Persistent "Cholerization" of Metropolitan Accra, Ghana: Digging into the Facts

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Abstract This paper examines the risk factors responsible for the 2014 cholera epidemic in Accra, Ghana's primate city which affected 30,000 people and claimed over 200 lives in five months (May to September). Drawing on insights from a wide range of sources, we observed that laxity in potable water provision and sanitation services, coupled with erroneous socio-cultural beliefs were at the heights among the risk factors but have tended to be viewed within a narrow analytical frame. The most deprived and inadequately housed, and the indigenous communities disproportionately exemplified these challenges. In our view, this situation demonstrates how ineffective and insufficiently attentive environmental governance has perpetuated the inequality in spatial patterns of vulnerability and health risks facing humanity. We advocate the need for a broad-spectrum environmental policy that in cooperates intensive public health education that can addresses the erroneous beliefs in the disease epidemiology.

Keywords: accra, cholera, ghana, poor sanitation, risk factors

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1. Introduction

In 2014, Ghana witnessed an unprecedented outbreak of cholera in its history. Within a period of five months (May-September, 2014), a total of 40,000 people were infected in all the ten regions [1]. The overwhelming outbreak of the disease was more acute in Accra, the nation's capital and the most urbanized city as well as the country's socio-economic nerve, with over 30,000cases and 200 deaths, a figure which far exceeds the monumental 1982 outbreak of 12,000 [1]. Like most cities in developing countries, Accra faces problems of improper liquid and solid wastes disposal [2] which is proving to be intractable. Statistics from the Accra Metropolitan Assembly (AMA) indicates that the city generates over 2,000 tonnes of solid waste per day, out of which 1,800 tonnes are properly managed. The remaining 200 tonnes are left to accumulate on the streets. They eventually find their way into drains preventing or limiting the flow of water. The stagnant water becomes a good breeding site for disease causing organisms of all kinds. Additionally, the empty containers may also be filled with water, especially during the rainy season, and may also serve as safe haven for disease causing organisms. The problem is worse in the low income communities, where uncollected waste accumulates at roadsides, or is disposed of in illegal dumpsites, which blight neighbourhoods and harm public health [3].

In terms of liquid waste, only 11 percent of households in Accra with improved toilet facilities may have proper disposal of their excreta [4]. The lack of proper sanitation practices (improper solid waste management, improper dislodgement of human excrement and lack of access to potable water) in Accra has resulted in continuous outbreak of cholera over the years which continue to confound city authorities [5]. This notwithstanding, there has been little coordinated attempt to address the sanitation situation; all efforts have been piecemeal, at best [6]. This situation has been compounded by the perennial flooding which has become an annual ritual in the national capital [7]. Over the past decades, floods have claimed several lives and destroyed public infrastructure and property [8]. The perennial floods also contaminate water bodies and affect the quality of water supply. Scholarship indicates that the contaminated water sources can contain 10, 000,000 viruses, 1,000,000 bacteria, 1,000 parasite cysts and 100 parasite eggs [9,10], a situation which provides the opportunity for cholera outbreaks.

Cholera, according to the World Health Organization (WHO), [10], is an acute intestinal infection caused by the waterborne bacteria *Vibrio cholera* O1 or O139 (*V. cholerae*). Research [11] posits that John Snow, in 1855 was the first to associate the disease with contaminated water in the 1850s, even before any bacterium was known. Kelly [12] concedes that infection is mainly through ingestion of contaminated water or food and that approximately 102-103 cells are required to cause severe diarrhoea and dehydration [13,14]. For someone to be

infected, the ingested cholera *vibrios* must pass through the acid stomach before they are able to colonize the upper part of the small intestine. After penetrating the mucus layer, *V. cholerae* colonizes the epithelial lining of the gut, secreting cholera toxin which affects the small intestine [10].

The clinical manifestation of cholera episodes is characterized by an unexpected onset of massive diarrhoea accompanied by vomiting. This is accompanied by the loss of profuse amounts of protein-free fluid along with electrolytes, bicarbonates and ions. The resulting dehydration produces tachycardia, hypertension, and vascular collapse, which can lead to sudden death [15]. The World Health Organization indicates that cholera can be one of the most rapidly fatal infectious illnesses if left unchecked. Within 3–4 hours of onset of symptoms, a previously healthy person may become severely dehydrated and if not treated may die within 24 hours [10]. Cholera is commonly diagnosed by isolating the causative organism from the stools of infected individuals. The main mode of treatment is the replacement of electrolyte loss through the intake of a rehydration fluid, that is, Oral Rehydration Salts (ORS) [13]. Without prompt treatment of an infected person, fatality rate can be as high as 50 percent [16,17]. However, Mahalanabis et al., [18] observes that with adequate treatment, the fatality rate can drop to approximately 1.0%.

In 2011, the 64th World Health Assembly adopted resolution WHA 64.15 recognizing the re-emergence of cholera as a significant public health burden and called for the implementation of an integrated and comprehensive approach to cholera control. This clarion call, according to WHO, has become imperative because the disease has claimed many lives throughout history and continues to be a global threat, especially for countries in Africa [19]. Responding to this all important call is our motivation for undertaking this study. While the trajectory of cholera outbreak in Accra is well mapped, current knowledge of the socio-demographic, household environmental and behavioral factors, which resulted in the 2014 outbreak of the disease remains inadequate. It is therefore necessary to conduct this research to isolate the specific risk factors that culminated in the massive outbreak of the disease. This paper which examines the risk factors responsible for the 2014 cholera epidemic in Metropolitan Accra which affected 30,000 people and claimed over 200 lives in five months (May to September), also examines the geographical distribution of the disease and its relationship with exposure to ecological hazards.

The study posits that although Accra, being Ghana's primate city, may statistically have had its fair share of development, the over-concentration of health hazards in specific locations is a reflection of poor environmental management and environmental 'classism' and this might result in environmental crisis and the outbreak of many more epidemics [20]. It is an attempt to fill gaps created by earlier studies with the view to providing a more appropriate framework for explaining the incidence of the cholera morbidity. This is considered important because many previously policy interventions that attempted to reduce the disease failed to demonstrate any effect, mainly due to the fact that they were culturally unsuitable and often developed without understanding the problem in the target community [21]. We argue that our findings will not only add to the rich store of academic research on the disease, it will inform and influence policy makers in adopting specific intervention programs to arrest the situation. The paper is arranged as follows: after the introductory paragraphs, we discuss the geographies of cholera both at the global and national levels. The next section of the paper discusses the methodological approach to the study while the subsequent two sections consider the results and discussions. The final section concludes the research and gives some policy recommendations.

1.1. Geographies of Cholera Morbidity

Cholera, one of the ancient diseases [22] is believed to have originated from the River Ganges Delta region in India. Since the recording of the first case from this region, it has spread throughout the world, causing six major pandemics between 1817 and 1961 [23]. The immense trading activity between India and their European partners enhanced the spread of the disease to other parts of the world.

Globally, cholera cases and deaths have increased steadily since the turn of the new century. WHO reports that from 2004 to 2008, a total of 838,315 cases were notified to WHO, compared with 676,651 cases between 2000 and 2004, representing a 24 percent increase in the number of cases [24]. A report by WHO [19] again indicates that by the end of 2011, a total number of 589,854 cholera cases had been reported globally, out of which 7,816 deaths were recorded. This figure represents an increase of 85 percent in the number of cases reported in 2010 and a 16 percent increase in the number of countries. However, a total of 188,678 cases were reported from Africa alone, representing an increase of 64% compared with the 2010 figure of 115,106 cases. The rest of the total figure was taken up by Asia – 38,298, Oceania – 1,514 and Europe – 71. The Americas took the largest chunk of 361,266, owing to the epidemic that hit Haiti as a result of the earthquake that struck on January 12, 2010, with that country alone reporting 340,311 cases, which resulted in 2,869 deaths during the period.

The burden of the disease is currently having a devastating toll on countries in the Global South with sub-Saharan African countries seriously under scourge. Africa alone has recorded over 2.4 million cases and 120,000 deaths from 1970 to 2005. This accounts for over 90 percent of both worldwide cases and deaths [15]. Countries that reported cases in Africa include Somalia, Nigeria, Democratic Republic of Congo, Cameroon, Niger, Angola, Benin, Burkina Faso, Ghana and Central African Republic. The rest were Chad, Congo, Cote d'Ivoire, Djibouti, Guinea, Kenya, Liberia, Mali, Mauritania, Malawi, Mozambique, Senegal, Somalia, Togo, Tanzania, Zambia and Zimbabwe. The chunk of cases recorded on the African continent was taken by five countries, with Somalia's 77,636 reported cases, 1,130 deaths and 1.46 percent case fatality rate (CFR) topping the African chart. Nigeria followed at a great distance with 23,377 reported cases, 742 deaths and a rather high CFR of 3.17 percent. The lowest was Cameroon with 22,433 reported cases, but with a larger number of deaths – 783 and, not surprising, the highest CFR of 3.49 percent for the period. The Democratic Republic of Congo placed fourth with 21,700 cases, 584 deaths and a CFR of 2.69 percent, while Ghana came fifth, having reported a

total of 10,628 cases by the close of 2011 and a total of 105 deaths with a CFR of 0.99 percent [10].

Ghana recorded 823 cases with no death in 2008. In 2009, a little over 431 cases with 12 deaths were recorded and 2010 had seven cases with no death while in 2011, the country recorded over 9,000 cases with 72 deaths. The figure reduced to about 7,000 cases in 2012 with 48 deaths and 2013 recorded 22 cases with no death. The 2014 cholera epidemic in the country has, as of September, 2014, claimed 230 lives, with a total of 40,000 people infected in the 10 regions with the Greater Accra Region alone recording 30,000 cases, with 200 deaths from about 20 communities[7].

2. Methodology

2.1. Ethical Principle

Ethical approval, confidentiality and consequences were carefully adhered to during the research. Consent was obtained from the Accra Metropolitan Assembly to carry out the research in the metropolis. Permission was also sought from the Metropolitan Health Directorate to carry out the study in the selected health centres chosen for the study. The purpose of the study was explained to each participant and their consent sought before they were recruited into the study. Respondents were also assured of strict confidentiality and data collected have been handled as such.

2.2. Study Area

The study was conducted in Accra, whose genesis dates back to 1826, with phenomenal expansion especially in 187 when the colonial administrators transferred the capital from Elmina to Accra [25]. The rapid development of the city, albeit in an unplanned manner, is putting much stress on existing service infrastructure and challenging city authorities who find difficulty in putting up new and the much-needed infrastructure. The inability of the authorities to invest adequately in such infrastructure is undermining economic growth, private sector development, and the achievement of social and poverty reduction goals [26]. Without a sustained infrastructural provision, some parts of the city become increasingly inefficient and unpleasant places to live and work, as pollution, overcrowding, social friction and deteriorating environmental conditions diminish the quality of life. At the same time, inadequate financing also constrains government and service providers' ability to provide equal levels of services, and usually the poor without secure tenure are most disadvantaged.

The Accra Metropolitan Area (AMA), with an estimated population of 4.3 million, has overgrown its boundaries. A study by the World Bank [27] reveals that the built-up area in the AMA increased from 133km^2 in 1985 to 344km^2 in 2000. Similarly, the built-up area per person also increased from 70m^2 in 1985 to 123m^2 in 2000, whereas the average density per square kilometer also decreased from 14,120 in 1985 to 8,102 in 2000 [28]. Such a scenario suggests that without strict involvement of the stakeholders in the planning process, sections of the city will be marginalized. The residential facilities in the study area have been divided into five different classes using the population density, housing quality and some economic parameters, a method in consonance with works of [2] (see Figure 1).
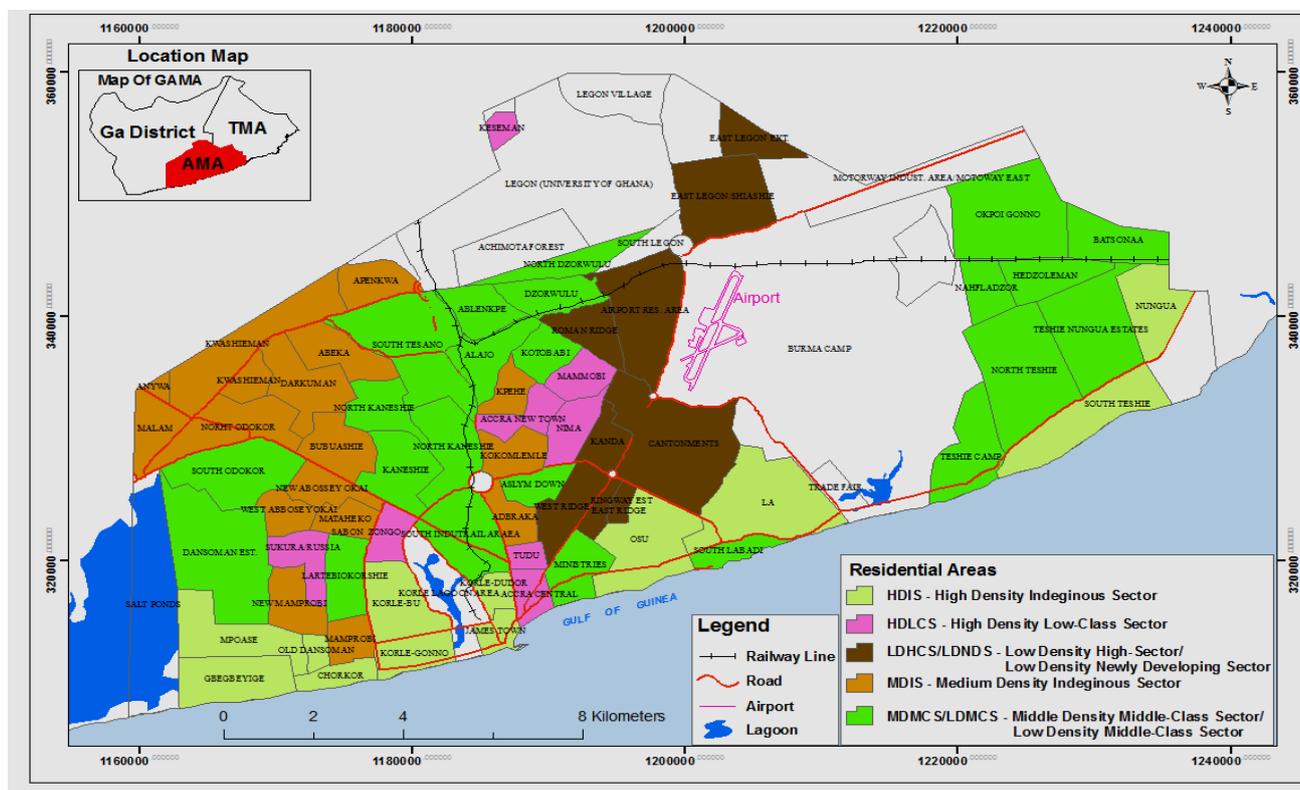

Figure 1. Residential Classification of AMA (Adopted from Songsore et al, 2005)

2.3. Data Collection

In order to meet the objectives of this study, we adopted multiple techniques in collecting the requisite data: participant observation, stakeholder interviews, comprehensive review of secondary data and the use of Geographic Information System (GIS). The data provided insights into how the current environmental management practices conform to the available laws and the extent to which they provide residents equal opportunities to a liveable city. They also provide insight as to whether the tenets of urban governance, in terms of equal opportunities for all residents, irrespective of one's social and economic status, are properly implemented [2,29,30]. The study participants were grouped into wealth classes according to wealth classification index adapted from [31] and [2]. The household wealth index was calculated using data on the household's ownership of consumer goods, characteristics of the dwelling, source of drinking water, access to sanitation facilities, and other household's socioeconomic status. Each of these assets was assigned a weight (factor score) generated through principal component analysis as follows; Electric lamp (10), iron (5), fan (5), radio (5), black and white television (10), colour television (20), video deck (20), line telephone (25), refrigerator (30), air conditioner (50), bicycle (10), motorcycle (40), and automobile (100) and the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and standard deviation of one. Households scoring 0–95 were designated low wealth; those scoring 96– 190 were designated medium wealth; and those scoring over 191 were designated high wealth. Respondents were then ranked according to the total score of the household in which they resided.

The first stage of the data collection process was a survey of 300 households, using a representative sample of residential areas randomly selected from residential categories in the study area as explained previously in Figure 1. This stratification distinguishes residential areas of the metropolis principally on the basis of rent and amenities (housing and its related facilities) values. The sample was apportioned across the residential categories according to the relative share of households residing in each stratum. Table 1 provides a detailed description of the sample frame.

Table 1. Stractification of the Study Area by Residential Classes

Residential Category	No. of households	Sample share	Sample size
Indigenous Residential area	15642	41%	123
Middle class Residential Areas	11114	30%	90
High class Residential Area	5078	14%	42
Newly Developing Residential Areas	3150	8%	24
Low class Rural Fringe	2493	7%	21
Total	**37977**	**100%**	**300**

Indigenous residential area: low rent and moderate amenity value
Middle class residential areas: varied rent and averagely developed amenities
High class residential areas: highest rent and amenities values
Newly developing residential areas: moderate rent with amenities that lag behind
Low class rural fringe: lowest rent and amenity value.

The issues covered in the survey included: the socio-economic profile of households; access to and use of water and sanitation facilities; and the occurrence of cholera in a household using a two-week symptom recall. The questionnaires were administered to the principal homemaker of each household, generally a woman. Women were biasly recruited because traditionally in Ghana, typical responsibilities of women are to manage sanitation both in the neighbourhood and household level as well as give care to the sick. They were therefore in a better position to give accurate answers. For the purpose of easy data collection, a cholera case was described as an unexpected onset of massive diarrhoea accompanied by vomiting in a 24-hour period resulting in dehydration [15]. However, it is the consistency of the diarrhoea accompanied by vomiting that was most important. Frequent passing of formed stools was not described as cholera. Also, babies who fed only on breast milk often pass loose, 'pasty' stools was not also considered as cholera.

The second stage of the data collection process was more qualitative, involving personal observation of the environmental quality, in-depth interviews with city officials and other key stakeholders and focus group discussions. This was based on the recognition that any determination of health status depends partly on the perceptions of those affected. It was therefore important that in-depth knowledge about the attitudes of the people towards cholera risk factors was obtained. Consequently, the personal observation and the focus group interviews were adopted to foster a more direct interaction with selected households. Two series of focus group discussions were conducted. The first series of group discussions were part of the broader household survey in June 2014, two months after the cholera outbreak. The second series were held in September 2014 when the outbreak had reached a crisis point and after the results of the initial survey had been collated. Since the more serious environmental problems and higher incidence of the disease were concentrated in the poorer areas, participants were selected to reflect this situation. The issues discussed were selected using the results of the survey plus the experience of the authors in the field. The results were supplemented with 25 key informant interviews including officials from the Environmental Protection Agency (EPA), Ghana Water Company Limited (GWCL), Regional Coordinating Council (RCC), Accra Metropolitan Assembly (AMA), Ghana Health Service, the Ministry of Health and Community Water and Sanitation Agency. The interviews covered themes on their role in water supply, healthcare delivery and sanitation and hygiene in the AMA.

After careful editing, the data obtained from the household survey were entered into Statistical Package for Social Sciences for analysis. The data from focus group

interviews and the participant observation survey were analyzed using largely qualitative methods. Analysis of variance (ANOVA) was used in analyzing the data for the various risk factors which were strongly associated with the incidence of the cholera morbidity. ANOVA models are robust to departures from normality as long as all groups come from populations with the same variance [32]. Logistic regression was also used to determine the relative strengths of the independent variables of the cholera morbidity. A logistic regression method is appropriate when outcomes are dichotomous and therefore, observations are censored. Significance was determined by a probability value of less than or equal to 0.05 ($p < 0.05$).

3. Results

3.1. Social Inequality and Cholera Risk

Overall, of the 300 households covered in the survey, 232 responded with a collection rate of about 77 percent. The results of our survey showed that over 60 percent of the respondents had either personally suffered or a family member had suffered from cholera in the two weeks preceding the study. As indicated in Table 2, the differences in cholera morbidity across residential areas and socio-economic groups were striking and reflected the wide variation in access to environmental services in the metropolis. The most deprived communities in terms of access to water supply and sanitation services had the highest prevalence of respondents with cholera. The respondents from the Indigenous Residential Areas had approximately 8 times as many cases of cholera as the respondents from the High Class Residential Areas ($F = 6.49$, $p < 0.01$, 95 percent Confidence Interval [CI]). Similar results were obtained for household wealth ($F = 6.49$, $p < 0.01$) and respondent's educational attainment ($F = 6.67$, $P = 0.03$).

Table 2. Cholera Prevalence by Household Socioeconomic Characteristics

Residential category	Total number of Respondent	Prevalence of Cholera (%)
IRAs	102	57.5
MCRAs	64	24.4
HCRAs	28	6.9
NDRAs	21	22.0
LCRF	17	41.9
Household Wealth	**Total number of Respondent**	**Incidence of Cholera (%)**
Low	126	54.9
Medium	62	31.0
High	44	8.9
Respondents Education	**Total number of Respondent**	**Incidence of Cholera (%)**
No Education	110	45.6
Basic Education	75	35.4
Secondary Education	32	10.7
Tertiary Education	15	8.3

3.2. Environmental Factors and Cholera Risk

Our study revealed that cholera outbreak was common and persistent at 'Mensah Guinea' and 'Old-Fadama' two popular slum communities in Accra and other low wealth households and indigenous residential areas where the people live in precarious environmental conditions that were more likely to impact on their health and well being. Old-Fadama is located on River Odaw and Korle-lagoon which have been heavily compromised. The two communities are characterized by choked drains, poor sewerage systems and improper dislodgement of both liquid and solid waste. In these communities, food vendors were seen selling cooked rice and 'Kofi Brokeman' (local name for roasted plantain) in less than 50 metres away from public toilets whose entrances are littered with excrement and from whose sanctums issue stench from putrefaction. This was in sharp contrast with the conditions in the high wealth and high class residential areas such as the Airport residential area and Cantoments. In an interview with the metropolitan health officer on the sordid state of the environment in the poor neighbourhoods, he opined:

"*It is not our fault; residents in these indigenous and low wealth residential areas like Chorkor and Korle Gonno have refused to pay rates that could be used to organize proper environmental service. What is more,*

they have erected unauthorised structures on water ways and access routes thus making it difficult for service providers to service them", he concluded.

The concerns of the metropolitan health officer were disputed in a focus group discussion when a 43 year old woman explained:

"*All they (AMA) want is the money. My brother, we have been paying our solid waste contractor to collect the waste every week but take a look; for one month, he has not come because he claims the government owes him and that until all arears have been paid to him , he will not collect the bins, whose fault is it*"? She asked.

In another focus group discussion, a 52 year old native at Chokor alleged:

"*They are quick in responding to the demands of those at East Legon and Airport residential areas (two high class residential facilities in Accra) because they have money and because we are nobody, they only listen to us anytime they want. It is not good. Now that cholera is killing us they are rushing here as if they care*".

These few insights provide a tiny snapshot of the perpetuation inequality in the provision of environmental services in highly populated metropolitan Accra. The findings confirm the studies of [33] who observed; "the development of health exposure indicators, seen as a characteristic of the environment that when measured,

quantifies the magnitude of stress, habitation characteristics, degree of exposure to the stress or degree of ecological response to the exposure," has attracted the attention of scholars. Interests in spatial environmental (in) justice, seen as an (un) equal access to healthy and clean environment, appears to be growing, and rapidly [34]. The increasingly extreme disparities in such exposure are not only due to in-migration from the rural communities but are also due to intra-urban differentials in policy planning and implementation. While metropolitan Accra seems to have attracted a lion's share of investments, redistributing the investments for the benefits of all is also skewed against the poor, a situation which if not rectified, the dream of building a sustainable and resilient city will only be a wishful thinking.

3.3. Behavioral Factors and Cholera Risk

The study also considered a number of risk factors in assessing the possible reasons for the persistent occurrence of cholera in Accra. To achieve this, eight risk factors were considered, see Table 3.

Table 3. Risk Factors of Cholera Morbidity in Accra

Risk Factor	Households	p-Value
Share toilet with more than four households	190	<0.01
Store water in pot	109	<0.01
Do not wash hand before cooking	120	<0.01
Depend on water from borehole, well or Dugout	145	<0.01
Do not wash hand after defecation	113	0.02
Depend on water from vendors	37	0.02
Many flies in cooking areas	67	0.04
Buy prepared food from open street venders	126	O.05

Our results show that there was a higher cholera incidence among households that depended on water from water vendors and boreholes/well/dugouts. In addition, there were more cases of cholera in households that shared toilets with more than four other households and where there were many flies in food preparation areas. The study further indicates the importance of behavioral factors in causing the cholera diseases. Storing water in pots was associated with higher cholera prevalence. Other behavioral factors which were identified as potential causes of higher cholera prevalence include not washing hands after defecation, not washing hands before cooking and buying prepared foods from street vendors.

Some key stakeholder interviews on some of the behavioral factors that are likely to lead to one getting cholera revealed some interesting results. For instance, commenting on the risk factors, a Public Health Specialist with the Ghana Health Service observed:

"These risk factors had confronted us as a nation for all these years, and most people rely on untreated water which poses a major threat for the disease infection," he said. He continued that:

"Improper handling of both solid and liquid waste has contributed immensely to the spread of the disease especially in communities where open defecation is rampant".

Commenting further, he also noted

"The lack of toilet facilities in most homes in the Greater Accra Region and most of the public's dependency on food and drinks sold on the streets was also a major source of the fast spread of the disease".

The Minister for Water Resources Works and Housing, commenting on the cholera outbreak noted:

"This is as a result of the country's failure to deal with sanitation issues. Tackling issues relating to water, sanitation and hygiene should be a way of life".

The minister expressed shock at the rampant state of open defecation in the nation's capital:

"We found out that at Circle (a popular bus terminal which also serves as home for migrants and criminals) people defecate in the open drains, and we are told that even in the afternoon, they do not feel shy and this same thing is happening in some of our communities."

All key stakeholders were unanimous that the issue of cholera could not be solely addressed until the risk factors were addressed and sanitation laws enforced, a situation which has been the bane to Ghana's quest for development.

Similarly, some key informants at the community level shared their experiences on some of the behavioral factors with the researchers. For example, on why the respondents preferred storing water in pots other than in more hygienic containers, a key informant had this to say:

"Since the time of our great grand fathers, the pot has been the safest way of storing water. If I stop then it means I am disrespecting the ancestors. The pot is good and will always be good for storing water. It keeps the very cool and clean all the time", he concluded.

Our study revealed that it was not storing the water in the pot that was the problem but how the content in the pot was scooped. The pots were kept in the outer yard of the house and any container that was regarded as reasonably clean was used to scoop the water. These containers were also placed on the lid of the pots and were therefore left at the mercy of flies and other insects which were seen around them. The contamination was therefore transferred to the content from the container. Similarly in a focus group discussion, a 32 year old trader explained why he does not normally wash his hands before eating when he said:

"it is even written in the Great Book, the Bible that it is not what enters your mouth that makes you unclean but what comes out and therefore for me the most important thing is to wash your hands after eating because that can really make you dirty", he concluded.

Others also blamed the persistent cholera outbreak on magico-religious factors. A 74 year old native of Nima, a highly populated migrant community opined:

"I certainly believed that it is the work of the supernatural forces. My late grandfather told me that there was once a popular fetish priest in this community who resided near this nearby stream and

when he died the next of king refused to pacify the gods. So anytime the gods are angry, they visit us with this watery stool disease this modern people call cholera. The disease will never go if we do not offer the sacrifice required of us".

These behavioral factors also affect efforts at reducing the re-occurrence and the spread of the disease.

4. Discussions: Digging into the Facts

Differential access to good drinking water and other sanitation services is a national phenomenon which has a spatial imprint. The staggering situation is that 52 percent of Ghanaians do not have efficient means of solid waste management; 16 million (almost 65percent of the total population) use unsanitary or shared toilets; while 4.8 million people have no access to latrine at all and thus defecate in the open, while nearly 20 percent depend on water from unprotected sources [4]. Almost without exception, it is the poor and the under privileged who do not have access to these important social services. While access to safe drinking water and sanitation is facilitated by good infrastructural facilities, very often these infrastructural networks are not extended to the poor communities and even where they are, they are somewhat truncated. The high prevalence of cholera in Accra is an indication of underlying safety problems related mainly to water and sanitation. The contamination of food and water prior to consumption is a serious problem where the quest for regular supply of water and the need to eat for survival often outweighs concerns about food and water safety.

The epidemiological links between cholera and unsafe water supply and regular consumption of prepared food from street vendors have been amply demonstrated in the literature [1,31,35,]. The literature indicates that in many instances, food from vendors was of poor quality and is also sold to customers in locations that may represent a serious health risk to the consumer. For instance, we observed during the research that in most instances, 'wakye' (local name for rice and beans) and 'kooko' (local name for porridge) were sold in compromised environments-mostly near stormed drains and crowded locations. Even as the environment may present health risks, vendors limited access to safe water supplies resulted in poor dish washing habit and also compeled them to cook and handle food with dirty hands. Additionally, raw foodstuffs are also kept in unsafe storage places and are therefore easily contaminated by vermin and insects. All these factors made the food from vendors unwholesome for human consumption. It was therefore not surprising that respondents perceived food from vendors as a major health risk, as most cholera patients suspected the onset of the disease with the consumption of food they had eaten from street vendors. The situation is particularly worrying given the fact that 56 percent of the households interviewed depended on vended water and 42 percent regularly patronized prepared foods from street vendors. Again, 74 percent of households in the study area share toilet facilities with other households.

While poor sanitation, limited water supply and unhygienic practices were implicated for the persistent outbreak, efforts by city authorities to improve the situation have been unimpressive. The study revealed that the current institutional structures for water and sanitation management were not living to their responsibilities. Respondents argued that in many instances, it takes several months or sometimes years to have their request for a new service (in terms of water and waste management) granted, a request that normally should have taken few weeks. Another lapse in the institutional structures is the concept of community participation in the implementation of water and sanitation programmes. Our research further revealed that the concept of community participation was absent. The limited coverage for these essential social services, the system failures, inefficiencies and the poorly implemented government policies, altogether tend to make good hygiene more difficult to achieve as users get exposed to disease causing pathogens.

The role of confounding variables, mostly related to behavioral issues, becomes particularly important when considering the relationship between toilet sharing and the prevalence of cholera. The data indicate that 70 percent of households sharing toilet uses public pit latrines and do not wash their hands after defecation. Generally, communal toilets do not offer water for hand washing. The majority of users of these facilities who washed their hands after defecating happened to be Muslims who carry their own water every time they visit the facilities, depicting a general situation where Muslims washed their hands after defecating albeit in most cases without soap. Such inappropriate behaviors of respondents make them vulnerable to cholera attacks.

A more direct danger associated with carrying water to toilets is that respondents usually also drink water directly from the ablution containers thus increasing the risk of the cholera disease. Moreover, young children of households using these facilities resort to the use of chamber pots since they can not share the same facilities. The contents of these chamber pots are disposed into toilet/ latrine or buried in yard or, in the majority of cases–72 percent, were thrown outside the dwelling or rinsed away. It was observed that in most cases chamber pots were not emptied immediately after use, creating unsanitary conditions in homes and sometimes attracting flies and even domestic animals, all of which were potential carriers of the cholera pathogens. On the whole, evidence from personal observation showed that insanitary toilets facilities were associated with having more flies in the home area.

The strong association between cholera and storing water in pots should be interpreted with care. Bacteria are more likely to thrive in earthenware pots than in other containers, but pots themselves may not contaminate water. Of particular importance to health considerations is the way pots and their contents are treated. Generally, pots are placed in the interior courtyards of compound houses, usually not covered or well covered, and exposed to dust and domestic animals. In addition, these pots are hardly disinfected, since most households do not know about disinfection. Children within the compound usually scoop water for drinking directly from these pots with any 'reasonably' clean cup or bowl, thereby increasing the risk of contamination.

An understanding of the high prevalence of cholera in the Accra Metropolitan Area can be achieved within the broader context of people's knowledge and attitudes to the

disease. The study revealed a very low level of knowledge about the causes of cholera. Generally, respondents believe that cholera is caused by eating cold other than hot or warm foods. The irony is that some respondents did not recognize the onset of cholera as an illness but a normal flushing of the body system to get rid of unwanted and undigested food. Consequently, appropriate medicine and visits to a health centre are not considered necessary for a condition which is not accepted as one of ill health. These misconceptions have resulted in widespread mismanagement of cholera.

5. Concluding Remarks

The study was purposed to dig into the factors responsible for the persistant outbreak of cholera in Accra, Ghana's most urbanized city with a fair share of infrastructural development. The general observations were that the environmental managemnt practices in the city have asumed notoriety and lot of public outcry because of its health consequences. From all indications, the provision of water and sanitation services have reached a crisis point. This is evident from the large proportion of people with limited access, a convinient euphemism for poor and inhumane conditions. While the persistant cholera outbreaks are inextricably linked to the related factors of the environment, economic power; the availability of functioning health care systems and access to essential medicines is partly to be blamed. Each of these factors are intertwined with the prevailing political system.

The observed spatial inequalities in the incidence of cholera in Accra show the importance of wealth and affordability of environmental services, and inaccurate socio-cultural practices in the spread of the disease. It is not uncommon for public health officers to look at one class of exposure and outcome at a time. In reality, there are a complex set of interactions between multiple risk factors and the cholera morbidity, which cannot be addressed within this framework. Each component of the environment is clearly an important risk factor in and of itself. However, when located within the context of the household environment, the complexities involved in characterizing the health effects of interrelated risk factors become apparent and go beyond access to water and sanitation.

The findings of this study, like several earlier ones, lead to the conclusion that lack of water and sanitation results in a higher prevalence of the cholera morbidity in the Accra Metropolitan Area. The most useful measure in preventing the spread of cholera is the provision of safe drinking water and sanitary disposal of human faeces. Our study has also highlighted the danger to which the general population in Accra is exposed to as a result of inappropriate behaviors. This strengthens the need for appropriate interventions within the household environment. Clearly, cholera has been a public health burden for ages and unlike the biological characteristics, relatively little effort has been made to understand its spatial epidemiology. The study makes two important recommendations. First, we believe that there is the need for further and a broader research into the analysis of the spatial distribution of disease incidence and its relationship to potential risk factors as the understanding of the spatial patterns will be useful for effective health planning and resource allocation. Second, we also call for further research into people's understanding of the links between the various risk factors and cholera, and advocate the need for well-planned, intensive health education programmes to change the erroneous beliefs and to educate the general population about the role of poor sanitation and poor hygiene in the persistent outbreak in cholera.

Authors' Contributions

We declare that this work was done by the authors named in this article and all liabilities pertaining to the claims relating to the content of this article will be borne by the authors. EOS and IKO conceived the idea and did the preliminary write-up; DAB performed the analyses; EOS, IKO and DAB jointly drafted and editored the manuscript. All authors read and approved the final manuscript.

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Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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