Water, Sanitation and Hygienic (WASH) Risk Factors That Promote Cholera Outbreaks in Nairobi County

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Abstract

BACKGROUND

Cholera is still a significant worldwide threat to global public health as it leads to about 100,000 deaths every year. It is a diarrheal water and foodborne disease with its person-to-person transmission resulting from limited sanitation access, poor hygiene, and inadequate water supply, which often leads to outbreaks. This study sought to examine Water, Sanitation and Hygienic (WASH) risk factors that promote cholera outbreaks in Nairobi County

METHODOLOGY

A cross-sectional descriptive research design was used in this study. The target population included 2,154,726 residents of Nairobi County aged 18 years and above. Slovin's Formula was used in the study to estimate the sample size. The study adopted stratified random sampling in the selection of 399 respondents from the target population. Primary datasets were collected using questionnaires and key informant interviews. The data from the questionnaires were analysed using descriptive and inferential statistics. Descriptive statistics such as percentages and frequencies were used to study the trends and WASH factors related to cholera outbreaks. Inferential statistics included Chi-square (X^2), which was used to analyze the relationship between variables.

RESULTS

The study established that the top five WASH challenges associated with the spread of Cholera disease included lack of enough water supply (76%); poor personal hygiene (54%); poor wastewater management (54%); poor community hygiene and sanitation (55%); and poorly maintained sewage facilities in the residential areas (44%). Communal water challenges included irregular supply of water (77%) and limited access to safe drinking water in most of the households (58%), lack of tap water in households (44%), unhygienic water vending facilities (57%) and supply of poorly treated water (38%).

CONCLUSION

The main risk factors related to Water, Sanitation and Hygiene practices (WASH) in areas reporting cholera outbreaks in Nairobi County were lack of adequate water supply, poor personal hygiene, poor wastewater management, poorly maintained sewage facilities, and poor culture of community hygiene and sanitation. Inadequate water supply, unregulated water vendors and water kiosks made water contamination likely.

***Keywords**: Cholera Hotspot, Food Handlers, Hygiene Practices, Spread of Cholera*

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Background

Cholera is still a significant worldwide threat to global public health leading to an estimated 100,000 deaths every year. It is a diarrheal water and foodborne disease with its person-to-person transmission resulting from limited sanitation access, poor hygiene, and inadequate water supply, which often lead to outbreaks.

Since its initial emergence in Ganges, India in 1817, the cholera epidemic has become worldwide with over seven times presence, causing significant catastrophes to populations (1). Most cholera outbreaks are not easily discovered but large cholera epidemics like those that occurred in Haiti, Viet Nam and Zimbabwe raised public health concern in recent years.

Cholera epidemics usually occur in Africa, Asia, the Middle East, and South and Central America. In these regions, epidemics are propagated by civil strife or war which interfere with sanitation services in public set-up. Earthquakes, tsunamis, volcanic eruptions, and landslides and floods also contribute to the epidemics, thus changing nature's balance.

One of the key aspects of a country's development is to strengthen the health and well-being of the people. Eliminating cholera and reducing the risk of spreading the disease among populations is expected to promote Sustainable Development Goals (SDGs). The SDG's goal number three aims to ensure healthy lifestyles and the promotion of well-being for all ages. Thus, a reduction in cholera deaths is one of the targets towards achieving Kenya's vision 2030. Moreover, reducing the transmission of waterborne diseases requires access to safe water and sanitation for all and this minimizes chances of cholera outbreaks (2).

In developing countries outbreaks occur as a result of poor sanitation, poor hygienic practices, excess and low water supply and lack of awareness (1,3,4,5,6). The largest number of cholera outbreaks in Kenya was reported between 1997 and 1999 with 26 901 cases and 1362 deaths. Since the first case was reported in 1971 there have been continuous upsurges of cholera cases erupting almost annually. In the last three years from 2014 to 2017, Kenya reported cholera outbreaks which began in Nairobi County and spread to 30 out of 47 counties in Kenya (9, 10). This study sought to examine Water, Sanitation and Hygienic (WASH) risk factors that promote cholera outbreaks in Nairobi County

Materials and Methods

Study area

This research was based in Nairobi County. The average temperature is between 21 and 22°C which is fairly warm from December to March, while June to July has cooler temperatures. Rainfall is moderate with drizzles around summer and autumn. The total population of the city is approximately 4 million people with an annual growth rate of 5.5 per cent and a population density of 4,800 people per km^2.

Study design and population

A cross-sectional descriptive design was applied. The study population were adult residents of Nairobi County. Key informants who were officials from public health facilities, sub-county health officers, officials from the Ministry of Health at the county level and the Sub-County Disease Surveillance Coordinators (SCDSC) also formed part of the study population.

Sampling

Stratified random sampling criteria was applied. Using proportionate stratification, the sample size was distributed across the 85 wards in 17 sub-counties in Nairobi County. Simple random sampling was finally used to select respondents from each of the wards. In each ward, the respondents were selected randomly

from different villages to ensure that differing Water, Sanitation and Hygienic (WASH) practices were captured. Some of the environmental and social factors that were considered included sources of water, waste management, proximity to a sewer system and open-air food eaters.

Data collection tools

Primary datasets were collected using questionnaires filled by household heads and key informant interviews. Household surveys of the residents of Nairobi County were done using a semi-structured digital questionnaire. Qualitative information was gathered using open-ended questions which helped the participants to give their open opinion and answers regarding the study targets. Structured questions were also utilized to gather quantitative data (12). Some observations were made at the respondents' households, places of work or business areas during data collection.

Observations were made particularly on the general hygiene conditions of the environment at the visited households. An interview guide was applied in this study to gather information from different groups of respondents by having one-on-one interviews with the head of public health in the Ministry of Health in the national government (1), one (1) head of public health in the county government of Nairobi, and one (1) public health officers (SCDSCs) from each of the seventeen constituencies (17).

Data analysis

Both both qualitative and quantitative data were collected. Descriptive statistics such as frequencies and percentages were used to summarize and check variability in the quantitative data of the study. Mode was computed to describe the distribution of qualitative data derived from especially, interview guides. The data from the questionnaires were analysed using Statistical Software for Social Sciences (SPSS) version 22.

Table 1:
Sample size and representative sampling from Sub-Counties in Nairobi

Constituencies	Total Population	Estimated % of Total Population	Sample Size
Westlands	121,367	5.6	22
Dagoreti North	124,449	5.8	23
Dagoreti South	125,379	5.8	23
Langata	124,555	5.8	23
Kibra	140,956	6.5	26
Roysambu	126,945	5.9	24
Kasarani	118,461	5.5	22
Ruaraka	135,429	6.3	25
Embakasi South	140,486	6.5	26
Embakasi North	126,547	5.9	23
Embakasi Central	133,241	6.2	25
Embakasi East	111,928	5.2	21
Embakasi West	110,062	5.1	20
Makadara	127,611	5.9	24
Kamukunji	141,443	6.6	26
Starehe	111,531	5.2	21
Mathare	134,338	6.2	25
Total	2,154,726	100.0	399

Descriptive statistics were used to study the trends and WASH factors related to cholera outbreaks. Continuous variables were summarized with mean standard deviation while categorical variables with frequencies and percentages. Inferential statistics including Chi-square were used to analyze the relationship between variables.

Results

Demographic characteristics

A total of 399 respondents participated in this study, out of whom 198 (49.6%) were male and 201 (50.4%) female. Most of the respondents were mature adults aged between 35-45 years (33%) and 45-55 (14%) (Table 2). At least 40% of the respondents had attained secondary education, 30% were diploma holders, 21% had primary education, and 9% were degree holders. (Figure 2).

Water supply and food hygiene practices

In this population, most households had individual taps (192, 48%) while taps shared in the yard were 33%. Water from water vendors and water kiosks were also common as indicated by 30% and 26% of the respondents, respectively. (Table 3). The other alternative sources of water although less common in most of the households included; water from boreholes (17%), bottled water (12%) and water obtained through rain-water harvesting (2%).

Table 2:
Age distribution of the respondents

Age (years)	Frequency (*n*)	Percentage (%)
18-25	28	7
25-35	172	43
35-45	132	33
45-55	55	14
55 and above	12	3

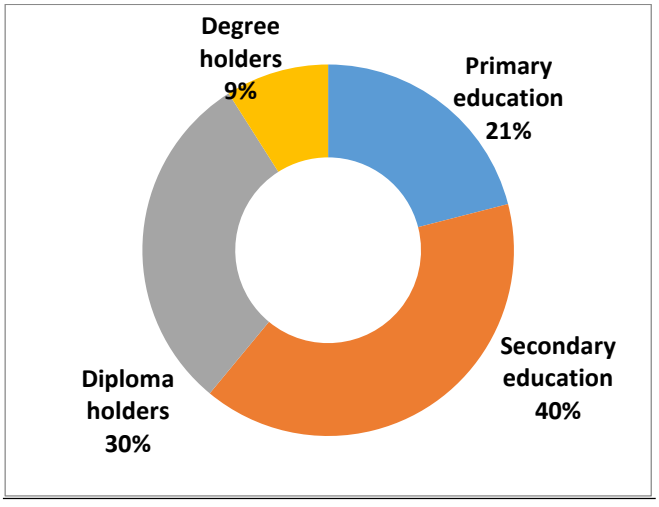

Figure 1:
Participants' level of education

Apart from the households where bottled water was used for drinking (12%), the rest (267, 67%) indicated that they drank untreated water directly from the source. Only 22% of the respondents indicated that they treated the water before drinking. The respondents who did not drink water directly from the source reported that chances of water contamination at the source were very high and therefore they considered the water not safe to drink. Nearly all participants (98%) used plastic containers to store water.

A majority (185, 49%) of the water points were within 0-10m from a toilet. Most of the damping sites (112, 44%) were more than 20 meters away from the water points. The distance from a water point in areas where open sewage lines were observed was commonly found within 10m (47%). Figure 3.

Communal water challenges

The most common challenge was the irregular supply of water (77%) and limited access to safe drinking water 58%. Unhygienic water vending facilities, supply of poorly treated water and minimal household water treatment were regularly observed water challenges as indicated by 57%, 38%, and 42%, respectively. Forty-four per cent of respondents did not have tap water in their households and depended on other sources of water for their households' uses. Uncontrolled and illegal water connections was indicated as a problem by 25% of the respondents. The high cost of water (KSh. 50 per 20 litre jeri-can) and water supply cartels were also indicated as challenges hindering access to safe water. Figure 4.

Food handling and hygiene practices

A majority of the respondents (64%) often consumed meals prepared from their households while only 1% sourced food from other sources. Among working participants, very few carried food to their workplace or were provided food prepared at their workplaces.

Most of the eateries (55, 38%) were located within 0-10m from sewer lines, 81 (43%) within 10-20m of toilets or latrines and 45% of located more than 20m from the closest damping site (Figure 5).

Lack of adherence to food hygiene and quality standards was a significant contributing factor to the spread of cholera disease (X^2=6.429, r=0.327, p-value=0.011), Poorly maintained water infrastructure contributed to water contamination in the supply lines that led to an increased number of cholera cases when residents consume contaminated water (X^2=5.157, r=0.293, p-value=0.023).

Poor personal hygiene also contributed to an increased number of cholera cases (X^2=4.625, r=0.837, p-value=0.032).

Table 3:
Sources of water for domestic use in the Nairobi area

Sources of water for domestic uses	Frequency (n=399)	Percentage (%)
I use tap water in my house	192	48
I use borehole water	68	17
I get water from vendors	120	30
water kiosk	104	26
rainwater harvesting	8	2
I use Bottled/ Mineral water	48	12
shared tap in my residence	132	33

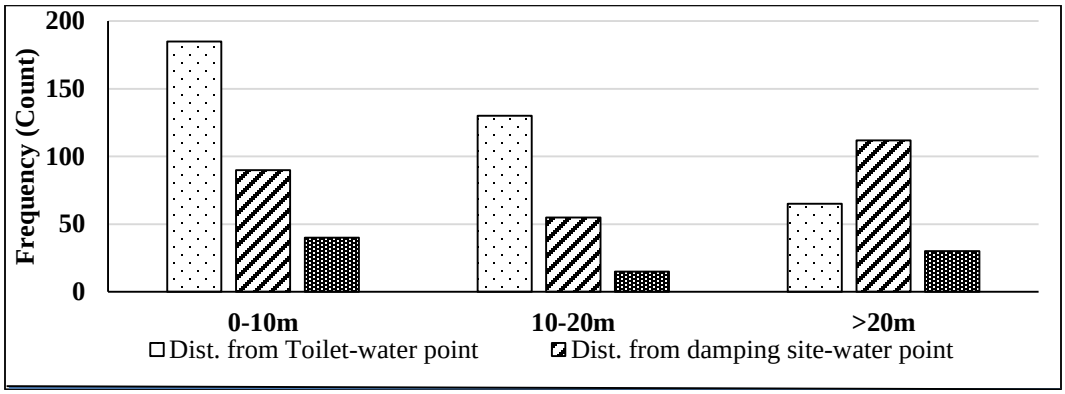

***Figure 3*:**
The proximity of household water points to sanitation facilities

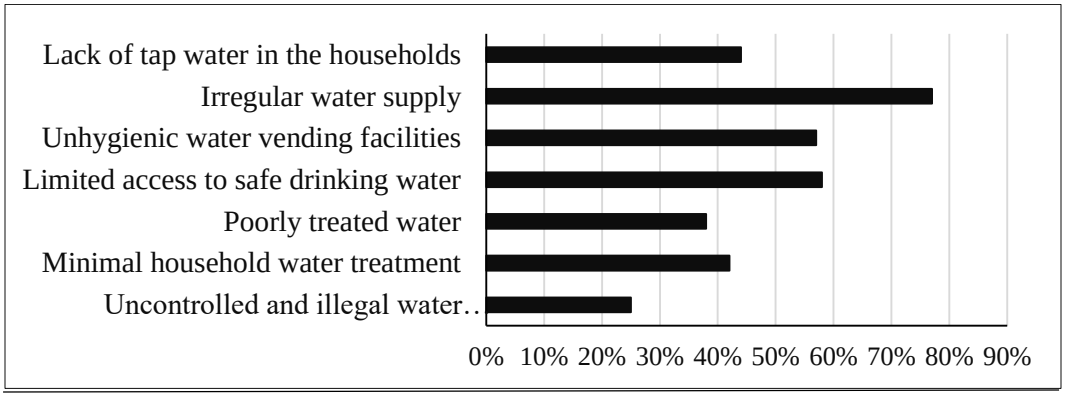

Figure 4:
Most common communal water-related challenges in the study area

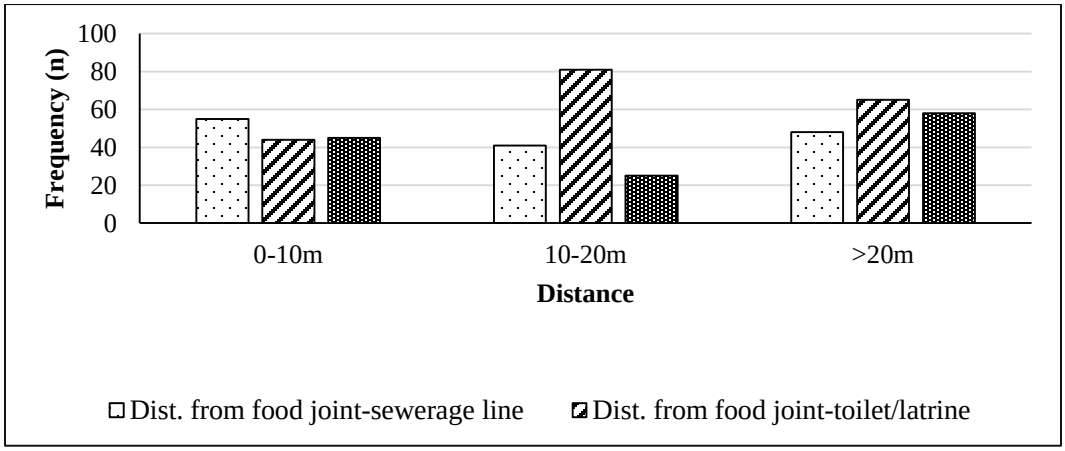

Figure 5:
The proximity of food joints/eateries to poor sanitation

Unhygienic food handling practices reported were informal food eateries exposing food to flies and dust (76%); unclean environment near the food eateries (81%); poor personal hygiene among the food vendors (62%); and unhygienic food preparation methods (58%). Table 4.

The majority of the Sub-County Disease Surveillance Coordinators (SCDSC) acknowledged that there were several hygiene challenges observed in the residences such as consumption of poorly prepared food, cooking and preparation of foodstuff on the roadsides by food vendors without credible heath certificates, consumption of untreated water, and poor hand-washing habits.

Discussion

Since 2007, the government of Kenya through the Ministry of Health introduced the National Environmental Sanitation and Hygiene Policy to support the provision of "hygienic, affordable, functional, and sustainable toilet and hand washing facilities" in "every school, institution, household, market, and other public place" (13). The Ministry of Public Health and Sanitation adopted Community Led Total Sanitation (CLTS) approach in 2012 to declare Kenya as open defecation-free (ODF) (14). However, open defecation in the Nairobi residences is still evident.

Open defecation in the estates was attributed to a lack of adequate toilets, particularly in congested informal settlements. Most of the residents used pit latrines which were within 10m of a water source and shared among several households. This study established that in most of the areas where previous cholera outbreaks were reported, the challenges of poor waste management and open defecation were common.

Although most of the households (48%) used personal tap water the problem of limited water supply in Nairobi was evident in several areas. The majority of the residents did not have a direct supply of water in their households. This study established that such households depended on water supplied through shared stand-pipes in their residences or from the water vendors and water kiosks in their estates. Chances of water contamination in shared sources are likely to be high thus exposing the households to the risk of spreading cholera disease.

Very few households relied on water tapped from boreholes and bottled water. Rainwater harvesting was also not common. A good number of the respondents in this study (40%) indicated that they always treated their drinking water. These results meant that apart from the few who used bottled water in their households, a bigger group of the residents mostly consumed untreated water. This was evident since the majority (67%) indicated that they could drink water directly from the source.

Table 4:
Food handling practices and the risk of cholera disease

Food Handling Practices	Yes	%	No	%
Consumption of poorly cooked food	72	18	327	82
Unhygienic practices in food preparation	231	58	168	42
Unclean environment near the food joints	323	81	76	19
Lack of clean water for domestic uses	235	59	164	41
Unhygienic food handlers	247	62	152	38
Poor storage of foodstuff	160	40	239	60
Lack of strict health controls from the government	188	47	211	53
Close exposure of food to flies and dust	303	76	96	24

Apart from the use of chlorine-based water treatment, boiling water was considered the most common method applied to make water safe for drinking.

The study revealed that most of the household water outlets were located within 0-10m from a toilet. This included water outlets identified in the study that is; personal taps, shared taps from the stand-pipe, and the water taps at the water kiosks. It was also observed that the proximity of these water outlets to waste collection or damping sites and sewage lines varied from one area to another with a range of about 10-20m distance. There is contamination of drinking water through illegal water connections and poor waste management in several areas that have had several episodes of cholera outbreaks.

This study found that water points located close to dumping sites and toilets contributed to the spread of cholera disease. This concurs with the report by the WHO and UNICEF (2017). These findings suggest the need to improve waste management, installation and maintenance of water supply infrastructure to assure water quality and reduce cholera cases. A review of previous evidence indicates that sufficient water supply and improved sanitation significantly reduces diarrhoea-related morbidity (3). In addition, the proximity of water outlets to toilets could be contributed to faecal contamination of the water if proper hygiene is not well maintained.

Although it may be a challenge to accurately tell the symptoms of cholera disease, the majority of the participants in this study indicated that they were able to identify the common symptoms, the risks underpinning cholera outbreaks and some prevention controls of the disease. However, a high percentage of the respondents (77%) expressed that they were not aware of how the disease could be treated. The areas that were identified with a high number of historical cholera cases showed that people lacked information on the risk factors of cholera and how the disease can be treated. Similar findings were found in a study undertaken in Kajiado in 2010 (15). These findings suggest that there is a need for public awareness programs to educate the public on the causes and how the disease can be treated. This approach has been found effective in reducing the spread of cholera (16). Some studies suggest that improving access to healthcare facilities, personal hygiene and access to healthcare services can reduce the spread of the disease (5)

The majority of the participants in this study acknowledged that washing hands regularly, use of clean and well-maintained toilets, proper waste disposal, consuming thoroughly cooked meals, boiling drinking water and use of clean water storage could help them to minimize the risk of cholera disease.

Conclusions

Main water, sanitation and hygiene practices (WASH) in areas reporting cholera outbreaks in Nairobi County were lack of adequate water supply, poor personal hygiene among food handlers, poor wastewater management, poorly maintained sewage facilities as well as poor culture of community hygiene and sanitation. Inadequate water supply, unregulated water vendors and water kiosks made water contamination likely. Further, the consumption of food from open-air eateries in the estates was commonly practised. Most of the food vendors' businesses were not regularly examined or controlled, thus compromising hygiene and public health standards.

Recommendation

Proper hygiene practices should be used at all times to reduce cholera outbreaks. Local governments should emphasize on the installation and maintenance of sewerage lines, enhance waste management and facilitate installations of more water pipelines.

References

1. **Ishaku, A., Shadrack, B.S., Olufemi, A., Olayinka, A. & Nguku, P. (2014)**. Investigation of Cholera Outbreak in an Urban North Central Nigerian Community-The Akwanga Experience. *Public Health Research, 4*(1), 7-12.
2. **UNICEF (2017).** *UNICEF Kenya Humanitarian Situation Report, 19 June 2017*. Retrieved from http://www.unicef.org
3. **Rieckmann A, Charlotte C. T., Gurley E. S, Rod N. H, and Jensen P. K. M., (2018).** Exploring Droughts and Floods and their Association with Cholera Outbreaks in Sub-Saharan Africa: A Register-Based Ecological Study from 1990 to 2010, *Am. J. Trop. Med. Hyg., 98*(5), 2018, pp. 1269–1274: doi:10.4269/ajtmh.17-0778
4. **Chamba, G. (2016).** An Assessment on the Factors Contributing to the Recurrence of Cholera Outbreak in Maiduguri Metropolitan Council (Case Study of Gwange Ward, Maiduguri, Borno State). *EC Microbiology, 3*(4), 500-510.
5. **Watyoka, N. N. (2016).** An Assessment of the Factors That Lead to Cholera Outbreak in Harare Urban District: a Focus on International Non-Governmental Organisations and United Nations Personnel. *Global Journal of Advanced Research, 3*(3), 189–199.
6. **Gretchen, C., Otipo, S., Njeru, I., Achia, T., Thirumurthy, H., Bartram, T. & Kioko, J. (2017).** Factors associated with cholera in Kenya (2008-2013). *The Pan African Medical Journal, 28*, 101-109.
7. **Eisenberg, M. C., Kujbida, G., Tuite, A. R., Fisman, D. N., & Tien, J. H. (2013)**. Examining rainfall and cholera dynamics in Haiti using statistical and dynamic modelling approaches. *Epidemics*, *5*(4), 197-207.
8. **WHO (2008).** Cholera: global surveillance summary, Wkly Epidemiol Rec 2009, 84:309– 324.
9. **Mutonga, D., Langat, D. Mwangi, D., Tonui, J., Njeru, M., Abade, A., Irura, Z., Njeru, I., and Dahlke, M., (2013).** National Surveillance Data on the Epidemiology of Cholera in Kenya, 1997–2010, The Journal of Infectious Diseases 2013; 208 (S1): S55–61. DOI:10.1093/infdis/jit201
10. **Nyambedha E.O, Sundaram N, Schaetti C, Akeyo L, Chaignat C.L, Hutubessy R, Weiss M.G (2013).** Distinguishing social and cultural features of cholera in urban and rural areas of Western Kenya: Implications for public health. *Glob Public Health*, *8*:534–551.
11. **Bhattacherjee, A. (2012).** *Social Science Research: Principles, Methods, and Practices*. New York: Free Press.
12. **Orodho, A. J. (2007).** *Techniques of Writing Research Proposals and Reports*. Nairobi: HP Enterprises.
13. **Republic of Kenya (2007).** Ministry of Health, National environmental sanitation and hygiene policy.
14. **Institute of Development Studies (2012).** Re-launching the ODF Rural Kenya by 2013 campaign. Accessed online on February 19, 2022, at http://www.communityledtotalsanitation.org/blog/re-launching-odf-rural-kenya-2013-campaign. Updated in 2012.
15. **Chepwogen, F. (2011).** *The risk factors that influence transmission of cholera in Bissil in Kajiado District.* Retrieved from http://erepository.uonbi.ac.ke
16. **Kirigia, J. M., Sambo, L. G., Yokouide, A., Soumbey-Alley, E., Muthuri, L. K., & Kirigia, D. G. (2015).** Economic burden of cholera in the WHO African region. *BMC International Health and Human Rights*, *9*, 8.
17. **Kenya National Bureau of Statistics (2016).** *Exploring Kenya Inequality: Nairobi County.* Nairobi: Kenya National Bureau of Statistics.