



Changes in knowledge, access to services and practices relating to water, hygiene and sanitation in the Beni and Mweso health zones, in the Democratic Republic of the Congo: results of baseline and end-line surveys conducted as part of the PPSSP interventions

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ABSTRACT

This study assessed households' knowledge, access to services and practices regarding water, hygiene and sanitation in the Beni and Mweso health zones in the Democratic Republic of the Congo, in the context of the implementation of WASH interventions under the Primary Health Care Promotion Programme (PPSSP). A descriptive cross-sectional survey was conducted amongst 418 households – 127 in Beni and 291 in Mweso – using a structured questionnaire covering access to water, the availability and treatment of drinking water, handwashing practices, access to latrines, open defecation and episodes of diarrhoea among children under five. The results were also compared with those of the baseline CAP survey to assess changes in the main indicators. A descriptive comparison with an initial CAP survey carried out prior to the main interventions showed a favourable trend in several WASH indicators: 97.1 per cent of households use an improved water source, 78.5 per cent have a sufficient supply of water and 75.8 per cent have access to a latrine. Furthermore, 57.9 per cent of respondents cited at least three key handwashing moments, whilst 35.4 per cent of households have a handwashing facility. However, only 5.0 per cent of households reported treating their drinking water. Open defecation by adults has fallen to 8.6 per cent, but 18.9 per cent of household's report that at least one child under the age of five had suffered from diarrhoea in the two weeks prior to the survey. These findings demonstrate significant progress in access to WASH services, but highlight the need to strengthen hygiene practices, water treatment and behaviour change interventions in order to consolidate these gains and reduce health risks in the long term.

Keywords: WASH; Knowledge, Attitudes and Practices (KAP); Safe drinking water; Hand hygiene; Sanitation; Democratic Republic of the Congo.

1. Introduction

Access to safe drinking water, hygiene and sanitation is a key determinant of public health, human dignity and socio-economic development. Safe and equitable water, sanitation and hygiene (WASH) services help to prevent many infectious diseases, including diarrhoeal diseases, cholera, dysentery and typhoid fever. They are also an essential component of achieving Sustainable Development Goal 6 (SDG 6), which aims to ensure universal access to water and sanitation as well as the sustainable management of water resources (WHO & UNICEF, 2023).

Despite the progress made over recent decades, significant disparities persist in access to WASH services, particularly in

low- and middle-income countries and amongst populations living in situations of poverty, conflict or displacement. According to data from the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, vulnerable populations remain particularly disadvantaged and the current pace of progress is insufficient to meet the targets set for 2030. In Africa, the situation remains a cause for concern: in 2022, only 31 per cent of the population had access to safely managed sanitation services and 28 per cent to basic hygiene services at household level (WHO & UNICEF, 2023).

Inadequate WASH services constitute a major health risk factor. Improving access to safe drinking water, sanitation and hygiene helps to reduce the risk of diarrhoeal diseases and other environment-related infections (WHO, 2023). Scientific evidence shows, in particular, that interventions combining improvements in water quality, sanitation and handwashing with soap can significantly reduce the risk of diarrhoea, particularly among children in low- and middle-income countries (Fewtrell et al., 2005; Wolf et al., 2022). However, the availability of infrastructure does not guarantee its adequate and sustainable use. Hygiene practices, perceptions of risk, social norms, conditions for water storage and handling, and community ownership also play a decisive role (Freeman et al., 2014; WHO, 2023). Assessing knowledge, attitudes and practices (KAP) is therefore essential for understanding people's behaviour and identifying discrepancies between stated knowledge and actual practices.

In the Democratic Republic of the Congo (DRC), challenges relating to water, hygiene and sanitation remain considerable, particularly in rural areas and contexts characterised by poverty, conflict and population displacement. In several provinces in the east of the country, the fragility of social infrastructure and population movements exacerbate difficulties in accessing WASH services and increase the associated health risks (UNICEF DRC, 2023). In the Beni and Mweso health zones, these constraints highlight the need for integrated approaches combining infrastructure development and rehabilitation with the promotion of health-promoting behaviours, the maintenance of facilities and community ownership.

It is against this backdrop that the Primary Health Care Promotion Programme (PPSSP) has implemented WASH interventions in the Beni and Mweso health zones, aimed in particular at improving access to water, sanitation conditions and the adoption of good hygiene practices at household and community level. The evaluation of these interventions was intended to assess the progress made, identify achievements and highlight shortcomings requiring further action.

This study aims to analyse knowledge, attitudes and practices relating to water, hygiene and sanitation in the Beni and Mweso health zones in the Democratic Republic of the Congo. It also aims to compare key WASH indicators between the baseline and end-of-project situations, in order to identify progress made, persistent gaps and the directions needed to strengthen future interventions. The expected results should help to improve the planning and monitoring of WASH interventions, by integrating infrastructure development, health education, social and behavioural change, and community monitoring.

2. Materials and methods

2.1. Context, framework, type and period of the study

The study was conducted in the Beni and Mweso health zones, in North Kivu province, in the Democratic Republic of the Congo (DRC), against a backdrop of a deteriorating security situation linked to armed conflict. This situation has increased the vulnerability of displaced and returned populations, as well as local communities, particularly with regard to access to water, hygiene and sanitation. A descriptive cross-sectional survey on knowledge, access to services and practices relating to water, hygiene and sanitation was carried out in the final phase of the project funded by the US Department of State in March 2026, amongst households benefiting from WASH interventions. It aimed to assess knowledge, attitudes and practices relating to water, hygiene and sanitation, as well as to evaluate access to WASH infrastructure and certain health indicators. The study also sought to compare the key WASH indicators observed in the final survey with those from the initial assessment.

The comparison between the baseline and final situations was based on **two cross-sectional surveys conducted at different times**. The households surveyed during the final assessment were therefore not necessarily the same as those included in the baseline survey. The comparison thus focused on changes in the indicators amongst the populations surveyed at each of the two time points, rather than on individual changes within the same households.

2.2. Study area and target population

The survey was carried out in four health zones: Malepe and Ngilinga in the Beni health zone, and Kashuga and Bukama in the Mweso health zone. The total population of these four health areas was estimated at **198,502 people**, corresponding to **33,082 households**. This included internally displaced persons, returnees and local populations benefiting from the project's interventions.

Table 1: Distribution of the population and households across the health zones

Health zone	Health area	Total population	Total number of households
Beni	Malepe	37,687	6,280
	Ngilinga	26,090	4,348
Mweso	Kashuga	110,582	18,430
	Bukama	24,143	4,024
Total		198,502	33,082

Source: reports from the Beni and Mweso health zones, March 2026

2.3. Sampling, sample size and eligibility criteria

The minimum sample size was determined using the formula for estimating a proportion: $n = Z^2 \times P(1 - P) / d^2$

where n represents the minimum sample size, Z the value corresponding to a 95 per cent confidence level (1.96), P the estimated proportion of the population exhibiting the characteristic under study, and d the acceptable margin of error. In the absence of a prior estimate of the proportion under study, P was set at 0.50 – a value that maximises the sample size – whilst the margin of error was set at 0.05.

Thus:

$$n = (1.96^2 \times 0.50 \times 0.50) / 0.05^2$$

$$n = (3.8416 \times 0.25) / 0.0025 = 384.16$$

The minimum sample size was therefore rounded to **384 households**. Given the large size of the target population (33,082 households) relative to the sample size, no correction for a finite population was applied. The sampling fraction is indeed very small: $384 / 33,082 \approx 1.16$ per cent.

Table 2: Proportional distribution of the sample across health districts

Health area	Health area	Number of households	Proportion (%)	Households to be surveyed
Beni	Malepe	6,280	19.0	73
	Ngilinga	4,348	13.1	50
Mweso	Kashuga	18,430	55.7	214
	Bukama	4,024	12.2	47
Total	-	33,082	100.0	384

The actual distribution of questionnaires may have differed slightly from the theoretical allocation shown in Table 2 due to the number of households actually surveyed during the data collection period. It should be noted that the final results are descriptive of the sample actually surveyed.

Households were selected by simple random sampling from pre-established lists of eligible households in the various health districts. Each eligible household was assigned an identification number, and the numbers corresponding to the households to be surveyed were then selected by manual random draw. Households residing in the selected health areas and having benefited from the WASH project's interventions were eligible. Households that were not beneficiaries or were not residing in the intervention sites at the time of the survey were excluded.

The calculated minimum sample size was 384 households. Upon completion of data collection, 418 complete and valid questionnaires were retained for analysis. The 34 additional questionnaires resulted from continuing data collection beyond the minimum sample size initially required. If a selected household could not be reached after three attempts to contact them, a replacement household was randomly selected from the same sampling frame.

2.4. Data collection tool and procedure

Data were collected using a structured CAP-type questionnaire, adapted from a standardised tool used in humanitarian WASH surveys and tailored to the local context. The questionnaire was administered at household level as a

quantitative tool using smartphones running the **KoboCollect** app.

Data collection was carried out by **independent teams** in order to enhance the objectivity of the process, minimise the risk of bias linked to the project's implementation, and improve the reliability of the results. The data collected were transmitted to the designated server. The data were checked for completeness and consistency before being incorporated into the final analysis database.

The questionnaire included sections covering, in particular, access to an improved water source and sufficient water availability, domestic treatment of drinking water, knowledge of and availability of handwashing facilities, access to latrines and open defecation by adults, and episodes of diarrhoea among children under five. Data were collected from respondents after the survey's objectives had been explained and their consent obtained.

Table 3: Operational definitions of the main WASH indicators analysed

Indicator	Operational definition	Measurement method
Improved water source	Household that primarily uses a water source classified as improved according to the categories set out in the WASH tool (borehole, protected well, protected spring) used for the survey.	Respondent's statement regarding the household's main water source.
Sufficient water availability	Household reporting that it has a sufficient quantity of water to meet the household's essential needs.	Household's response to the CAP questionnaire.
Treatment of drinking water	Household reporting that it uses at least one appropriate method of treating water intended for consumption.	Statement by the respondent on usual treatment practices.
Awareness of key times for handwashing	Respondent able to name at least three key times when handwashing is required.	Multiple-choice question in the CAP questionnaire.

Handwashing facility	Household with a handwashing facility identified during the survey, regardless of whether soap and water are available at the same time.	Observation or respondent's statement, depending on the data collection protocol.
Access to a latrine	Household with a latrine that is accessible and intended for use by its members.	Statement by the respondent and/or observation during the household visit.
Open defecation	The practice of defecating in an open space rather than using a sanitary facility.	Statement by the respondent regarding the practices of household members.
Diarrhoea in children under five	Household reporting an episode of diarrhoea in at least one child under five: a household that reported that at least one child under five living in the household had experienced an episode of diarrhoea during the two weeks preceding the survey, as defined in the questionnaire.	Report by the respondent at household level

2.5. Data processing and analysis

The data were exported, verified, cleaned and analysed using SPSS **version 27.0**. The analysis was primarily descriptive. Qualitative variables were presented as absolute frequencies and proportions, for the entire sample and separately by health zone. The results were presented in tabular form to facilitate their interpretation.

For the main WASH indicators – notably the use of an improved water source, sufficient water availability, knowledge of key handwashing times, the presence of a handwashing facility, access to latrines, open defecation and the incidence of diarrhoea among children under five – the observed frequencies and proportions were calculated. The analysis was descriptive and was based primarily on the calculation of absolute frequencies and proportions.

2.6. Comparison of the baseline and end-line surveys

The initial CAP survey had been carried out before the main project interventions began, using a methodology comparable to that used in the final survey. It covered 384 households in the same health zones. The same operational definitions were used for the indicators selected for comparison.

In order to assess changes in the main WASH indicators over the course of the project's implementation period, the results of the final survey were compared with those of the initial CAP survey. This comparison was based on two cross-sectional surveys carried out at different times. The indicators measured in a comparable manner in both surveys were selected for the analysis. The comparison did not constitute a longitudinal follow-up of the same households, but focused on the differences observed between the indicators measured in the two surveys and did not allow the observed changes to be directly attributed to the project's interventions.

The change in each indicator was expressed in percentage points, using the following formula:

Change (percentage points) = final value – initial value

A positive value indicated an increase in the indicator between the two periods, whilst a negative value indicated a decrease.

2.7. Ethical considerations

The objectives of the survey were explained to respondents and their free and informed consent was obtained prior to data collection. Participation was voluntary, and the confidentiality and anonymity of the information collected were guaranteed throughout the process.

3. Presentation of results

Table 4: Access to an improved water source and sufficient water availability

Health zone	N	Improved water source n (%)	Sufficient water n (%)
Beni	127	115 (90.6)	110 (86.6)
Mweso	291	291 (100.0)	218 (74.9)
Total	418	406 (97.1)	328 (78.5)

This table shows that 406 out of 418 households (97.1 per cent) used an improved water source. This proportion was 100.0 per cent in Mweso (291/291) compared with 90.6 per cent in Beni (115/127). With regard to water availability, 328 out of 418 households (78.5 per cent) reported having sufficient water to meet their basic needs. This proportion was

higher in Beni (86.6 per cent; 110/127) than in Mweso (74.9 per cent; 218/291).

Table 5: Domestic treatment of drinking water

Domestic water treatment	N	%
Treats drinking water	21	5.0
Does not treat drinking water	397	95.0
Total	418	100.0

This table shows that, of the 418 households surveyed, 21 (5.0 per cent) reported treating their drinking water, compared with 397 (95.0 per cent) who did not.

Table 6: Knowledge of and availability of handwashing facilities

Health zone	N	≥3 key moments n (%)	Handwashing facilities n (%)
Beni	127	53 (41.7)	68 (53.5)
Mweso	291	189 (64.9)	80 (27.5)
Total	418	242 (57.9)	148 (35.4)

This table shows that, of the 418 households surveyed, 242 respondents (57.9 per cent) were able to name at least three key times when handwashing is required. This proportion was higher in the Mweso health zone (64.9 per cent; 189/291) than in the Beni health zone (41.7 per cent; 53/127). In contrast, the presence of a handwashing facility was reported in 148 households (35.4 per cent) in total. This proportion was significantly higher in Beni (53.5 per cent; 68/127) than in Mweso (27.5 per cent; 80/291).

Table 7: Access to latrines and open defecation among adults

Health zone	N	Access to a latrine n (%)	Open defecation by adults n (%)
Beni	127	115 (90.6)	11 (8.7)
Mweso	291	202 (69.4)	25 (8.6)
Total	418	317 (75.8)	36 (8.6)

This table shows that 317 of the 418 households surveyed (75.8 per cent) reported having access to a latrine. This proportion was higher in the Beni health zone, where it stood at 90.6 per cent (115/127), compared with 69.4 per cent (202/291) in Mweso. Furthermore, open defecation by adults was reported in 36 households (8.6 per cent) across the entire sample. The proportions observed were similar between the two health zones, at 8.7 per cent in Beni (11/127) and 8.6 per cent in Mweso (25/291).

Table 8: Households reporting an episode of diarrhoea in at least one child under five

Health zone	N	Diarrhoea in children under 5 n (%)
Beni	127	27 (21.3)
Mweso	291	52 (17.9)
Total	418	79 (18.9)

This table shows that, of the 418 households surveyed, 79 (18.9 per cent) reported that at least one child under the age of five had experienced an episode of diarrhoea in the two weeks prior to the survey. This proportion was 21.3 per cent in Beni (27/127) and 17.9 per cent in Mweso (52/291).

Table 9: Changes in key WASH indicators between the initial CAP and the final CAP

Indicator	Initial CAP	Final CAP	Change in percentage points
Improved water source	79.0 per cent	97.1 per cent	+18.1 percentage points
Sufficient water	18.9%	78.5%	+59.6 percentage points
Access to a latrine	41.4%	75.8%	+34.4 percentage points
≥3 key handwashing moments	33.0%	57.9	+24.9 percentage points
Handwashing facility	8.1%	35.4%	+27.3 percentage points
Open defecation by adults	19.0%	8.6%	-10.4 percentage points

This table shows that a comparison of WASH indicators between the initial CAP survey and the final CAP survey reveals a positive trend in several indicators. The proportion of households using an improved water source rose from 79.0 per cent to 97.1 per cent, an increase of 18.1 percentage points. Sufficient water availability recorded the greatest increase, rising from 18.9 per cent to 78.5 per cent, an increase of 59.6 percentage points. Access to a latrine rose from 41.4 per cent to 75.8 per cent, corresponding to an increase of 34.4 percentage points. The proportion of respondents able to name at least three key times for handwashing rose from 33.0 per cent to 57.9 per cent, an increase of 24.9 percentage points, whilst the availability of handwashing facilities rose from 8.1 per cent to 35.4 per cent, an increase of 27.3 percentage points. Furthermore, the proportion of households reporting open defecation by adults fell from 19.0 per cent to 8.6 per cent, a reduction of 10.4 percentage points. Overall, the comparable indicators show favourable trends between the two survey periods, although levels remain relatively low for certain indicators, notably the availability of handwashing facilities.

4. Discussion

The results of this study show a generally favourable trend in the main indicators relating to water, hygiene and sanitation (WASH) in the Beni and Mweso health zones. Progress has been made in particular regarding access to improved water sources, sufficient water availability, access to latrines, knowledge of handwashing and the reduction in open defecation. However, these improvements vary depending on the specific aspects of WASH and the health zones. The findings highlight, in particular, a disconnect between access to infrastructure, knowledge and the actual adoption of hygiene practices, which poses a significant challenge to the consolidation of the gains made.

4.1. Access to and availability of water

97.1 per cent of households surveyed used an improved water source, with coverage of 100.0 per cent in Mweso and 90.6 per cent in Beni. This high level reflects good coverage of households by sources meeting the improvement criteria used in WASH monitoring. This is consistent with the guidelines of the WHO/UNICEF Joint Monitoring Programme for Water, Sanitation and Hygiene (JMP), which considers access to water to be a central aspect of SDG 6, whilst emphasising the need to also consider its availability, accessibility and safety (WHO & UNICEF, 2023). The JMP report also points out that global progress towards universal access to safe WASH services remains insufficient, particularly amongst vulnerable populations.

However, the use of an improved water source alone does not guarantee the quality of the water consumed. Contamination can occur during transport, storage or handling at the household level. This distinction is important in the present study, as **only 5.0 per cent of households reported treating their drinking water**. The work of Prüss-Ustün et al. (2019) also highlights that WASH-related health risks do not depend solely on the presence of infrastructure, but on the actual quality of the services available and in use.

Sufficient water availability, estimated at **78.5 per cent**, was also lower than the proportion of households using an improved water source. This discrepancy shows that the existence of a water source does not necessarily guarantee a sufficient quantity of water to meet household needs. The situation differed between the two areas: Beni had a higher rate of sufficient water availability (86.6 per cent) despite lower coverage of improved water sources, whilst Mweso achieved 100.0 per cent for improved water sources but only 74.9 per cent for sufficient availability. This discrepancy

could be linked to infrastructure capacity, distance, waiting time or the quantity actually available at the time of collection.

The improvement between the two surveys is particularly significant: sufficient water availability rose from **18.9 per cent to 78.5 per cent**, an increase of 59.6 percentage points. The use of an improved water source has also risen from 79.0 per cent to 97.1 per cent. These results represent a positive trend and are consistent with the literature, which shows that improved water services are a key determinant in reducing WASH-related health risks (Fewtrell et al., 2005; Prüss-Ustün et al., 2019).

4.2. Domestic water treatment: a priority challenge

Despite high coverage of improved water sources, **only 5.0 per cent of households reported treating their drinking water**. This finding represents one of the main gaps in the study and highlights a disconnect between access to an improved water source and the practices required to maintain water quality right up to the point of consumption.

This situation is particularly significant from a public health perspective. Prüss-Ustün et al. (2019) demonstrated that inadequate water, sanitation and hygiene services remain associated with a significant burden of preventable diseases, particularly in low- and middle-income countries. Similarly, Fewtrell et al. (2005), based on a meta-analysis of numerous studies, demonstrated that interventions targeting water, sanitation and hygiene can help reduce diarrhoeal diseases. More recent work by Wolf et al. (2022), however, emphasises that the extent of the health benefit depends on the actual level of service achieved, which reinforces the importance of not limiting the assessment to the mere presence of an improved water source.

Several factors could explain the low uptake of domestic water treatment in the households studied: the availability or cost of treatment products, the acceptability of the methods, the perception that the water is already sufficiently safe because it comes from an improved source, or a lack of practical awareness. These hypotheses should be explored in greater depth through qualitative investigations.

4.3. Hygiene: improving knowledge but still limited practices

The proportion of respondents able to name at least three key times for handwashing rose from **33.0 per cent to 57.9 per cent**, an increase of 24.9 percentage points. The proportion was higher in Mweso (64.9 per cent) than in Beni (41.7 per cent). This increase reflects improved knowledge, but it also

shows that a significant proportion of respondents did not yet have a sufficient grasp of the key times for handwashing.

These findings are consistent with those of **Freeman et al. (2014)**, whose international systematic review shows that handwashing remains under practised in many settings, despite its importance in preventing diarrhoeal diseases. Their analysis highlights, in particular, that knowledge of good hygiene practices does not guarantee their systematic implementation.

The availability of handwashing facilities has also increased, rising from **8.1 per cent to 35.4 per cent** – an increase of 27.3 percentage points. Despite this improvement, the level remains relatively low. The comparison between Beni and Mweso is particularly interesting: Beni had better availability of facilities (53.5 per cent), whilst Mweso showed better knowledge (64.9 per cent). This discrepancy shows that **knowledge and physical availability do not necessarily progress at the same rate**.

This finding is consistent with the work of Freeman et al. (2014), who highlight the persistent gap between knowledge, intentions and actual behaviour regarding handwashing. It is also in line with international data from the JMP, which show that access to handwashing facilities with soap and water remains inadequate in many communities (WHO & UNICEF, 2023).

The main challenge is therefore no longer simply to convey messages, but to create an environment that enables their daily application. Interventions should combine **awareness-raising, the availability of water and soap, the installation of simple and accessible facilities, and monitoring of their actual use**.

4.4. Sanitation and the reduction of open defecation

Access to a latrine was reported by **75.8 per cent of households**, with a notable difference between Beni (90.6 per cent) and Mweso (69.4 per cent). Despite this disparity, the trend over time is positive, as access to latrines has risen from 41.4 per cent to 75.8 per cent, representing an increase of 34.4 percentage points.

At the same time, open defecation by adults fell from **19.0 per cent to 8.6 per cent**, a reduction of 10.4 percentage points. This trend is a positive outcome, as it reflects a decrease in the proportion of households reporting open defecation by adults.

These findings are consistent with the work of **Fewtrell et al. (2005)**, who demonstrated that WASH interventions, particularly those focusing on sanitation, can help reduce

diarrhoeal diseases. They are also in line with the work of **Wolf et al. (2022)**, who emphasise that the level of sanitation service achieved is a key determinant of the impact on health.

However, nearly one in four households still reported no access to a latrine, and open defecation persisted in 8.6 per cent of households. These results show that **the availability of infrastructure must be accompanied by measures to promote its effective use, maintenance and acceptance**. Sanitation should therefore be addressed from both an infrastructural and a behavioural perspective.

4.5. Episodes of diarrhoea among children under five

An episode of diarrhoea during the two weeks preceding the survey was reported in 18.9 per cent of the households surveyed; that is, 79 out of 418 households reported that at least one child under five had experienced an episode of diarrhoea. This proportion was 21.3 per cent in Beni and 17.9 per cent in Mweso. As this indicator is calculated at household level, it does not constitute an estimate of the individual prevalence of diarrhoea among children under five.

This data must be interpreted with caution, as it is based on household self-reporting and does not allow for the determination of the total number of children under five at risk, nor the individual number of children who have experienced diarrhoea. It nevertheless serves as a descriptive indicator of the frequency with which households report an episode of diarrhoea in at least one child under five

The literature confirms the role of WASH conditions in this issue. **Prüss-Ustün et al. (2019)** demonstrated that inadequate WASH services contribute significantly to the global burden of disease, whilst **Wolf et al. (2022)**, in a systematic review and meta-analysis of 124 WASH interventions, confirmed that improvements in water, sanitation and handwashing are associated with a reduced risk of diarrhoea among children in low- and middle-income countries.

The persistence of reported cases of diarrhoea despite **97.1 per cent coverage of improved water sources** and **75.8 per cent access to latrines** is therefore particularly instructive. It suggests that infrastructure improvements alone are not sufficient to eliminate health risks. Water quality at the point of consumption, water storage, hand hygiene, food handling, latrine maintenance and general environmental conditions may continue to facilitate the transmission of infectious agents.

This observation is also consistent with the findings of **Fewtrell et al. (2005)**, who emphasise the importance of the various components of WASH in the prevention of diarrhoeal

diseases. It thus reinforces the relevance of an integrated approach rather than interventions limited to a single component.

4.6. Changes in indicators between the initial CAP and the final CAP

The indicators measured during the final survey were generally more favourable than those observed during the initial survey, with particularly marked improvements in the adequate availability of water (+59.6 points), access to latrines (+34.4 points), the availability of handwashing facilities (+27.3 points) and knowledge of key handwashing times (+24.9 points). The proportion of households using an improved water source also rose from 79.0 per cent to 97.1 per cent, an increase of 18.1 percentage points. At the same time, open defecation among adults fell from 19.0 per cent to 8.6 per cent, a reduction of 10.4 percentage points.

This positive trend is in line with international guidelines aimed at progressively improving access to WASH services under SDG 6. The JMP report nevertheless highlights that, despite the progress made, the world remains off track to achieve the universal targets for access to water, sanitation and hygiene by 2030 (WHO & UNICEF, 2023).

The findings of this study are therefore encouraging in the specific context of Beni and Mweso, but they should not lead to the conclusion that the WASH targets have been met. The final figures still reveal significant shortcomings, particularly regarding domestic water treatment (5.0 per cent) and the availability of handwashing facilities (35.4 per cent). This situation is consistent with the findings of Wolf et al. (2022), according to whom the health effects of interventions depend on the actual level of service achieved. In other words, moving from a situation with no service to an improved water source constitutes significant progress, but the potential health impact is greater when water is available, accessible and safe, and when the other components of WASH are also in place.

These results must, however, be interpreted with caution, as both surveys were cross-sectional and did not necessarily cover the same households. They therefore describe changes in the indicators between two observation periods, without allowing the observed changes to be directly attributed to the project's interventions. The changes noted occurred during the period when the WASH interventions were being implemented; however, the cross-sectional design of the two surveys and the lack of follow-up with the same households mean that it is not possible to establish a causal link between the interventions and the changes observed.

4.7. Overall assessment and implications for interventions

Taken as a whole, the results show a generally positive but mixed picture. Access to WASH infrastructure and services improved significantly between the two survey periods, but this improvement was not matched to the same extent by the adoption of domestic prevention practices. The contrast is particularly striking between the use of an improved water source, observed in 97.1 per cent of households, and the domestic treatment of drinking water, reported by only 5.0 per cent of households. Similarly, whilst 57.9 per cent of respondents were able to name at least three key times for handwashing, only 35.4 per cent of households had a handwashing facility.

These discrepancies highlight a disconnect between access to infrastructure, knowledge and the actual adoption of hygiene practices. They suggest that improving the physical environment is a necessary, but not sufficient, condition for achieving sustainable WASH behaviours. The existence of an improved water source or a latrine does not necessarily guarantee safe and regular use, any more than a correct understanding of the key times for handwashing guarantees the availability of the means to put this knowledge into practice. This observation is directly in line with the findings of **Freeman et al. (2014)**, who show that handwashing remains generally under practised despite awareness of its importance. It is also consistent with **Wolf et al. (2022)**, who emphasise the value of integrated WASH interventions and higher service levels in achieving greater health benefits.

This disconnect between access, knowledge and practices poses a significant challenge to the consolidation of WASH achievements. It highlights the need to combine infrastructure interventions with approaches aimed at social and behavioural change, as well as ensuring the effective availability of the resources necessary for the adoption of recommended practices.

Future priorities should therefore focus not only on consolidating infrastructure, but also on **the treatment and safe storage of water, access to soap, the installation and maintenance of handwashing facilities, the effective use of latrines and the sustainable reduction of open defecation**. This approach is also consistent with that of the JMP, which now views WASH through the lens of multiple service dimensions rather than solely in terms of the presence of infrastructure.

In the specific context of Beni and Mweso, characterised by the vulnerability of the populations, the sustainability of the gains achieved is ultimately a major challenge. WASH

interventions should therefore combine infrastructure investment **with community mobilisation, social and behavioural change, regular monitoring of practices and the maintenance of facilities**. This integrated approach appears all the more relevant given that the literature shows that the health benefits of WASH depend on the quality and effective use of available services (Fewtrell et al., 2005; Prüss-Ustün et al., 2019; Wolf et al., 2022).

Conclusion

This study has highlighted an overall favourable trend in water, hygiene and sanitation (WASH) conditions in the health zones studied in Beni and Mweso. A comparison between the baseline and end-line CAP surveys shows significant progress, particularly in terms of sufficient water availability, which rose from 18.9 per cent to 78.5 per cent; the use of an improved water source, which rose from 79.0 per cent to 97.1 per cent; and access to latrines, which rose from 41.4 per cent to 75.8 per cent. Awareness of key handwashing times and a reduction in open defecation by adults also indicate a positive trend.

Despite these gains, several significant gaps remain. Domestic water treatment remains particularly low (5.0 per cent), whilst only 35.4 per cent of households had a handwashing facility. The persistence of open defecation (8.6 per cent) and the proportion of households reporting that at least one child under five had suffered from diarrhoea in the two weeks prior to the survey (18.9 per cent) show that improved access to infrastructure alone is not sufficient to guarantee safe and sustainable WASH practices. These findings are consistent with those of Prüss-Ustün et al. (2019), Freeman et al. (2014) and Wolf et al. (2022), who emphasise the importance of an integrated approach combining access to services, hygienic behaviour and a supportive environment.

The findings therefore call for the consolidation of WASH gains through the strengthening of water treatment and safe storage, the promotion of handwashing with soap and water, the use and maintenance of latrines, and the continuation of awareness-raising and social and behavioural change activities. In the vulnerable contexts of Beni and Mweso, the sustainability of the results will also depend on the functionality of the infrastructure, community ownership of it, and regular monitoring of practices.

Finally, although the trends observed between the two surveys are encouraging, their cross-cutting and independent nature means that the changes cannot be directly attributed to the project alone. Nevertheless, they reflect a positive trend in WASH indicators, whilst highlighting areas where further

efforts are still needed to transform the progress made into sustainable improvements in the health and well-being of the population.

References

- Fewtrell, L., Kaufmann, R. B., Kay, D., Enanoria, W., Haller, L., & Colford, J. M., Jr. (2005). Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: A systematic review and meta-analysis. *The Lancet Infectious Diseases*, 5(1), 42–52. [https://doi.org/10.1016/S1473-3099\(04\)01253-8](https://doi.org/10.1016/S1473-3099(04)01253-8)
- Freeman, M. C., Stocks, M. E., Cumming, O., Jeandron, A., Higgins, J. P. T., Wolf, J., Prüss-Ustün, A., Bonjour, S., Hunter, P. R., Fewtrell, L., & Curtis, V. (2014). Hygiene and health: Systematic review of handwashing practices worldwide and update of health effects. *Tropical Medicine & International Health*, 19(8), 906–916. <https://doi.org/10.1111/tmi.12339>
- Prüss-Ustün, A., Wolf, J., Bartram, J., Clasen, T., Cumming, O., Freeman, M. C., Gordon, B., Hunter, P. R., Medlicott, K., & Johnston, R. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. *International Journal of Hygiene and Environmental Health*, 222(5), 765–777. <https://doi.org/10.1016/j.ijheh.2019.05.004>
- Wolf, J., Hubbard, S., Brauer, M., Ambelu, A., Arnold, B. F., Bain, R., Bauza, V., Brown, J., Caruso, B. A., Clasen, T., Colford, J. M., Jr., Freeman, M. C., Gordon, B., Johnston, R. B., Medlicott, K., Prüss-Ustün, A., & Boisson, S. (2022). Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on the risk of diarrhoeal disease in children in low- and middle-income settings: A systematic review and meta-analysis. *The Lancet*, 400(10345), 48–59. [https://doi.org/10.1016/S0140-6736\(22\)00937-0](https://doi.org/10.1016/S0140-6736(22)00937-0)
- World Health Organization. (7 March 2024). *Diarrhoeal disease*. <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>
- World Health Organisation. (13 September 2023). *Drinking water*. <https://www.who.int/news-room/fact-sheets/detail/drinking-water>
- World Health Organisation. (2024). *Guidelines for drinking-water quality: Small water supplies*. <https://www.who.int/publications/i/item/9789240088740>
- World Health Organisation and United Nations Children’s Fund. (2021). *Progress on household drinking water, sanitation and hygiene 2000–2020: Five years into the SDGs*. World Health Organisation. <https://www.who.int/publications/i/item/9789240030848>
- World Health Organisation and United Nations Children’s Fund. (2023). *Progress on household drinking water, sanitation and hygiene 2000–2022: Special focus on gender*. World Health Organisation. <https://www.who.int/publications/i/item/9789240076921>
- World Health Organisation and United Nations Children’s Fund. (2025). *Progress on household drinking water, sanitation and hygiene 2000–2024: Special focus on inequalities*. World Health Organisation. <https://www.who.int/publications/i/item/9789240115149>