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Medical Sciences

An Assessment on WASH Interventions and other Risk Factors of Diarrhoea among Under Five Children in Some Rural Parts of Zambia where Survive to Thrive Project Operates

Kalaluka Kalaluka[1*], Ekwase Msoni[1], Moffat Mtonga[1], Masauso Nqumayo[1], Thomas Chirwa[1], Wongani Zulu[1], Malelo N. Ilukena[2], Jessy S. Mahongo[2], Wanty M. Maposa[2]

[1]Strategy, Impact and Learning Department-World Vision Zambia
[2]Integrated Programs Department-World Vision Zambia

*Corresponding author: Kalaluka Kalaluka
Strategy, Impact and Learning Department-World Vision Zambia

Abstract		Original Research Article

Background: In developing countries like Zambia, diarrhoea in the under-five children is one of the major causes of morbidity and mortality. Many efforts and interventions have been put in place by different stakeholders in the quest to lower the prevalence of diarrhoea. Despite all these efforts, diarrhea is still the major cause of morbidity and mortality due to many factors which may include; limited access to clean water, poor sanitation and hygiene practices in many different homes especially in rural communities. The main objective for this study was to identify the WASH and other related factors associated with diarrhoea in the under-five children in some parts of rural communities of Zambia. *Methods*: This study conducted a cross-sectional study among 840 women of child bearing age and 827 children under the age of five years who were sampled from households surrounding the Supervisory Enumeration Areas (SEAs) that were within the catchment radius of the 39 health facilities under World Vision Zambia where Survive to Thrive (S2T) Project operates. A structured questionnaire was used to collect sociodemographic, WASH, nutrition and hygiene data using KOBO platform and the data was analysed using STATA Version 15 where the statistical significance was considered if $p < 0.05$. Descriptive analysis was used to estimate the prevalence of diarrhea. Additionally, univariate and multivariate logistic regression were conducted to estimate the association of Water, Sanitation and Hygiene and other related factors to diarrhoea among the under-five children. *Results*: From the 827 under-five children who participated in this survey, 25% (n=207) experienced diarrhoea in the previous two weeks prior to the survey with Makungwa in Eastern province recording the highest number of cases (n=90) out of a total of 240 participants. On the other hand, Lunga in North Western province recorded the lowest number of cases (n=17) out of a total of 96 participants. The inferential statistics results showed that children who were exposed to other liquids besides break milk had increased odds (OR=2.89, 95% CI=1.20, 6.94) of experiencing diarrhoea and most of those with diarrhoea had increased odds of experiencing fever (OR=1.97,95% CI: 1.28,3.03). It is important to note that most of those with diarrhoea were under the age of 6 months suggesting that they were still breastfeeding with (OR=1.69, 95% CI: 1.075,2.654). Finally, the results indicated that, there were reduced odd of a child from a female headed household to experience diarrhoea (OR=0.317, CI: 0.117,0.857) as compared to male headed homes. All these results were statistically significant at 0.05 level of significance. *Conclusion*: The results showed a significant association between children who were exposed to other liquids and them experiencing diarrhoea and a significant association to also experiencing fever. The results further showed that female headed homes recorded fewer cases compared to male headed homes with more cases recorded in Makungwa of Eastern province and the lowest number of cases was recorded in Lunga area program of North Western province of Zambia.
Keywords: WASH, Diarrhea, Under-5 children, Survive to Thrive.

1.0 INTRODUCTION

Improved access to clean Water, Sanitation and Hygiene practices and good nutrition have high chances of contributing to the reduction of diarrhoea morbidity and mortality globally by 50%, (McClelland *et al.,* 2022). In spite of different gains and efforts put in place to combat the diseases, diarrhoea still remains one of the leading causes deaths among the under five children

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especially in developing countries like Zambia. (Hussain *et al.,* 1999) defines diarrhoea as the passage of loose stools three or more times in a 24-hour period in adults, and with twelve or more loose or watery stools for a breast-fed baby. According to (Nemeth & Pfleghaar, 2024), diarrhoea is generally classified as acute watery, persistent or dysentery. The difference among these types of diarrhoea is that, acute watery diarrhea has a sudden beginning which may last before two weeks while persistent diarrhea may go beyond two weeks.

It is important to note that, despite diarrhoea being one of the leading causes of deaths in developing countries like Zambia, it is preventable with some good sanitation services, hygiene interventions that reduce on contamination at household level. A study which was done by (Hamooya *et al.,* 2020) showed that diarrhoea is the third largest killer of children aged less than five in Zambia and it is estimated that every year 15 000 die as a result of the disease. Due to longer distances to health care facilities in many rural communities in Zambia, most people prefer home management of diarrhea and those who manage to seek health care services, are often inadequately treated due to lack of high-quality health facilities and poverty in rural areas. It is important to note that fighting diarrhoea should be approached from different angles because the predictors of the disease are multifaceted with many factors such as hygiene behaviour, pathogenicity and also the epidemiology of the disease among others, (Bandoh *et al.,* 2024). However, it has been observed in different interventions that the predictors of diarrhoea have generally been tackled in silos focusing on particular causes leaving some out depending on the focus of the implementation approach and/or objectives. Despite all these glitches and caveats surrounding the fight against diarrhoeal disease in the under five children, what is comforting is to note that diarrheal diseases are preventable by safe water and improved hygiene and sanitation. One of such interventions highlighted by (Bhandari *et al.,* 2008) showed that primary control strategies for diarrhea morbidity that have proven to be more cost effective and efficacious are timely administration of oral rehydration salt (ORS), and Zinc tablets. Another study by (Bosomprah *et al.,* 2016) further showed that most of diarrhoeal diseases can be prevented by use of *rotavirus* vaccine along with the implementation of water, sanitation and hygiene (WASH) programmes.

1.1 Background
A study by (Hartman *et al.,* 2022) indicated that, in 2021 diarrhoea was a leading killer of children, accounting for approximately 9% of all deaths among children under the age of 5 worldwide which translates to over 1,200 young children dying each day, or about 444,000 children a year, despite the availability of a simple treatment solution. In another study by (Manetu *et al.,* 2021),the results showed that nearly one in every nine child deaths, which is about 1.6 million each year,

are due to diarrhea which is more than children who die due to malaria, measles and acquired immunodeficiency syndrome (AIDS) combined. In order to fight the disease, a better understanding of diarrhoea prevention in the under-five children may help to reduce associated morbidity and mortality rates especially in developing countries like Zambia.

In sub-saran Africa, access to clean water, sanitation and hygiene are not readily available especially in rural communities which may be highly associated with the high burden of diarrheal diseases compared to the rest of the world. A study which was done by (Owusu *et al.,* 2024) showed that the prevalence of diarrhoea was standing at 15.3% in the sub-Saharan Africa. A study by (Bosomprah *et al.,* 2016) showed that in 2015 in Zambia, an estimated 39,000 live-born children died before their fifth birthday, of which 26,000 occurred among post-neonatal under-five children. The study further showed that, about 16 % of Zambian children under the age of 5 experienced episodes of diarrhoea and about 66 % of these cases involved at least one health facility visit for diarrhoea.

In order to combat diarrhoea among the under 5 children, World Vision Zambia through Survive to Thrive (S2T) Scale Up project is implementing Water, Sanitation and Hygiene, Health and nutrition interventions in some parts of Southern, Central, Northern, North-Western, Muchinga and Eastern provinces. The goal of the project is to reduce morbidity and mortality among women of child bearing age and children who are under the age of five in targeted Communities through provision of access to integrated primary health care. The projects targets to reach this goal by sensitizing community members to adopt positive behaviour and also through improved access and utilization of quality essential health care services for mothers, new-borns and under five children in targeted communities. These two drivers to achieving the goal of the project are also expected to be achieved through capacity building of community-based volunteers in key models like Community led Total Sanitation (CLTS), Timed and Targeted Counselling (TTC), Positive Deviance Hearth (PD-Hearth) among other models. Capacity building for health facility staff has also been done in key models like Infection Prevention and Control (IPC), Integrated Management of Childhood Illnesses (IMCI) and Essential New-born Care. The project also is in to construction of piped water systems and ablution blocks in all the 39 health care Facilities in the catchment area of the project and 6 maternity annexes in some selected health care facilities.

2.0 METHODS AND MATERIALS
2.1 Study Design
A cross-sectional study was conducted among 840 women of child bearing age (15-49 years) and 827 children under the age of 5 who were sampled from

households surrounding the Supervisory Enumeration Areas (SEAs) that are within the catchment radius of the 39 health facilities under World Vision Zambia where Survive to Thrive (S2T) Project operates.

2.2 Study Sites
The study population included children under the age of 5 years at baseline residing in the 14 districts (Kalomo, Namwala, Pemba, Mazabuka, Monze, Sinazongwe, Kapirimposhi, Kasama, Luwingu, Mwinilunga, Isoka, Nyimba, Katete and Kasenegwa) where Survive to Thrive Project operates. The care givers were interviewed on different items which included childhood illnesses, hygiene practices, their understanding of feeding programs, antenatal care visits among others where the caregiver was either the child's father, mother or relative with adequate information on the child.

2.2 Statistical Methods
Data was analysed using a Stata Software package version 17. The analyses of descriptive statistics were conducted in order to establish the distribution of sociodemographic and other factors for the study. Frequencies and percentages were obtained for categorical variables. Additionally, the prevalence of diarrhoeal disease among the under 5 children was estimated which also included the establishment of which province had the highest number of diarrhoea cases. On inferential statistics, multivariable logistic regression model with Odds Ratios was used to identify the relationship between the predictors and the presence of diarrhoeal disease. In selecting a parsimonious model, A forward stepwise regression model was applied to select variables used in the final regression model. A p-value of <0.05 was the cut-off for statistically significant measures in the final model, with a 95% confidence level.

3.0 DATA ANALYSIS AND RESULTS
Descriptive statistics were estimated in this study in order to bring out the insight on the frequencies observed from the data on each of the variables associated with diarrhoeal cases among the under 5 children in areas where S2T Scale Up project was implemented. In order to estimate the degree of association between diarrhoea and its predictors, a multi-variable logistic regression model was used since the outcome variable (A child experiencing diarrhoea in the past two weeks) was binary (Yes/No). A parsimonious model was estimated using the Akaike Information Criterion (AIK) and Bayesian information Criterion (BIC) which represented the data properly.

3.1 Descriptive Statistics
The results in this study indicated that out of 827 under five children who participated in the baseline survey for the Survive to Thrive Project, 25% (n=207) experienced diarrhoeal disease in the previous two weeks before the survey was conducted and 75%(n=620) did not experience diarrhoea. The results further indicated the highest percentage of 37.5%(n=90) of the children experienced diarrhoea in Eastern province (Katete, Makungwa and Chipata) within the catchment area of Survive to Thrive Project. Figure 2.1 below shows the number of diarrhoeal cases which were recorded based on the baseline data in the S2T Scale Up project catchment area.
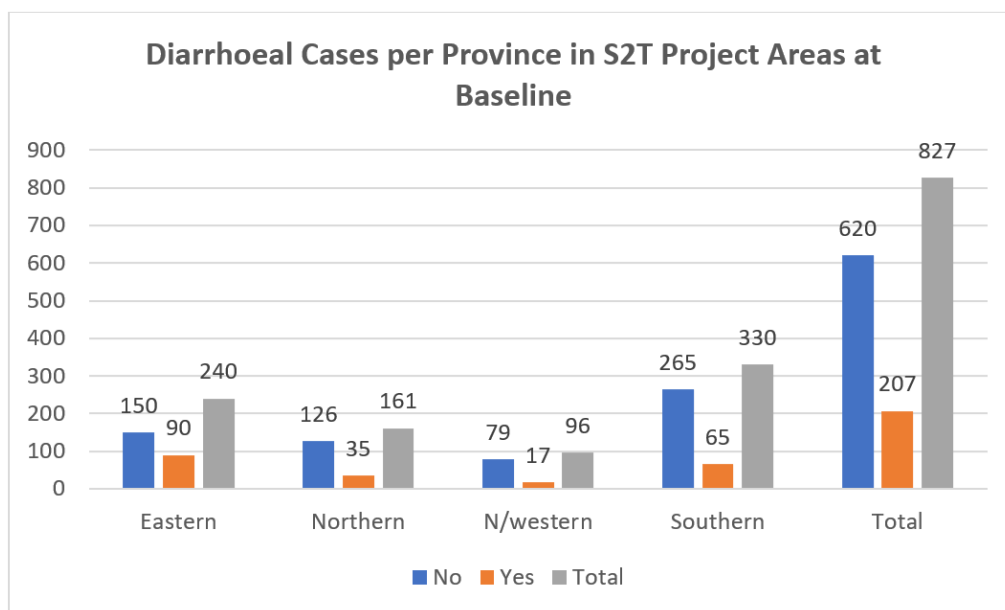

Figure 2.1: Number of diarrhoea cases in S2T Project Catchment areas at baseline

The results in figure 2.1 above further showed that, the lowest number of cases at 17.7% were observed in North-Western province (Mwinilunga district) in the catchment area for Survive to Thrive Project at baseline.

Additionally, table 1 below gives a description of the variables which were considered in this study through a detailed description of statistics for each category.

Table 1: Descriptive statistics of the variables used in this study

Characteristics	No diarrhoea	Had diarrhoea	Total
Caregiver's age in years			
15-24	256 (74.5%)	86 (25.14%)	342
25-34	194 (72.4%)	74 (27.64%)	268
35-49	170 (78.3%)	47 (21.74%)	217
Caregiver's marital status			
Married	473 (73.4%)	171 (26.64%)	644
Widowed	12 (92.34%)	1 (7.74%)	13
Single	64 (80%)	16 (20%)	80
Never married	18 (81.84%)	4 (18.24%)	22
Divorced/separated	53 77.94%)	15 (22.14%)	68
Caregiver's level of education			
Never attended	23 (60.54%)	15 (39.54%)	38
Lower primary	71 (77.24%)	21 (22.84%)	92
Upper primary	261 (73.74%)	93 (26.34%)	354
Lower secondary	180 (74.44%)	62 (25.64%)	242
Upper secondary	74 (864%)	12 (144%)	86
Tertiary	11 (78.64%)	4 (21.44%)	15
Gender of the child			
Male	256 (71.9%)	109 (28.14%)	365
Female	276 (76.2%)	86 (23.84%)	362
Gender of the household head			
Male	371 (71.9%)	145 (28.14%)	516
female	50 90.9%)	5 (9.14%)	55
Distance to the facility			
0-30minutes	316 (70.9%)	130 (29.14%)	446
30min-1 hour	175 (76.1%)	55 (23.94%)	230
2hrs-3 hours	109 (85.2%)	19 (14,84%)	128
Above 3 hours	30 (91.0%)	3 (9.04%)	33
Water source			
Open well	148 (71.8%)	58 (28.24%)	206
River/Stream	102 (73.9%)	36 (26.14%)	138
Pond/Canal	26 (83.9	5 (16.14%)	31
Protected sources	213 (77.7%)	61 (22.34%)	274
Hand washing facility with soap and water			
Yes	98 (72.1%)	38 (27.94%)	136
No	522 (75.5%)	169 (24.54%)	691
Wash of hands before feeding the child			
Yes	221 (70.2%)	94 (29.84%)	315
No	399 (77.9%)	113 (22.14%)	512
Availability of latrine			
Yes	435 (73.6%)	156 (26.4%)	591
No	185 (78.4%)	51 (21.6%)	236

Out of 827 women of child bearing age in this study, the majority at 41.4%(n=342) were aged between 15 and 24 years, 32.4%(n=268) were between 25 and 34 years while 26.3% (n=217) were aged between 35 and 49 years. the highest level of education for most of the care givers was upper primary (grades 5-7) at 42.8%(n=354). About 77.9% (n=644) of the respondents were married with the least being those who were widowed at 1.6%(n=13). Among the under 5 children, 44.1%(n=365)

were girls and 43.8%(n=362) were boys. Most of the respondents came from the male headed households at 62.4% (n=516). The results of this study showed that most respondents 53.9%9(n=446) were within 30 minutes to reach the health care facility. Additionally, 24.9%(n=209) draw water from open water wells while 33.1%(n=274) draw water from protected water sources. On hygiene practices, the results showed that 83.6% (n=691) of respondents had no hand washing facilities

with soap and water present. The results further showed that the majority of the respondents 61.9%(n=512) did not wash hands before feeding the child while 71.5% (n=591) indicated that they had latrines.

3.2 Model Explorations

In order to model the diarrhoeal cases in the World Vision S2T Scale Up Project catchment areas, there was need for a careful selection of one or more statistical models that could provide a good description of our outcome variable (a child experiencing diarrhoea), estimation of parameters for the selected models and also statistical testing for selection of one of the considered models. Since the outcome variable is binary (whether a child experienced diarrhoea or not) the distribution of such events follows a binomial distribution. Statistical modelling to come up with a parsimonious model was done and these models were compared to select the best fit model for the S2T Scale Up Project baseline data through the use of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). The table below shows the results for the parsimonious model which was selected.

Table 2: 2 Multivariate logistic regression model with odds rations, P-value and confidence intervals for diarrhoeal disease among the under 5 children in parts of rural Zambia

Predictor	Odds Ratio	P-Value	95% C.1
A child exposed to other Liquids			
Yes	2.89	0.018*	(1.20, 6.94)
Gender of the Child			
Female	0.79	0.255	(0.520,1.189)
Age of Household head	1.00	0.806	(0.98,1.01)
Availability of handwashing facility with water and Soap			
Yes	1.100	0.528	(0.682,2.108)
A child having Fever			
Yes	1.97	0.0028*	(1.28,3.03)
Availability of Latrine			
Yes	1.01	0.971	(0.616,1.65)
Gender of the household head			
Female	0.317	0.024*	(0.117,0.857)
Sensitization by community Health Workers			
Yes	0.396	0.041	(0.131,1.189)
Child <2yrs			
Yes	1.689	0.023*	(1.075,2.654)
Availability of Rubbish pit			
Yes	1.29	0.288	(0.804,2.083)

A forward stepwise approach was used in order to come up with a parsimonious model presented in table 2 above. The results showed that children who were exposed to other liquids (livestock milk, local home-made drinks, e.g. Munkoyo, Chibwantu e.t.c) had increased odds of developing diarrhoea (OR=2.89, 95% CI=1.20, 6.94) with p-value=0.018. On the other hand, the children who had fever compared to those who did not have, were likely to have diarrhoeal disease (OR=1.97,95% CI: 1.28,3.03) with p-value=0.024. The gender of the under 5 children, age of the household head, availability of handwashing facility with water and soap, availability of the latrine and the rubbish pit were all not statistically significant at 0.05 level of significance. Furthermore, the results showed a reduction in diarrhoeal disease in female headed households as compared to the male headed households (OR=0.317, CI: 0.117,0.857) with p-value =0. 024. The study also looked at whether the children who were under the age of two were more at risk of developing the diarrhoeal disease or not. It has been shown in this study that children who were under the age of two years had increased odds of developing diarrhoeal disease (OR=1.69, 95% CI: 1.075,2.654) with p-value=0.023.

4.0 DISCUSSION

In this study, one of the key factors which was looked at was how liquids (livestock milk, local home-made drinks, e.g. Munkoyo, Maheu, Chibwantu e.t.c) could be associated with the diarrhoeal disease among the under 5 children in the areas where Survive to Thrive Project was being implemented. The results showed that most children who were exposed to other liquids had increased odds of experiencing diarrhoeal disease and the majority were under the age of two. These results may suggest that the other liquids which care givers give their children could be stale leading to food poisoning. On the other hand, a study which was done by (Brown *et al.,* 1994) indicated that Cow's milk contains high concentrations of protein and minerals, which can stress a newborn's immature kidneys which may lead to fever, diarrhea or heart stress.This may suggest that some of the parents maybe giving cow's milk to their children which may be contributing to the diarrhoeal disease to the under 5 children. Another study which was

conducted by (Bányai *et al.*, 2018) showed that Viral gastroenteritis is an intestinal infection that includes signs and symptoms such as watery diarrhea, stomach cramps, nausea or vomiting, and sometimes fever which may develop through contact with an infected person or by consuming contaminated food or water and this may be deadly for infants, old adults or people with compromised immune systems.

The results further showed that the female headed households had reduced odds of their child experiencing diarrhoeal disease compared to male headed households. In many households in rural communities of Zambia, male headed homes where couples stayed together, there is mainly attention shift where the mother spends more time looking for what the family will eat and care less about the welfare of the children. This may suggest as to why male headed households living as couples have increased odds of children experiencing diarrhoea as compared to female headed households. A study done by (Mahmud *et al.,* 2020) showed that in female headed households, women tend to prioritize healthcare and worry more about the health of their children leading to seeking medical attention sooner, leading to better disease prevention and management compared to men. In addition, women typically spend more time caring for children, recognizing early signs of illness and taking prompt action.

It is important to note that, lack of caregiver awareness of diarrheal disease prevention is a risk factor for for children to experience the disease among susceptible paediatric populations. The findings of this study showed that caregivers sensitized by community health workers had reduced odds of their children experiencing diarrhoea. Additionally, other Community Based Volunteers like SMAGS showed less or no impact in sensitizing mothers/caregivers on protecting their children from diarrhoeal disease. A study which was conducted by (George *et al.,* 2014) showed that, caregiver lack of awareness of practices related to personal and food hygiene for diarrhea prevention were a significant risk factors for diarrheal disease in the cohort of children under the age of five.

5.0 CONCLUSION

The findings of this study suggest that, the under 5 children in areas where Survive to Thrive Project was being implemented who were exposed to other liquids like traditionally brewed drinks, dairy milk or Maheu bought from local shops had increased odds of experiencing diarrhoeal disease and most of these children also experienced fever. The fact that most of the children who experienced diarrhoea were under the age of two may suggest that most of them were still breastfeeding. Results on gender of the household head indicated that female headed homes had reduced odds of children experiencing diarrhoea as compared to male

headed home. This suggests that female parents/caregivers take more care of their children as compared to men in terms of the hygiene conditions their children are found in. For male headed homes who were living with their spouses, the results suggest that women tend to have divided attention between their children and their spouses which may leave children vulnerable to risk exposures which may lead to diarrhoea. Finally, it has been observed in this study that caregivers who were sensitized by the community health workers had reduced odds of their children experiencing diarrhoea.

RECOMMENDATION

- There is need to re-align the hygiene promotion messaging to include feeding practices for breast feeding mothers in order to ensure that exclusive breast feeding is encouraged where possible unlike giving other liquids to the children. Additionally, there is need to establish which other fluids (dairy milk, locally brewed drinks, Maheu e.t.c) caregivers give their children which are associated with diarrhoea disease and which best practices such fluids should be given to children with reduced odds of experiencing diarrhoea.
- There is need to sensitize male headed households whether living with a spouse or not on best hygiene practices. In homes where both parents are live together, female parents should be encouraged to take keen interest in the wellbeing of their children.
- In this study, the role community health workers play seems to help yielding results in reducing the odds of children experiencing diarrhoeal diseases through sensitizing the community members on risk factors associated with diarrhoea. In this regard, there may be need to strengthen and fortify this cadre in order to reduce the number of diarrhoeal cases even further.
- Additional research may be needed in order to establish which other liquids besides breast milk were highly associated with diarrhoea.

It is believed that if these recommendations are followed, the cases of diarrhoea will reduce when the Survive to Thrive Project conducts the end line evaluation when the project comes to an end in 2025.

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