

Factors Associated with the Incidence of Cholera Among Children Aged 0–18 Years: A Case Study of Kanyama Level 1 Hospital During the 2023–2024 Period, Lusaka, Zambia

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***Factors associated with the incidence of cholera
among children aged (0-18) years: a case study of
Kanyama level 1 hospital during the (2023-2024)
period, Lusaka, Zambia.***

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Abstract

Cholera remains a major global health threat, affecting millions annually, with children in Zambia facing significant challenges due to poor sanitation and limited access to clean water and sanitation. Kanyama, a peri-urban settlement in Lusaka, experiences frequent outbreaks, disproportionately impacting children. This study aimed at examining the incidence of cholera among children aged (0-18) years at Kanyama Level 1 Hospital from (2023-2024), exploring contributing demographic, socio-economic, and environmental factors, and aiming to provide evidence-based interventions to reduce the disease burden in this high-risk population. This study utilized a retrospective descriptive-analytical study with a quantitative approach involving 138 children who presented with a confirmed case of cholera at the hospital. Data was collected through secondary sources

involving the hospitals public health unit records. Data was analyzed using Statistical Package for the Social sciences (SPSS) version 20 into descriptive and inferential statistics with tables, pie-charts and bar-graphs. The study of 138 children revealed that younger children under 5 years were significantly more vulnerable to cholera, with 1.75 times higher odds of infection (95% CI: 1.10–2.85, $p = 0.02$). Larger households (>8 members) had more than double the risk (OR = 2.20; 95% CI: 1.30–3.75, $p = 0.01$), while low parental education increased cholera odds by 1.95 times (95% CI: 1.15–3.20, $p = 0.03$). Treatment delays were highly predictive, raising risk almost threefold (OR = 2.80; 95% CI: 1.75–4.50, $p = 0.001$). Environmental factors were also significant. Use of unsafe water sources increased cholera risk ($p = 0.002$), and lack of water treatment further elevated risk ($p = 0.002$). Open defecation showed a strong association with cholera ($p = 0.001$). Water chlorination was protective, reducing cholera by 50% (OR = 0.50; 95% CI: 0.30–0.80, $p = 0.005$). Correlation analysis showed significant relationships between cholera incidence and household size ($r = 0.25$), education ($r = -0.28$), treatment delay ($r = 0.35$), water source ($r = 0.31$), and sanitation ($r = 0.39$). Therefore, cholera incidence among children is significantly influenced by younger age, large household size, and lower parental education, indicating the role of demographic and socioeconomic vulnerabilities. Delays in seeking treatment further exacerbate the risk, underscoring the need for improved healthcare accessibility. On the environmental aspect, reliance on unsafe water sources, inconsistent water treatment, and inadequate sanitation facilities are major contributors to cholera outbreaks. Effective intervention strategies must therefore, focus on education, safe water access, timely treatment, and improved sanitation to reduce cholera incidence in vulnerable communities.

Keywords: *Associated-Factors; Cholera-Incidence; Children (0-18years); Kanyama-Level 1 hospital; Lusaka, Zambia.*

Introduction

Cholera, caused by the bacterium *Vibrio cholerae*, remains a significant global health challenge, particularly affecting children under five years of age (1). Recent data indicates a troubling rise in both cholera cases and associated mortality rates (2). In 2023, the World Health Organization reported 535,321 cholera cases and 4,007 deaths across 45 countries, with 38% of these cases occurring in children under five (3). Cholera outbreaks in humanitarian crises, such as Yemen and Syria, have disproportionately affected children due to disrupted healthcare services and poor sanitation, accounting for 47% of cases in refugee camps (4). Sub-Saharan Africa remains a hotspot for cholera outbreaks due to the convergence of environmental factors, population density, and limited healthcare infrastructure (5). Contaminated water sources account for approximately 80% of cases in the region (6). Between 2010 and 2019, Sub-Saharan Africa experienced 24% of global cholera cases, with mortality rates in children under five exceeding 10% during severe outbreaks (7).

A randomized trial in Ethiopia demonstrated that oral cholera vaccines reduced morbidity by 60% in children aged 6 months to 5 years during an outbreak (8). In Nigeria, children aged (0–14) accounted for 65% of cholera cases during a major outbreak in Kano State, with poor access to clean water being a key determinant (9).

Cholera outbreaks are a recurring issue in Zambia, particularly in peri-urban areas with inadequate water and sanitation infrastructure (10). The Ministry of Health Zambia has reported that the ongoing (2023–2024) outbreak has been particularly severe in peri-

urban areas such as Kanyama, with 60% of hospital admissions being children aged (0–18) years and a mortality rate of 3.4% in this group (11). Vaccination campaigns targeting peri-urban areas in Zambia have significantly reduced cholera incidence, particularly among children under five, who were previously the most affected group (12). Therefore, this study aimed at determining the key factors in terms of demographic, socio-economic, and environmental factors associated with the incidence of cholera among children (0-18) who presented at Kanyama level 1 hospital during the (2023-2024) period.

Materials and methods

Study design, time-period, and study setting.

A retrospective descriptive-analytical study design with a quantitative approach was employed to assess the demographic, socioeconomic, environmental, and treatment-related characteristics of children aged (0–18) years with documented cholera at Kanyama Level 1 Hospital during the (2023–2024) period. The retrospective design was appropriate because the study relied on previously recorded information contained in routinely collected hospital and public health records rather than prospectively recruiting participants or collecting data directly from patients or their caregivers.

The descriptive component of the study was used to characterize the documented cholera cases according to variables such as age, household characteristics, parental education, water source, water treatment practices, sanitation conditions, and treatment-related factors. The analytical component was used to examine statistical relationships between selected demographic, socioeconomic, environmental, and treatment-related variables and the outcomes recorded in the available health records.

This approach enabled the study to identify patterns and factors associated with the

90 documented cholera cases while making use of routinely collected secondary data.

91 The study covered the period from (December 2023 to December 2024). Records of

92 children aged (0–18) years with confirmed cholera managed at Kanyama Level 1

93 Hospital during this period were reviewed. A total of 138 eligible records were

94 included in the analysis. Data were extracted from existing hospital records and the

95 public health unit records using a structured data extraction tool. No prospective

96 participant recruitment or direct interaction with children or their caregivers was

97 undertaken. Permission to access and use the relevant secondary health records was

98 obtained from the responsible health authorities and institutional offices. Ethical

99 approval was obtained from the University of Lusaka Ethics Committee under

100 reference number FWA00033228-518(08)/2024, dated 25 February 2025. Additional

101 approval was obtained from the National Health Research Authority (NHRA) under

102 Certificate Number NHRAR-R-2509/23/02/2025, dated 25 February 2025, and NHRA

103 Letter of Approval reference number NHRA-2338/28/02/2025. Permission was also

104 obtained from the Lusaka District Health Office under reference number LDHO/101/2/2,

105 dated 24 February 2025.

106 Confidentiality and data privacy were maintained throughout the study. Only information

107 relevant to the approved research objectives was extracted from the

108 records, and direct personal identifiers were excluded from the research dataset. The

109 extracted data were used solely for academic and research purposes and were not

110 disclosed to unauthorized persons or third parties.

111 This study was conducted at Kanyama Level 1 hospital it is a peri-urban settlement

112 located within Lusaka province in the Central business area of Lusaka. The settlement

113 is located about 7km west from the central business district (CBD). Geographically, the
114 location is approximately at the coordinates 15.3320° S latitude and 28.2799° E
115 longitude. It is bounded by Los Angeles and Mumbwa roads on the western and eastern
116 sides. It is commonly known for spread of water borne diseases mainly cholera in
117 Zambia.

118 **Study area**

Map_Of_Lusaka_City.

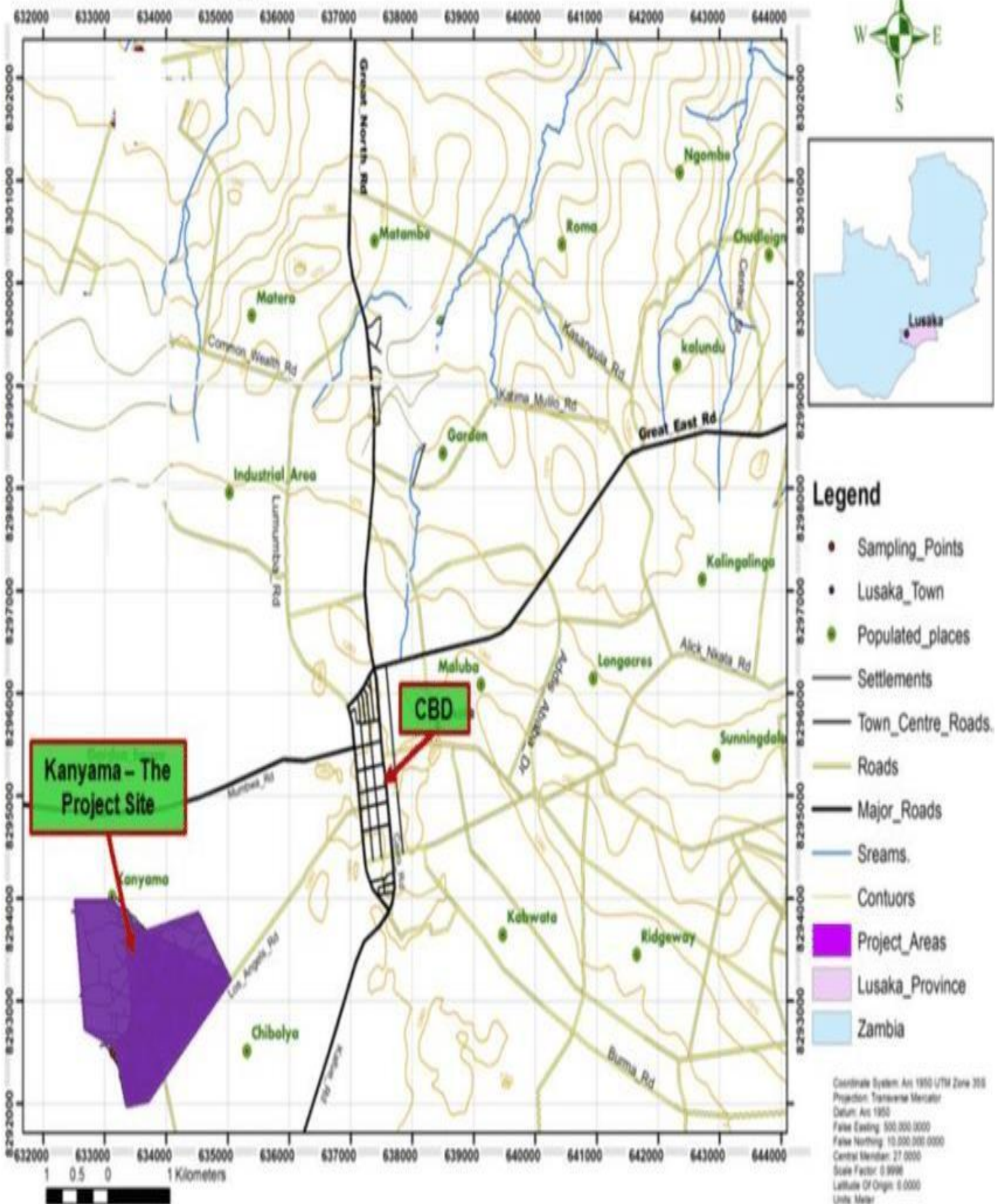


Fig 1: Location Map of the Kanyama Study Area in Lusaka, Capital City of Zambia

Source: [\(3\)](#).

Kanyama is a densely populated township with poor water sanitation and hygiene delivery drainage system. This study was conducted at Kanyama Level 1 hospital it is a peri-urban settlement located within Lusaka province in the Central business area of Lusaka. The settlement is located about 7km west from the central business district (CBD). Geographically, the location is approximately at the coordinates 15.3320° S latitude and 28.2799° E longitude. It is bounded by Los Angeles and Mumbwa roads on the western and eastern sides. It is commonly known for spread of water borne diseases mainly cholera in Zambia.

Lusaka, including Kanyama Compound, experiences a monsoon-influenced humid subtropical climate characterized by a warm and wet season from November to March, a cool dry season from April to August, and a short hot season in September and October. During the wet season, heavy rainfall combined with Kanyama's flat topography and inadequate drainage frequently leads to flooding. Temperatures range from approximately 15°C in the cool season nights to the low 30s°C during the hot months, while rainfall is strongly seasonal and concentrated in the November–March period [\(13\)](#). This climate-induced seasonality has direct implications for cholera transmission among children. Flooding during the rainy season increases the likelihood of water contamination as pit latrines overflow and surface water mixes with household water sources. The prolonged dry season contributes to water scarcity, forcing families particularly in high-density, low-income areas to rely on unsafe or informal water points.

Such conditions create an environment conducive to *Vibrio cholerae* transmission, disproportionately affecting children who are more vulnerable to diarrheal diseases. Kanyama was selected as the study area because it presents multiple risk factors associated with cholera incidence. It is characterized by high population density, limited access to formal water and sanitation infrastructure, widespread reliance on shallow wells, and poor drainage systems. These environmental and socio-economic conditions, compounded by seasonal climatic variability, make Kanyama one of Lusaka's cholera hotspots. Understanding the local geographic, climatic, and infrastructural context is therefore, essential for assessing how these factors influence the occurrence of cholera cases among children aged (0–18) years during the (2023–2024) outbreak period.

Study population and eligibility criteria

A population is defined as a group of individuals of the same species that live in a specific geographic area and are capable of interbreeding, sharing a common gene pool, and exhibiting similar characteristics or traits [\(14\)](#). A total number of 5,253 confirmed cases of cholera were recorded for one year from (December, 2023–December, 2024) according to the [\(15\)](#). This study only included children aged (0–18) years who were admitted at Kanyama Level 1 Hospital which is a peri-urban area and presented with a confirmed case of cholera during the stated period. Children without confirmed cholera diagnosis and cases from other hospitals were not used in this study.

Sampling techniques and sample size determination

A sampling frame was created using hospital public health unit records, listing all eligible children. Each unit record of a child was assigned a unique identification number,

and a random selection method was applied to ensure unbiased selection. This approach guaranteed equal probability for every child, minimizing selection bias and improving the study's generalizability. The process continued until the required sample size was met, with replacements made if necessary (16).

The study sample size following the number of confirmed cases was calculated using the (17). This formula was used for the known population and also helped to estimate the appropriate sample size needed to achieve a desired level of precision in survey research.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size,

N = population size,

e = margin of error (as a decimal),

At 90% confidence level and 8.4% (0.084) error level,

Where N= 5,253,

The margin of error = (0.084), meaning,

$n=5,253/[(1+5,253(0.084^2))]= 138$,

Sample size = **138**.

Therefore, a sample size of 138 was used in this study consisting children (0-18) years.

Data collection, procedure, and quality assurance

The study relied on secondary data from the hospital records at Kanyama Level 1 Hospital, specifically focusing on cholera cases among children aged (0–18) years. These records provided key quantitative information for the study's variables. To ensure the relevance of the data, only records pertaining to children aged (0–18) years from (2023-2024) a one-year period was considered only in this study. Who were diagnosed with cholera during the study period were selected.

The data extraction was focused on the following key variables: Age of the patient (0–18 years) to categorize the child population; Sex-to assess any gender-related differences in cholera incidence; Date of Admission: To track the timeline of cholera admissions and identify seasonal trends or outbreaks; Treatment Outcomes: Including discharge status, recovery rates, or mortality data; Underlying Health Conditions: To determine the impact of pre-existing health conditions such as malnutrition, immune deficiencies, or other comorbidities on cholera susceptibility and outcomes. The data collection was carried out by accessing and reviewing patients records from the hospital's database and physical files. Hospital staff assisted in retrieving the necessary records, ensuring that the data was comprehensive and covered all relevant cholera cases during the specific study period. A systematic approach was employed to filter out irrelevant records and focus exclusively on those involving cholera cases among children.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 20, a quantitative approach was utilized. Descriptive statistics summarized key variables, including cholera case frequencies, age distribution, and access to sanitation. Chi-square tests, were used to examine associations between categorical variables such as gender

and water source with cholera incidence. T-tests were used to compare cholera incidence across different groups, such as those with varying sanitation access or age groups. Logistic regression assessed the likelihood of cholera based on multiple factors, including water source and sanitation conditions, while multiple linear regression explored relationships between continuous variables like age and cholera case frequency. Finally, data was presented into tables, bar-graphs, and pie-charts with frequencies and percentages.

To maintain the reliability and validity of the data, each record was cross-checked for completeness. This process involved verifying the presence of essential information such as the patient's age, sex, and clinical outcomes. Records that were incomplete or lacked necessary details were flagged for further review or excluded from the analysis. Data verification protocols were strictly followed to ensure accuracy. This step was critical for minimizing errors and ensuring that the study results would be robust. After extraction, the data were organized and cleaned to remove any inconsistencies or outliers. This involved standardizing variables such as dates, ensuring that admission dates and treatment outcome dates were in the correct format, and resolving discrepancies in patient identification details. Any duplicate or erroneous entries were identified and corrected.

Data security and confidentiality were paramount throughout the study. All patient information was anonymized to protect individual privacy, in compliance with ethical guidelines. The data were securely stored in encrypted files, and access was restricted to authorized research personnel only. All physical records were kept in locked cabinets

and digital records in password-protected databases. This ensured the integrity of the data and compliance with institutional and legal data protection standards.

Results

Demographic and socio-economic factors

(Table 1-Table 3) summarize the demographic and socio-economic factors of the participants. The study found that younger children under 5 years are significantly more vulnerable to cholera ($p = 0.01$), indicating a critical need for targeted intervention. Larger households (>8 members) show a significant association with higher cholera incidence ($p < 0.05$), likely due to overcrowding and sanitation challenges. Lower parental education levels significantly correlate with higher cholera risk ($p = 0.03$), indicating the need for education-based preventive strategies. Distance to healthcare facilities significantly contributes to treatment delays ($p < 0.05$), reinforcing the need for improved healthcare accessibility. Water chlorination significantly reduces cholera rates ($p = 0.005$), indicating the importance of safe water practices.

Table 1: Descriptive Statistics (n=138)

Table 1: Table 1 presents the descriptive characteristics of the 138 participants. Children under 5 years constituted the largest age group (45%, $n=62$), while males accounted for 52% ($n=72$) and females 48% ($n=66$). Most households had 6–8 members (40%, $n=55$), followed by 3–5 members (35%, $n=48$). Primary education accounted for 45% ($n=62$), while 38% ($n=52$) had secondary education. Prompt cholera treatment was reported by

70%(n=97), whereas 30% (n=41) experienced delayed treatment. Distance was the most

156 commonly reported barrier to treatment (60%, n=82). Water chlorination was the most

157 common prevention measure (50%, n=69). The table also indicates statistically significant

158 associations for the variables reported with p-values below 0.05.

Variable	Category	Mean/Proportion	Standard Deviation	p-value	Significance Level
Age Group	Under 5 years	45% (n=62)	High	0.01	High
	11–15 years	38% (n=52)	—	—	—
	16–18 years	17% (n=24)	—	—	—
Gender	Male	52% (n=72)	Low	—	—
	Female	48% (n=66)	—	—	—
Household Size	1–2 members	8% (n=11)	—	—	—
	3–5 members	35% (n=48)	—	—	—
	6–8 members	40% (n=55)	—	—	—
	>8 members	17% (n=24)	Moderate	<0.05	Moderate
Education Level	Primary	45% (n=62)	High	0.03	Moderate
	Secondary	38% (n=52)	—	—	—
	Tertiary	7% (n=24)	—	—	—
Cholera Treatment	Prompt Treatment	70% (n=97)	—	—	—
	Delayed Treatment	30% (n=41)	Moderate	<0.05	Moderate
Barriers to Treatment	Distance	60% (n=82)	Moderate	<0.05	Moderate
	Cost	30% (n=41)	—	—	—
	Other Barriers	10% (n=15)	—	—	—
Prevention Measures	Water Chlorination	50% (n=69)	Moderate	0.005	High
	Sanitation Campaign	40% (n=55)	—	—	—
	Other prevention measures	10% (n=14)	—	—	—

459 **Table 2:** Table 2 presents the correlation analysis among the demographic, household,
 460 Treatment, and cholera-related variables. Household size showed a positive correlation with
 461 cholera incidence ($r = 0.25$), while education level showed a negative correlation with cholera
 462 incidence ($r = -0.28$). Treatment delay had a positive correlation with cholera incidence ($r = 0.35$),
 463 representing the strongest correlation with cholera incidence among the variables presented.
 464 Age and gender showed weak correlations with cholera incidence ($r = 0.10$ and $r = -0.05$,
 465 respectively).

Variables	Age	Gender	Household Size	Education Level	Treatment Delay	Cholera Incidence
Age	1	0.02	-0.11	-0.15	0.05	0.10
Gender	0.02	1	0.01	-0.03	0.07	-0.05
Household Size	-0.11	0.01	1	-0.20	0.15	0.25
Education Level	-0.15	-0.03	-0.20	1	-0.30	-0.28
Treatment Delay	0.05	0.07	0.15	-0.30	1	0.35
Cholera Incidence	0.10	-0.05	0.25	-0.28	0.35	1

321 **Table 3: Multivariate Analysis (n=138)**

322 **Table 3:** Table 3 presents the unadjusted and adjusted odds ratios for factors associated with
 323 Cholera. After adjustment, children under 5 years had higher odds of cholera (OR = 1.75, 95%
 324 CI: 1.10–2.85, $p = 0.02$). Households with more than 8 members also had higher odds (OR =
 325 2.20, 95% CI: 1.30–3.75, $p = 0.01$), while low education was associated with increased odds
 326 (OR = 1.95, 95% CI: 1.15–3.20, $p = 0.03$). Treatment delay was strongly associated with cholera
 327 (OR = 2.80, 95% CI: 1.75–4.50, $p = 0.001$). Water chlorination had an adjusted OR below 1 (OR

328 = 0.50, 95% CI: 0.30–0.80, $p = 0.005$). Gender was not statistically significant after adjustment
 329 ($p = 0.45$).

Variable	Unadjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Age (Under 5)	1.90	1.20–3.00	0.01	1.75	1.10–2.85	0.02
Gender (Male)	1.15	0.90–1.45	0.30	1.10	0.85–1.40	0.45
Household Size (>8)	2.50	1.50–4.10	0.002	2.20	1.30–3.75	0.01
Education (Low)	2.10	1.30–3.40	0.01	1.95	1.15–3.20	0.03
Treatment Delay	3.00	1.90–4.80	<0.001	2.80	1.75–4.50	0.001
Water Chlorination	0.45	0.28–0.75	0.002	0.50	0.30–0.80	0.005

459 **Environmental Factors**

460 The following tables present the environmental factors associated with cholera incidence
 461 among the 138 households.

462 **Table 4: Descriptive Statistics (n=138)**

463 **Table 4:** Table 4 describes environmental factors among the 138 households. Community
 464 boreholes/wells were the most commonly reported main source of drinking water (50%, $n=69$),
 465 followed by piped water from the council (42%, $n=58$) and streams (8%, $n=11$). Half of the
 466 households reported treating water occasionally or sometimes (50%, $n=69$), while 30% always
 467 treated their water and 20% never treated it. Pit latrines were used by 70% of households ($n=97$),
 468 whereas 30% ($n=41$) reported open defecation. The reported p -values indicate statistically
 469 significant associations for the environmental factors presented.

470

Factor	Category	Frequency (%)	Standard Deviation	p-value
Main Source of Drinking Water	Community Boreholes/Wells	50% (n=69)	High	p = 0.002
	Piped Water from council	42% (n=58)	Low	—
	Streams	8% (n=11)	Low	—
Water Treatment Practices	Always Treated	30% (n=41)	Low	—
	Occasionally/Sometimes Treated	50% (n=69)	Low	—
	Never Treated	20% (n=28)	High	P=0.002
Toilet Facilities	Pit Latrines	70% (n=97)	Low	—
	Open Defecation	30% (n=41)	High	P=0.001

321 **Table 5: Correlation Analysis (n=138)**

322 **Table 5:** Table 5 presents the correlations among the main source of drinking water, water
323 Treatment, toilet facilities, and cholera incidence. Cholera incidence showed positive
324 Correlations with the main source of drinking water ($r = 0.31$), water treatment ($r = 0.25$), and
325 toilet facilities ($r = 0.39$). The strongest correlation with cholera incidence was observed for toilet
326 facilities ($r = 0.39$). The correlations among the environmental variables themselves were
327 relatively weak, including the correlation between water treatment and toilet facilities ($r = 0.12$).

Variable	Main Source of Drinking Water	Water Treatment	Toilet Facilities	Cholera Incidence
Main Source of Drinking Water	1	0.23	-0.15	0.31
Water Treatment	0.23	1	0.12	0.25
Toilet Facilities	-0.15	0.12	1	0.39
Cholera Incidence	0.31	0.25	0.39	1

Table 6: Multivariate Analysis (n=138)

Table 6 presents the unadjusted and adjusted coefficients from the multivariate analysis of environmental factors associated with cholera. After adjustment, the main source of drinking water remained statistically significant ($\beta = 0.58$, SE = 0.12, $p = 0.002$). Water treatment was also, statistically significant ($\beta = 0.43$, SE = 0.08, $p = 0.01$), as was toilet facilities ($\beta = 0.35$, SE = 0.09, $p = 0.001$). These findings indicate that the environmental factors included in the model remained significantly associated with cholera incidence after adjustment.

Variable	Unadjusted Coefficient (β)	Standard Error (SE)	p-value	Adjusted Coefficient (β)	Standard Error (SE)	p-value
Main Source of Drinking Water	0.65	0.15	<0.001	0.58	0.12	0.002
Water Treatment	0.50	0.10	0.003	0.43	0.08	0.01
Toilet Facilities	0.42	0.11	<0.001	0.35	0.09	0.001

Discussion

The findings of this study provide a comprehensive understanding of the multifactorial determinants driving cholera incidence among children aged (0–18) years in Kanyama, a high-risk peri-urban settlement in Lusaka, Zambia, and align strongly with the conceptual framework linking socio-demographic vulnerabilities, behavioral factors, and environmental exposures to waterborne disease transmission. Consistent with global evidence, this study demonstrated a disproportionately high burden of cholera among children under five years, who accounted for 45% of cases and had significantly elevated odds of infection (OR = 1.75, $p = 0.02$), a pattern corroborated by (3), (1), and (18), all of whom highlight biological susceptibility, immature immunity, and increased dehydration risk in young children. This aligns with studies in Kenya (19) and Malawi (20), which similarly identified young children as primary cholera victims due to higher faecal-oral exposure pathways. Household size emerged as a significant predictor, with overcrowded households (>8 members) recording 2.2 times greater odds of cholera ($p = 0.01$), reinforcing findings from (12), (21), and (9), who reported that congestion compromises hygiene, escalates shared water use, and amplifies environmental contamination. Supporting the social determinants of health (SDH) theory, these results indicate that structural poverty and suboptimal living conditions heighten exposure levels, echoing insights from (22) and (23), which documented similar dynamics in informal settlements

313 across West and East Africa. Low parental education showed a significant association
314 with cholera incidence (OR = 1.95, $p = 0.03$), consistent with studies by [\(8\)](#), [\(24\)](#), and
315 [\(25\)](#), which emphasize that education enhances household hygiene practices, water
316 treatment behaviors, and timely treatment-seeking. This aligns with the behavioral

317 component of the conceptual framework and with earlier evidence by [\(26\)](#), who found that
318 hygiene knowledge significantly reduces diarrheal diseases in low-income settings.
319 Treatment delays were strongly correlated with increased cholera incidence ($r = 0.35$; OR
320 $= 2.80$, $p = 0.001$), mirroring findings from [\(4\)](#), [\(27\)](#), and [\(28\)](#), who report that geographic
321 barriers, high transport costs, and long facility queues hinder timely rehydration, thereby
322 increasing morbidity and community spread. These findings reinforce documented
323 challenges in Zambia noted by [\(29\)](#), who reported that peri-urban families often delay
324 care due to limited facility accessibility, a barrier also noted in studies in Uganda and
325 Tanzania [\(30; 31\)](#). Preventive practices, particularly water chlorination, were strongly
326 protective (OR = 0.50, $p = 0.005$), validating earlier evidence from [\(12\)](#), [\(7\)](#), and [\(2\)](#), which
327 identify chlorine-based interventions as essential in interrupting *Vibrio cholerae*
328 transmission. Environmental determinants showed substantial influence: reliance on
329 boreholes and community wells significantly increased cholera risk ($p = 0.002$), consistent
330 with investigations by [\(5\)](#), [\(32\)](#), and [\(33\)](#), who documented contamination of shallow wells
331 during rainy seasons in Sub-Saharan Africa. Only 30% of households consistently treated
332 their water, and untreated water was associated with significantly higher cholera
333 incidence ($p = 0.002$), supporting evidence from Ethiopia [\(8\)](#), Mozambique [\(34\)](#), and
334 Zambia [\(35\)](#), which confirm that inconsistent water treatment practices are major
335 contributors to recurrent outbreaks. Sanitation practices showed a strong relationship with

336 cholera, with open defecation (30% of households) significantly associated with disease
337 incidence ($p = 0.001$), aligning with [\(3\)](#), [\(9\)](#), and [\(21\)](#), whose studies demonstrate that
338 poor sanitation infrastructure in urban slums results in widespread environmental

contamination of water sources. Similar results have been reported in Haiti (36) and Bangladesh (37), where open defecation was directly associated with cholera clusters.

Therefore, these findings affirm the interconnectedness of demographic, socio-economic, behavioral, and environmental determinants as outlined in the ecological model of health, demonstrating that cholera transmission arises from overlapping risk pathways rather than isolated factors. Collectively, the results support the need for multi-sectoral interventions, including household-level WASH strengthening, continuous behavior change communication, improved water infrastructure, targeted campaigns, and enhanced healthcare access, to effectively address the persistent cycle of cholera in peri-urban communities. This study therefore contributes robust empirical evidence positioning cholera in Kanyama not merely as a biomedical phenomenon but as a socio-environmental challenge requiring sustained, integrated, and context-specific public health interventions.

Conclusion

This study demonstrates that cholera incidence among children in Kanyama, Lusaka is strongly influenced by demographic, socioeconomic, healthcare and environmental factors. Children under five years, those living in large households, and those with low parental education were at significantly higher risk. Delays in seeking

357 treatment further increased vulnerability, while unsafe water sources, lack of water
358 treatment and poor sanitation practices such as open defecation were major contributors
359 to infection. Conversely, water chlorination was protective.

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My sincere appreciation is also extended to the health professionals working in Kanyama, whose dedication to serving vulnerable communities continues to play a critical role in controlling cholera outbreaks and improving child health outcomes. I am also grateful to my colleagues and friends who provided moral support, valuable suggestions, and encouragement during the preparation of this research. Lastly, I would like to acknowledge my family for their unwavering support, patience, and encouragement throughout my academic journey.

Ethics approval and consent to participate

This retrospective descriptive analytical study was conducted in accordance with the ethical

Principles of the Declaration of Helsinki and applicable national and institutional requirements governing research involving human participants and the use of routinely collected health information. The study used retrospective secondary data obtained from routine hospital records at Kanyama Level 1 Hospital for children aged (0–18) years who presented with cholera during the study period of (2023–2024). No participants were recruited prospectively, and no direct interaction with patients or their caregivers was undertaken for purposes of data collection.

Consequently, individual written informed consent was not obtained from participants because the study involved the retrospective review of routinely collected hospital records and did not involve direct participant contact. The use of secondary health information was conducted in accordance with the conditions and requirements specified by the relevant ethics and health research authorities.

To protect confidentiality and privacy, the researchers did not extract participants' names, telephone numbers, residential addresses, hospital identification numbers, or other direct personal identifiers. Data were accessed only for the purposes of the approved study and were handled confidentially. The extracted information was stored securely and was not disclosed to unauthorized persons or third parties. Results are presented in aggregate form to minimize the possibility of identifying individual patients.

Consent for publication

Consent for publication was not applicable because this was a retrospective study based exclusively on secondary hospital records and did not involve the collection of identifiable personal narratives, interviews, photographs, or audio recordings. No individual participant is identifiable in the manuscript, and no direct personal identifiers are reported. Findings are

presented

in aggregate form, and any information that could reasonably facilitate identification of individual patients was excluded from the manuscript.

Data availability

The data generated and analyzed during this study are not publicly available because they were obtained retrospectively from routine hospital records and contain potentially sensitive health information relating to children. Public release of the underlying records could compromise patient confidentiality and privacy. De-identified and appropriately aggregated data relevant to the findings may be made available from the corresponding author on reasonable request, subject to approval by the relevant institutional authorities and compliance with the conditions of the University of Lusaka Ethics Committee, the National Health Research Authority, and the Lusaka District Health Office.

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