water

MDPI

Article

Evaluating Equity and Inclusion in Access to Water and Sanitation for Persons Living with HIV/AIDS in Wukro, Ethiopia

Ruben Jimenez-Redal [1,*], Natalie Holowko [2], Jabier Almandoz [1], Javier Soriano [3], Francisco Arregui [3] and Francesc Magrinya [4]

1 Faculty of Engineering, UPV-EHU, 20018 San Sebastian, Spain; jabier.almandoz@ehu.eus
2 Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, 17177 Stockholm, Sweden; natalie.holowko@ki.se
3 ITA Instituto Tecnológico del Agua, Polytechnic University of Valencia, 46022 Valencia, Spain; jasool@ita.upv.es (J.S.); farregui@ita.upv.es (F.A.)
4 Department of Civil and Environmental Engineering, Universitat Politecnica de Catalunya, 08034 Barcelona, Spain; francesc.magrinya@upc.edu
* Correspondence: ruben.jimenez.redal@outlook.com; Tel.: +34-94-601-7280

Received: 31 July 2018; Accepted: 11 September 2018; Published: 13 September 2018

Abstract: For more than a decade, foreign aid-supported water interventions focusing on an increase in household private connections have been implemented in the small urban center of Wukro. However, little has been investigated about the effectiveness of these interventions in achieving equitable and inclusive access to water and sanitation for all, including the most vulnerable. With this purpose, a cross-sectional comparative analysis of service provision between the HIV-infected population (n = 199) and non-infected population (n = 199) was undertaken. Findings suggest significant inequalities regarding the primary water source, monthly expenditure in water, water consumption, and time employed to fetch water, as well as the type of toilet facility, number of users, and the time employed to access it. Results also show a reported feeling of discrimination with regard to service provision within the HIV-positive population. This study provides evidence on local-scale interventions increasing the number of household water connections but overlooking the pursuit of equity and inclusion for the most vulnerable. The study also presents recommendations on how to specifically target the needs of persons living with HIV/AIDS in order to achieve equitable and inclusive access to water and sanitation for all.

Keywords: equity; inclusion; water intervention; sanitation intervention; PLWHA

1. Introduction

Inequities and exclusion in access to water and sanitation have been ranked as one of the great moral and technological challenges in global health [1].

Aware of this challenge, in 2010 the United Nations General Assembly formally acknowledged water and sanitation as human rights [2]. The intention was to encourage the international community to enhance its efforts towards making access to water and sanitation a reality for everyone [3]. This event became pivotal in laying the foundations of the Sustainable Development Goals (SDGs) targets on universal water, sanitation, and hygiene (WASH) services.

On 1 January 2016, the SDGs officially came into force within the 2030 Agenda for Sustainable Development [4]. The Goals call for global action to mobilize efforts to end poverty and fight inequalities by 2030. The SDGs embrace a philosophy of social inclusion [5–7], and they pay special attention to areas of high vulnerability [8]. The SDGs present a new approach to development

interventions, and water interventions in particular. This new approach not only demands that services are available, affordable, acceptable, accessible, and safe, but also requires a focus on equality, non-discrimination, and accountability for participation [9,10]. Interventions must ensure that the most disadvantaged, marginalized, and discriminated against are targeted by service providers [11]. Hence, equity and inclusion emerge as core elements of the human-rights-based approach to water and sanitation [12,13].

However, to date, there has been limited investigation on effectively assessing equity and inclusion in WASH interventions [14]. Further, current indicators target only certain components of the right to water [15], such as physical accessibility [16,17], but fail to monitor other aspects related to inequalities and discrimination within the standards of the UN 2030 Development Agenda. Progressive realization of the human right to water and sanitation requires new metrics to measure disparities in access to water and sanitation [14].

The aim of this investigation is to evaluate equity and inclusion in access to water and sanitation for persons living with HIV/AIDS (PLWHA) in the small urban center of Wukro, Ethiopia. The authors compare disparities in service provision between HIV-positive and HIV-negative populations and assess the effectiveness of water interventions in achieving equitable and inclusive outcomes. The vulnerable group of PLWHA was examined as it is particularly sensitive to the social and health impacts of insufficient water and inadequate sanitation [18–23].

Following the introduction, we describe the study area, sample frame, and data collection strategy employed in the investigation. We then present our methodology for a comparative analysis through an in-person survey (n = 398), focus group discussions, and water system mapping. Findings show significant inequalities in access to water and sanitation between the HIV-positive and HIV-negative populations as well as a reported feeling of discrimination. We conclude with discussions of these findings. Additional analyses related to water and sanitation disparities between the two groups are provided in Appendix A.

2. Materials and Methods

2.1. Study Area

Wukro is a small urban center located in the Tigray administrative region in the north of Ethiopia. It lies on the latitude 13°47′59″ N and longitude 39°35′59″ E, at an elevation of 1997 m above sea level [24]. Water supply to Wukro depends largely on groundwater abstraction from deep aquifers. Although the annual rainfall is estimated at 565 mm [25], the rainy season is heavily concentrated from July to September, and surface water sources are scarce. The Wukro water supply system consists of a branched distribution network serving approximately 35,000 residents [26] through private household connections and public standpipes.

From 2003 to 2014, a large proportion of overseas development assistance for water and sanitation in Wukro was framed within a needs-based approach, focusing on water supply network extension and the promotion of household private water connections. Local and international agents designed such interventions aiming to increase water coverage in absolute terms, regardless of the socio-economic circumstances [27].

2.2. Data Collection Strategies

In January 2013, quantitative and qualitative data were collected from four different sources; focus group discussions, interviews with the heads of households and key informants, and a technical assessment of both the water and sanitation systems.

Qualitative information was gathered through three separate focus group discussions, which were held at an early stage of the process in order to specify and prioritise the questions included in the survey. For the first focus group discussion, ten participants were selected from a cooperative for HIV-positive farmers. For the second discussion, ten participants were recruited at a construction

cooperative for HIV-positive workers. The third focus group comprised of ten participants from the Wukro association of home-based carers of PLWHA.

Structured interviews were also held with key informants at the Wukro Social Welfare office. These key informants were selected among water technicians responsible for the management and maintenance of the water systems, social workers involved in providing training to PLWHA, medical practitioners in charge of caring for HIV-positive patients, and local authorities. The requested information was related to the organisation and management of water and sanitation resources covering the needs of the HIV-positive population. An extensive review of documentary material [5,28–32] was also used to prepare the survey questionnaire.

Quantitative information was gathered through a formal, in-person survey conducted with 398 heads of households, half of whom were HIV-positive. The group of non-infected persons were interviewed at their homesteads by trained university students, while the self-reported HIV-positive individuals were interviewed at the Social Welfare office by trained members of the local association of PLWHA. The survey comprised of close-ended questions related to water, sanitation, and hygiene. All respondents were informed about the purpose of the survey and verbally gave their informed consent. Respondents were informed that they were free to terminate the interview at any time and were assured that their answers would remain anonymous.

A technical assessment of the water distribution system and public sanitation facilities included visits to monitor the condition and functionality of the infrastructures as well as an in-depth review of billing archives. Collected data were used to simulate hydraulic models through EPANET software. The objective was to analyse whether the water pressure and yield were supplied consistently across all the residential areas. GIS Mapping was also employed in the study in order to geolocate public facilities and cross-check their location with demographic data from the survey. This process exposes service disparities within the studied suburbs.

2.2.1. Sampling Strategy

The focus of this research is limited to the case of Wukro, which results in a small sample size. Accordingly, the sample population, sampling techniques, and data collection methodologies were designed to match the research objectives within the context and resources available. The survey was conducted combining two differentiated sampling techniques. For the interviews with HIV-negative heads of households, a systematic sampling approach was undertaken. The city was subdivided into suburbs, and each suburb was subdivided into zones of similar population density. Interviewers undertook a set number of interviews for each zone, randomly selecting households. For the interviews with the HIV-positive population, a purposive homogeneous sampling approach was adopted. The research team established contact with a local association of PLWHA. Firstly, a group of eight active members of this association were trained to act as interviewers. Secondly, 199 volunteer participants from within the local association of PLWHA were interviewed.

2.2.2. Variables

This comparative cross-sectional study uses primary data collected from two sample groups, HIV-positive (n = 199) and HIV-negative (n = 199) populations. Demographic and socioeconomic data were collected from all survey respondents by asking about the location of their home, their gender, age, marital status, level of education, occupation at the time of the survey, and monthly income. Responses were categorized as indicated in Table A1.

"Water availability" was measured by asking about daily water consumption in the home; the number of days of water shortage experienced per month at their main source of water; the alternative source of water they use to cope with increased water needs; and options utilized to save water in case of shortage. The survey responses for these variables were established within the focus group discussions and were supervised and approved by key informants. "Accessibility to water" was measured by asking beneficiaries about their primary source of drinking water and the time spent

fetching water per day. "Acceptability of water" refers to the degree of water quality the households were prepared to accept. "Water quality" was measured by asking users about the types of water treatment they use at home and the method used to store water at home, given that water storage is a possible source of contamination. "Affordability" was measured by asking heads of households about their monthly expenditure for water.

"Accessibility to sanitation" was measured through the following three variables: The type of toilet facility available at the homestead; how long it takes to access sanitation facilities; and the number of persons sharing the toilet facility. "Hygiene practices" were measured by asking respondents about the frequency of bathing and the reason for this, and whether they had received training in hygiene practices.

In addition, a number of questions were asked specifically to respondents who were HIV-positive. HIV status-related variables were measured by asking respondents about the number of years since they had been informed about their HIV status, their use of anti-retroviral treatment (ART), and the duration of this treatment. Additional requirements of water and sanitation facilities were measured for the HIV-positive sample. Respondents were asked about the additional volume of water they required since their HIV-positive diagnosis. In the same line, surveyors enquired about increased frequency of toilet usage per day post-diagnosis. Respondents were also asked about the additional volume of water they required during episodes of diarrhoea. "Sense of discrimination" was assessed by asking respondents the following three questions: Whether respondents felt discriminated against by service providers; whether they were prevented from collecting water from public facilities due to their HIV status; and whether they had been prevented from using public sanitation facilities.

2.3. Data Analysis Framework

This study addresses equity by evaluating inequalities in water and sanitation service provision for the vulnerable group of PLWHA. This includes identifying specific service requirements, identifying barriers to access in the built environment, and evaluating the allocation of targeted resources for vulnerable groups in the water and sanitation services.

Inclusion is addressed by assessing the empowerment of PLWHA to engage in organisational processes of water and sanitation interventions. The study investigated the participation of PLWHA in the planning, managing, and decision-making of service delivery and whether PLWHA felt discriminated with regard to service provision. The study further assesses attitudinal and institutional barriers to inclusion, such as stigma, misinformation, legislative blockage, and a lack of inclusive policies.

2.4. Statistical Analysis

Descriptive statistics were used to describe a number of characteristics of the population and WASH service provision: Demographic and socioeconomic, water availability, accessibility, affordability, acceptability, sanitation, and hygiene among the full sample. Chi-square tests (and Fisher's exact test where one or more cell counts was under 5) were used to test for significant differences in these variables based on HIV status (significant at $p < 0.05$). A number of key variables were identified. Specific characteristics among HIV-positive individuals, such as additional requirements for water and sanitation and any feeling of discrimination were also described. Binary logistic regression was used to analyse the association between the main features of water access and sanitation facilities based on HIV status, see Table 1 modelling the association among the HIV-positive population in reference to the HIV-negative population. We first present the odds ratios from an unadjusted model, followed by a model which adjusts for key social factors (education, occupation, and marital status) that may influence the main association studied. Some categories of responses were merged for this analysis (due to low cell count). The reference category for each main feature of water access or sanitation was the most prevalent response—aside from the main source of water, for which we used the second most prevalent source as our reference group.

Data analysis was performed in 2018 using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

Table 1. Association between main features of the water and sanitation services among individuals in Wukro based on HIV status. Odds ratios (95% confidence intervals) from logistic regression models. (*N* = 365 *).

	N	%	HIV-Negative		HIV-Positive		
			(Ref)	O.R 1	95% C.I.	O.R 2	95% C.I.
Primary source of water							
In-house tap	200	54.8	1.00	0.17	0.10, 0.27	0.21	0.12, 0.38
Backyard tap	125	34.3	1.00	1.00	-	1.00	-
Other (water points, river, roof water)	40	10.9	1.00	1.15	0.52, 2.54	1.26	0.50, 3.16
Expenditure in water (monthly)							
≤20 ETB	159	43.6	1.00	1.00	-	1.00	-
21–30 ETB	126	34.5	1.00	1.66	1.03, 2.66	2.06	1.14, 3.72
>30 ETB	80	21.9	1.00	2.17	1.26, 3.75	2.65	1.35, 5.23
Water consumption (L/day)							
≤60	147	40.3	1.00	1.00	-	1.00	-
61–80	104	28.5	1.00	2.37	1.42, 3.97	2.41	1.28, 4.53
81–100	63	17.3	1.00	3.06	1.66, 5.64	3.41	1.59, 7.23
>100	51	13.9	1.00	1.55	0.81, 2.96	1.69	0.76, 3.74
Travel time to fetch water (minutes)							
<10	252	69.0	1.00	1.00	-	1.00	-
≥10	113	31.0	1.00	6.69	4.02, 11.15	6.77	3.63, 12.62
Toilet facility (home)							
Flushing toilet	124	33.9	1.00	0.05	0.03, 0.09	0.07	0.03, 0.15
Roofed superstructure latrine	125	34.3	1.00	1.00	-	1.00	-
Open superstructure latrine	81	22.2	1.00	0.06	0.03, 0.13	0.05	0.02, 0.11
Other (Slab latrine, Field)	35	9.6	1.00	0.07	0.03, 0.17	0.06	0.02, 0.181
Time to access toilet (minutes)							
<10	279	76.4	1.00	1.00	-	1.00	-
≥10	86	23.6	1.00	4.34	2.54, 7.40	3.79	1.98, 7.26
How many people share the toilet?							
≤2	28	7.7	1.00	1.21	0.54, 2.73	0.65	0.24, 1.75
3–5	165	45.2	1.00	1.00	-	1.00	-
6–10	122	33.4	1.00	2.77	1.71, 4.49	3.10	1.68, 5.74
>10	50	13.3	1.00	0.99	0.52, 1.90	0.93	0.42, 2.07

* Sample slightly lower than full population due to only including those individuals with information for all variables in the final model. O.R 1 = unadjusted odds ratios. O.R 2 = odds ratios adjusted for education, income and marital status.

3. Results

3.1. Household Characteristics

The majority (80%) of the HIV-positive respondents were female and roughly two-thirds were aged between 18 and 40 years. Among this group, 42% had not received any formal education, a quarter had completed primary school, and 13% had completed secondary school or beyond. Among the sampled HIV-positive population, nearly three-quarters were unemployed, 25% were employed as unskilled labour, and only 2% were employed as skilled labour. In terms of marital status, 40% of the HIV-positive sample were single, 11% were married, 29% were widowed, and the rest were divorced. Over 80% of this sample reported an average monthly income under 300 Ethiopian Birrs ETB (in 2013, 1 USD = 19 ETB). Almost half of respondents had learnt of their HIV status in the period of two to five years preceding the survey. Around 40% had known their HIV status for more than five years prior to

the survey. The vast majority of the PLWHA sample group (85.9%) were exposed to anti-retroviral treatment (ART) and had been receiving treatment for longer than a year (86.2%).

Of the HIV-negative respondents, 71% were female and over half of them were aged between 18 and 40 years. Of the total sampled HIV-negative population, 30% had completed a primary education, a quarter had never received formal education, and 21% had completed a secondary education. Roughly a third of this sample were unemployed, another third were working as unskilled labour, and one-fifth were employed as skilled labour. Over half of the HIV-negative sample were married, 14% were single, 19% were widowed, and 11% were divorced. In terms of income, around 55% of the HIV-negative sample reported an average monthly income under 300 ETB.

3.2. Inequalities in Water Accessibility, Availability, Affordability, and Acceptability Based on HIV Status

Inequalities in water service provision between the vulnerable HIV-infected population and the non-infected population were investigated. Overall, approximately half of survey respondents had an in-house tap as their main source of drinking water, and one-tenth used public water points, see Table 2. Three-quarters of the HIV-negative sample had access to an in-house tap and around one fifth had access to a backyard tap. For the HIV-positive population, however, only a third had access to an in-house tap and 16% relied on the public water points as their main supply. Compared to individuals who were HIV-negative, HIV-positive individuals were significantly less likely to have an in-house tap as their main source of drinking water (O.R 0.17: 95% C.I. 0.10, 0.27), see Table 1.

In terms of time employed to fetch water, two-thirds of the sample employed less than 10 min. The vast majority (87%) of the non-infected population employed less than ten minutes to fetch water, compared to just under half of the HIV-positive group. Importantly, ~14% of the HIV-positive sample required over half an hour to fetch water each time. HIV-positive individuals were almost seven times more likely to travel 10 min or more to fetch water (O.R 6.78: 4.19, 11.21).

Two-fifths of the total sample used less than 60 L of water per day per household, see Table 3, but in contrast, water consumption exceeded a hundred litres per day for 14% of the sample. Almost half of the immuno-deficient group and almost a third of the immuno-competent group consumed less than sixty litres of water per day. Compared to individuals who were HIV-negative, HIV-positive individuals were at least twice as likely to consume between 61 and 80 L per day (O.R 2.15: 1.30, 3.54) or between 81 and 100 L per day (O.R 2.85: 1.57, 5.17), see Table 1. Shortages in the water supply occurred less than three days per month for almost 40% of the population while 8.8% experienced more than ten days of shortages per month.

Regarding acceptability of the network supplied water, the results differ greatly in the two samples. While the entire HIV-positive sample treated their supplied water before consumption, almost half the HIV-negative sample consumed water without home treatment, see Table 4. In order to prevent domestic cross-contamination, ~80% of both groups used a closed-lid plastic container to store water at home.

Table 2. A comparison of water access among the HIV-negative and HIV-positive groups in Wukro (N = 398).

Water Dimension		*N* (%)	HIV-Negative (n = 199)	HIV-Positive (n = 199)	*p*-Value		*N* (%)	HIV-Negative (n = 199)	HIV-Positive (n = 199)	*p*-Value
			%	%				%	%	
Accessibility	***Primary water source***				<0.0001	***Travel time to fetch water (minutes)***				<0.0001
	In-house tap	213 (53.6)	75.4	31.8		<10	268 (67.5)	86.9	47.9	
	Backyard tap	137 (34.5)	19.1	50		11–30	98 (24.7)	12.1	37.4	
	Water points	42 (10.6)	5.5	15.7		>30	31 (7.8)	1	14.7	
	Other (e.g., river, roof water)	5 (1.3)	0	2.5						

Table 3. A comparison of water availability among the HIV-negative and HIV-positive groups in Wukro (N = 398).

Water Dimension		*N* (%)	HIV-Negative (n = 199)	HIV-Positive (n = 199)	*p*-Value		*N* (%)	HIV-Negative (n = 199)	HIV-Positive (n = 199)	*p*-Value
			%	%				%	%	
Availability	***Water consumption (L/day)***				0.003	***Water shortages (monthly)***				0.014
	≤60	159 (40.4)	48.7	31.8		≤3 days	158 (39.9)	39.4	40.4	
	61–80	112 (28.4)	24.1	32.8		4–5 days	143 (36.1)	31.3	40.9	
	81–100	69 (17.5)	13.1	22.1		6–10 days	60 (15.2)	20.7	9.6	
	>100	54 (13.7)	14.1	13.3		≥10 days	35 (8.8)	8.6	9.1	
	Cope with shortages				0.095	***Saving water***				0.346
	River water	33 (8.4)	5.1	11.6		Reuse	21 (5.3)	7	3.5	
	Water from neighbour	87 (22.1)	20.9	23.2		Reserve storage	243 (61.1)	61.3	60.8	
	Saving water	166 (42.1)	44.4	39.9		River water	83 (20.9)	20.6	21.1	
	Other (e.g., hand dug well, buy more etc.)	108 (27.4)	29.6	25.3		Other	51 (12.8)	11.1	14.6	

Table 4. A comparison of water acceptability and affordability among the HIV-negative and HIV-positive groups in Wukro (*N* = 398).

Water Dimension		*N* (%)	HIV-Negative (*n* = 199)	HIV-Positive (*n* = 199)	*p*-Value		*N* (%)	HIV-Negative (*n* = 199)	HIV-Positive (*n* = 199)	*p*-Value
			%	%				%	%	
Acceptability	***Water treatment used***				<0.001	***Water storage at home***				0.0079
	Boiling	138 (35.8)	25.9	45.4		Open plastic container	31 (7.9)	6.6	9.3	
	Filter	110 (28.6)	8.5	48		Closed plastic container	324 (82.7)	79.8	85.6	
	Chlorination	30 (7.8)	9	6.6		Clay container	17 (4.3)	5	3.6	
	Chemicals	15 (3.9)	7.9	0		Other	20 (5.1)	8.6	1.5	
	None	92 (23.9)	48.7	0						
Affordability	***Expenditure in water (monthly)***				0.025					
	≤20 ETB	176 (44.6)	50.7	38.3						
	21–30 ETB	132 (33.4)	31.7	35.2						
	>30 ETB	87 (22)	17.6	26.5						

Monthly expenditure on water was used to measure service affordability. A quarter of the HIV-positive sample and 18% of the HIV-negative sample reported an average expenditure of more than 30 ETB per household, see Table 4. Compared to individuals who were HIV-negative, HIV-positive individuals were twice as likely to have a monthly water expenditure over 30 ETB per month (O.R 1.97: 1.16, 3.35). Another relevant component of affordability is the cost of a private connection: Focus group participants revealed that in Wukro a private water connection could cost up to 1300 ETB at the time of the survey, depending on the distance from a household to the network. Two out of three focus groups emphasized the difficulties they faced to finance an in-house tap connection.

3.3. Inequalities in Access to Sanitation Facilities and Hygiene Practices Based on HIV Status

Inequalities in sanitation services between the vulnerable HIV-infected population and the non-infected population were also investigated. Table 5 shows key indicators of access to sanitation facilities and hygiene practices based on HIV status. Overall, a third of the survey had a flushing toilet at home, and a similar percentage had access to a roofed superstructure pit latrine. Out of the HIV-negative sample, almost half accessed a flushing toilet, for just under one-fifth of the HIV-positive sample. Compared to individuals who were HIV-negative, HIV-positive individuals were significantly less likely to have a flushing toilet at home (O.R 0.05: 0.03, 0.09), see Table 4. A large percentage of the HIV-positive group (62%) accessed a roofed superstructure pit latrine.

Regarding the time employed to access sanitation facilities, three-quarters of the total population surveyed employed less than 10 min. In fact, the majority of both groups required less than ten minutes to access a toilet facility. In contrast, 13% of the HIV-positive group required more than half an hour. Compared to individuals who were HIV-negative, HIV-positive individuals were over four times more likely to employ 10 min or more to access sanitation facilities (O.R 4.34: 2.56, 7.34), see Table 4. In addition, 53% of the immuno-competent group shared the toilet facility with three to five people, while 44% of the immuno-deficient group shared with six to nine people.

Hygiene practices were measured through bathing frequency. Roughly half of the non-infected sample and 37% of the HIV-positive sample bathed twice a week, see Table 6. Around 11% of the HIV-infected population bathed only once a fortnight. Lack of water was reported as the reason for low bathing frequency for a quarter of the HIV-negative group and 41% of the HIV-positive group. It is necessary to point out that despite ten years of water and sanitation interventions, 67% of the whole population had not received training in hygiene practices and water use.

Table 5. A comparison of sanitation indicators among the HIV-negative and HIV-positive groups in Wukro (N = 398).

	N	**(%)**	**HIV-Negative *N* = 199**	**HIV-Positive *N* = 199**	***p*-Value ***
			%	**%**	
Toilet facility					<0.001 *
Flushing toilet	133	33.6	49.3	17.8	
Roofed superstructure pit latrine	139	35.1	8.5	61.9	
Open superstructure pit latrine	85	21.5	29.7	13.2	
Slab latrine	29	7.3	7.5	7.1	
Field	10	2.5	5	0	
Time to access toilet (minutes)					<0.001 *
<10	294	75.2	87.4	62.7	
10–30	68	17.4	10.6	24.4	
>30	29	7.4	2	12.9	
How many people share the toilet?					0.0004
≤2	31	7.9	8.2	7.7	
3–5	177	42.3	52.5	37.9	
6–9	131	33.5	23.5	43.6	
>10	52	13.3	15.8	10.8	

Table 6. A comparison of hygiene indicators among the HIV-negative and HIV-positive groups in Wukro (N = 398).

	N	(%)	HIV-Negative N = 199	HIV-Positive N = 199	p-Value *
			%	%	
Bathing frequency					0.001
Everyday	25	6.4	5.1	7.8	
Every 2 days	66	16.9	11.6	22.3	
Twice a week	166	42.5	47.4	37.3	
Once a week	102	26.1	30.8	21.2	
Once a fortnight	32	8.2	5.1	11.4	
Reason for bathing frequency					<0.001
Don't like	30	7.8	6.7	8.9	
Unnecessary	114	29.5	44.1	14.7	
Lack of water	129	33.4	26.1	40.8	
Cannot afford soap	65	16.8	10.8	23	
Cold environment	48	12.4	12.3	12.6	
Hygiene training received					0.072
No	258	66.7	62.4	71.1	
Yes	129	33.3	37.6	28.9	

3.4. Specific Needs in Water and Sanitation for HIV-Positive Individuals

Within the sample of HIV-positive individuals, 40% reported an increase in water consumption, following their diagnosis, of 6 L or more per day. Over 80% of the sample reported an additional use of a toilet facility, after diagnosis, of two times or more per day. Over 40% of respondents reported a requirement of more than 20 additional litres of water per day during episodes of diarrhoea.

3.5. Physical Barriers to Accessing Water and Sanitation Services

A substantial increase in the number of household water connections took place between 2003 and 2014. During this period the number of new private connections expanded from 290 to 3250. Consequently, the number of users at the public water points decreased markedly and so did the revenue collection at those water points. Given this drop in revenue, the number of public facilities was drastically reduced from seventeen public standpipes in 2003 to only nine in 2014. In addition, assessment of service infrastructures confirmed that, during this period of time, existing public sanitation facilities in Wukro deteriorated significantly.

3.6. Sense of Discrimination and Participation in Decision-Making

Almost half (47%) of the HIV-positive sample reported feeling discriminated against by service providers. Moreover, a quarter declared being prevented from collecting water from public water standpipes, either by family members (12%) or by community members (14%), and over a fifth (21%) reported being prevented from accessing public sanitation facilities due to their HIV status. In addition, participants in all three focus groups identified they had not participated in decision making during the design stage of the interventions.

4. Discussion

The adoption of the 2030 Agenda for Sustainable Development encourages the international community to address water interventions through a new perspective. Equity and Inclusion emerge as core elements of this new approach to achieve access to water and sanitation for all, including the most vulnerable. To date, however, there has been limited investigation on the effectiveness of water interventions in attaining equity and inclusion. This investigation evaluates local-scale water

interventions in Wukro by examining their effectiveness in achieving equitable and inclusive outcomes for the vulnerable group of PLWHA. The study provides three key insights.

First, in an attempt to reach the most disadvantaged groups, specific measures should be established to compensate for current inequalities in access to water and sanitation. The findings show that the HIV-positive population employs more time to fetch water, their monthly expenditure in water is greater, they have limited access to a private water connection, they employ more time to access toilet facilities, they share facilities with a larger number of users, and rarely benefit from having access to a flushing toilet at home compared to the HIV-negative population. In this scenario, water and sanitation interventions require larger efforts to reach the vulnerable group of PLWHA. Measures should be established to compensate for current inequalities in order to ensure equitable access. Focus groups have proposed that the number of public water points should be increased, specifically targeting those without access to in-house or backyard taps. Moreover, in order to maximise the focus on the most disadvantaged, water providers should set specific incentives for them. Focus groups participants revealed that fees for private water connections at the time of the survey were unaffordable for some householders. They claimed that if vulnerable households were able to access specifically targeted subsidies to reduce the fee there would likely be a rise in the number of private water connections. Householders under financial stress could also benefit from the splitting the connection fee into several instalments [33]. In parallel, foreign aid disbursements should also focus on up-scaling public sanitation facilities, which will decrease the time required to access facilities and reduce the number of users at each facility.

Second, in the pursuit of equity, groups with greater needs in water and sanitation should receive greater support. The findings of this study show that PLWHA require additional amounts of water and additional access to sanitation facilities. In fact, 40% of PLWHA in Wukro require 6 L of water more per day compared to the amount they consumed before diagnosis. Moreover, on average, during episodes of diarrhoea PLWHA use an additional 20 L per day. Regarding sanitation, findings show that 83% of the HIV-positive sample reported an increased need to access toilet facilities of at least twice per day compared to before diagnosis. In contrast to equality where all persons are treated the same, an equitable approach to water and sanitation should enable vulnerable groups to access what they need [10,34–36]. Accordingly, differentiated support to PLWHA in Wukro should be provided in order to ensure that the real water and sanitation needs of PLWHA are met.

Third, an inclusive approach for PLWHA in Wukro should promote a focus and awareness of inclusion in the policies and practice of all agents involved in the water and sanitation sector. Given that 47% of the HIV-positive sample felt discriminated by service providers, specialized training on inclusive public-health practices should be undertaken by the water supply staff to overcome prejudices. Training for policymakers and technical staff should increase awareness of the challenges faced by vulnerable and marginalized groups. Moreover, the fact that 27% of the HIV-positive respondents were prevented from accessing public water points and 22% were prevented from accessing toilet facilities, also indicates a need for sensitization campaigns within the broader Wukro population to reduce HIV-related stigma. In addition, PLWHA in Wukro should be efficiently empowered to participate in decision-making processes at all stages of WASH projects. Accordingly, it will be important to involve representatives of the HIV-positive community during both the planning and the management of service delivery [37,38].

Due to the cross-sectional design, this study is limited to identifying significant associations at a particular moment in time. The small sample size is another limitation, as is possible information bias due to issues with English as a second language (ESL) which may have influenced the translation of questions and answers. We tried to limit interviewer bias by having only eight interviewers who were trained at the same time. Another possible limitation of the present study is sample bias, given that the interviewees were volunteers. The use of a purposive sample strategy could also be observed as a threat to the external validity of the findings and a potential loss of robustness, but the nature of this study requires an HIV-positive sample to clearly exemplify the target population.

5. Conclusions

Emerging human-rights based approaches to water and sanitation emphasize the importance of achieving equitable and inclusive access to services for all. To date, however, there have been very few evidence-based investigations on small-scale interventions. This study addresses this gap by analysing inequalities in service provision in Wukro and evaluating inclusion in access to water and sanitation among the vulnerable group of PLWHA. Despite a decade of foreign aid supported interventions in this small urban center, findings reveal that inequalities between PLWHA and non-infected population are significant, and a sense of discrimination is experienced by HIV-positive householders. These results are important for development agencies and water providers to enhance understanding on how to reach vulnerable groups. The study shows that a needs-based approach focusing primarily on the increase of private water connections may overlook the pursuit of equity and inclusion. The results highlight a need to specifically target vulnerable groups during the design phase of water and sanitation interventions, in order to achieve equitable and inclusive outcomes.

Author Contributions: Conceptualization, R.J.-R., J.A. and F.M.; Methodology, R.J.-R., J.S. and F.A.; Software, N.H.; Formal Analysis, N.H. and R.J.-R.; Investigation, N.H. and R.J.-R.; Resources, R.J.-R., J.A. and F.M.; Writing-Original Draft Preparation, R.J.-R.; Writing-Review & Editing, J.S. and F.A.; Supervision, J.S. and F.A.; Funding Acquisition, R.J.-R., J.A. and F.M.

Funding: This research was funded by ICLI and the University of the Basque Country.

Acknowledgments: The authors would like to thank Wukro Water Supply Office for supporting the work reported above. We wish to thank Wukro Social Development Program and St. Mary College for supplying data and sharing knowledge during the field component of this research. Financial support was provided by ICLI and the University of the Basque Country. We would also extend our gratitude to A. Antonas and ICLI board members for their valuable contributions.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Differences in socioeconomic characteristics among the HIV-negative and HIV-population of Wukro (N = 398).

	N	(%)	HIV-Negative *N* = 199	HIV-Positive *N* = 199	*p*-Value *		*N*	(%)	HIV-Negative *N* = 199	HIV-Positive *N* = 199	*p*-Value *
			%	%					%	%	
Gender					0.063	***Education***					0.0003
Female	300	75.4	71.4	79.4		None	134	33.8	25.8	41.9	
Male	98	24.6	28.6	20.6		Literate	70	17.7	15.1	20.2	
						Primary	108	27.3	30.3	24.2	
						Secondary	61	15.4	20.7	10	
						Post-Secondary	23	5.8	8.1	3.5	
Age					0.0068 *	***Occupation***					<0.0001 *
<18 years	12	3	5	1		Unemployed	207	53.5	36.2	71.8	
18–40 years	238	60	55.3	64.7		Student	18	4.7	8	1.1	
41–60 years	124	31.2	31.2	31.3		Unskilled labour	119	30.8	36.2	25	
>60 years	23	5.8	8.5	3		Skilled labour	43	11.1	19.6	2.1	
Marital status					<0.0001	***Income (monthly)***					0.0004 *
Married	131	33.6	55.3	10.9		<300 ETB	170	63.2	55.8	83.3	
Single	101	25.9	14.1	38.2		300–500 ETB	64	23.8	28.4	11.1	
Widowed	96	24.6	19.6	29.8		501–1000 ETB	22	8.2	9.7	4.2	
Divorced	62	15.9	11.1	20.9		>1000 ETB	13	4.8	6.1	1.4	
						No answer	129				

Table A2. Characteristics of HIV status.

	N	%		*N*	%		*N*	%
Known HIV status (years)			*Use of ART*			*Duration of ART*		
<1	8	4	No	28	14.1	≤1year	26	13.4
1-2	27	13.6	Yes	170	85.9	>1 year	163	86.2
3–5	89	45						
>5	74	37.4						

Table A3. Sense of discrimination with regard to service provision among HIV-positive individuals (*N* = 199).

	N	%		*N*	%		*N*	%
Discriminated by service providers			*Prevented from accessing public water point*			*Rejected from public toilet facilities*		
No	102	52.9	No	142	73.2	No	144	78.3
Yes	91	47.1	Yes, family	24	12.4	Yes, family	25	13.6
			Yes, community	28	14.4	Yes, individuals	15	8.2

Table A4. Description of additional water and sanitation requirements among HIV-positive individuals following HIV-positive diagnosis (*N* = 199).

	N	%		*N*	%		*N*	%
Increased water need			*Increased water need due to diarrhoea (L/day)*			*Increased toilet need*		
≤2	64	32.5	≤10	75	38.3	Once	33	17
3–5	55	27.9	11–20	41	20.9	Twice	110	56.7
6–7	57	28.9	21–30	57	29.1	Three times or greater	51	26.3
>7	21	10.7	>30	23	11.7			

References

1. West, B.; Hirsch, J.; El-Sadr, W. HIV and H_2O: Tracing the Connections between Gender, Water and HIV. *AIDS Behav.* **2013**, *17*, 1675–1682. [CrossRef] [PubMed]
2. UN General Assembly. *The Human Right to Water and Sanitation*; 108th Meeting, U.S.C; UN General Assembly: New York, NY, USA, 2010.
3. UN Human Rights Council. *The Human Right to Safe Drinking Water and Sanitation*; UN Human Rights Council, Sixteenth Session: Geneva, Switzerland, 2011.
4. UN General Assembly. *Transforming Our World: The 2030 Agenda for Sustainable Development*; Report No.: A/70/L.1; United Nations: New York, NY, USA, 2015.
5. Boucher, N.; Vincent, P.; Geiser, P.; Fougeyrollasa, P. Involvement of persons with disabilities in local governance: Project aiming at measuring the impact of inclusive local development strategies. *ALTER Eur. J. Disabil. Res.* **2015**, *9*, 51–63. [CrossRef]
6. Lorenzo, T.; Van Pletzen, E.; Booyens, M. Determining the competences of community based workers for disability-inclusive development in rural areas of South Africa, Botswana and Malawi. *Rural Remote Health* **2015**, *15*, 2919. [PubMed]
7. Pouw, N.; Gupta, J. Inclusive development: A multi-disciplinary approach. *Curr. Opin. Environ. Sustain.* **2016**, *24*, 104–108. [CrossRef]
8. Gupta, J.; Vegelin, C. Sustainable development goals and inclusive development. *Int. Environ. Agreem.* **2016**, *16*, 433. [CrossRef]
9. Luh, J.; Baum, R.; Bartram, J. Equity in water and sanitation: Developing an index to measure progressive realization of the human right. *Int. J. Hyg. Environ. Health* **2013**, *216*, 662–671. [CrossRef] [PubMed]
10. De Albuquerque, C. *On the Right Track, Good Practices in Realising the Rights to Water and Sanitation*; United Nation: Lisbon, Portugal, 2012; ISBN 978-989-8360-09-0.
11. Joint Monitoring Programme. *Progress on Drinking Water and Sanitation*; WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP): Geneva, Switzerland; New York, NY, USA, 2014.
12. Gosling, L. *Equity and Inclusion: A Rights-Based Approach*; Framework; WaterAid: London, UK, 2010.

13. Mohanty, A.; Gurpur, S.; Beerannavar, C. Rethinking Inclusive Development: A Human Rights Critique of South Asia. *Procedia Soc. Behav. Sci.* **2014**, *157*, 128–136. [CrossRef]
14. Flores Baquero, O.; de Palencia, A.J.F.; Perez Foguet, A. Measuring disparities in access to water based on the normative content of the human right. *Soc. Indic. Res.* **2016**, *127*, 741–759. [CrossRef]
15. Roaf, V.; Khalfan, A.; Langford, M. *Monitoring Implementation of the Right to Water: A Framework for Developing Indicators*; Global Issue Papers; Report No. 14; Heinrich Böll Foundation: Berlin, Germany, 2005.
16. Admasie, A.; Debebe, A. Estimating Access to Drinking Water Supply, Sanitation, and Hygiene Facilities in Wolaita Sodo Town, Southern Ethiopia, in Reference to National Coverage. *J. Environ. Public Health* **2016**, *2016*, 8141658. [CrossRef] [PubMed]
17. Emenike, C.; Tenebea, I.; Omole, D. Accessing safe drinking water in sub-Saharan Africa: Issues and challenges in South–West Nigeria. *Sustain. Cities Soc.* **2017**, *30*, 263–272. [CrossRef]
18. Eisenberg, J. Associations between water-treatment methods and diarrhoea in HIV-positive individuals. *Epidemiol. Infect.* **2002**, *129*, 315–323. [CrossRef] [PubMed]
19. Manase, G. Using water and sanitation as an entry point to fight poverty and respond to HIV/AIDS: The case of Isulabasha small medium enterprise. *Phys. Chem. Earth* **2009**, *34*, 866–873. [CrossRef]
20. Lule, J.; Mermin, J.; Ekwaru, J.; Malamba, S.; Downing, R.; Ransom, R.; Nakanjako, D.; Wafula, W.; Hughes, P.; Bunnell, R.; et al. Effect of home-based water chlorination and safe storage on diarrhea among persons with human immunodeficiency virus in Uganda. *Am. J. Trop. Med. Hyg.* **2005**, *73*, 926–933. [CrossRef] [PubMed]
21. Ngwenya, B.N.; Kgathi, D.L. HIV/AIDS and access to water: A case study of home-based care in Ngamiland, Botswana. *J. Phys. Chem. Earth* **2006**, *31*, 669–680. [CrossRef]
22. Peletz, R.; Simunyama, M.; Sarenje, K.; Baisley, K.; Filteau, S.; Kelly, P.; Clasen, T. Assessing Water Filtration and Safe Storage in Households with Young Children of HIV-Positive Mothers: A Randomized, Controlled Trial in Zambia. *PLoS ONE* **2012**, *7*, e46548. [CrossRef] [PubMed]
23. Yallew, W. Assessment of water, sanitation, and hygiene practice and associated factors among people living with HIV/AIDS home based care services in Gondar city, Ethiopia. *BMC Public Health* **2012**, *12*, 1057. [CrossRef] [PubMed]
24. Gebresilassie, L.; Afera, B. Prevalence of Ovine Haemonchosis in Wukro, Ethiopia. *J. Parasitol. Res.* **2015**, *2015*, 635703. [CrossRef] [PubMed]
25. Haile, F.; Yemane, D.; Gebreslassie, A. Assessment of non-financial incentives for volunteer community health workers—The case of Wukro district, Tigray, Ethiopia. *Hum. Resour. Health* **2014**, *12*, 54. [CrossRef] [PubMed]
26. Alemayehu, M. Rural women are more likely to use long acting contraceptive in Tigray region, Northern Ethiopia: A comparative community-based cross sectional study. *BMC Women's Health* **2015**, *15*, 71. [CrossRef] [PubMed]
27. ICLI. *Proyecto de Abastecimiento de Agua Para el Desarrollo de Wukro, Etiopía*; Ayudas a Proyectos con Cargo al Fondo Para la Cooperación y Ayuda al Desarrollo; Report No. PRO-2004K1/0149; Departamento de Vivienda y Asuntos Sociales: Vitoria-Gasteiz, Spain, 2004.
28. UN General Assembly. *Implementation of the United Nations Millennium Declaration*; United Nations Report No. Fifty Seventh Session; UN General Assembly: New York, NY, USA, 2002.
29. Kirkermann, J.; Martin, T. *Applying a Rights-Based Approach*; The Danish Institute for Human Rights: Copenhage, Denmark, 2007.
30. UNDESA. *Global Sustainable Development Report United Nations Department of Economic and Social Affairs*; UNDESA: New York, NY, USA, 2014.
31. Maya Fehling, M.; Nelson, B.; Venkatapuramd, S. Limitations of the Millennium Development Goals: A literature review. *Glob. Public Health* **2013**, *8*, 1109–1122. [CrossRef] [PubMed]
32. UNSTT. *Review of the Contributions of the MDG Agenda to Foster Development: Lessons for the Post-2015 UN Development Agenda*; UN System Task Team on the Post-2015 UN Development Agenda. 2012. Available online: http://www.un.org/millenniumgoals/beyond2015.shtml (accessed on 12 September 2018).
33. Jimenez-Redal, R.; Parker, A.; Jeffrey, P. Factors influencing the uptake of household water connections in peri-urban Maputo, Mozambique. *Util. Policy* **2014**, *28*, 22–27. [CrossRef]
34. Satterthwaite, D. From professionally driven to people-driven poverty reduction: Reflections on the role of Shack/Slum Dwellers International. *Environ. Urban.* **2001**, *13*, 135. [CrossRef]

35. Dos Santos, R.; Gupta, J. Pro-poor water and sanitation: Operationalising inclusive discourses to benefit the poor. *Curr. Opin. Environ. Sustain.* **2017**, *24*, 30–35. [CrossRef]
36. Rauniyar, G.; Kanburb, R. Inclusive development: Conceptualization, application and the ADB perspective. *J. Asia Pac. Econ.* **2010**, *15*. [CrossRef]
37. WaterAid. *Access to Water, Sanitation and Hygiene for People Living with HIV and AIDS: A Cross Sectional Study in Nepal*; WaterAid-Nepal: Pabitra Tole Nakkhipot, Nepal, 2010.
38. Seyoum, S.; Graham, J. Equity in access to water supply and sanitation in Ethiopia: An analysis of EDHS data (2000–2011). *J. Water Sanit. Hyg. Dev.* **2016**, *6*, 320–330. [CrossRef]