Non-Functioning Water Points and Child Health In Nigeria

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Abstract: *Nigeria is fascinating to research since it ranks badly in human development indices and is badly afflicted by high under-five mortality rates, with the majority of deaths occurring due to preventable causes. While it is a well-known fact that Nigeria has a large number of non-functional water points, to the best of my knowledge, no study has measured the impact this has on the country. As a result, the study estimates the impact of non-functioning water points on children's health outcomes in Nigeria, such as diarrhoea and mortality. Given the dichotomous nature of the outcome variables, the study used logistic regression to estimate the models. The study's key finding was that children who live near non-functional water points are more vulnerable to diarrhoea and mortality than children who live near functioning, safe, and enough water points. Maternal education is the driving force behind the observed discrepancies. The study suggests that the present water source be maintained, renovated, and revitalized using a community-based approach.*

Keywords: Non-Functioning Water Point, Children Health, Diarrhoea, Mortality
JEL Code: I12 Q25 J24

Introduction

Water and sanitation access are significant determinants of good health. Water-sanitation-related diseases such as diarrhoea, dengue fever, malaria, and cholera can be fatal if exposed to polluted or non-functioning water points. Exposure to polluted or non-functioning water points is estimated to cause over 500,000 diarrhoea deaths per year, according to the World Health Organization (WHO, 2018). It is also one of the leading causes of child mortality, particularly among children under the age of five in underdeveloped countries (Centre for Disease Control, 2016). Children under the age of five are particularly vulnerable to water-sanitation-related diseases due to their developing immune systems. As a result, research like (Waziri, Nor, Hook, & Hassan, 2018) and (Kasirye, 2010) propose improving family access to safe drinking water to lower mortality rates, particularly among children under the age of five in poor nations.

There has recently been more emphasis on the need to expand investment in Water, Sanitation, and Hygiene (WASH). This aims to lessen the health risks connected with contaminated water, particularly for those who are most vulnerable. For example, the United Nations Children's Fund (UNICEF) recommends allocating 1.7 percent of the annual budget to WASH provision, and one of the Sustainable Development Goals (SDGs) is to expand capacity-building and international cooperation to developing countries, as well as support in activities and programs related to water and sanitation, by 2030. Despite these advocacy efforts, the United Nations estimates that around 2 billion people lack access to clean and safe drinking water as of 2017. A total of 159 million people are estimated to have collected water directly from unsafe sources such as lakes and streams, while another 263 million spent at least 30 minutes of productive time collecting water from various water points (WHO, 2017). According to a survey done in 2015 in Nigeria by the Federal Ministry of Water Resources, just about 19 percent of households have access to safely regulated drinking water, while 60 percent of the country's water facilities are non-functional. These poor WASH conditions may have a substantial impact on the country's prevalence of water-sanitation-related diseases. Indeed, according to a 2019 research by the National Bureau of Statistics (NBS), poor WASH services are responsible for 68.6% of the 104.3 deaths of children under the age of five per 1,000 live births in Nigeria. Malaria, diarrhoea, and acute respiratory infections were the main causes of death for children aged 1 to 59 months worldwide in 2016, according to WHO (WHO, 2018). Diarrhoea deaths, which are caused by poor water sanitation, account for around one million new-borns fatalities each year. Furthermore, three-quarters of these children are said to live in developing nations, thereby affecting their growth and economic performance (WHO, 2017).

The study presents new evidence on how children's health outcomes in Nigeria are affected by exposure to non-functional water points. There are two key reasons behind Nigeria's selection. To begin with, the country ranks low on human development indices and is heavily impacted by high under-five mortality rates, with the majority of deaths occurring due to preventable causes. As a result, determining the magnitude to which children exposed to unsafe drinking water sources differ in terms of early life health outcomes is critical. Second, while it is a well-known fact that Nigeria has a large number of non-functional water points (Khan, Niang, Jurji, & Mahato, 2018), to the best of my knowledge, no study examined has assessed the impact this has on the country. An analysis like this could be useful for policy advocacy in underdeveloped nations targeted at improving access to safe drinking water.

The following is the format of this paper: section one begins with a general introduction in which the problem is highlighted and questions are presented. While section two deals with literature review. The study's data and empirical strategy are discussed in the next section. The questions mentioned in section one is examined in the following chapter, and the results are presented along with the discussions. Conclusions and recommendations are presented in the final section.

Literature Review

The concept of on-functioning water point is defined as any source of water for the household or community found not to be usable at the period of the study, hence, switching to other alternative sources that could affect both quantity and quality of the water. In this analysis, the conceptualization of sanitation by Kwiringira et al., (2016) is adopted. As a result, sanitation is described as the safe end-use or disposal of human excreta (faeces) and urine through the provision of facilities and services that ensure adequate conveyance from the toilet to containment, storage, and treatment onsite or conveyance and treatment. Child health is a collection of interconnected characteristics that determine the costs of disease for children. This involves functioning, impairments, social roles, and activity participation, as well as enhancing quality of life. A change in normal body function or structures is referred to as deficiency. As a result, diarrhoea and mortality are proxy of child health for this study.

Khanna (2008) looked at how access to water and sanitation, as well as other socioeconomic factors, affects child health in India. The survey was evaluated using the propensity score method (PSM). The findings revealed that diarrhoeal risk probabilities have significant marginal effects on reducing disease-specific in children, which are consistent across the models used.

Kasirye (2010) used Probit to demonstrate how access to clean water and improved sanitation affect diarrhoea in Ugandan households based on environmental conditions and disease prevalence. When Probit was used in the survey, it was discovered that only piped water in the home and access to private covered pit latrines had a major effect on diarrhoea prevalence. The findings also showed that having group standpipes results in the greatest reduction in disease burden due to the accessibility of a large number of households. Odima (2014) aimed to look into the relation between poverty and ill-health in Kenya, as measured by child mortality and the household wealth index. The data is from Kenyan demographic and health survey, and it was analyzed using the two-stage Least Square method. According to the 2SLS findings, child mortality rates in Kenya are influenced by poverty (wealth index), residence type, mother's education, access to water, sanitation, and cooking fuel, as well as the gender of the household head.

Waziri et al., (2018) investigated access to clean drinking water, adequate sanitation, under-five mortality, and living standards in developing countries. The analysis sampled 81 developing countries using the Generalized Method of Moment. According to the GMM findings, access to healthy drinking water has a negative and important effect with under-five mortality. Similarly, the findings indicate that good sanitation in developing countries is negatively linked to the prevalence of under-five mortality. Olukanni and Okorie (2016) investigated water, sanitation, and hygiene practices in a semi-urban environment in Ondo state, using a socio-economic and cultural lens. A descriptive study was conducted on the survey that was conducted. The findings revealed that literacy level and age group have a significant impact on housing settlements, while water supply and quality have a significant impact on health, and water quantity has an impact on sanitation practices. The study's findings also revealed that cultural traditions and access to water supplies had no direct relationship.

Pruss-Ustun et al. (2019) looked at the burden of disease caused by poor water, sanitation, and hygiene for a number of negative health outcomes in Low and Middle-Income Countries (LMICs). In 2016, about 829,000 WASH-attributable deaths and 49.8 million DALYs were reported to have resulted from diarrheal diseases, accounting for 60 percent of all diarrheal deaths. WASH-related diarrhoea caused 297,000 deaths in children under the age of five, accounting for 5.3 percent of all deaths in this age group.

The above findings of the literature showed how some authors had agreed on the impact of water and sanitation on children health outcome specifically for under-five children. In the same vein, it showed how some studies also differ on the extent to which the magnitude of such effect has on child health outcome. They are very important in suggesting the dynamics of the problem and how it should be looked at when analyzing, keeping in mind such controversies. Thus, these studies (reviewed above) indicated the existence of the problem of having access to non-functioning water points on children health outcomes precisely in developing countries. Hence, the study hypothesized that children exposed to non-functional water points have impaired health outcome particularly for under-five children.

Data and Empirical Strategy

Water Point Data

The Water Point Data Exchange (WPDx) provides data on water points in Nigeria. Water Point Data Exchange is an open-source platform that allows people from all over the world to share water-related data. There are already 250,000 water point sources in the database from 25 nations (Water Point Data Exchange 2015). The data for Nigeria comprises 89,885 water stations with supplementary information for each of them (e.g. non-functionality, latitude and longitude location, documentation, source of water, the technology of water source, installation date, and installer name).

Health Data

Individual-level data from the Demographic and Health Surveys (DHS), a nationally representative survey done every 5 years in several low- and middle-income countries, was used to quantify health outcomes and monitor for confounding variables. The households surveyed were selected using a two-stage sampling technique in which representative clusters were randomly selected, followed by a random sample of households within each cluster. Women aged 15 to 49 were interviewed for the household and provided information on the number and health of the children. Only children under the age of 5 years old at the time of the interview were included in this study (N = 33,924), as well as deceased children who would have been less than 5 years old if still alive at the time of the interview. In this study, the data from the 2018 survey was used. Diarrhoea occurrences in children under the age of 5 are the key outcome variable. The second outcome predictor is child mortality, as reported by the female household head.

Confounding variables were also controlled for using extra survey questions from the DHS data. The level of education of the family head was established. The administrator went into great detail on the toilet facilities in the house, as well as the floor material used. For both of these parameters, a binary ‘Improved' or ‘Unimproved' variables was developed to further measure their effects.

Combining datasets (DHS & WPDX)

To use the DHS and WPDX datasets, they must first be combined. Merge compares and merges matching observations from the master dataset and the using dataset on one or more major variables. The master dataset is DHS, and the utilizing dataset is WPDX, using location as the key (common) variable for the purposes of this study (represented by coordinate X and Y: X is latitude while Y is longitude). Remember that the exact position of the household and the water point are not necessarily the same, because in Nigeria, water points are shared by families, though individual homes have recently begun to construct their own. As a result, each household's coordinates were manually mapped to the nearest water source. After that, the model was estimated, and the calculated marginal effects were reported. The marginal effect is calculated from the predicted odd ratios to show the magnitude of the effect. As a result, the average marginal effect is chosen over an arbitrary estimate for the purposes of this research due to its superiority in creating a single quantity description that represents the whole distribution of X (Leeper, 2021).

Model Specification

This study defined the model based on the seminal work on child survival in underdeveloped countries (Mosley & Chen, 1984). It is considered that a child's health is influenced by maternal factors, environmental factors, nutritional deficiencies, and socioeconomic circumstances. Child diarrhoea and child mortality were used as proxy for child health outcomes in this study.

$$CH_{ij} = \beta_0 + \beta_1 Wat_j + \beta_2 San_j + \chi X_{ij} + \delta_j H_j + \varepsilon_{ij} \quad \ldots\ldots\ldots\ldots (1)$$

Where CHij is a binary outcome for child I in household J, Watj is the status (non-functioning) of household j's water point, Sanj is the toilet facility in household j, Xij is a vector of both child and household characteristics, Hj is a vector of household fixed effect, and ij is the error term for child I in household J.

Estimation Technique

A logistic regression model was utilized in this study. The logit regression approach was employed since both the dependent and key independent variables of interest are dichotomous. In logit regression, the transformation is given as:

$$\beta_1 X_1 + \ldots + \beta_k X_k \quad \ldots\ldots\ldots\ldots (2)$$

$$1 = \text{Logit (Y)} = \ln\left[\frac{p}{1-p}\right] = \beta_0 + \beta x \quad \ldots\ldots\ldots\ldots (3)$$

In the logit regression strategy, the intercept (β_0) and regression coefficients (β_s) are commonly computed using the maximum likelihood estimation technique (Peng, Lee, & Ingersoll, 2002).

$$\text{Thus,} \quad \text{Logit (Y)} = \ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_0 + \beta_1 Wat_j + \beta_2 San_j + \chi C_{ij} + \delta_j H_j + \varepsilon_{ij} \quad \ldots\ldots\ldots\ldots (4)$$

Equation is transformed to give the following;

$$\frac{\partial P(Y \mid X; \beta)}{\partial} = \frac{e^{\beta_0 + \beta_1 Wat_j + \beta_2 San_j + \chi C_{ij} + \delta_j H_j + \varepsilon_{ij}}}{1 + e^{\left(\beta_0 + \beta_1 Wat_j + \beta_2 San_j + \chi C_{ij} + \delta_j H_j + \varepsilon_{ij}\right)}} \quad \ldots\ldots\ldots\ldots (5)$$

As a result, the marginal effect is given by equation (5). As a result, it became our final model, which we estimated and reported in our results section.

Results

Table 4.1 Logistic regression results for non-functioning water point and diarrhoea

	Diarrhoea			
Independent Variable	(1)	(2)	(3)	(4)
Water	0.1589***	0.1591***	0.1614***	0.1635***
	(0.0038)	(0.0037)	(0.0038)	(0.0037)
Sanitation	0.0133***	0.0131***	0.0194***	0.0163***
	(0.0042)	(0.0042)	(0.0044)	(0.0044)
Child Characteristics	No	Yes	Yes	Yes
Household Control	No	No	Yes	Yes
Household Fixed Effect	No	No	No	Yes
Observations	30,712	30,712	29,149	29,149

Coefficient estimates displayed are Marginal Effects, Delta-Method Standard errors in parentheses. Household control includes the household's Number of under-five, wealth index, and household's total number of children. Household Fixed effects are: the age of mother at first birth, educational attainment of mother, marital status and educational attainment of partner. The child's characteristics includes birth interval, child sex and birth type. Note: * denotes significant at 10%, ** at 5%, *** at 1%

Table 4.1 shows the links between a non-functioning water point, sanitation, and the risk of diarrhoea in children under the age of five. For each outcome variable, the results of four models were displayed: a baseline result with only key predictors (water and sanitation) in column 1, child characteristics in column 2, and a final result with all main predictors (water and sanitation) in column 3. In column 3, there was also a household control. The model's entire specification, including child characteristics, household control, and fixed effects, were then estimated. According to the findings, access to operational, safe, and abundant water points appears to be protective for Nigerian children under the age of five. The baseline model in column 1 of Table 4.1 shows a 15.89 percent increase in the chance of diarrhoea episodes among under-five children exposed to non-functioning water stations. The estimated preventive effects of water are increased when child features and family control are added. When compared to the baseline model, the result in column 3 reveals an average increase of roughly 0.25 percent in the probability of child diarrhoea due to exposure to non-functioning water points.

When the home fixed effect and the child fixed effect were evaluated individually, the result revealed that the Household fixed effect had a greater impact on diarrhoea disease in children under the age of five. The estimated effects are identical to the findings in column 3 when all confounders are taken into account, with a 16.35 percent chance of diarrhoea. Furthermore, children who live in a household where confounding factors are controlled have a 0.46 percent higher risk of diarrhoea than children who live in households where confounding variables are not controlled. In a similar vein, enhanced sanitation appears to be less protective of child health (only 1.33 percent to roughly 1.94 percent chance of diarrhoea episode) than water facilities.

Table 4.2 Logistic regression results for non-functioning water point and mortality

	Mortality			
Independent Variable	(1)	(2)	(3)	(4)
Water	0.1274***	0.1240***	0.1155***	0.1143***
	(0.0035)	(0.0034)	(0.0033)	(0.0032)
Sanitation	0.0077**	0.0066***	0.0216***	0.0199***
	(0.0035)	(0.0035)	(0.0035)	(0.0034)
Child Characteristics	No	Yes	Yes	Yes
Household Control	No	No	Yes	Yes
Household Fixed Effect	No	No	No	Yes
Observations	33,922	33,922	32,189	32,189

Refer to Table 4.1

Table 4.2 the format of the result is the same as it has been in prior results. Only that the outcome variable is for child mortality. The findings suggest that in Nigeria, access to operational, safe, and enough water stations appears to be protective for children under the age of five. The baseline model in column 1 of Table 4.2 shows a 12.74 percentage point increase in the chance of mortality among under-five children exposed to a non-functioning water point. When child features and family control were taken into account, the estimated protective effects of water were lowered, though not dramatically. When confounders are taken into account, the risk of dying as a result of non-functioning water points is reduced. Even when all confounding is controlled for, the assessed impacts are significant: children living in a household near a non-functioning water point have a risk of dying before reaching their fifth birthday that is 1.31 percent lower than when all confounding is adjusted for.

Similarly, the findings show that a sanitation facility is less protective for children under the age of five than water. In contrast to the preceding Table (4.1), the result in Table 4.2 shows that the chance of child death due to sanitation is 0.77 percent when no confounding factors are taken into consideration. When all factors are considered, however, there is a 1.99 percent increase in the likelihood of a child dying before reaching the age of five.

Discussions

The result in this study implies that having access to adequate, safe water and improved sanitation facilities has a favourable impact on children's health outcomes. The costs of a non-functioning water points seems to be higher than the costs of sanitation. When all factors are taken into account, children in households with a safe, functioning water source have a lower risk of diarrhoea and stunting than children in households with a non-functioning water source. The results of the models that included all control factors, as shown in column 2 and 4 of Table 4.1, suggest that children in families with improved sanitation have a lower risk of diarrhoea in the short term and a nearly lower risk of stunting.

This study of the relationship between child health outcomes and the household's source of drinking water and sanitation facility suggests that there are explicit protective effects, particularly for the functioning and safe water points. Access to a hygienic sanitation facility has a relatively strong impact on child health outcomes, which is robust to controls for the family's human and physical capital and does not appear to differ significantly by child characteristics. When controls for household human and physical resources are included, the effects of increased water supply on child morbidity outcomes are also robust, and they are of similar magnitude for diarrhoea episodes, stunting, and mortality.

The protective effects of maternal education on children's health outcomes, particularly diarrhoea and mortality, are found to be robust and consistent with what is known in the literature. When compared to the effect of maternal education, the magnitude of the protective effect of paternal education is found to have a lesser effect, particularly for diarrhoea, and a substantially similar effect for mortality. For each of the model estimated for children's health outcomes, the marginal impact for four maternal and five paternal education groups, with no education as an excluded category, the results are controlling for household characteristics. In general, the outcomes of partner education are similar to those of maternal education, however they are slightly lower.

Given that both biological and physiological traits are constant; these findings have an economic consequence that children's health outcomes can be a potentially worthwhile investment. The literature is clear in demonstrating how investing more in children's health results in adults who are more informed and efficient, hence shifting society to a more favourable demographic setting (see Belli et al. (2005), Currie, and others) (2019). This assumes, however, that having a good health experience throughout childhood is more important than having a good health experience at any other age, because poor health during a child's early years is more likely to impact them permanently later in life (Belli et al., 2005).

Conclusion and Recommendations

In Nigeria, the study looked at the consequences of non-functional water stations on children's health. Using combined datasets from the highly standardized, nationally representatives DHS and WPDX for under-five children in Nigeria. The data reveal that the protective effects of functioning, safe, and abundant water are strong for risks of diarrhoea episodes and child mortality risks; in effects, the size falls in between the protection derived mostly from mothers' secondary level of education. The advantages of enhanced sanitary facilities are usually minor. As a result, calls for a new way of thinking about sanitation initiatives became a top priority. Although considerable progress has been made in boosting water supply in line with MDGs and consolidating program SDGs, the study suggests. As a result, a community-based approach should be used to preserve, renovate, and revitalize the existing water source. Every household should also be connected to the public water system.

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