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Evaluation of access to water, hygiene and sanitation (WASH) in the Lushagala displaced persons camp, Goma, Democratic Republic of the Congo: Compliance with SPHERE standards

Kambale, M. C., Kyomba, K. G., Wembolua, B., Ebolo, F. B., & Ngweme, G. N.

School of Public Health, University of Kinshasa, Kinshasa, Democratic Republic of the Congo

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Correspondence to:
Cornéille Kambale Makombani
corneillemako@gmail.com

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ABSTRACT

Introduction
Access to safe drinking water, hygiene, and sanitation (WASH) is a fundamental human right and a critical public health determinant, particularly in humanitarian emergency settings.

Purpose
This study aimed to assess access to WASH services in the Lushagala displaced persons camp in Goma, Democratic Republic of the Congo (DRC), and to compare the findings with the SPHERE minimum standards in order to identify gaps and inform improvement interventions.

Methods
A descriptive cross-sectional study was conducted from 1 to 31 July 2024 among 446 households selected using a systematic two-stage probability sampling method. Data were collected using KoboCollect and analysed with Stata version 15.0. The study received ethical approval (Approval No. ESP/CE/200/2024) and was conducted after obtaining verbal informed consent from participants.

Results
Average water consumption was 5.9 litres per person per day. Sixty-two per cent of households spent more than 30 minutes collecting water (95% CI: 57.5%–66.5%). The sanitation coverage ratio was 63 people per latrine. Only 6.3% of sanitation facilities (95% CI: 4.0%–8.6%) had a functional handwashing station, and 82% of latrines were poorly maintained (95% CI: 78.4%–85.6%). In addition, 87.7% of households (95% CI: 84.6%–90.8%) reported the presence of solid waste in their household surroundings.

Conclusion
The study reveals critical gaps in access to WASH services in the Lushagala displaced persons camp when compared with SPHERE minimum standards. These findings highlight the urgent need to increase water supply to at least 15 litres per person per day and to address sanitation deficits through the construction of approximately 2,900 additional latrines, thereby reducing the current ratio of 63 people per latrine to the recommended standard of 20 people per latrine. These results provide essential evidence to guide the actions of authorities and humanitarian actors.

INTRODUCTION

Access to safe drinking water, hygiene, and sanitation (WASH) is a fundamental human right and a major determinant of public health. In humanitarian crises, particularly in camps for internally displaced persons (IDPs), these services are often inadequate, exposing populations to increased health risks such as diarrhoeal infections and diseases associated with poor water, hygiene, and sanitation (Kanungo et al., 2021; Sphere Association, 2018; World Health Organization [WHO], 2018).

The Lushagala displaced persons camp, located near the city of Goma in North Kivu Province, has hosted a growing number of displaced people for more than two years following recurrent armed conflict in the region. These populations live in precarious conditions, with limited access to basic services such as drinking water, hygiene, and sanitation. Existing infrastructure is often insufficient, poorly maintained, or entirely absent, thereby exacerbating the risks of waterborne diseases and malnutrition. The situation is particularly concerning as humanitarian interventions, although present, struggle to meet the rapidly increasing needs of the displaced population (Office for the Coordination of Humanitarian Affairs [OCHA], 2024).

According to OCHA, fighting between the March 23 Movement (M23) and government forces intensified on Wednesday, 7 February 2024, particularly around the town of Sake. This escalation significantly restricted humanitarian access to beneficiaries due to insecurity and led to the paralysis of project activities in and around Sake. Several IDP camps, both spontaneous and officially recognised, including Lushagala, Rego, Lac Vert, Buhimba, Nzulo, Rusayo 2, Lwashi, and others, experienced massive influxes of displaced persons. As a result, the number of internally displaced persons in Goma and surrounding areas increased from 1,524,179 to 1,771,692 as of 28 May 2024 (OCHA, 2024).

The resurgence of clashes in the Masisi territory since early January 2024 also led to a significant influx of displaced persons into the town of Bweremana, located approximately ten kilometres from Goma, within the Kirotshe Health Zone. This large-scale displacement further strained already fragile WASH infrastructure, according to the WASH Cluster. For instance, as of 19 January 2024, approximately 110 latrines were available for more than 8,600 households, corresponding to an average of 78 people per latrine, far exceeding the recommended standard of 20 people per latrine. Despite WASH assistance provided by humanitarian actors in Bweremana and neighbouring areas since December 2023, the rapid influx of displaced persons in January 2024 exceeded response capacities, posing serious challenges to the maintenance of acceptable hygiene conditions (Emergency Response Mechanism [ERM], 2024).

The Health Cluster reported approximately 3,390 disease cases in North Kivu Province as of December 2023, including 1,040 suspected cases of cholera recorded between 11 and 17 December, representing the highest weekly number since March 2023. According to health authorities, the majority of cholera cases in the province occurred in IDP camps. The United Nations Children's Fund (UNICEF) reported that suspected cholera cases increased by more than 50 per cent, rising from approximately 1,300 to 2,020 cases between October and November 2023. During the eleventh epidemiological week of 2023, approximately 1,841 cases were recorded in a single week, marking a significant outbreak that notably affected the Lushagala and Bulengo IDP camps. In addition to official epidemiological data, interviews with key informants indicated that the most common illnesses in the camps included malaria, diarrhoea, malnutrition, and acute respiratory infections (UNICEF, 2024, February 20).

Despite interventions by authorities and humanitarian organisations, sanitary conditions in the Lushagala camp remain a major concern. Insufficient access to water, hygiene, and sanitation continues to threaten the health and dignity of displaced populations. Médecins Sans Frontières (MSF) installed a 3.5-kilometre pipeline connecting the Bulengo water treatment plant to Lushagala, with a treatment capacity of 2,000 cubic metres per day. Nevertheless, water availability in the camp remains critically low, with an average of only 5 litres of water available per person per day (MSF, 2023).

Furthermore, more than 83 per cent of displaced households do not have access to private latrines and are forced to share facilities with multiple households. Overcrowding and open defecation significantly increase the risk of environmental contamination and the transmission of diarrhoeal diseases, while hygiene practices remain inadequate (ERM, 2024).

Despite ongoing efforts, persistent cholera outbreaks and critically high latrine-to-user ratios in neighbouring sites, such as the reported 78 people per latrine in January 2024, indicate continued non-compliance with international standards. Existing documentation remains fragmented and lacks a recent, systematic, quantitative assessment explicitly benchmarked against the SPHERE emergency minimum standards for the Lushagala camp as of July 2024. Such an assessment is essential to accurately quantify WASH service deficits and guide the strategic allocation of resources. This study therefore aimed to evaluate access to water, hygiene, and sanitation in the Lushagala displaced persons camp.

METHODS

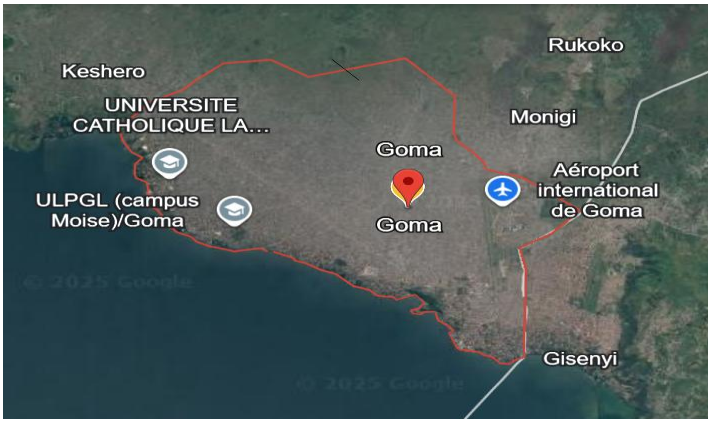
Type and Period of Study

A cross-sectional study using a quantitative approach was conducted from 1 to 31 July 2024.

Description of the Study Site

The study was conducted in the Lushagala displaced persons camp, located in Goma, within the Karisimbi Health Zone, approximately 2 kilometres from Lake Kivu. Established in January 2023, the camp is situated on former lava flows from the Nyiragongo volcano and is characterised by the presence of *mazuku*, pockets of naturally occurring carbon dioxide gas that pose significant health risks. The site is also exposed to multiple hazards, including insecurity, armed violence, fires, and bombardments. At the time of the survey, the camp comprised 239 blocks, approximately 12,000 households, and an estimated population of over 85,000 inhabitants.

Figure 1:
Map Showing the Location of Goma



Inclusion Criteria

Households were eligible for inclusion if they:

1. Had resided in the Lushagala camp for at least one month prior to the survey
2. Were located within one of the 239 camp blocks
3. Included at least one adult aged 18 years or older capable of providing informed consent
4. Had participants present at the time of the survey

Statistical Unit and Study Population

The statistical unit was the household. The study population comprised all households residing in the Lushagala camp at the time of data collection.

Sample Size

The minimum sample size was calculated using the simple random sampling formula, with an assumed proportion (p) of 0.5 to maximise variability, a margin of error (d) of 5%, and a 95% confidence level (Z = 1.96). This yielded a minimum sample size of 384 households. Anticipating a non-response rate of 15% due to the volatile security context, the target sample size was adjusted to 442 households. After data cleaning, a final sample of 446 households was retained for analysis.

Sampling Weighting and Design Effect

The two-stage systematic sampling design was self-weighted, as an equal number of households (four) were selected from each of the 120 sampled blocks. Consequently, each household had an equal probability of selection, and no weighting adjustments were required during descriptive analysis. Given the high proportion of blocks sampled (50%) and the systematic design, the

sample was considered to approximate simple random sampling, and a design effect of 1.0 was assumed for precision estimates.

Sampling Technique

First Stage: Block Selection

Systematic sampling was used to select 120 blocks, representing 50% of the 239 camp blocks, to ensure broad geographical coverage. The sampling interval (k_1) was calculated as 239/120. A random starting point between 1 and 2 was selected, after which blocks were chosen sequentially. Block 105 was excluded due to fire damage.

Second Stage: Household Selection

Within each selected block, four households were chosen using systematic sampling. Based on an estimated average of 50 households per block, the sampling interval (k_2) was calculated as 50/4 = 12. A random starting point between 1 and 12 was selected, and subsequent households were identified by adding the interval sequentially.

Data Collection and Analysis

Data were collected by ten trained local enumerators (seven men and three women) fluent in Swahili and French, all of whom had prior experience in humanitarian surveys. A two-day training session was conducted to standardise data collection procedures and the use of the digital KoboCollect tool. Field supervision was provided by a team leader, and quality control checks were conducted using EpiData version 3.1. Data were cleaned, coded, and analysed using STATA version 15.0, with descriptive statistics including frequencies and means generated.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of the School of Public Health, University of Kinshasa (Approval No. ESP/CE/200/2024). Verbal informed consent was obtained from all participants prior to data collection. This approach was approved by the Ethics Committee to minimise barriers related to illiteracy. Participants were informed about the study objectives, their right to withdraw at any time, and the confidentiality of their information.

Operational Definitions

i. **Sanitation:** Practices and infrastructure used to collect, treat, and dispose of human excreta in a manner that protects public health and the environment.
ii. **Distance to drinking water source:** The physical distance or travel route between the household and the drinking water source.
iii. **Water storage device:** Any container used by a household to store water.
iv. **Drinking water:** Water considered safe for consumption and not harmful to health in the short, medium, or long term, in accordance with physicochemical and microbiological standards.
v. **Basic hygiene practices:** The presence and use of a functional handwashing facility (bucket, jerrycan, tippy-tap, or tap) containing water and a cleansing agent (soap or ash) at key locations, including near the latrine and at the entrance to the shelter or food preparation area.
vi. **Hygiene promotion:** Activities encouraging proper use of water supply, sanitation, and waste disposal facilities among households and communities.
vii. **Adequate latrine maintenance:** A latrine meeting all required criteria, including cleanliness, safe filling level, and the presence of a functional handwashing facility.
viii. **Inadequate latrine maintenance:** A latrine exhibiting one or more of the following conditions: visible faecal contamination, excessive filling level (less than 0.5 metres from the slab), absence of a functional handwashing facility, foul odours, or a high presence of flies.

RESULTS

This section presents the findings of the assessment of access to water, hygiene, and sanitation (WASH) services in the Lushagala displaced persons camp, with the aim of determining compliance with international norms and SPHERE minimum standards.

Socio-demographic Characteristics of Respondents

Table 1 presents the socio-demographic characteristics of respondents residing in the Lushagala displaced persons camp as of July 2024. The majority of respondents originated from the Masisi territory (98.4%), which is

predominantly rural. Most respondents were women (72.2%), and nearly half had no formal education (48.4%). The mean household size was 6.6 persons (SD = 1.9).

Table 1:
Socio-demographic Characteristics of Respondents (n = 446)

Variable	Category	n	%
Position in household	Head of household	140	31.4
	Spouse	272	61.0
	Other	34	7.6
Sex	Male	124	27.8
	Female	322	72.2
Place of origin	Masisi	439	98.4
	Rutshuru	7	1.6
Marital status	Single	33	7.4
	Cohabiting	74	16.6
	Divorced	11	2.5
	Married	269	60.3
	Widowed	59	13.2
Level of education	None	216	48.4
	Primary	112	25.1
	Secondary	115	25.8
	University	3	0.7
Religion	Protestant	247	55.4
	Catholic	82	18.4
	Awakening churches	67	15.0
	Adventist	41	9.2
	Muslim	9	2.0

Access to Drinking Water

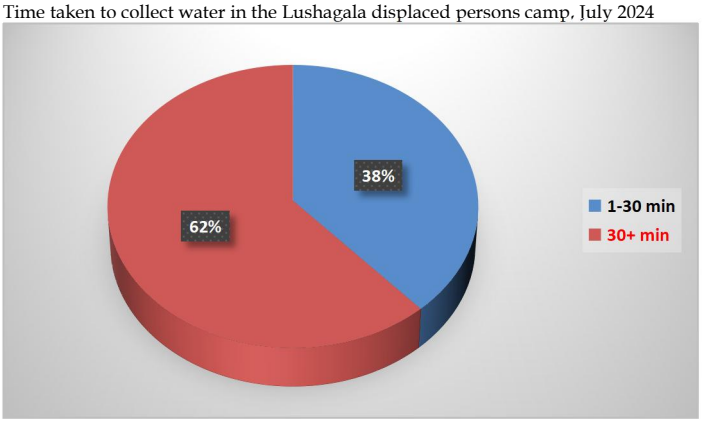
Indicators of Access to Drinking Water

Table 2 summarises the key indicators relating to access to drinking water in the Lushagala camp in July 2024. The average daily water consumption was 5.9 litres per person per day (SD = 3.4). All households relied exclusively on public taps as their primary source of drinking water, and 90.4% lived within 500 metres of a water point. All respondents reported treating water prior to consumption.

Table 2:
Indicators of Access to Drinking Water in Lushagala Camp (n = 446)

Indicator	Category / Statistic	n	%	95% CI
Daily water consumption (L/person/day)	Mean (SD)	5.9 (3.4)	–	5.6–6.2
Main source of drinking water	Public tap	446	100.0	–
Distance to water source (metres)	< 500 m	403	90.4	87.6–93.2
	≥ 500 m	43	9.6	–
Water treatment before use	Yes	446	100.0	–
	No	0	0.0	–
Household water treatment method	Bleach/chlorine	185	41.5	–
	Aquatabs	178	40.0	–
	Boiling	43	9.6	–
	Settling	40	9.0	–

Figure 2:
Time taken to collect water in the Lushagala displaced persons camp, July 2024



Sixty-two per cent of respondents reported spending more than 30 minutes collecting water.

Access to Hygiene and Sanitation

Table 3 presents indicators relating to hygiene and sanitation conditions in the camp. Only 6.3% of latrines had handwashing facilities nearby, and less than half of these had functional soap and water at the time of observation. The majority of latrines (82.1%) were poorly maintained, and solid waste was observed in the yards of 87.7% of households. All respondents reported having received hygiene awareness education.

Table 3:
Indicators of Access to Hygiene and Sanitation in Lushagala Camp (n = 446)

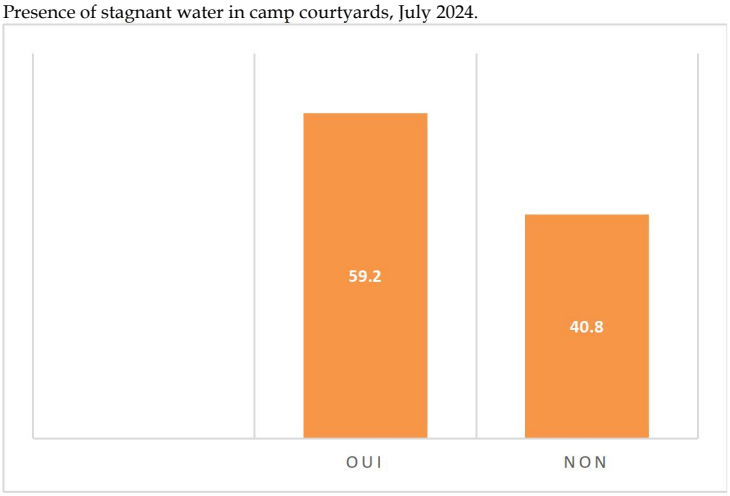
Indicator	Category	n	%	95% CI
Handwashing facility near latrine	Yes	28	6.3	–
	No	418	93.7	–
If present, functional (soap and water)	Yes	13	46.4	4.0–8.6
	No	15	53.6	–
Source of soap	Purchased in camp	308	69.0	–
	Purchased outside camp	62	13.9	–
	Donation	76	17.1	–
Hygiene awareness received	Yes	446	100.0	–
	No	0	0.0	–
Poorly maintained latrines	Yes	366	82.1	78.4–85.6
	No	80	17.9	–
Solid waste in household yard	Yes	391	87.7	84.6–90.8
	No	55	12.3	–

Figure 3;

Presence of handwashing facilities near latrines in Lushagala camp, July 2024

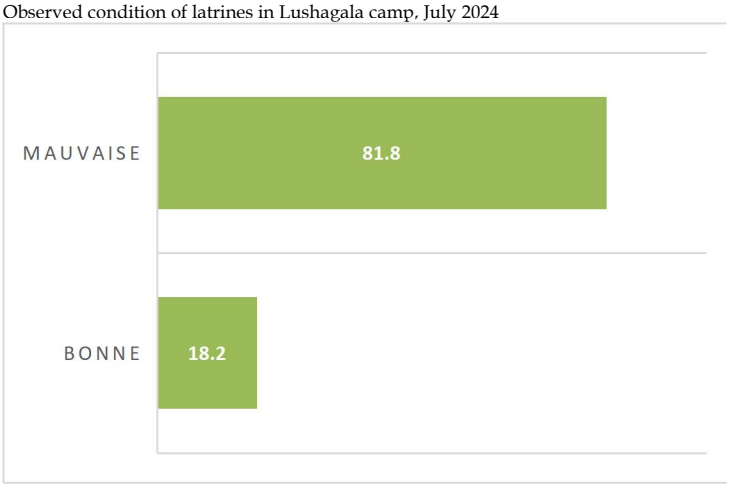
Most latrines lacked adjacent handwashing facilities.

Figure 4:
Presence of stagnant water in camp courtyards, July 2024.



Stagnant water was reported in 59.2% of camp blocks.

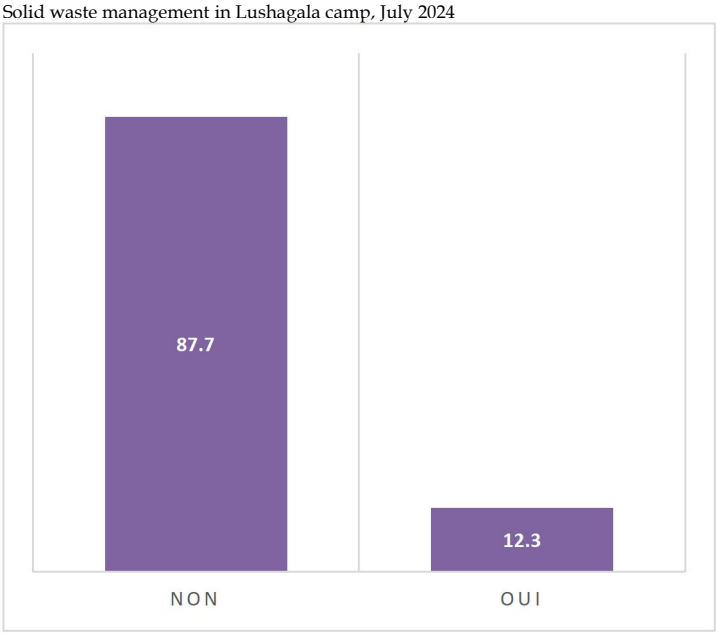
Figure 5:
Observed condition of latrines in Lushagala camp, July 2024



Approximately 82% of latrines were poorly maintained.

Figure 6:

Solid waste management in Lushagala camp, July 2024



Nearly 87.7% of households had solid waste present in their yards.

Compliance with SPHERE Minimum Standards

Table 4 compares observed WASH indicators with SPHERE minimum standards for emergency settings. All assessed indicators showed substantial non-compliance.

Table 4:
Summary of Compliance with SPHERE Minimum Standards

SPHERE Standard	Observed Value (95% CI)	Compliance Assessment
Water consumption: ≥ 15 L/person/day	5.9 L/person/day (5.6–6.2)	Non-compliant (61% deficit)
Water collection time: ≤ 30 minutes	> 30 minutes for 62% of households (57.9–66.5)	Non-compliant
Sanitation coverage: ≤ 20 people/latrine	63 people/latrine	Non-compliant (3.15 times standard)
Functional handwashing facilities: 100%	6.3% (4.0–8.6)	Non-compliant

DISCUSSION

Interpretation of Gaps and Emergency Context

The findings of this study demonstrate a substantial failure to meet SPHERE minimum standards for WASH services in the Lushagala displaced persons camp, despite the statistical robustness of the estimates, as reflected by narrow confidence intervals. Average water consumption of 5.9 litres per person per day represents a 61% deficit relative to the SPHERE emergency standard of 15 litres per person per day (Sphere Association, 2018). Similarly, the average water collection time of 62.2 minutes (95% CI:

57.9–66.5) exceeds the recommended maximum of 30 minutes by more than twofold.

These deficiencies are largely attributable to intense population pressure resulting from repeated and unanticipated influxes of internally displaced persons into the camp. The rapid expansion of the camp population has overwhelmed already fragile infrastructure, resulting in a sanitation coverage ratio of 63 people per latrine, which is more than three times the SPHERE standard of 20 people per latrine in emergency settings. Consequently, all households rely on shared sanitation facilities. The high proportion of poorly maintained latrines (82%) and the extremely low availability of functional handwashing facilities (6.3%) are direct consequences of excessive usage, inadequate maintenance mechanisms, and insufficient management capacity.

Feasibility and Operational Implications

Immediate action is required to address the severe sanitation deficit. Based on an estimated camp population of approximately 85,000 individuals and the observed sanitation ratio of 63 people per latrine, the camp currently has an estimated 1,349 latrines. To comply with the SPHERE standard of 20 people per latrine, approximately 4,250 latrines are required. This implies an urgent need for the construction of at least 2,900 additional latrines.

Beyond infrastructure expansion, targeted operational interventions are essential to mitigate the ongoing public health emergency. Priority actions should include:

1. **Water supply:** Increasing water availability to a minimum of 15 litres per person per day and implementing measures to reduce average water collection time to less than 30 minutes.
2. **Hygiene infrastructure:** Ensuring that 100% of latrine blocks are equipped with functional handwashing facilities containing water and soap or ash.

To promote sustainability, low-cost and community-centred strategies must be implemented. These include the establishment of community-based latrine management and maintenance systems to reduce the high rate of infrastructure degradation, as well as the implementation of community-led total sanitation and hygiene (CLTS) initiatives. Such approaches are particularly relevant given the observation that solid waste was present in the yards of 87.7% of households, reflecting widespread environmental contamination.

Access to Water

Water availability in the Lushagala camp falls far below the SPHERE emergency standard of 15 litres per person per day. Displaced persons access an average of only 6 litres per day, representing a deficit of nearly 60%. This shortfall is primarily due to an insufficient number of functional water distribution points, compounded by sustained population growth, now exceeding 80,000 individuals.

This situation is consistent with historical observations in similar emergency contexts. During the massive influx of Rwandan refugees into Goma in 1994, access to water dropped to as little as 1 litre per person per day due to the sudden scale of displacement and the absence of coordinated WASH actors (Goma Epidemiology Group, 1995; Action Against Hunger [ACF], 2017; Shapna et al., 2023).

Although 90% of households are located within 500 metres of a water source, water access remains problematic due to long waiting times and congestion. The average collection time exceeding 30 minutes is comparable to conditions observed in the Rohingya refugee camps in Cox's Bazar, where individuals often spend one to three hours per day collecting water (Biran et al., 2012; Cronin et al., 2008).

Figure 7:
Water access point in the Lushagala displaced persons camp, July 2024

Access to Sanitary Facilities

The lack of adequate sanitation infrastructure represents a major threat to public health in the camp. Although most facilities are pit latrines with slabs, they are shared by multiple households. On average, 63 individuals use a single latrine, significantly exceeding SPHERE recommendations of a maximum of 20 people per latrine in emergencies and 50 in extreme situations (United Nations High Commissioner for Refugees [UNHCR], 2024; Sphere Association, 2018).

Overuse has resulted in severe deterioration, with approximately 82% of latrines classified as poorly maintained. This level of degradation facilitates pathogen transmission and mirrors conditions observed in the Minawao refugee camp in Cameroon, where latrine deterioration contributed to widespread open defecation (ACF, 2017; Calderón-Villarreal et al., 2022).

Distance also constitutes a major barrier to safe sanitation. More than 85% of households reported latrines located more than 50 metres from their dwellings, in violation of SPHERE standards. This spatial constraint encourages unsafe alternative practices and increases the risk of waterborne and gastrointestinal infections (Nounkeu et al., 2022; Sphere Association, 2018).

In contrast, sanitation facilities in the Bidibidi refugee camp in Uganda were found to be more evenly distributed and accessible, largely due to lower population density and quicker stabilisation of the humanitarian response, unlike the protracted crisis observed in Lushagala (Bako et al., 2021).

Figure 8:
Latrine block and a full latrine in the Lushagala camp, July 2024

Sanitation and Waste Management

Solid waste management in the camp relies predominantly on open-air dumping sites, many of which are saturated. More than 60% of waste disposal sites were reported to be full, and each site serves more than 50 households, far exceeding WHO and UNICEF recommendations of a maximum of 10 households per disposal site. This overcrowding reflects systemic failures in waste management and contributes significantly to environmental degradation and disease transmission (World Health Organization & UNICEF, 2023).

Figure 9:
Waste disposal area in Lushagala camp, July 2024

Limitations of the Study

The exclusion of Block 105, which was damaged by fire in June 2024, introduces a potential selection bias by omitting a possibly more vulnerable subgroup. This exclusion may limit the representativeness of the sample and lead to an underestimation of the true magnitude of WASH needs within the camp.

CONCLUSION

This study reveals critical deficiencies in access to Water, Sanitation, and Hygiene (WASH) services in the Lushagala displaced persons camp when benchmarked against SPHERE minimum standards. The findings highlight an urgent need for targeted, large-scale interventions. The highest priority actions for humanitarian actors and local authorities include:

1. **Water security:** Immediate scaling-up of water supply to reach the emergency minimum of 15 litres per person per day, alongside interventions

to reduce average water collection time to less than 30 minutes.

2. **Public health protection through sanitation:** Implementation of an emergency construction programme for approximately 2,900 additional latrines, each equipped with functional handwashing facilities, to restore the recommended ratio of 20 people per latrine.

Failure to address these gaps will perpetuate preventable morbidity and compromise the dignity of displaced populations.

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Author Contributions

i. **Kambale Makombani Cornéille:** Study design, data collection, data analysis, manuscript drafting.
ii. **Georgette Ngakiama Ngweme:** Scientific supervision, methodological validation, critical manuscript review.
iii. **Gabriel Kyomba Kalombe:** Proofreading and editorial support.
iv. **Bismarck Wembolua:** Data analysis and contribution to the literature review.
v. **Faustin Bolia Ebolo:** Support in manuscript writing.

All authors read and approved the final version of the manuscript.

Ethical Approval: Ethical approval was obtained from the Ethics Committee of the School of Public Health, University of Kinshasa (Approval No. ESP/CE/200/2024)..

Conflicts of Interest: None declared.

ORCID iDs:

Kambale, M. C.: https://orcid.org/0009-0001-7891-7471
Kyomba, K. G.: Nil identified.
Wembolua, B.: https://orcid.org/0009-0007-2070-0994
Ebolo, F. B.: https://orcid.org/0009-0003-9753-3662
Ngweme, G. N.: https://orcid.org/0009-0005-8501-5686

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