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An Analysis of Factors Influencing Household Water, Sanitation, and Hygiene (WASH) Experiences during Flood Hazards in Tsholotsho District Using a Seemingly Unrelated Regression (SUR) Model

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Abstract: Communities around the world living in either urban or rural areas continue to experience serious WASH problems during flood episodes. Communities and individual households are affected differently depending on their coping capacities and their resource base. Flooding causes extensive damage to water and sanitation infrastructure, leaving communities vulnerable to WASH-related illnesses. This paper aimed to analyze factors influencing the community WASH experiences during flood incidences in Tsholotsho District using a Seemingly Unrelated Regression (SUR) model. The quantitative approach was used in this study. A questionnaire was used to collect data from household heads in Tsholotsho District. A total of 218 Questionnaires were administered in four wards that were purposively selected for this study. Gathered data were analyzed using the Statistical Package for Social Sciences (SPSS Version 22) and principal component analysis was done, which culminated in a SUR model. The key findings of the study were that outbreaks of water and hygiene-related diseases, ponding of water which provides a breeding ground for mosquitoes, and contamination of surface water were the major WASH problems experienced in Tsholotsho District among other problems. The study also found that access to Non-Governmental Organisations (NGOs) programs, access to treated water, and level of education were positive and statistically significant in influencing some of the problems experienced during flooding. To increase the coping capacities of Tsholotsho communities, it is pertinent for governments and NGOs to consider implementing more WASH programs, increasing access to safe and clean drinking water, and increasing the level of education of communities.

Keywords: WASH; flood hazard; coping capacity; seemingly unrelated regression

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1. Introduction

Globally, the discrepancies between those who have access to water in urban or rural areas have reduced but large gaps still persist [1]. About 80% of people who do not have access to safe drinking water live in rural areas and more than half of them are in sub-Saharan Africa [2]. The most underprivileged of the communities are still relying on untreated and unsafe surface waters, such as lakes, rivers, swamps and dams. Most of these disadvantaged communities are found in isolated and inaccessible areas [3]. States that one out of seven people around the world, or 946 million people out of the total world population still practice open defecation. Of all people who practice open defecation, 90% are in rural areas. India is one of the countries that has the largest number of people who are still relying on open defecation as a sanitation facility, with approximately 564 million people [4]. One of the main problems encountered in trying to end open defecation is not only the lack of resources to provide clean and safe toilets, but also transforming the behaviour of the whole community [5]. The shortage of proper sanitation facilities

remains a serious challenge in Zimbabwe, particularly in rural areas and in urban areas in recent years as a result of a deepening economic crisis and vast urbanization that is now surpassing the level of service provisions. Consequently, rural water supply still is, and will continue to be, a problem for most national governments in Sub-Saharan Africa and development stakeholders in the coming years [6,7].

Generally, the problems associated with the quality of drinking water include unsafe storage in the household, the transportation of water, and the use of unsafe containers that can contaminate water drawn from safe sources by the time it reaches households and is finally used as unsafe in the household. In addition to this challenge, there is a problem of contamination of water sources either natural or resulting from human pollution [8]. Water that is polluted with dangerous minerals, such as arsenic and fluoride, is a health hazard to millions of people in some countries. Water that is polluted with human excreta is among the main reasons for outbreaks of diseases such as diarrhea, which is purported to kill above 800 children a day [9–11]. At least 80% of people who have limited access to clean and safe water are inhabitants of rural areas of the developing world. About 159 million people throughout the world rely on unsafe and untreated water from natural and man-made water bodies, most of which are unsafe water sources that are largely contaminated, and some are polluted with feces [12].

Insufficient supply of WASH services can result in amplified danger of numerous illnesses, including: diarrhea, hepatitis A, cholera, typhoid, dysentery, intestinal helminths, malaria, protozoan parasites, trachoma and increased exposure to neglected tropical diseases (NDT) [13–15]. Infections can also be spread by the intake of water or food that has been polluted by the environment naturally or by handling and use [16]. The contagions can also be transmitted by unclean hands when there is lack of water for personal hygiene. Another transmission can be through vectors such as flies and mosquitoes which breed close to or on waste dumps and stationary water [17]. Improper management of human feces poses a severe health hazard due to probable pollution of available water sources [18]. Children's feces can be a major risk and are more communicable than the excreta of adults; however, they are often supposed by communities to be harmless and thus not properly and safely disposed of [19]. The shortage of improved WASH services limits the carrying out of safe medical practices in health facilities by health workers. The risks that result from the exposure to pathogens from medical waste include hepatitis B and C, HIV, viral hemorrhagic fevers, and skin, respiratory, and gastro-enteric infections [20]. It is therefore projected that about 20% of medical care waste is highly infectious.

In Sub-Saharan Africa, about 98 percent of people with limited access to a safe drinking water source dwell in rural areas and about 42 percent of the rural population still practices open defecation [21,22]. Concealed behind the available data, there has also been a substantial decrease in the nature of urban and rural essential WASH services, which has resulted in poor quality of water, sporadic supplies, and long walking distances [23]. Sanitation improvement has remained stagnant in most Sub-Saharan African countries since 1990, with a mere slow decrease in open defecation. Starved of an improvement and recovery in the WASH services sector, most countries in Sub-Saharan Africa will be faced with more cholera outbreaks, more deaths, illnesses, continued poverty, and negative effects on livelihoods, industry, tourism, food production and agriculture, as well as pollution of rivers, river basins and other water sources [24]. This essentially translates to more hardships, particularly for women, children, the disabled, and the elderly.

Floods have the greatest potential to damage WASH systems compared to all other natural hazards and disasters experienced worldwide, and impact the largest number of people in a given location [25]. When floods are experienced in economically less developed countries, they can completely wipe out millions of investments in WASH infrastructure, drastically retard economic fortunes, and lead to thousands of deaths and the outbreak of epidemics [26]. Reliant on the background, flood tides can be tricky or even cause a disaster. Floods are a challenge when the scale and effects of their occurrences surpass the capability of the impacted communities to survive. When they turn into a

disaster, especially when the flood event causes a severe interruption of the functioning of a community or society, they can trigger widespread human, material, economic, and or environmental harm, which exceed the capacity of the affected community to manage using their available resources [27]. This kind of destruction can negatively affect the socio-economic development of the immediate community, the environment, and the country at large, thus resulting in a disaster [28,29]. Also view floods as having a severe, damaging impact on human life, property, or livelihood activities.

The effects of floods on WASH services include destruction to water infrastructure, shortage of clean water supplies, contamination of water sources (reduction in water quality), destruction of better sanitation amenities, and amplified occurrences of waterborne illnesses [30]. The extensive damage that floods exact on WASH infrastructure calls for urgent attention whenever a community is faced with the hazard [31,32]. Postulated that flooding also aggravates poverty levels because of the disturbance and destruction of livelihoods that would have been amassed over a long period, which can be used to meet the immediate WASH demands [33]. Also assert that flooding harms hygiene practices because it results in a serious lack of clean water. As a result of climate change, there has been a notable increase in the frequency of flood hazards in different parts of the world, and in Sub-Saharan Africa in particular. Zimbabwe has over the years experienced serious floods and Tsholotsho is one of the districts that has repeatedly been affected.

This research aimed to contribute to the attainment of Sustainable Development Goal (SDG) number six (6) by identifying areas that need more focus for improved rural WASH in Zimbabwe. WASH is at the heart of the development plan, with a separate sector goal that is Sustainable Development Goal 6 (SDG 6) that imagines worldwide, sustainable, and unbiased access to harmless drinking water, sanitation and hygiene, and the eradication of open defecation through to the year 2030. SDG 6 likewise emphasises the power of protecting and competently handling water resources and the requirement to focus on wastewater management. The prerequisite for knowledgeable risk planning to guarantee the long-term protection of water sources is more critical than ever before.

This research was in tandem with the dictates of the Sphere Project's key response sector of water, sanitation, and hygiene promotion. The Sphere Project, under the WASH key response sector, emphasises community involvement in WASH as a vibrant practice linking the community and the stakeholders so that people faced with an emergency have extra control over the response and its effects on them. As the Sphere Project also underpins effective engagement by linking societies and response squads to capitalize on community power to lessen community health hazards, this was also in sync with the objectives of this research.

2. Materials and Methods

The research was conducted in Tsholotsho District, which is among the seven districts in Matabeleland North province of Zimbabwe [34,35]. Tsholotsho District lies to the north-western part of Bulawayo, which is the second largest city in Zimbabwe after Harare. Tsholotsho district covers 7844 km^2. It is about 114 km west of Bulawayo and borders with Lupane to the north, Umguza to the east, Hwange to the northwest and Bulilima to the south [Figure 1]. The eastern part of Tsholotsho district projects into the Gwayi River and the western part drains into Manzamnyama River [Figure 2].

Tsholotsho District has a population of 115,119 people with a population density of 16 persons/km^2. About 54% of the population are females translating to 62,189 whilst 46%, translating to 52,930, are males. The district has a total of 23,630 households with an average household size of 4.8 people.

Rainfall episodes in Tsholotsho are short and strong, particularly during the summer season between late November and April. It is during this time that most parts of Tsholotsho are exposed to flooding. Historically, heavy rainfalls that result in flooding have fallen most frequently between December and March, and are linked to tropical cyclones and the shifting of the Inter-Tropical Convergence Zone (ITCZ) to the south of the Zambezi

River [35]. The district has been facing an increased frequency of catastrophic flood episodes with the recent floods recorded in the 2017 to 2018 rainfall season.

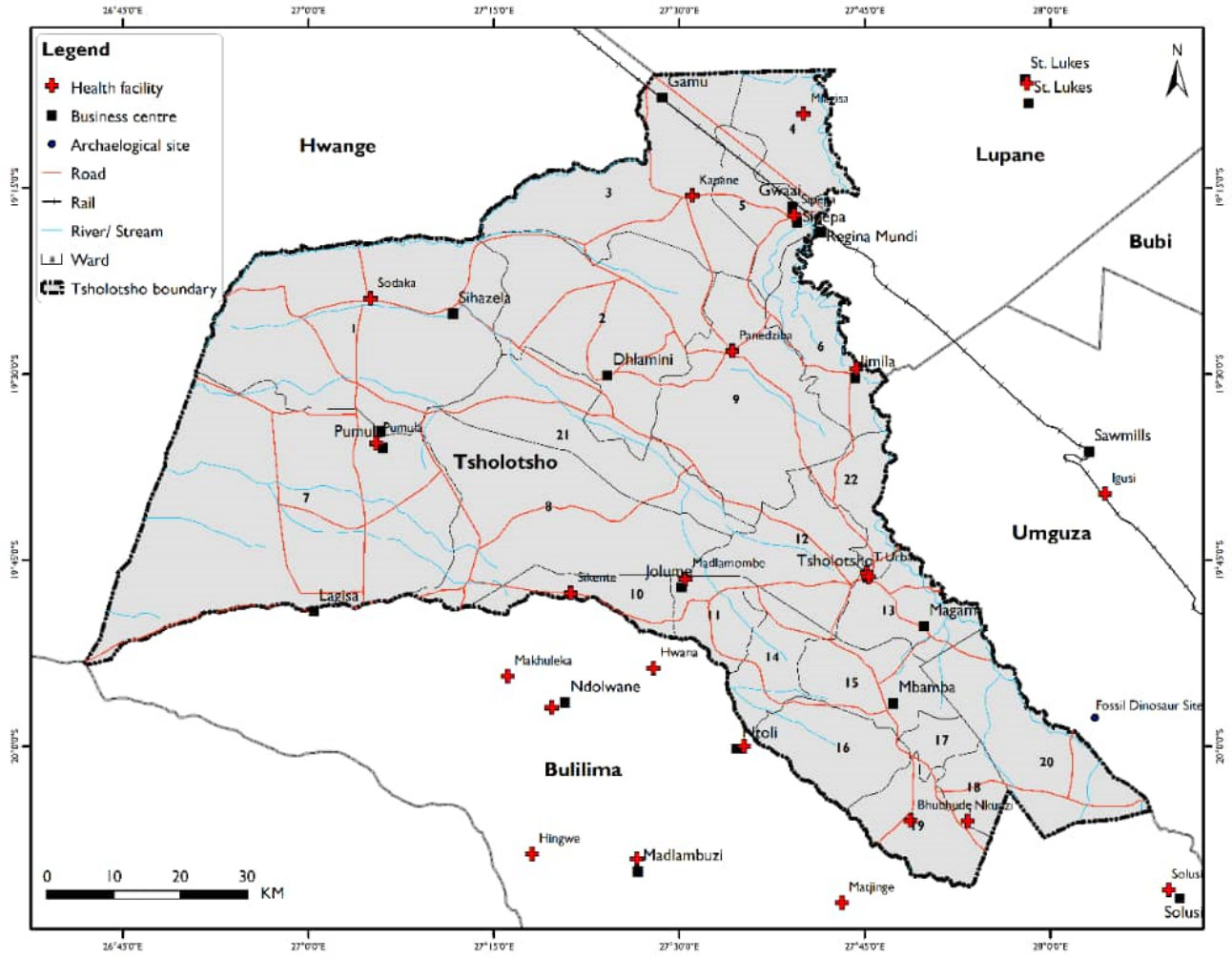

Figure 1. Tsholotsho District Map.

A quantitative approach was used in this study to analyze the factors that influence household WASH experiences in flood-prone areas in Tsholotsho District. Ethical clearance was obtained from the University of the Free State Ethics Committee with the ethical clearance number UFS-HSD2021/1858/21. The household heads were targeted since they are responsible for the well-being of their families, and they are key in all community WASH programs. The flood-prone wards were purposively selected, and these are ward (Sipepa) 5 with 1026 households, ward (Jimila) 6 with 1400 households, ward 7 (Patalika) with 860 households, and ward 8 (Mbiriya) with 1120 households [Figure 2]. Systematic random sampling was used to select the villages that were to be sampled in all four wards as well as household heads for the questionnaires (Supplementary Material). In selecting the villages to be sampled, all villages in wards 5, 6, 7, and 8 were listed down randomly and every 6th village in the list was chosen for sampling. Therefore, a total of four villages were then chosen for the questionnaire. This study used the Raosoft software package to define the sample size from the study population using the formula presented below.

$$x = Z(c/100)2r(100 - r) \quad (1)$$

$$n = N\,x/((N - 1)E2 + x) \quad (2)$$

$$E = Sqrt[(N - n)x/n(N - 1)] \quad (3)$$

Using the formula, sample size **n** and error margin as **E** are provided where **N** represent the population size, **r** is the fraction of responses that the researcher is concerned about, and **Z(c/100)** is the critical value for the confidence level **c** [36]. Using the Raosoft online sample calculator, the total sample for the questionnaire survey generated was 239 respondents for all four wards. The Questionnaire survey sample was selected by choosing a random starting place in each village and then picking every *k*th component in sequence from the sampling frame. The sampling interval during the questionnaire survey in all four selected villages was the third household. The questionnaire used was developed by the researchers and was pilot tested in ward 13 of Tsholotsho District. A total of 12 questionnaires were administered during the pilot test and these translated to 5% of the targeted respondents in the study area. The pilot test was done in the last week of December 2021. Data was collected in the month of January 2022 through the assistance of four research assistants who were trained prior to the actual data collection. Gathered data were analyzed using Statistical Package for Social Sciences (SPSS Version 22) and principal component analysis was done to extract factors which were then analyzed using a seemingly unrelated regression (SUR) model.

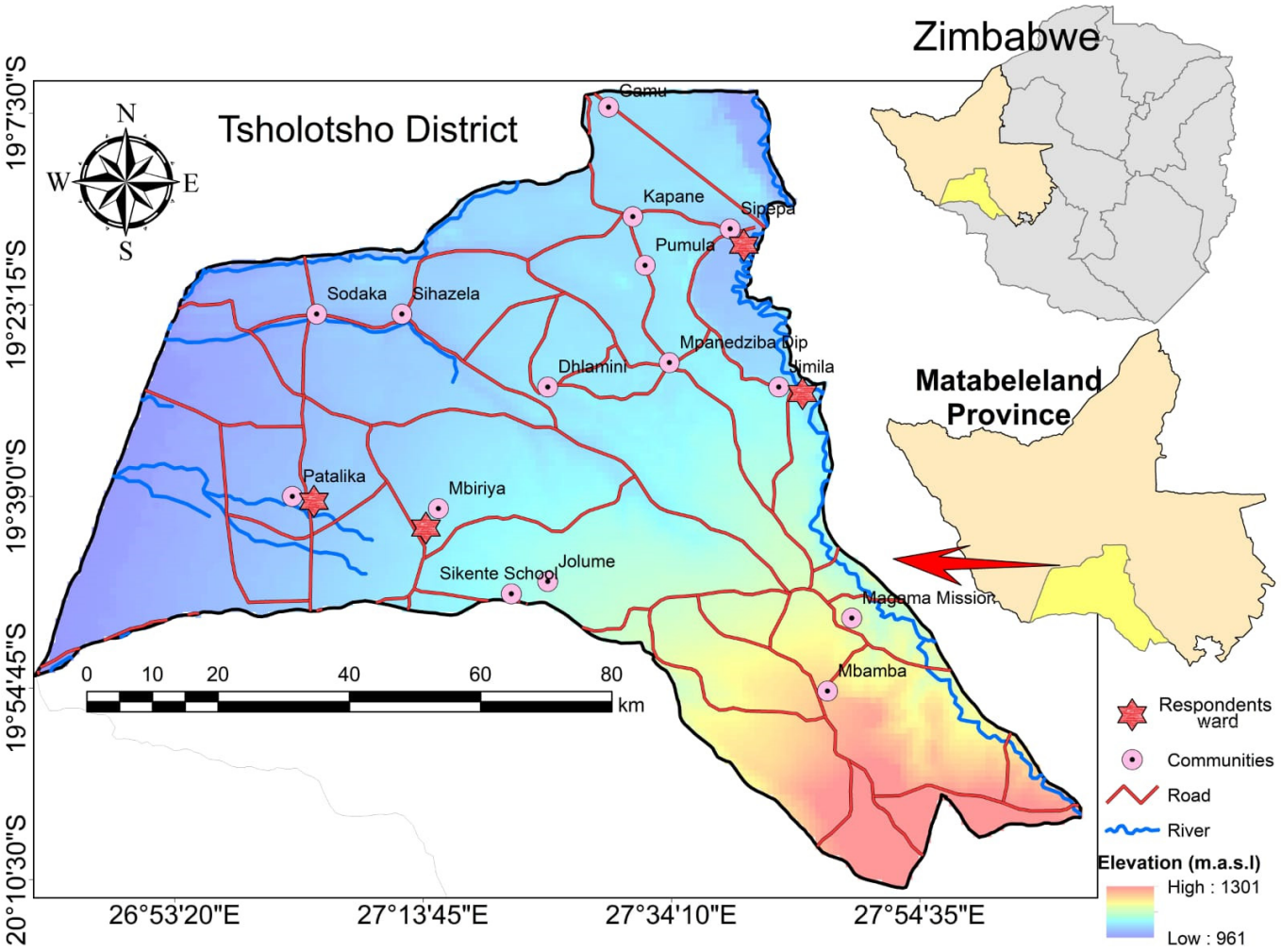

Figure 2. Map showing location of communities and respondents.

3. Results and Discussions

The targeted questionnaire respondents were 239 household heads, and 218 household heads responded to the questionnaire, translating to a response rate of 91.2%. In all the four wards which were targeted, female respondents were the majority, comprising 55.9% whilst 44.1% were males, with no respondents who were transgender. In wards 5, 7 and 8, female respondents were generally the majority, and it was only in ward 6 where male respondents outnumbered female respondents with 57.4% and 42.6%, respectively. Even though Zimbabwe has a population of 52% females, the composition of the sex of the respondents in this study was a clear confirmation that Tsholotsho District's economically active population comprises mostly males living outside the district, as was also postulated by [37]. According to [38], most of the males living outside the district work in neighboring countries such as Botswana and South Africa; this migration dates back as far as the slave trade era [28]. Zimbabweans are dotted around the Southern African countries, and some have even migrated to other developed countries around the globe due to the geopolitical situation.

In all four wards combined, the age group of 60 plus years had the highest number of the respondents with 22.1%, whilst 19 years had the least number of respondents, with 2.3%. Generally, the majority of the respondents were 41 years and above with a combined total of 59% of the total respondents. The male respondents between the ages of 31 to 40 years had the highest percentage, of 26%, whilst the male respondents between the ages of 20 and 30 years had the least number, of 6.3%, and there were no male respondents who were 19 years. The female respondents' age group that had the highest number of respondents was 20 to 30 years with 26.1% and the one with the least was that of 19 years, with 2.3%.

The obtained data from the household questionnaires showed that the majority of the respondents (summing to 40.1%) in all four wards had only attained primary level of education. A total of 17.5% of all respondents in the four wards had never attended school. Only a few respondents had attained a university level of education—a total of 0.9%. Ward 5 had the majority of respondents (56.5%) who had attained a secondary education. Combining the percentage of those who had never gone to school and those who attained primary education gives a total of 57.6% and this has a serious bearing on training, awareness, and education programs on WASH. The higher number of respondents who had a low level of education coincides with the claim by [39], who indicated that some WASH programs are barely embraced by communities as they fail to comprehend the explanations in the program.

The average household size for all the sampled households in all four wards in Tsholotsho District was 2.01 persons per household. Wards 5, 7 and 8 had almost the same household size whilst ward 6 had the largest household sizes, with an average of 2.25 persons per household. Household size has a bearing on the coping capacities of these communities, depending on the situations faced by the communities, according to [40].

The questionnaire respondents in all four wards with a mean of 0.67 indicated that the most common problem faced during the flood episodes in Tsholotsho District is ponding water that provides a breeding ground for mosquitoes, as shown in Table 1. The outbreak of water and hygiene-related diseases was also classified to be common, with a mean of 0.55. Loss of non-food items, contamination of surface water, the collapse of pit latrines, and contamination of household items were classified as more common problems during flood episodes in Tsholotsho District. Flooding and collapse of boreholes and wells, and an increase in water salinity were experienced less often than other problems during flooding. This implied that there are severe WASH problems that are faced by the communities which are increased by the flooding incidences.

The questionnaire respondents indicated that communities lack clean water during flood incidences due to the collapse of boreholes. Since most of the areas still depend on open water sources which become contaminated, in some instances these result in water-borne diseases. They further revealed that the collapse of toilets is experienced, while

some toilets also fill up and spill into the environment. Due to water-logging, communities usually face water shortages due to the inaccessibility of some water points. There is also an increased problem of open defecation when sanitation facilities are affected. The diseases that affect communities during flooding are diarrhoeal diseases including typhoid; dysentery, especially in children; cholera; malaria; and bilharzia.

Table 1. WASH problems experienced during flood episodes in Tsholotsho District.

Name of Ward		Flooding and Collapse of Boreholes and Wells	Increased Water Salinity	Contamination of Household Items	Loss of Non-Food Items	Collapse of Latrines	Contamination of Surface Water	Ponding Water That Provides Breeding Ground for Mosquitoes	Outbreak of Water and Hygiene Related Diseases
5	Mean	0.13	0.24	0.17	0.15	0.15	0.26	0.46	0.52
	Std. Deviation	0.341	0.431	0.383	0.363	0.363	0.444	0.504	0.505
6	Mean	0.18	0.29	0.72	0.90	0.51	0.87	0.97	0.93
	Std. Deviation	0.384	0.459	0.454	0.306	0.503	0.341	0.170	0.263
7	Mean	0.07	0.11	0.58	0.62	0.53	0.53	0.58	0.58
	Std. Deviation	0.252	0.318	0.499	0.490	0.505	0.505	0.499	0.499
8	Mean	0.07	0.08	0.10	0.25	0.44	0.15	0.54	0.12
	Std. Deviation	0.254	0.281	0.305	0.439	0.501	0.363	0.502	0.326
Total	Mean	0.11	0.19	0.41	0.51	0.42	0.48	0.67	0.55
	Std. Deviation	0.319	0.392	0.492	0.501	0.495	0.501	0.473	0.499

Household Experiences of Flood Incidences Using Principal Component Analysis (PCA)

Table 2 shows the rotated PCA of major households' experience of flood incidences in Tsholotsho District of Zimbabwe. From the PCA result, three factors were extracted based on the responses of the respondents. To check the appropriateness of the data on household's experience of flood incidences in Tsholotsho District of Zimbabwe, both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity as used by [41] were employed. The value of the KMO test was 0.81, signifying that the acceptability of input variables for the PCA was suitable, though the test of the negative theory that the correlation matrix was an identity matrix reported a p-value < 0.000, showing that there was a connection between the variables. Consequently, PCA was, for that reason, a suitable technique for the extraction of households' experience of flood incidences. Table 2 shows the retained principal component (PC) representing the different dimensions of the households' experience of flood incidences in Tsholotsho District of Zimbabwe. Only variables with factor loadings of ±0.3 and above at 1% overlapping variance were used in naming the factors, and were significant at a 1% level of probability. The three retained variables were then renamed as outbreak and contamination of water; lack of access to clean and safe drinking water; flooding and collapse of boreholes and increased water salinity. The variables were then used as the outcome variables in the seemingly unrelated regression (SUR) model.

Table 2. Dimensions of experience of flood incidences-Principal component analysis (PCA).

Variable	Outbreak and Contamination of Water	Lack of Access to Clean and Safe Drinking Water	Flooding and Collapse of Boreholes and Increases Water Salinity
Lack of access to clean and safe drinking water	0.2156	0.3872	−0.5391
Flooding and collapse of boreholes and wells	0.2156	0.2549	0.6973
Increased water salinity	0.2655	0.429	0.3597
Contamination of household items	0.4113	0.1188	−0.0759
Loss of household Non-Food Items (NFI)	0.4036	−0.073	−0.1639
Collapse of latrines	0.197	−0.646	0.2167
Contamination of surface water	0.4317	−0.0268	−0.0519
Ponding of water that provides breeding ground for disease vectors	0.3213	−0.4043	−0.0287
Outbreak of water and hygiene related diseases	0.4195	−0.0072	−0.1031
Eigenvalue	4.000	1.333	1.034
% Variance	71		
Correlation matrix	0.024		
KMO Test	0.81		
Barllet's test (p-value)	0.0000 [a]		
Chi-Square	792.696		

Note(s): [a] represents significance level at 1%.

In estimating factors influencing the households' experiences of flood incidences in Tsholotsho District of Zimbabwe, a seemingly unrelated regression was employed, and the results are presented in Table 3.

Table 3. A seemingly unrelated regression model of factors influencing the experience of flood incidences in Tsholotsho.

	Diseases Outbreak and Contamination of Water			**Lack of Access to Clean and Safe Drinking Water**			**Flooding and Collapse of Boreholes and Increases Water Salinity**		
	Coeff	**Std. Err.**	***p* > z**	**Coeff**	**Std. Err.**	***p* > z**	**Coeff**	**Std. Err.**	***p* > z**
Marital Status	0.073	0.310	0.813	0.026	0.340	0.938	0.112	0.315	0.722
Gender	−0.117	0.238	0.624	−0.198	0.262	0.448	−0.153	0.243	0.529
Treated Water	0.600	0.245	0.014 **	0.469	0.269	0.081 *	0.531	0.249	0.033 **
Source of Water	−0.411	0.095	0.000 ***	−0.371	0.104	0.000 ***	−0.413	0.096	0.000 ***
Distance to nearest water source	0.457	0.078	0.000 ***	0.458	0.085	0.000 ***	0.457	0.079	0.000 ***
Level of education	−0.259	0.132	0.049 **	−0.192	0.145	0.185	−0.274	0.134	0.041 **
Head of household	0.032	0.114	0.777	0.152	0.126	0.226	0.085	0.116	0.463
RDC	−0.322	0.218	0.139	−0.111	0.239	0.642	−0.360	0.222	0.104
DDF	−0.234	0.137	0.088 *	−0.218	0.151	0.148	−0.231	0.140	0.097 *
NGOs	−0.411	0.096	0.000 ***	−0.475	0.105	0.000 ***	−0.392	0.098	0.000 ***
Income source	−0.258	0.252	0.306	−0.216	0.277	0.434	−0.277	0.256	0.281
Remittances	−0.125	0.305	0.682	−0.153	0.335	0.647	−0.165	0.311	0.595
_cons	0.934	1.028	0.364	0.185	1.130	0.870	1.208	1.047	0.248
Equation	RMSE	R-squared	chi2	*p* > chi2					
Outbreak and Contamination of water	1.500	0.387	134.160	0.000					
Lack of access to clean and safe drinking water	1.648	0.310	95.660	0.000					
Flooding and collapse of boreholes and increases water salinity	1.527	0.373	126.840	0.000					

Note(s): * Significant, ** Very Significant, *** Highly Significant.

The suitability of approximating the three equations, then estimating each of the equations individually using SUR is obtained by the non-zero cross-correlation coefficients of the estimated equations' error terms. The results of the SUR model revealed that different factors affected the household's experience of flood incidences in Tsholotsho District of Zimbabwe. The theorized and verified independent variables were incorporated in the model as indicated in Table 3. The three retained factors of the households' experience of flood incidences as extracted by PCA had variants of negative and positive coefficients.

Access to NGOs had a negative and statistically significant effect on the three variables representing households' experience of flood incidences. This implies that as the household members have access to training and advocacies from the NGOs, the probability of facing "outbreak and contamination of water"; "lack of access to clean and safe drinking water" and "flooding and collapse of boreholes and increases water salinity" reduces. This is in line with the study by [1], who opined that the precise adaptation and coping activities of individuals, local communities, and institutions (local governments, NGOs, and private sector) are all significant because together they can possibly decrease the problem of scarcity of safe water in an area. In the same vein, Ref. [42] posited that NGOs play a vital role in working directly, and in coordination, with the communities. Additionally, some NGOs specialise in emergency response in outbreaks and also manage treatment centers.

The coefficient of access to treated water is positive and statistically important in prompting the experience of 'outbreak and contamination of water', 'lack of access to clean and safe drinking water', and 'flooding and collapse of boreholes and increase in water salinity'. This denotes that the more households have less access to treated water, the greater the increase in outbreaks and contamination of water, in the lack of access to clean and safe drinking water, in flooding and collapse of boreholes, and in increases in water salinity. A study by [43] affirmed that access to treated water is pertinent in addressing WASH problems as it reduces the incidences of water-borne disease outbreaks.

The level of education had a negative and statistically significant coefficient on outbreaks and contamination of water as well as on flooding and collapse of boreholes and increases in water salinity. This means that household heads with a higher level of education are more aware and can receive training and education, which is significant in dealing with WASH issues. Therefore, statistically, the higher the level of education. the lower the level of outbreaks, contamination of water, flooding, collapse of boreholes, and increases in water salinity. This result is in agreement with the study by [44] in Bolivia which concluded that education at all levels of the community is the necessary approach to tackling water and sanitation problems in the 21st century.

The coefficient of the source of water has a negative value and is statistically important in reducing 'outbreak and contamination of water', 'lack of access to clean and safe drinking water', and 'flooding and collapse of boreholes and increase in water salinity'. The implication is that an improved source of water is more likely to reduce these experiences during flood incidences. This result corroborates the findings by [1] that improved sources of water are critical in addressing water and sanitation challenges experienced in low-income countries. The distance to the nearest water source is also statistically significant, with a positive coefficient in outbreaks, contamination of water, access to clean and safe drinking water, flooding and collapse of boreholes, and an increase in water sanity. Statistically, the longer the distance to the nearest water source, the greater the likelihood of outbreaks and contamination of water, lack of clean and safe drinking water, flooding, collapse of boreholes and an increase in water salinity. Studies indicate that the significance of improving the drinking water sources and reducing the distance between water sources in communities is a way of dealing with WASH challenges.

4. Enhancing Coping Capacities to WASH Related Problems

Goal number six of the 17 SDGs is about guaranteeing the obtainability and viable utilisation of water and sanitation for all [45]. Some of the targets for this goal include attaining worldwide and equal accessibility to safe and affordable drinking water for all

citizens by 2030, attaining improved accessibility to sufficient and justifiable sanitation and hygiene for all, and stopping the problem of open defecation, giving exceptional consideration to the requirements of women and girls and those in susceptible circumstances by 2030. Tsholotsho district is far from attaining improved access to safe and treated water. The greater number of communities in Tsholotsho District rely on unsafe water sources and they do not have proper sanitation facilities as they continue to practice open defecation. Another target involves increasing international collaboration and capacity-strengthening support to less economically developed countries in water and sanitation-associated actions and projects, which include, among others, water harvesting, desalination, water efficiency, wastewater treatment, recycling, and re-use technologies. Zimbabwe, as a country, still lags behind in embracing technologies that can be used to improve WASH services, thus the achievement of the aforesaid goal remains a dream.

To increase the coping capabilities of communities to WASH-related challenges that are experienced during flooding in Zimbabwe and in Tsholotsho District in particular, there is a need for cautious plans by governments meant to revamp rural WASH. Improvement of rural WASH infrastructure by making it more resilient to flood hazards is pivotal in ensuring that communities continue to have access to clean and safe water during flood incidences. Through improvements in water quality and disease surveillance, most of the WASH-related illnesses that affect communities can be contained. There is a need for Tsholotsho District to strengthen the Rural Water Information Management System (RWIMS), which helps to keep track of the water supply situation and infrastructure. Communities in Tsholotsho District should be at the centre of decision-making and implementation of all WASH programs to enhance full community participation, which can also lead to sustainability. An integrated effort in coordinating Tsholotsho communities, government ministries and agencies, NGOs, and the private sector will also help to make sure that vulnerable members of the communities, such as women, the elderly, disabled and chronically ill individuals, and children are empowered. To improve rural water supply, Tsholotsho District needs to roll out and strengthen programs to repair and rehabilitate wells and boreholes and also to fully implement systems such as RWIMS mapping and needs assessments. Tsholotsho District also need to build every sector's capacity through participatory health and hygiene education (PHHE) whilst assuring support from communities and the private sector [44]. To address rural sanitation and hygiene challenges, Tsholotsho Rural District Council needs to create a specific budget line for rural sanitation and hygiene in its local budgets. Efforts should be made to develop a schedule for latrine construction and management as well as a district sanitation behavior change program to eradicate open defecation [45].

5. Conclusions

Frequent WASH-related challenges are experienced by communities during flood hazards. Tsholotsho communities experience flooding and collapse of boreholes and wells, increased water salinity, contamination of household items, loss of non-food items, the collapse of latrines, contamination of surface water, ponding water that provides a breeding ground for mosquitoes, and outbreaks of water and hygiene-related diseases. Using a seemingly unrelated regression model, this study revealed that access to NGO programs is one of the most important factors that influence households' experiences during flooding. Access to treated water and an improved source of water was also revealed to be critical in influencing the way households are affected during flooding incidences in Tsholotsho. The level of education of the household heads was also found to be an important factor that has a bearing on household experiences during flood episodes in Tsholotsho District.

Government needs to formulate and implement deliberate programs that are meant to help communities to withstand the challenges they experience during flooding, even if they face budgetary constraints. Improvement of the WASH sector in areas that are prone to flooding should be one of the top priorities of both national and local governments. Communities should be at the centre of decision-making by both government and NGOs. With

the increased frequency of flooding due to climate change, there is a need for communities to be capacitated to withstand any WASH problems that may result.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/w15020371/s1, Household Questionnaire and Ethical clearance letter.

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