Health education program and distributed to all cultures population by social media, TV, Decision makers and clergy about the causes of the diseases and the ways of transmission of vibrio to help them to break the cycle of transmission to humans by improving personal hygiene as proper way for hand-washing, encourage breastfeeding and safe preparation of food such interferences prevent cholera and other water-borne diseases, as well. and 4- the implementation of oral cholera vaccines (OCVs) during epidemic to protect high risk populations for getting the infection. Further researches are needs to identify the other causes of high attack and mortality rates.

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