FACTORS ASSOCIATED WITH A CHOLERA OUTBREAK IN DAR ES SALAAM CITY

BY

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DECLARATION

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DEDICATION

This study is dedicated to all cholera victims who lost their lives in our country and throughout the world

Dr. Noel John Makuza

ABSTRACT

A case control study was conducted in three municipals – Ilala, Kinondoni and Temeke in Dar es Salaam City from 26 May 2002 to 14th June 2002. The aim of the study was to determine factors associated with current cholera outbreak in Dar es Salaam. One hundred cholera cases and Two hundreds controls, all hospitalized patients were interviewed. Information about availability of water, risk behaviors, history of the disease regarding time person and place, access to liquid and solid waste disposal system all related to cholera transmission were collected using closed and open ended structured questionnaires. The researchers findings revealed that cholera outbreak in Dar as salaam city was mainly associated with shallow well water sources for domestic use and behavior of drinking unboiled well water. Study showed that there was a relation of cholera transmission with increasing in number of people sharing toilets and houses as a risk factor but it was statistically not significant. In order to avoid this problem to continue in future, the city authority has been advised to consider the problem of water to be one of their first priorities in their plan, health education should be used to educate people to change their behaviors because control of cholera will depend on educating these people in healthful sanitation methods Authorities should regularly adhere to health regulation instead of present traditional periodical strictness following periods of outbreak crises. The community in the other hand has been advised to practice habit of drinking safe water-boiled or special bottled to minimize risk of cholera infection and to work hand in hand with authorities and follow advises from health expertise

LIST OF ABBREVIATION

CI	-	Confidence interval
DAS	-	District Administrative Secretary
DMO	-	District Medical Officer
DFID	-	Department For International Development (UK)
MoH	-	Ministry of Health
MUCHS	-	Muhimbili University College of Health Sciences
IDWE	-	Infectious Disease Weekly Ending
IPH	-	Institute of Public Health
OR	-	Odds Ratio
RAS	-	Regional Administrative Secretary
RMO	-	Regional Medical Officer
WHO	-	World Health Organization

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CHAPTER ONE

1.0 INTRODUCTION

In Tanzania cholera outbreaks have been occurring every year since 1977, this has resulted into millions of cases and thousands of deaths in the country (GMP MWALUKO *et al.* 1991), underscoring the importance of communities and the administration working together towards the control of this disease.

Reasons for recurrent outbreaks, which remain the same or even increase year after year, are not understood despite experience, adequate knowledge about the disease and effort done by Health workers and community. As a result cholera remains a major public health problem throughout the years since the outbreaks started. Dar es salaam city is one of areas most frequently hit by cholera outbreaks every year.

Cholera is an acute infectious diarrhea disease caused by a Gram-negative, comma-shaped bacterium called *Vibrio cholerae.* The disease is spread principally through water, which has been contaminated with fecess containing the *Vibrio cholerae* bacteria.

Water can be contaminated directly and in turn this may contaminate, fish, shellfish or vegetables "fleshed" with such water. Contaminated water, hands and domestic flies may so contaminate other types of food.

Experience has shown that cholera is not a major public health problem in a country or community that has a properly organized programme for the control of diarrhoea (Diarrhoea Dialog ISS No. 32 1988). Hygienic practices in disposing of excreta, hand washing, particularly after defecation and before preparing food or eating are essential interventions for preventing diarrhea.

Small children's stool must be disposed of with particular care; older children and adults should use latrines. Cholera can only be reliably prevented by ensuring that all people have access to adequate excreta disposal systems and safe drinking water (WHO 1992)

Controlling Cholera means Controlling of all other diarrhoea diseases!

The bacteria was discovered by German researcher Robert Koch in 1883, during work in Alexandria and Calcutta, he was the first to conclusively show that it was the cause of cholera. Two strains, or varieties of *Vibrio cholerae* have been identified as causative agents of cholera – *Vibrio cholerae* clasical and *Vibrio cholerae* biotype El Tor.

The characteristic differences between *V. cholerae* El Tor and *V choleae* are not sufficiently to justfy their separation as two species. Consequently *V. cholerae* El Tor is considered a biotype of classical *V cholerae*. Meaning that they both have the same genetic make up.

V cholerae El Tor is the primary cause of the present seventy pandemic, which began in Indonesia in 1961, virtually replacing *V cholerae* as the main epidemic strain *(Lancet vol.. 1: 805 – 807).*

Vibrio cholerae El Tor was first found in 1905 isolated among pilgrims returning from Mecca pilgrimage at El Tor Quarantine Camp in Sinai (Khan 1970). Mackay states that *V cholerae* El Tol is better able to survive in the environment than *V cholerae* and causes a much wider spectrum of disease. While *V Cholerae* causes patients to become immobilized, reducing their capacity for spreading the disease, the El Tor strain may cause many moderate cases, allowing the victims to move around with only mild discomfort. These victims then act as dangerous vectors of the disease. But not all cases of El Tor cholera are mild – a major infection with *V cholerae* El Tor has similar symptoms to *V cholerae* and can be as fatal.

The first well-defined cholera pandemic began in August 1817 in what was then Jessore, India, and is now Bangladesh, 70 miles from Calcuta. The term "Asiatic cholera" was used to distinguish this malady from similar but distinct diseases. After spreading through India, the disease moved across the Arabian Sea to the Middle East and into Russia. By 1832 nearly every European capital had been touched by Asiatic cholera. Worldwide cholera epidemics have recurred seven times. Currently in its seventh pandemic, cholera is endemic in a variety of countries across the globe

Cholera is found in many tropical countries around the world where outbreaks are common, the disease is now endemic to most of Africa. The spread of cholera to sub Saharan Africa is one of the major natural disasters of the 1970's in its short time stay in Africa; Cholera has had a significant destructive impact. Between 1970 and 1974, African countries reported a total of 103,000 Cholera cases (WHO 1992). Approximately 1,000,000 people developed cholera of whom perhaps 100,000 died, this was a serious out break affecting most of West African countries and part of East Africa, Ethiopia, Somalia and Angola. **table 1:3** shows the magnitude of the problem in recent year of 1999 in Sub Saharan African countries.

The cholera epidemics in East Africa were first described in 1921 when a slave ship arrived from Zanzibar via Muscat and Oman with cholera infected individuals on board (Stock.R .F 1976).

In Tanzania outbreaks have been occurring every year since 1977 (**table (1:1-1:2)** when the first person believed to have been affected by the disease was first reported. He was an adult male from Twasalie, a remote village on the delta of the Rufiji River as it enters the Indian Ocean. Three days before he fell ill, he had been a host to a merchant from the East, which was reporting cholera cases at the time. Soon after burial of this victim, outbreaks of the diseases began to appear in several adjoining villages of the district (Mhalu 1991)

1.1 PROBLEM STATEMENT

According to the MoH statistics Abstract of 1998, all Admission in the country due to notifiable diseases for 5years old and above patients in Tanzania mainland 48% were cholera cases for the year 1997, and deaths due to notifiable diseases for 5 years old and above patients 53% were cholera cases. Dar es salaam is one of areas most frequently hit by outbreaks in the country. Recurrence of outbreaks has been a debate since the 1980s when quarantine was used to minimize transmission of the disease.

TABLE 1.1 Trends of notified cholera cases and death in the united Republic of Tanzania from October 2, 1977 to December 31, 1988

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Cases	1671	13,300	2492	5859	5236	7986	2476	2762	2541	2569	1892	5267
Death	135	1067	263	594	397	933	200	347	246	220	232	580

Source: Adopted from Health and Disease in Tanzania by GMP M WALUKO et al (1991)

TABLE 1. 2 Cholera outbreaks in Tanzania 1989 – 1999

YEAR	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Cases	40,198	3.067	15,857	29,623	1986	5,470	2,957	983	40,226	7,224	11,855

Source: MoH Tanzania (2001)

TABLE 1.3 Reported cholera cases, by Country 1999

Country	Population in millions	No of cases	No of deaths	Prevalence/ per 10,000	Ranking in severalty
Benin	6.6	855	25	1.3	16
Burkina Faso	12	93	6	0.07	24
Burundi	6.2	3,440	63	5.5	9
Cameroon	15.8	326	35	0.20	23
Chad	8.7	217	18	0.23	22
Comoros	0.6	1,180	42	19.7	5
Congo	3.1	4,814	20	15.5	6
D.R Congo	53.6	12,711	783	0.24	21
Ghana	19.9	9,432	260	4.74	10
Guinea	7.6	546	44	0.72	18
Kenya	29.8	11,039	350	3.7	12
Liberia	3.2	215	0	0.7	19
Madagascar	16.6	9,745	542	5.87	8
Malawi	10.5	26,508	648	25.0	1
Mali	11	6	3	0.05	26
Mozambique	19.9	44,329	1,194	22.3	3
Niger	10.4	1,186	85	1.14	17
Nigeria	126.6	26,358	2,085	2.1	14
Rwanda	7.3	217	49	0.3	20
Sierra Leone	5.4	834	5	1.50	15
Somalia	7.5	17,757	693	23.7	2
South Africa	43.6	68	2	0.02	27
Swaziland	1.1	7	0	0.06	25
Tanzania	36.2	11,855	584	3.27	13
Togo	5.2	667	31	1.3	16
Uganda	24	5,169	241	21.7	4
Zambia	9.8	11,535	535	11.8	7
Zimbabwe	14.4	5,637	385	3.9	11

Source: Weekly epidemiological record (WER), No 31 (August, 2000), World Health Organization.

Cholera outbreaks have been common in Dar es Salaam city, in recent years for example **(table 1.4)** in 1997 there was 2687 cases and 22 deaths occurred (case fatality rate = 0.81%), in 1998 there was 2306 cases and 19 deaths (case fatality rate = 0.82%), in 1999 there was 1,008 cases and 9 deaths case fatality rate = (0.89%) and in year 2000 data shows that there was a good future, as cases dropped up to 67 cases and only one death (case fatality rate= 0.67%). In the year 2001 there were 439 cases and 13 deaths. Year 2002 situation seems to be very bad as data shows that from Jan. – April already there are 743 cases and 27 deaths.

Table 1.4 Trends of cholera outbreak in Dar es Salaam. From 1997-April 2002

Dar es Salaam	Year	1997	1998	1999	2000	2001	2002 Jan-Apr
	Case	2687	2306	1,008	67	439	743
	Death	22	19	9	1	13	27

Source: IDWE (MoH)

1.2 RESEARCH QUESTION

What are factors associated with a cholera outbreak in Dar es Salaam?

1.3 RATIONALE OF THE STUDY

Recurrence of outbreak in Dar es Salaam has been a debate since 1980s, when quarantine was used to minimize transmission of disease. In the recent previous years besides of proper organized programmes for the control of diarrhea disease, water supply and health education the problem remain the same.

Although several studies have been done with other researchers in other areas, the information obtained could answer only problems related to that locality since environmental and social factors differ for each population. This study therefore intends to determine factors associated with recurrence of cholera outbreak in this population in order to help workers and community of this particular area.

1.4 OBJECTIVES

Broad objective was:

To determine factors associated with cholera outbreak in Dar es Salaam city

Specific objective were: -

1. To identify environmental factors related to cholera disease outbreaks among population in Dar es Salaam city.

2. To determine the association between availability and usage of excreta disposal facilities.
3. To determine the association between the main types of water sources in the city and the cholera outbreak
4. To identify social behaviors related to cholera outbreak.

CHAPTER TWO

LITERATURE REVIEW

Studies reveled different determinants of cholera disease

These include: -

Type of water supply – river, borehole, tape, pond, lake and sea. Type of eaten food – nutrients and acidity. No risk is to be expected from foods where either the physical or chemical character, or processing, are such that *Vibrio cholerae* organisms are unlikely to be present; these include acid foods PH < 4.5 irradiated foods, food that have been subjected to heating process and foods with reduced water activity (WHO 1992).

Other determinants are hygienic practices such as hand washing, latrine use and social economic status - income, land ownership. Communication with people outside the area, presence of cattle and other animals in the compound, knowledge about diarrhoea – cause, prevention and number of people living in the house or village – population density (Nagelkerke 1990).

Studying the geography of infectious disease which has been defined as "the application of geographic concepts and techniques to health related problem is very important in epidemiology" (Hunter 1973) Jacques May in American Geography: Inventory and

prospects (1954 pp 453) define medical geography as the "Study of the area distribution of disease and its relationship to environment".

John Snow's treatise on cholera in London in 1849 was a Landmark study. By careful mapping of Cholera deaths in a part of central London, he was able to demonstrate a connection between the spread of cholera and the use of water from the pumps of particular Supply Company (Snow 1836). This is an example of map correlation approach between a disease and certain environmental condition demonstrated by showing coincidence of their spatial distribution. Findings from a study done at Rumange outbreak in Burundi aiming at determining the patterns of transmission in the Great Rift valley lake region, suggest that extensive use of great lakes and connecting rivers as a source of water for domestic purposes encourages the rapid and widespread dissemination of *Vibrio cholerae*. (Birmingham. 1997)

Others studies, more over, have shown that *V Cholerae* survives longer in water with high salinity, such as a sea water and water with unusually high concentrations of organic nutrients.

Pesigan (1965) in the Philippines and Barua (1970) in India found that *V Cholerae* could survive for up to 7 days at room temperature fruits and vegetables.

El Tor biotype of *V cholera* can survive in water from different sources, fresh milk, coconut fluid and alcoholic beverages for a range of periods depending on the P_H, temperature, exposure to direct sunlight and alcohol concentration (Lema O. *et al,* 1979). The viability of *V cholera* outside the human body is of great epidemiological importance because the disease it transmitted from person to person by direct contact or through the environment. It therefore follows that if the environment is favorable for the multiplication and survival of the organism, chances of transmission are enhanced especially where personal hygiene and environmental sanitation are poor as is the case in most tropical countries.

The 13th November 1817 cholera epidemic in Calcuta – India was due to river Ganges and the cholera epidemic of 1873 in USA was due to river Mississippi (USA surgeon general's office 1875). Studies done to determine the modes of transmission of cholera in Lugoba Village, Bagamoyo district in the United Republic of Tanzania revealed that the outbreak was caused by contaminated well water following break down of the village's water pumping system (Mhalu S.F. *et al,* 1984)

Another study done in Ifakara during a Cholera outbreak revealed that bathing in the river, long distance to water source, and use of unboiled water were significantly associated with risk for cholera (Acosta J.*C et al* 1997)

These results illustrate the usefulness of conducting epidemiological investigations in the control of cholera outbreaks in order to employ specific disease control measures depending on environmental and social-cultural factors

CHAPTER THREE

METHODOLOGY

3.1. DESCRIPTION OF THE STUDY AREA

Dar es Salaam is the largest commercial center in Tanzania and covers about 11,200 square kilometers. Administratively the city of Dar es Salaam is divided into three municipals of Kinondoni, Ilala and Temeke.

The city has 2,977,159 inhabitants out of which; 1,439,443 are residents of Kinondoni, 823,525 are of Ilala and 714,191 are of Temeke (Dar es Salaam city council Health profile 2000) the city is highly populated by residents of low income and middle-income classes and occupations. The housing consists of mainly traditional six roomed concrete structures shared by several families with common service facilities in the backyard.

The city has a piped water supply that is mostly intermitted and inadequate. The millions living in slums, resettlement and unauthorized areas use water from shallow tube wells for drinking, cooking and other domestic purposes. These people do not have access to sewerage. They usually defecate and urinate in the open places because community latrines, even if available in some slum areas, are usually poorly maintained. The topography consists of unevenly distributed coral, which accommodates numerous water collection sites during the rainy season, and the water table is high which cause permanent water bodies to exist. The drainage system is poorly achieved through several

furrows which leads water towards Msimbazi creek into Indian Ocean .The basic health infrastructures of the area is under developed to maintain adequate sanitation for the dense population .Of the top ten diseases diarrhoea ranks number 4 for outpatients and ranks number 3 for inpatients. The city is served by several health facilities as shown in the table below.

Table 3.1. Health facilities inventory and distribution by municipals in Dar es salaam city

	Owner ship				
Type of health facility	Government	Voluntary	Parastatal	Private	Total
Hospitals	3	1	2	18	24
Health centers	4	1	2	8	15
Dispensaries	54	20	19	367	435

3.2. Study Design.

This was a case control study

(a) Study population

The study population which consisted of cases and controls was derived from admitted patients in four Health facilities within the Dar es Salaam City namely:

(1) Amana Hospital in Ilala Municipal

(2) Temeke Hospital in Temeke Municipal

(3) Mwananyamala Hospital in Kinondoni Municipal

(4) Mburahati Dispensary in Kinondoni Municipal

(a) Recruitment and data collection

(i) Case definition and detection of cases

This was based on clinical and laboratory backgrounds. A case was defined as a patient suffering from an acute onset of watery diarrhea and/or vomiting, hospitalized patients in a cholera ward during the period of conducting the study. Laboratory confirmed by isolation of *Vibrio cholerae* bacterial from stool or vomitus.

(ii) Selection of Controls

The control group included those patients admitted in the same or nearby hospital – due to illness other than study case (cholera illness). The time of admission must be the same or immediately after admission of the case. Every single case had 2 controls.

(iii) Study sample

One hundred cases and two hundreds control were interviewed using structured questionnaires.

3.3 ETHICAL ISSUE

Permission to conduct research was obtained from relevant authorities. These included MUCHS, District Medical Officer and District Executive Director. Consent from the health workers and patients were also solicited before conducting the interviews.

3.4. DATA COLLECTION PROCEDURES

Three research assistants were recruited to assist the principal researcher in data collection. Their selection was based on the following criteria: Fluency in Swahili language, willingness to be a member of the research team, availability during the whole study period, knowledge on conducting interviews and willingness to work long hours. They were trained for one day on interview skills and how to fill questionnaires. Questionnaires in Swahili language were pre tested at Amana hospital to assess peoples' responses to various questions, a total of ten patients were interviewed and these were not included in the study sample. Then relevant changes and modification were made. The study involved four health facilities. Of the sampled individuals only one individual could not be interviewed fully for reasons of language barrier. To avoid cross infection, the principle researcher dealt with cholera cases only and passed questionnaires to research assistants for control tracing and for interview.

Identification of information, on knowledge of disease, availability of water, risk behaviors, history of the disease regarding time, person and place; in relation to

transmission of cholera infection were collected using structured questionnaire. The questionnaire (appendix A and B.) was designed in English and translated into Swahili (National language). It was administered in the form of face-to-face interviews. For small children cases, their caretakers were interviewed on their behalf. Some of the questions were open ended while others were closed, Answers to open – ended questions were post coded.

3.5. STUDY LIMITATIONS

Cases

1. Some cholera patients were found in comma state thus the interview was postponed till the time the patient was conscious
2. Follow up was not possible to be done as was planned in the study proposal due to set up of Dar es Salaam city housing.

Controls

1. Most of control was not able to remember some past history.

Cases and Control

1. Selection bias:

   The cases and controls may not be representative of cases and controls in the general population. There may be systematic differences in characteristics between cases and controls.

2. Bias may arise because of different rates of admission to hospitals for people with different disease for both hospitals case and control

3.6 DATA MANAGEMENT

Completed interview schedules were sorted by the principal investigator. Questionnaires from four health facilities were given serial numbers and then coded prio to data entry. Data entry, cleaning and validation were done with the assistance of an experienced computer operator using EpiInfo 6 computer programme . Data analysis for statistical associations was done using the same programme. Odds ratios and P-Values were determined at 0.05 level of significance (95% confidence limits for Odds ratio).

To investigate the role of confounding logistic regression analysis was carried out with case-control status as the outcome variable. The statistix programmed was used for this purpose. For ease of analysis all variables were analyzed as binary (two levels). Confidence intervals around the adjusted odds ratios are also reported at 95% level.

The specific objectives of the study were met as shown by the matched specific objectives and appropriate variables or risk factors. **Appendix A**

Specific Objective	**No of the questionnaire covering the variable**
1. To identify environmental factors related to cholera disease outbreaks among population in Dar city.	Questionnaire No. 7 section A and No 3 section D
2. To determine availability and usage of excreta disposal facilities	Q. No. 1 – 7 section D
3. To determine main types of water sources in the city in relation to cholera outbreak	Q. No. 1 – 4 section B
4. To identify social behavioral factors related to cholera outbreak	Q. No. 1 – 7 section C

Questions asked were directed to get information about:

A. Demographic characteristic of respondents

3.1.0 Distribution of the study population by sex and age group in years

3.1.1 Demographical / Residential distribution of the cases and control group

B. Water source and use

Type of water source

3.2.1. Distance to water source.

3.2.2. Satisfaction with water quantity (water enough).

3.2.3. Satisfaction with water quality (water clean and safeness).

c. Social behavioral factors

3.3.0. Type of drinking water used

3.3.1. Habit of washing hands

3.3.2. Type of hand washing

3.3.3. Type of water used for hand washing

3.3.4. Habit of using soap in hand washing

3.3.5. Habit of sharing food

3.3.6. Number of individuals/ families sharing the house

C. Environmental sanitation & waste disposal facilities

3.4.0. Toilet availability

3.4.1. Number of people sharing the Toilet

3.4.2. Availability of bathroom

3.4.3. Access to central / main liquid waste disposal system

3.4.4. Access to solid waste disposal system

CHAPTER FOUR

RESULTS

One hundred cholera cases and two hundred controls, all hospitalized patients were interviewed regarding suspected cholera exposures. Of one the hundred cases, 49 were male and 51 were female and of total 200 interviewed controls 78 were males and 121 were females **(table 4.1)**

4.1.1 Age and sex distribution of cases and the control group

The age distribution of the respondents is as shown in **table: 4.1**

The youngest case was 2 years old and the oldest was 80 years old (controls were in between these age). The range was 78 and the mean was 29.

The most affected age group among cases was between 16 – 30 (47%), this can be explained by the nature of this group of people in Dar es salaam city who are mostly active, dealing with vending business, making them to walk long distance in this hot climate = 30°c, leading to severe dehydration ending by subjecting them to drink water frequently and they normally take their meals at local and unhygienic "Mama nitilie" local meal stations where food is cheap but very risky.

In this age group both sex were equally affected, 24 male and 23 female cases (47%). This is the same valid to the overall sex distribution as 49% were male and 51% were

female for all cases. Regarding controls interviewed female were more (60.8%) compared to male (39.2%), **table 4 .1**

Table 4.1 Distribution of cholera cases and control patients by age group and sex during the Dar es Salaam

	Cases (1) n = 100				**Controls n = 200**			
Age group in years	**Male**		**Female**		**Male**		**Female**	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
4 – 15	12	(12.0)	7	(7.0)	2	(1.0)	4	(2.0)
16 – 30	24	(24.0)	23	(23.0)	34	(17.1)	73	(36.0)
31 – 45	8	(8)	12	(12.0)	32	(16.1)	32	(16.0)
46 – 80	5	(5.0)	9	(9.0)	10	(5.0)	12	(6.0)
Total	**49**	**(49.0)**	**51**	**(51.0)**	**78**	**(39.2)**	**121**	**(60.8)**

4.1.2 Geographical distributions of cases and the control group

Study considered geographical distribution of cholera in Dar es Salaam in terms of 3 Municipal zones, each covering hundreds of localities. The cases did not occur uniformly in all parts of the city, there was a tendency of small geographical units with high concentration of cholera cases; some areas were heavily involved, while others were almost completely spared. The most severely affected are shown in **table 4.3 this** should make it possible to focus control measures appropriately.

Table 4.2 Geographical distributions of cases and controls

Address	Cases (1)	Control (1)	Total
Buguruni	9	18	27
Changombe	0	1	1
Gongo laMboto	1	6	7
Ilala	3	8	11
Jangwani	0	1	1
Kariakoo	1	5	6
Keko	0	7	7
Kigogo	7	11	18
Kimara	1	2	3
Kinondoni	2	12	14
Kipawa	7	8	15
Kisenvua mkulanga	1	0	1
Kiwalani	6	5	11
Kongowe (Mbagala)	6	3	9
Kunduchi Salasala	0	1	1
Kurasini	0	5	5
M'nymala	2	20	22

Table 4.2 (Continue)

Address	Cases (1)	Control (1)	Total
Mabibo	3	4	7
Magomeni	3	10	13
Manzese	5	3	8
Mbagala	8	9	17
Mburahati	5	3	8
Mbezi	0	2	2
Mikocheni	0	1	1
Msasani	6	02	8
Sinza	0	1	1
Tabata	5	7	12
Tandale	1	1	2
Temeke	4	8	12
Tandika	4	12	16
Ubungo	2	5	7
Vingunguti	6	12	18
Yombo	2	9	11
Total	100	199	299

Table 4.3 Geographical distribution of cases in the three municipals by percentages

Municipal	Area	
Ilala	Buguruni	9%
	Kipawa	7%
	Kiwalani	6%
	Vingunguti	6%
	Tabata	5%
	Ilala	3%
	Others	2%
	Total	**38%**
Kinondoni	Kigogo	7%
	Msasani	6%
	Mburahati	5%
	Manzese	5%
	Magomeni	3%
	Mabibo	3%
	Others	8%
	Total	**37%**
Temeke	Mbagala	8%
	Kongowe	6%
	Tandika	4%
	Temeke	4%
	Others	3%
	Total	**25%**
Grand Total		**100%**

4.1.3 Risk of developing cholera in relation to water source

Analysis of type of water source risk factors showed that, cholera transmission in Dar es Salaam was mainly associated with shallow well water source for domestic use. The strength of association was 4.47 odds ratio corresponding with significant of 0.001 P value for crude odds ratio and CI of 1.5-13.53. This relationship still existed even after adjusting for confounding was done. Epidemiological finding also showed that there is scarcity of water in Dar es Salaam city as a primary cause, only 38% of people were accessible to clean and safe water (piped water) compared to 68% of controls. Access to clean and safe water is disadvantaged to some localities in the city; this is evidenced to those places with high number of cholera cases during epidemic.

Other risk factors of distance to water sources, satisfaction with water quality and quantity all had considerable association regarding their value of odds ratio, but again all of these risk factors were not significant, **table 4.4.**

Table 4.4 Risk of developing cholera in relation to type of water source, distance, quantity and quality

Risk factors	Cases n = 100	Controls n = 200	Crude odds ratio		Adjusted odds ratio	95% CI*	P-value
Type of water source							
Piped water	38	136	1.0		0.1		
Spring water	10	8	**4.47**	1.5 - 13.53	**1.42**	1.1 – 1.7	0.001
Deep well	31	39	**2.84**	1.51- 5.38			0.0004
All possibility	21	15	**5.01**	2.22 - 11.41			0.000
Distance to water source							
Not far	88	180	1.0		1.0		
Far	12	16	**1.53**	0.65- 3.61	**1.08**	0.046-2.59	0.28
Satisfaction with water quantity (water enough)							
Enough	45	88	1.0		1.0		
Not enough	55	107	**1.01**	0.60 - 1.68	**0.76**	0.43–1.35	0.98
Satisfaction with water quality (water clean)							
Clean	59	92	1.0		1.0		
Not clean	15	10	**2.34**	0.91- 6	**0.7**	0.55 – 0.89	0.49
Sometimes not clean	26	96	**0.42**	0.24-0.75			0.001

CI = Confidence Interval

4.1.4 Risk of developing cholera in relation to water treatment and hygiene

Epidemiological evidence suggested that, there was a statistical association existing between cholera and behavior of drinking shallow well- unboiled water by strength of 22.22 odds ratio, C I (0.94-5.25) and a significance association of P value=0.043. Other risk behaviors of habit of washing hands, type of hand washing, type of water used for hand washing and habit of using soap in hand washing had considerable strength of association of odds ratio but low confidence interval and no significant in P values although both cases and controls were much exposed in bad habit of washing hands with cold water and without using soap before eating. None of these risk factors however, were significant, **table 4.5.**

Table 4.5. Risk of developing cholera in relation to water treatment and Hygiene

Risk factors	Cases n = 100	Controls n = 200	Crude odds ratio + (95% CI)		Adjusted odds ratio	95% CI*	P-value
Risk behaviors Type of drinking water							
Boiled	22	69	1.0	1.0			
Bottled	4	3	**4.18**	0.71- 26.02*	**1.16**	1.0 – 1.39	0.05
Well – not boiled	17	24	**22.**	2.20.94-5.25			0.04
Piped not boiled	57	124	**1.76**	0.95-3.36			0.04
Habit of washing hands							
Before & after meals	4	11	1.0	1.0	**1.16**	0.6 – 2.44	0.56
Before meal only	91	178	**1.41**	0.4-5.4			
After toilet only	5	9	**1.53**	0.24-9.89*			
Type of hand washing (How WASH)							
Running water	29	79	1.0		1.0		
Together in common container	71	119	**1.63**	0.94-2.82	**1.40**	0.76 – 2.57	0.06
Type of water used for hand washing (water Temp)							
Hot water	9	18	1.0	1.0			
Cold water	90	179	**1.019**	0.41-2.53	**0.81**	0.36 – 1.82	0.98
Sometimes not clean	26	96	**0.**42	0.24-0.75			0.001
Habit of using soap in hand washing							
Wash with soap	9	16	1.0	1.0			
Wash without soap	91	182	**0.89**	0.35-2.29	**0.76**	0.29 – 2.01	0.786

4.1.5 Risk of developing cholera in relation to excreter disposal facilities

Study showed that, there was a relation of cholera transmission with increasing in number of people sharing toilets and houses as a risk factor, but it was statistically not significant. The rest of risk factors in this group: excreta disposal facilities, washing rooms and access to liquid waste disposal central system were statistically not significant although both cases and controls were very much exposed in these factors, **table 4.6.**

Table 4.6 Risk of developing cholera in relation to excreta disposal facilities

Risk factors	Cases n = 100	Controls n = 200	Crude odds ratio + (95% CI)		Adjusted odds ratio	95% CI*	P-value
Grouped number of people sharing one toilet							
1 – 7	30	70			1.0		
8 – 14	36	84	**1.00**	0.54-1.86	**1.04**	0.99 - 1.10	1.00
15 – 21	17	31	**1.28**	0.58-2.82			1.50
22 – 45	16	14	**2.67**	1.07-6.68			0.01
Grouped no of people living in one house							
1 – 7	27	61	1.0				
8 – 14	37	88	**0.95**	0.50-1.80	1.0		0.865
15 – 21	18	34	**1.20**	0.54-2.64	**0.98**	0.9 - 1.3	0.63
22 – 29	8	9	**2.01**	0.62-6.49			0.189
30 – 45	10	7	**3.23**	0.99-10.70			0.026
Excreta disposal facilities							
Toilet facility							
Have	96	196	1.0		1.0		
Don't have	4	3	**2.72**	0.5-18	**1.86**	0.49 -7.08	0.17
Washing Room							
Have	43	108	1.0		1.0		
Don't have	57	90	**1.59**	0.12.6	**1.45**	088 - 2.38	0.05
Access to liquid waste disposal central system							
Connected	6	10	1.0		1.0		
Not connected	94	198	**0.8**	0.26-2.7	**0.83**	0.27 - 2.57	0.6

CHAPTER FIVE

DISCUSSION

DISCUSSION

Between may 26 and June 14, 2002, 100 cholera patients were admitted in the three cholera treatment centers in Dar es salaam. No death was reported (case-fatality rate was 0). Analysis of the risk factors for cholera showed that cholera outbreak in Dar es Salaam city was mainly associated with shallow well water sources for domestic use and behavior of drinking unboiled well water. Study also showed that, there was a relation of cholera transmission with increasing in number of people sharing toilets and houses as a risk factor, but this relation was not statistically significant. In conclusion, in Dar es Salaam, as reported previously in Tanzania, cholera transmission seems to have been predominantly water borne (Webber *et al* 1983). This result can also be compared to another hospital based, case control study in rural setting done in Ifakara, Southern Tanzania which revealed that, risk factors for exposure to water, including long distance to water sources, use of unboiled water, bathing in the river were all significantly associated with transmission process of cholera outbreak (Camilo J. Acosta *et al* 1997).

In contrast, a study done in Dhaka, the capital city of Bangladesh, there were two outbreaks of cholera in 1974 and 1975, the result of case-control indicated that there was an association with contaminated food served by street vendors and restaurants (Khan

1975). Control measures in African setting as described in a study done in Guinea-Bissau in a densely populated cities such as Dar es salaam, chlorination of water was recommended to help control of spread of cholera (Rodrigues A, *et al* 1997).

Muslem U. Khan, ICDDR, confirmed the close link between water used for drinking, bathing, and laundry and the risk of cholera. The authors suggest that the only effective means of control is protected water supply and the prevention of contaminated water use (Khan et al 1981).

As was stated earlier the findings of this study could also be explained by different sources of bias. At the design stage, blinding was impossible because of the nature of the disease been obvious and patients must be isolated. The cases and controls may not be representative of cases and controls in the general population and there may be systemic differences in characteristics between cases and controls. Bias may arise because of different rates of admission to hospitals for both cases and controls.

The contribution of research finding in coming up with specific disease control measures in the city in this outbreak is a clear testimony of the importance of conducting epidemiological investigations to assist in deciding which specific disease control measures to adopt instead of enforcing wide range control measures which often result in wastage of scarce manpower and material resource.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1.CONCLUSION

This study has shown that; using spring shallow well water for domestic purposes was strongly linked to illness. Epidemiological findings also showed that there is scarcity of water in Dar es Salaam city as a primary cause. Access to clean and safe water is disadvantaged to some localities in the city; this is evidenced to those places with high number of cholera cases during epidemic.

6.2. RECOMMENDATIONS

The following recommendation should be born in mind by public health planners and community social workers of Dar es Salaam city in tackling this problem of cholera outbreak.

1. Shallow well water sources should be protected and treated regularly.
2. The problem of water shortage should be solved as first priority in the city plans.
3. Plastic packed water vendors should be educated in hygienic handling and food vending Business should be improved well organised and monitored.
4. Authorities should not only be active during time when there is an outbreak by insisting on cleanness of the city, strictness to Restaurants and markets,

forbidding selling and serving food in open areas, bannning water vending but also these strictness should be permanently adhered.

What the authority is working now in a way that as soon as the disease is under control all banned activities resume again in full swing, the city becomes once again dirty and within some months, the disease strike again, is not wise.

5 Health education should be used to educate people to change their risk behaviors, because control will depend on educating these people in healthful sanitation methods that do not intrude on cultural or religious tenets and that therefore can be easily accepted.

6 In the other hand community has been advised to practice habit of drinking safe water –boiled or special bottled to avoid transmission of cholera infection and to work hand in hand with authorities and follow advises from health expertise.

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