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Impact of WaSH Project on Rural Households' Health: The Case of Ethiopian Kale-Hiwot Church WaSH Project in Gimbichu District, East Shewa Zone of Oromia Region

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***Abstract*—** the study aimed to examine the impact of water, sanitation, and hygiene project on water access, the prevalence of water-borne diseases, sanitation, and hygiene practices of rural households in Gimbichu District, East Shewa Zone of Oromia Region. The findings of the study depend on 350 randomly selected rural households from three project interventions and two non-project intervention kebeles. It engaged Propensity Score Marching methods in order to measure the estimated average treatment effect of the project on outcome variables. Therefore, the finding has made a significant impact on water access and the distance of water sources, where project beneficiaries have an average of 7.6 additional litter of water per day with 0.96Km reduced distance. Similarly, the project has made a significant contribution to improving access to toilet, liquid and solid waste discarding services where project users have a 14.7% increase to access toilet service and a 42.2 % increase to access solid and liquid waste disposal structures. Prevalence of water-borne diseases significantly reduced where participants experience on average 44.10% lower cases. In general, the Kale-Hiwot Church water, sanitation, and hygiene project have made a significant contribution to improving water access in nearby villages, locally standardized toilets, solid and liquid west disposal system which have a direct implication to enhance the health status of the family. The project needs extra initiatives to maintain water access standards, scale up to address non-intervention areas, and document best practices for further lessons.

Keywords—Propensity Score Matching,Water, Sanitation and Hygiene

I. INTRODUCTION

Access to water and sanitation is a fundamental human right and essential to life, health and dignity. The timely and adequate delivery of clean water and sanitation services to people living both in urban and rural settings is particularly important, given the vulnerability of their situation. The provision of adequate sanitation facilities is equally critical so that carriers of communicable diseases are controlled to mitigate crucial health risks and prevent epidemics [1]. Inadequate access to water, sanitation, and hygiene (WASH) is linked to serious health problems including diarrhoea, hepatitis A, cholera, typhoid, dysentery, intestinal helminths, malaria, and trachoma. In addition to health risks, vulnerable populations are also burdened by the severe economic and social costs associated with a lack of access to water. In 2016, the World Health Organization attributed more than $260 billion in global economic losses to the reduced productivity of the people affected by the disease and the opportunity cost of water extraction time [2].

Access to safe drinking water supplies and sanitation services in Ethiopia are among the lowest in Sub-Saharan Africa. The access to safe potable water for urban areas was 91.5%, while the access to potable water in rural Ethiopia is about 68.5%1 (within 1.5 km) in the year 2010 [3]. Poor hygiene practices continue to cause illness contributing to poverty and overall health deprivation in wider rural areas.

On average 50 litters of water per capita per day (1/c/d) is recommended to ensure personal hygiene and sanitation, domestic cleaning, and laundry needs [4]. However, in case of emergency and disaster conditions, 7.5 litters of water are the absolute minimum recommended for consumption and cooking [5]. Average domestic water consumption in rural Ethiopia is much lower than the recommended amounts, where the estimated litters of drinking water for urban and rural populations varies from between 3 to 20 l/c/d [6].

The Ethiopian Kalehiwot Church (EKHC) WaSH program targets poor communities who have little to no access to

water infrastructure, sanitation and hygienic practices. An important goal of the project is to increase the supply of clean water to communities such as public health, as well as the expected results of education and improvement of children, increase schooling and reduce the time load of water collection so that they can spend more time on income-generating activities and allow children to spend more time on education-related activities Following the implementation of WaSH project by EKHC major improvement have been observed in reduction of trachoma, diarrhoea and other water borne diseases, as well as overall heath improvements.

Controversial findings of studies on impact of WaSH interventions to reduce water-borne diseases encouraged to conduct specific impact assessment on implemented projects. Meanwhile, conducting detail impact assessment on WaSH project even in EKHC, to evaluate the severity and magnitude of the community health problem with related to WaSH is extremely important. In addition evaluating the level of relevancy of such projects in the specific circumstance of Ethiopia for mitigation of overall health problems and their role to improve standard of living is also vital. In this study, the researcher investigated whether EKHC WaSH project has brought tangible outcome to improve overall health conditions of user communities or not.

II. RELATED WORK

Numerous empirical studies have investigated the impact of water supply and sanitation services on the health status of the community. There are convincing empirical shreds of evidence that show access to improved drinking water supply significantly improves child health in terms of reducing the risk of diarrheal diseases [7, 8 & 9].

Traveling and waiting time to fetch water can greatly affect the quantity of water available to a given household [10]. The author reviewed several studies and found the following general relationship between water use and collection time. First, the quantity of collected water significantly decreases as the time taken to fetch is greater than 5 minutes/ 100 meters away from home. Second, considering water collection time between 5 to 30 minutes/ 100 to 1000 meters' distance, the quantity of water remains the same. Third, the amount of collected quantity of water further decreases when the nearby water source is 1000 meters away from home or collection time is longer than 30 minutes [10].

Many scholars argued that the time spent to fetch water mainly by women and girls can be used to do other income generation activities like schooling, community engagements, domestic chores, taking care of younger siblings, visiting health care services which have direct and indirect consequences on the family [11, 12].

A study conducted in India by analysing national representative data taken from District Level Household Survey, DLH-3 revealed households with improved sanitation facilities registered a 2.2% lower incidence of diarrhoea in under-five children [13]. A similar study in Nepal indicates that the incidence of diarrhoea has shown an 11% reduction among younger children below 24 months of age [14].

A study conducted in Pakistan urban areas using randomized control trial method revealed that continuous promotion on handwashing could reduce diarrhoea by 51% [15]. Strong supportive evidence was observed on the effect of handwashing to reduce the incidence of both diarrhoea and pneumonia in under-five children, where households that are addressed through the intervention experience 53% and 50% reduced diarrhoea and pneumonia incidents respectively [16]. A review on hygiene and sanitation practices revealed that handwashing with soap can reduce diarrhoea risk by 48% in the case of low and middle-income countries where there is access to water[17].

Conceptual framework of the study: The study mainly used participation of households in the project as a treatment where treated groups are project beneficiaries and non-participants are control groups. Hence, the impact of the project is measured by the estimated average effect on outcome variables. Prevalence of water-borne disease, access to adequate water, distance to water service, access to a toilet, and waste disposal systems are taken as outcome variables.

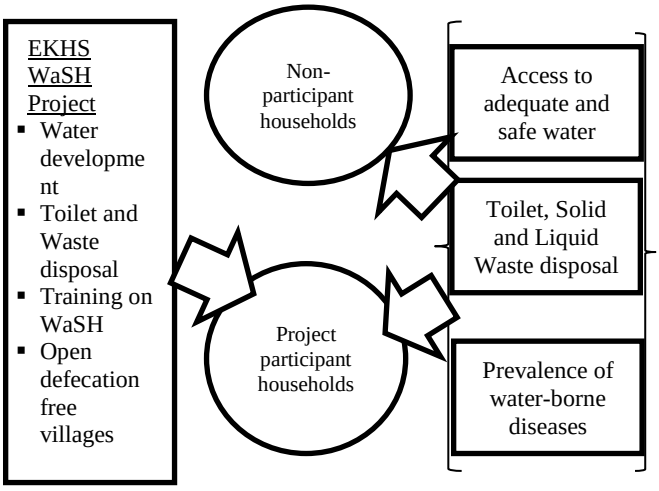

Figure 1. Conceptual Framework of the Study
Source: Illustrated by Authors, 2021

The conceptual framework illustrated above indicate that wash project intervention is a treatment variable where two group of households (WaSH project participants and non-participants) are subjected to the study in order to measure the impact of the project on outcome variables (access to water; toilet, solid & liquid waste disposal services and prevalence of water-borne diseases.

III. METHODOLOGY

Study Area: Gimbichu District among districts of East Shewa Zone of Oromia Region and located around the Eastern outskirt of Addis Ababa.

Table 1. Demographic profile of the study area

Study area	Districts		WaSH Project		Total population in ("000")			
	U	R	U	R	M	F	U	R
Gimbichu District	3	32	0	14	58.7	53.9	10.2	102.4
% Compos	8.6	91.4			50.1	47.9	90.9	9.1%

Source: Gimbichu District FECO, 2021

3.1. Sampling and Method of Analysis

The study employed a mixed sampling technique which passed through different steps to address sample units. The first step of the sampling process was stratifying Kebeles under project intervention and non-intervention areas and then three Kebeles from project intervention and two from non-project intervention Kebeles were selected randomly. The total number of households in selected five (3 intervention and 2 on-intervention) is 4,050. The study used a simplified sample size determination adapted by [18]. $n = \frac{N}{1+N\,(e^2)}$

Where, n represents the sample size; N denotes the population of the study and e represents the level of precision. The formula utilize 95% confidence interval, P=0.05.For the consumption of this study±5% is taken as level of precision which consider the cost and availability of time to have reasonable sample which can represent the population under study. The total number of households in selected five Kebeles is 4,050. Accordingly, the study relies on 364 sample rural households with in early equal proportion of project participants and non-participants.

3.2. Estimation Strategy: Logit Model Specification

Following [19], the logistic distribution function of determining factors in WaSH project participation status of households is specified as follows:

$$P_i = E(y = 1|X_1) = \frac{1}{1+e^{(\beta_0+\beta_1 X_1)}} \text{ .... (1)}$$

Equation (1) can be simplified as:

$$P_i = \frac{1}{1+e^{z_i}} \text{ .... (2)}$$

The probability that a given household is WaSH project participant is expressed by equation (2) while, the probability for being program non-participant is given by:

$$1 - P_i = \frac{1}{1+e^{z_i}} \text{ ....(3)}$$

Therefore, the odds ratio can be written as:

$$\frac{P_i}{1-P_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \text{ ....(4)}$$

Now $\frac{P_i}{1-P_i}$ is simply the odds ratio in favour of participation in WaSH- the ratio of the probability that a household would be influenced by the program to the probability of that they are not influenced. Finally, taking the natural logarithms of the odds ratio of equation (4) would result in the logit model as indicated below.

$$L_i = ln\left(\frac{P_i}{1-P_i}\right) = ln(e^{z_i}) = e^{z_i} \text{........................ (5)}$$

Where: z_i is a function of n explanatory variables (X_i) which can also be expressed as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n \text{..................... (6)}$$

Where, β_0 is an intercept$\beta_1, \beta_2, \dots\dots, \beta_n$ are partial slopes of the equation in the model. L_i is natural logarithm of the odds ratio, which is not only linear in variable X but also linear in the parameters. $X_i$is vector explanatory variables for household i. Finally, we incorporate disturbance term μ_i such that $\mu_i \sim N(0, \sigma^2)$. Thus, the complete logit model specified as below:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n + \mu_i$$

3.3. Propensity Score Matching (PSM) Model

In case of binary treatment of the program, the treatment indicator D_i equals 1 if individual; receives treatment and 0 otherwise. In the context of this study, treatment group refers to households who are program participant while control group are those who do not participate in the program. The potential outcomes are then defined as: $Y_i(D_i)$ for each individual$i$, where$i = 1,2, \dots, n$, then the treatment effect of individual; can be expressed as;

$$T_i = Y_i(1) - Y_i(0) \text{... (7)}$$

This is used only to evaluate potential observable outcomes for each individual and leads to counterfactual problems since other unobservable individual's characteristics which are known as counterfactual outcomes are there. Hence, estimating individual treatment effect T_i is not possible. Therefore, Average treatment effect on the treated (ATT) is developed which is specified as:

$$\tau_{ATT} = E(\tau|D = 1) = E[Y(1)|D = 1] - E[Y(0)|D = 1] \text{.. (8)}$$

Therefore, the counterfactual mean for those being treated represented by $-E[Y(0)|D = 1]$ which is actually not observed. Following [20] and further manipulation, we have the following expressions:

$$E[Y(1)|D = 1] - E[Y(0)|D = 1] = \tau_{ATT} + E[Y(0)|D = 1] - E[Y(0)|D = 0] \text{......................... (9)}$$

τ_{ATT} is so-called 'self-selection bias'; then the true parameters of $\tau_{ATT}$is only identified if $E[Y(0)|D = 1] - E[Y(0)|D = 0] = 0$. By rearranging equation (9), we have:

$$[Y(0)|D = 1] - E[Y(0)|D = 1] = 0 => \tau_{ATT} = E[Y(1) - Y(0)] \text{.. (10)}$$

Common support region given by: (overlap) $0 < p(D = 1|X) < 1$. Ultimately, the general PSM model specified as a fallow:
$\tau_{ATT}^{psm} = E_{p(x)|D=1}\{E[Y(1)|D = 1, P(X)] - E[Y0|D = 0, P(X)]\}$..... (11) This shows that PSM estimator is simply the mean difference in outcomes over the common support region; appropriately weighted by the propensity score distribution of participants.

IV. RESULTS AND DISCUSSION

4.1. Data and Summary Statistics

The study utilized primary data collected during January and February 2021 from 350households of five Kebeles of Gimbichu District.

Table 2.Summary statistics and mean difference t-test for continuous variables

Variable	Non-Participants		WaSH Participants		Mean Difference	Two-group sample t-test
	Mean	Std. Dev	Mean	Std. Dev		Mean
Age of the HH head	44.35	9.94	43.92	11.80	0.42	0.36
Family Size	5	1.09	4.87	0.92	0.13	1.18
Daily water consumption	36.99	13.21	46.33	14	-9.33	-6.42***
Distance to water source	2.43	1.03	1.79	0.77	0.64	6.58***
Health extension visit	1.03	0.78	2.23	1.71	-1.62	-8.51***

Source: Survey result, 2021; *** indicates significance at 1%.

4.2. Water source, Access to toilet and Prevalence of Water born disease

Source of Water: Figure (2) indicates the source of water, where both WaSH project participants and non-participant households have access to their family consumption. 82.56% of WaSH project beneficiary households access potable water from developed springs and 17.44% from an improved hand-dug well. On the contrary, only 21.91% of non-participant households have water supply from developed spring and 8.99% from improved hand-dug well water points.

The majority of non-participant households utilized unprotected and untreated water points where 33.71% of households receive from unprotected spring, 21.35% from a traditional hand-dug well,s and 14.04% from rivers. The above figure shows that 69.10% of non-participant households have a water supply from unprotected water sources which is not safe for consumption.

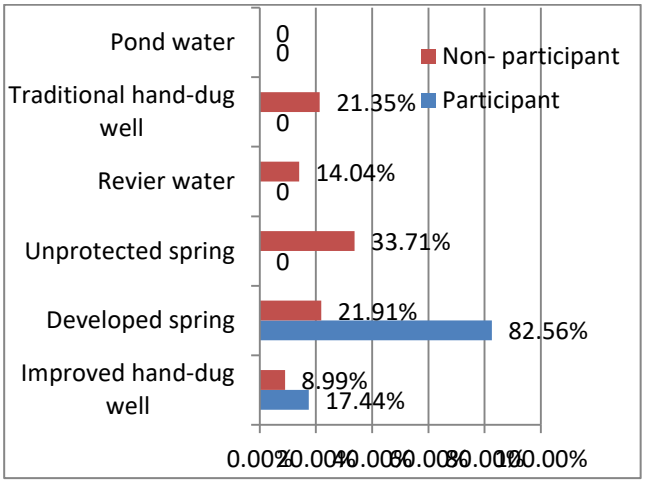

Figure 1. Source of water in Gembichu Woreda
Source: Survey result, 2021

Access to Toilet Services: All WaSH project participant households have access to toilet service, while only 74.7% of non-participant households have access to toilet service, and the rest of family members used open defecation. Considering the minimum standard of local toilets (depth > 3 meters, > 10 meters from home, hand washing in front of the get, properly covered, and roofed), the result shows that 37.79% of WaSH project households utilize locally standard toilets and 55.23% partially standard and 6.98% utilize non-standard local toilets. On the other hand, 48.88% of non-participant households utilize non-standardized toiles and 51.12% have partial standard toilets. None of the non-participant households have utilized locally standardized toilets.

Prevalence of water borne diseases: Project participants experience less prevalence of water-borne diseases and trachoma compared to non-project beneficiaries. 47% of non-WaSH project part-takers experienced the water-borne disease in the last year, while only 17% of project beneficiaries encounter such health problems. Besides, 15% of control households experienced trachoma incidence within their family, while only 2% of treated households came across trachoma. On the other hand, 4% of non-project participants face the death of fewer than five children in the last five years.

4.3. Model Estimation Results

The first step in propensity score matching analysis is drawing propensity score for each variable and matching starts from each treated case's propensity score and tries to find a control case with a similar propensity score to use as a match. Logistic regression comes first and is followed by the comparison of unmatched and Average treatment effects for treated.

Table (3), logistic regression result indicates that the estimated model appears to perform well for the intended matching exercise since Pseudo R2=0.4691 and significant at <1%. Logistic regression result indicates that sex, education, family size and training on WaSH are factors that favour or limit households to participate in WaSH project.

Table 3.Logit regression result

Participation on WaSH project	Coef.	Std. Err.
Age	0.01	0.02
Sex	0.27	0.44**
Education	0.04	0.19**
Major occupation	-0.42	0.51
Family size	-0.42	0.18***
Training on WaSH	4.10	0.36***
_cons	-0.34	1.42
Log likelihood = -128.77 Prob > chi2 =0.000 Number of obs = 350 Pseudo R2=0.4691 LR chi2(6)= 227.56		

*** &** indicates correlation is significant at 1% and 5% respectively; Source: Survey result, 2021

4.3.1. Testing the balance of propensity score

Before trusting ATT estimation, it is mandatory to check the balancing whether the matching is effective to create good control groups or not. Basically, the balancing result yield percent of bias using the average treatment on the treated value of each matching variable followed by a summary of mean bias. In the standardized bias before and after matching, where mean bias after matching is expected to be less than 5% [21].

Table 4.Mean bias to test balancing

Sample	PsR2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	%Var
Unmatched	**0.469**	**227.5**	**0.000**	**45.2**	**9.2**	**225.9***	**0.51**	**83**
Matched	**0.005**	**2.43**	**0.876**	**4.8**	**4.3**	**16.8**	**2.19***	**33**

* If B>25%, R outside [0.5; 2] Source: Survey result, 2021

Accordingly, table (4) indicates that the mean bias of all matching variables reduced to the standard and acceptable level which is 4.8 which indicates that the balancing is good to proceed further. The estimated propensity score of non-participant households (control) is within the range of 0.12 to 0.67 with a mean score of 0. 48. The estimated propensity score of participant households (treated) ranges between 0.29 and 0.65 with a mean score value of 0.50.

The common support region would then lie between 0.29 and 0.65 it excludes control units whose propensity score is higher than the highest propensity score of the treated units and control units whose propensity scores are lower than the lowest propensity score of the treated units. Therefore, households whose estimated propensity scores are less than 0.29 and larger than 0.65 are not considered for the matching exercise.

Table 5.Distribution of propensity scores

Group	mean	sd	min	max
Non-participant	**0.48**	**0.08**	**0.12**	**0.67**
Participant	**0.50**	0.06	0.29	0.65
Total	**0.49**	0.07	0.12	0.67

Source: Survey result, 2021

4.3.2. Impact estimation result analysis

Impact on average daily water consumption: The intervention of WaSH project in the Gimbichu District has brought a significant impact to improve the average daily water consumption of households. The nearest neighbour matching indicates that treated households have matched with only 46 control groups and the ATT result revealed that project participant households have a higher amount of average daily water consumption by 5.846 litters due to their participation in the project and the impact is significant at 10% (t=1.862). Using kernel matching techniques 172 treated households found 153 matches from control households and WaSH project beneficiaries have increased access to water on average 7.67 litters per day per household. The average increment of project intervention household's daily water consumption is substantial 1% level of significance. To sum up, table (6) disclosed that WaSH project intervention in the district has a significant impact to increase daily water consumption in households where water is a base to maintain family health and improve sanitation.

Table 6. Impact of WaSH on access to water

Type of matching			Daily water consumption		Distance to water sources	
	n. treat.	n. contr.	ATT	t-value	ATT	t-value
NNM	172	46	5.846	1.862	-0.96	-3.807
KM	172	153	7.669	3.730	-0.673	-3.486
SM	172	153	8.070	3.173	-0.626	-3.146
RM	79	59	10.05	2.939	-0.651	-2.997

Source: Survey result, 2021

Impact on access to toilet service: Improve aces to locally standardized toilets is among the major objectives of the project where the study used a dummy variable (1= have access & 1= no access) to measure the extent of sample household's toilet service utilization.

Accordingly, nearest-neighbour matching revealed that participant households have an average of 14.2% increase to access and utilize toilet service; however, its significance is much lower than the standard. With similar positive impact and strong significance, kernel matching result disclosed that treated households have an average of 14.7% increase to access toilet service.

In general, table (7) also asserted that the intervention of the project in Gimbichu District has a significant impact to increase access to toilet service which directly reduces open defecation. Taking into account forward and backward consequences, reduced open defecation in the

project intervention area has great implications to improve the overall health status of the family.

Table 7. Impact of WaSH on access to sanitation services

Type of matching			Access to toilet		Solid & liquid waste disposal	
	n. treat.	n. contr.	ATT	t-value	ATT	t-value
NNM	172	46	0.142	1.556	0.441	3.753
KM	172	153	0.151	2.383	0.284	3.403
SM	172	153	0.147	2.444	0.265	3.087
RM	79	59	0.238	3.117	0.361	3.563

Source: Survey result, 2021

Impact of the project on access to solid and liquid west disposal system: Solid and Liquid Waste Management (SLWM) is one of the key components of the WaSH project with the objective of bringing improvement in cleanliness, hygiene, and the general quality of life in project intervention rural areas. In order to achieve the stated objective, the project has taken awareness-raising initiatives and conducted practical skill training sessions followed by home-to-home technical support and follow-up. The major question here is that was the project able to bring a positive impact to improve household's access to prepare and utilize solid and liquid waste disposal structures.

ATT estimation result using nearest neighbour and kernel matching on the table (7) disclosed that treated households have an average of 44.1% and 28.4% increase to access and utilize solid and liquid waste disposal structures. The estimation result is highly significant at less than 1% for all matching types. Hence, the intervention of WaSH project in the Gimbichu District has a highly significant impact to improve solid and liquid waste disposal mechanisms which is a key practice to enhance the healthy living of the family.

Impact of WaSH project intervention to reduce water borne diseases: The project has a major objective to reduce water-borne diseases in project intervention areas through promoting water, sanitation, and hygiene practices. Meanwhile, a dummy variable (0= no & 1= yes) was used to assess the prevalence of water-borne diseases including diarrhea within the last six months. Accordingly, the ATT result of the nearest neighbor matching method indicates that project targets have 42.2% decreases to be affected by water-borne diseases and it is significant at less than 0.01 levels. Similarly, ATT estimation results of kernel matching technique confirmed that project partakers have 29.6% decreases to be affected by water-borne diseases respectively. The impact estimation is strongly significant at less than 0.01 levels for all matching algorithms.

ATT estimation table (8) proved that the project made a significant impact to minimize water-borne diseases that enable to conclude it is on right track to succeed in planned project objectives. This result is similar to the study conducted by [7, 8, 13 & 22].

Table 8. Impact of WaSH on prevalence of waterborne diseases
Source: Survey result, 2021

Type of matching			Water borne disease	
	n. treat.	n. contr.	ATT	t-value
NNM	172	46	-0.422	-3.595
KM	172	153	-0.296	-3.303
SM	172	153	-0.291	-3.089
RM	79	59	-0.379	-3.628

4.4. Summary of findings

The study was conducted in Gimbichu District, East Shewa Zone of Oromia Region to examine the impact of WaSH project implemented by Ethiopian Kale-Hiwot Church on access to water, toilet, solid & liquid waste disposal service, and water-borne diseases. The study involved a total of 364 households with a response rate of 96.15%. Major findings of the study are summarized as follows:

82.56% & 17.14% of project beneficiary households have access to potable water from developed water springs and improved hand-dug well, while 69.1% of non-beneficiary households' access drinking water from unprotected water sources (un-tapped spring & traditional hand-dug well). The average water consumption of project beneficiary households is 46.33 litters/day/head, while this figure declined to 36.99 litters in the case of non-beneficiary households. The difference in water consumption among project participants and non-participants is significant (t= -6.417). In terms of walking distance to reach water sources, on average non-participants, households are expected to walk 2.43 Km from their home to fetch water, while project participants are expected to walk only 1.79Km.

100% of project beneficiaries have access to toilet service, while only 74.7% of non-project beneficiaries have access to toilets. Measuring the standard of toilets as per local scale, 55.23% & 33.79% of project beneficiaries have partial standard and full standard toilets respectively, while 51.12% of non-participant households have partial standard and none of them have full standard toilet services. 91% of project beneficiaries have solid and liquid waste disposal services, while only 37% of non-participant's households possess such services.

Regarding the prevalence of water-borne disease 47%, 15% & 4% of non-project participants experience water-borne diseases; Trachoma and death of fewer than five years children respectively while only 17% and 2% of project beneficiaries experience water borne-disease and Trachoma respectively.

PSM estimate revealed that Kale-Hiwot Church WaSH project intervention in Gimbichu District has made a significant contribution to enhancing the health status of the rural family through enhancing access to water, sanitation, and hygiene services. Improvement of water access in nearby villages is a basic element to promote sanitation and hygiene practices where the project brought significant contribution in the intervention area.

Furthermore, the impact of the project is also observed through significantly improving access to locally standardized toilets and solid and liquid west disposal systems which have a direct implication to enhance the health status of the family. Henceforth, the prevalence of water-borne diseases significantly declines in project intervention areas.

V. CONCLUSION AND FUTURE SCOPE

The central theme of the study was examining the impact of the Kale-Hiwot WaSH project to improve the health status of rural households in the Gimbichu District, East Shewa Zone of the Oromia region. The study came up with important findings that clearly indicate the impact of WaSH project intervention to enhance the health status of rural households. Using Propensity Score Matching (PSM) along with different matching types, the project has made a significant impact to improve water access of intervention rural households where project beneficiaries have an average of 7.6 additional litter of water per day. The average distance of water sources was significantly minimized due to the intervention of the project that project target groups have on average a 960 m lower distance to fetch water for their family consumption.

Similarly, the project has made a significant contribution to improve access to toilet services and maintain standards of constructed toilets to satisfy minimum local criteria. Accordingly, project participant households have on average 14.7% increase to access toilets and a 73.8% increase to maintain local standards of prepared toilets. Besides, project beneficiaries have on average 44.10 % increase to access and utilize solid and liquid waste disposal structures. Considering the prevalence of water-borne diseases, the intervention of the project has a significant impact to reduce the prevalence of water-borne diseases on average 42.20%, using different matching types. Under-five child mortality in project participant households shows a significant decrease by an average of 10%. However, the project didn't succeed to bring significant impact on Trachoma prevalence reduction in the last five years.

Even though the project has registered remarkable results to create access to safe water supply in nearby villages, the minimum standard of 15 litters of water per day within a 1 Km radius is not yet achieved. Hence, the project needs further effort to meet the minimum adequate and safe water supply for rural households in the intervention area. Recognized efforts are made to create access to toilet service for targeted households, however, maintaining local standards of constructed toilets is still remaining where only 37.79% of toilets fully meet locally developed standard criteria. Hence, the project needs to deploy more initiatives that encourage rural families to maintain the standard of toilets.

EKHC should scale up its project to non-intervention areas since open defecation everywhere can spoil and affect the health of project intervention areas. The impact of the project to minimize the prevalence of Trachoma is not significant which reminds the need to investigate basic reasons why the project fails to achieve and revise the planned activities in a result-oriented manner. Like-minded Non-Government organizations and concerned Government offices should investigate and learn from the Ethiopian Kale-Hiwot project success to scale up and diversify WaSH project initiatives in order to improve the health status of rural families. The project should develop and capitalize on documentation of success stories and best practices in order to share experiences with other organizations as well as to foster sanitation and hygiene practices.

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