Inappropriate Household Water, Sanitation and Hygiene practices are associated with Wasting for children under 5 years in Rural Tanzania: Evidence from the 2015/2016 Survey

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Abstract

Introduction: Wasting is a serious problem which lead to various morbidity and mortality incidences among infants and young children in developing countries. More is needed to reveal the environmental factors affecting infant and young child health in various settings particularly rural areas. Objectives: The objective of this analysis was to examine the association between Water, Sanitation and Hygiene (WASH) factors with children acute malnutrition (wasting), and investigate weather rural and urban areas being prone to poor WASH practices in Tanzania. Methods: This is a secondary data analysis of the 2015 Tanzania Demographic and Health Survey (TDHS) which is a cross-sectional study. The data was retrieved and re-analysed according to the study objective. The study involved 8,937 children aged 0 to 5 years living in Rural and Urban areas of the United Republic of Tanzania. A child was considered to be wasted if weight-for-height Z-scores were below minus two standard deviations (-2 SD) from the median of the WHO reference. Adjusted for Rural and Urban, the WASH factors were entered in the binary logistic regression model for analysis. Multivariate logistic regression was used to control for confounders. Results: Overall, this analysis reveals that rural areas have relatively poor WASH practices compared to their urban counterparts. The result showed that three WASH factors were retained in the model in rural areas. After controling for potential confounders of wasting like diarhoea and fever. The backward selection procedures of the logistic regression showed that: inappropriate disposal of stool (AOR=1.28; 1-1.59 95% CI); more than 30 minutes spent to get water (AOR=0.74; 0.54-1.01 95% CI) and unavailable place for handwashing (AOR=1.23, 0.96-1.56 95% CI) were associated with wasting in rural areas. Only one factor of inappropriate disposal of stool (AOR=2.8; 1.59-4.89, 95% CI) was found to be significantly associated with wasting in urban areas. Both rural and urban areas, there was no association between availability of handwashing facilities, type of sanitation and access to improved water sources with childhood wasting. Conclusion: This study justifies the importance of interventions for WASH targeting on promotion of nutrition and disease prevention in Tanzania especially in rural areas.

Background

Acute malnutrition (wasting) is a recent and severe weight loss as a result of acute food shortage and/or illnesses. Acute malnutrition remains one of the most common cause of morbidity and mortality among children in the world through its direct and indirect effects on mortality [1-3]. The global nutrition report showed that 50.5 million children (7.5%) were wasted and at the same time 38.3 million children (5.6%) were overweight [4]. The magnitude of wasting is substantial and persistent in the Sub-Saharan Africa [5] including Tanzania, where by a lot of children are suffering from the effects of acute malnutrition [6]. Different studies in Tanzania reported a high prevalence of wasting among children of under–five years [7-9]. The 2015 Tanzania Demographic and Health Survey report showed that wasting was more common in Zanzibar Island than in Tanzania Mainland (7% versus 4%). The rate of wasting was very high in Kusini Pemba and Kaskazini Pemba regions (9% each) and Kusini Unguja (8%) Region [6]. These prevalences were substantially higher in rural (4.7%) than urban (3.8%) setting. Despite the economic progress in the country, nutrition data in Tanzania show that the prevalence of wasting has remained

virtually unchanged between 1999 and 2016. Meanwhile, the prevalence of stunting and underweight has been decreasing steadily since the year 1996 [6]. Forexample, in 2010, the prevalence of wasting was 4.8% and severely wasting was 1.2%; while in 2015, the prevalence of wasting was 4.5% and severely wasting was 1.2% [6]. These trends give clues that the current burden of wasting is unchanged in the country. Furthermore, this gives an indication that in most parts of the country, the authorities may need additional efforts to mitigate the possibilities of infants and young children being wasted. Informed evidence is therefore needed to shine a light to spur the relevant actions that aims to eliminate wasting in both rural and urban settings.

Though, it is widely recognized that the occurrence of wasting is a result of inadequate food intake or from a recent episode of illness that cause weight loss [1, 4]; more is needed to reveal the environmental factors succumbing children in various settings. Unhealthy and unsafe environments are known to cause 1 in 4 child death worldwide [10]. Also, poor socio-economic and environmental conditions in developing countries are known to increase early exposure to adverse conditions, such as illness or under-nutrition [5], as previously stipulated in the UNICEF's conceptual framework of malnutrition [11]. Globally, there has been increasing demand to use the water, sanitation, and hygiene (WASH) information to measure the Sustainable Development Goal (SDG 6) of access to water and sanitation for all [12]. The Tanzania demographic and health surveys considers water, sanitation and hygienic practices as important avenue to factor in when dealing with under-nutrition in particular wasting [6]. The existence of the rural-urban socioeconomic inequalities in terms of access to key WASH parameters is evidenced from the various DHS studies [13, 14]. These further calls for a need to embrace WASH as an important entry-point to address the occurrence of wasting in Tanzania.

Globally, over 850 million people worldwide with over 2.5 billion are limited by access to good water and sanitation facilities. The global burden of disease and mortality rates could be reduced by about 9.1% and 6.3%, respectively, if rapid success is attained in facilitating access to water, sanitation, and hygiene facilities [15]. A large proportion of these diseases are related to diarrhea incidences which contribute to the mortality rate of about 1.9 million and new diarrhea cases estimated at 4 billion annually, especially among children under five years old [16]. Previous literature has shown considerable effects of inappropriate water sanitation and hygiene practices on children under-nutrition including wasting in various countries [17-19]. However, very few and limited studies in Tanzania [7, 20] have evaluated the WASH among sub-groups of population. Therefore, this analysis was done purposely to examine the association between Water, Sanitation and Hygiene (WASH) factors with children acute malnutrition (wasting), and investigate weather rural and urban areas being prone to poor WASH practices in Tanzania.

Methods

Data source

This study was based on secondary data analysis from the Tanzania Demographic and Health Survey (TDHS) to investigate the WASH factors associated with wasting among children less than 5 years in Tanzania. TDHS 2015 was implemented by the National Bureau of Statistics in collaboration with the other government partners [6]. Data collection procedures have been described and published in TDHS 2015. Briefly, TDHS 2015 was designed to produce representative samples at the national, regional and rural-urban levels. The TDHS of 2015 was part of the worldwide DHS program in order to assist the countries to collect data to monitor and evaluate the population, health and nutrition programs.The survey employed two-stage sampling design. In the first-stage sampling, 608 clusters were selected. The second-stage sampling involved systematic sampling of households from the selected clusters. From that, 22 households were selected from each clusters. A total of 13,376 households were selected from the TDHS 2015. In this analysis, only data of children less than 5 years matched with their household were finally selected for further analysis. The participants for this study were 8,937 children from rural and urban areas.

Data handling and processing

This is a cross-sectional study design which used secondary data conducted on 2015/16. The retrieved data were from two files namely; household's file and children's file. Children's file contains the total children assessed in the survey, and the question about child feeding practices, stool disposal, and child care practices. Household file contains the household's socioeconomic and demographic informations including source of drinking water, type of sanitation facilities, time (minutes) used to fetch water, handwashing facilities and place used for handwashing. Moreover, information on the child's age, sex, morbidity in the past two weeks, size at birth; were collected from respective mother or caregiver. Household with missing or not reported information were coded as a separate categories. Out of the 10,406 children, we excluded from the analysis children where no household line number identified (n=1,018); height out of plausible limits or flagged cases (n = 105); children not slept in the household last night or not defacto (n = 151); and missing anthropometric information (n=195). The final sample comprised of 8,937 children-household pairs. Among them, 22.5% (n=2016) from urban, and 55.5% (n=6921) in rural.

Dependend and Independet Variables

Anthropometric measurements (weight and height) were taken from children's file which contains all children under 5 years. The outcome variable of interest in this study was having acute malnutrition (wasting) or being well-nourished. A child with a Weight-for-height Zscore (WHZ) below minus two standard deviations (−2 SD) was considered acutely malnourished, as defined by the 2006 WHO growth standards [4]. Children with a WHZ above −2 were considered to be well-nourished. The key independent variables examined were all variables related to WASH. In the analysis, we included a number of theoretically important WASH factors that have been considered before in other studies [13, 21-24]. A group of six variables (Type of sanitation, source of drinking water, availability of handwashing place, handwashing facilities, disposal of children stool, and time used to fetch water) were selected and

classified according to many international survey programmes, as well as from the operational definitions as stated in the DHS guide [25]. We also included three confounding factors: Diarrhoea in the past two weeks, presence of fever in the past two weeks, and presence of symptoms of Acute respiratiry infection (ARI) within the past two weeks.

Statistical analysis

We first conducted a descriptive analysis of the study subjects. We then performed descriptive analysis to describe the subjects into rural and urban based wasting of children. Then, using logistic regression procedures, we estimated the odds ratios (ORs) and 95% confidence intervals (CIs) for each covariate to identify predictors of wasting. Adjusted for rural, urban and total; we used forward, backward, and stepwise model selection procedures to select the best predicting model. We entered diarrhoea, fever and acute respiratory infections in the model to eliminate their effects. To check for collinearlity problem, variance inflation factors has been used to see the possibility of multicollinearlity between dependent and independent variables. We performed all statistical tests and modeling exercises in Stata/MP 13 (StataCorp LLC) and SPSS version 23.

Results

Participant's characteristics

Out of 8,973 children assessed in this study, 56.4% of them were between the age of 24 to 59 months, 50.1% were males, and 93.7% of children had an average size at birth (Table 1). Above 60% of the children were born at the hospital. In terms of child morbidity, 12.2%, 17.9% and 3.7% of children recently suffered from diarrhea, fever and acute respiratory infections (ARI), respectively. Regarding households wealth, 44.1% of households were classified as poor. About 84.2% of the head of the households were male. Table 1 shows that 34.7% of household head were above 45 years. The prevalence of wasting was higher among male (5%) than female children (4.4%). More than 7% of children were found to be wasted in Zanzibar zone. Among the rural children, 4.8% of wasted children were from the poorer households. Younger children were found to be more affected by wasting compared to older children. About 10.1% of children aged less than 5 months have acute malnutrition, which is higher compared to their older ones. Adjusted between rural and urban areas, this analysis reveals that rural areas have relatively poor WASH practices compared to their urban counterparts. About 25.8% of the rural households have no any handwashing facilities in their house, and 22.7% have no place for hand washing, 50.8% spend more than 30 minutes to get drinking water. Moreover, 64.8% of households in rural areas have unimproved sanitation, 18.5% have no any sanitation facilities. About 25.8% in rural areas have been found to dispose the children stool improperly. In this study, 48.9% of the rural households get drinking water from unprotected sources, only 13.8% have water sources in the house. These data are consistent with those reported in a Tanzania Demographic and Health Survey final report [6].

Factors associated with wasting

The factors associated with acute malnutrition were analyzed by using univariate and multivariate analysis techniques (Table 2). When looking at the significant WASH predictors of wasting in this study by using multiple logistic regression model we found that, three WASH factors that remained in the model are from rural areas, even after the control of confounders. The analysis shows that; place of handwashing, disposal of children stool, and time to get drinking water are the predictors of wasting for children in rural areas. However; in urban areas, only disposal of children stool was found to be significantly predicting the risk of wasting. Table 2 shows that in rural areas, the odds of getting wasting for children in the household where there was no place for handwashing is significantly higher compared to the household where there is place for handwashing (OR=1.28; 95% CI: 1.01-1.63); however, not significant (p>0.05) after controling of confounders (AOR=1.23; 95% CI:0.96-1.56) . The study showed that, in rural areas there is significantly high odds of wasting for children whom their stool was not properly disposed compared to those properly disposed (AOR=1.28; 95% CI: 1-1.59). For urban areas; the odds of wasting for children is more than twice if their stool were improperly disposed (AOR=2.8; 95% CI: 1.59-4.89).

Table 2 also shows that, in rural areas, the variable of time to get drinking water remained in the model even afer the control of the confounders; however, the odds of getting wasting was not significantly higher for household that doesn't have drinking water in their house. In both rural and urban areas, the presence of handwashing facilities, and types of sanitation were not among the predictors for wasting. In addition, the unadjusted analysis of the country reveals that, more than 30 minutes to get drinking water (AOR=1.19; 95% CI: 0.9-1.5) and improper disposal of stool (AOR=1.5; 95% CI: 1.2-1.8) remained to be the predictors of wasting even after the control of the confounders.

Discussion

In this study we report the association between child wasting and household water sanitation and hygiene factors in Tanzania, based on large survey data representative at national, regional and rural-urban areas. To our knowledge, this is the first study to utilise the nationally representative data to explore the association between WASH and acute malnutrition in Tanzania. Overall, this study shows that the risk of wasting was associated much with WASH in rural areas compared to urban areas. This study shows that there is association between wasting and time spent by household to access drinking water in rural areas. Time spent by a household to fetch drinking water was retained in the model ofter controling of potential confounders which is consistent with the findings of a previous case-control study done among Ethiopian children [21]. In contrast, recent data from multiple countries showed that water access was not associated with incidence of wasting or stunting [14]. However, there are many other evidences showed that water acess is very significant in predicting diarrhoea incident among children which may impact to

the child health [13]. The findings of our analysis reinforce that low access to clean and safe water in rural areas may indeed greatly increase the likelihood of child diseases like wasting, diarrhoea.

Household access to an improved source of drinking water was not among the predictors for wasting in this study after multiple logistic regression. This is in agreement with the study done among children in India and Ethiopia which showed that no association between improved sources of drinking water to under-nutrition [24, 26]. However, this contradicts earlier findings from other studies which indicate the potential effects of improved water sources on children nutrition status [17, 27]. The analysis of various Demographic and Health surveys in developing countries reveals that; access to improved water was associated with lower risk of diarrhoea, and lower risk of severe stunting [13]. Using water from protected sources was reported to be significantly associted with the reduced risk of undernutrition among Ethiopian children [27]. This lack of association in our analysis may be due to the current predominant use of an improved drinking water in Tanzania. This study shows that 51.1% and 85.5% of the households in rural and urban areas, respectively, have access to improved drinking water. Therefore, in multivariate analysis, the effect of having low access to improved water sources was nullified in this study.

Nevertheless, improvement in sanitation facilities was noted by some scholars that it brings to the reduction of diarrhoea and significantly improved children nutrition status [21, 24]. Overall, this study did not find the association between improved sanitation and wasting in both rural and urban areas, tend to confirm the findings of other analysis from Demographic and Health Surveys of 59 countries which showed that; improvements in sanitation was not associated with stunting or wasting, but was associated with diarrhoea reduction[14]. This lack of association is likely because of that— presence of improved or unimproved sanitation doesnot necessarily means that proper toilet use or proper disposal of children stool[14].

It is clear that children become more affected by environmental contamination when they start growing up, walking, exploring and putting objects in their mouths, which increases the risk of ingesting faecal bacteria from both human and animal sources [18, 20]. This could lead to repeated diarrhoea and infections for younger children, which in turn deteriorates the nutritional status of children. This study shows that the prevalence of wasting was higher among younger children compared to older children. In this study, 10.1% of younger children aged less than 5 months have been found to be acutely malnourished. Only 3.2% of their older ones aged 24 to 59 months have wasting (Table 1). This might be because of that, younger children are more prone to diseases like diarrhoea and infections compared to older ones [28]. Diarrhoea and infections are widely reported to be significantly associated with wasting and underweight among children in various countries [21, 29]. In comparison to this study, various studies in different countries proved that younger children are at more risk of wasting compared to older children like in Myanmar[30] and Bangladesh [19, 31].

We found that availability of handwashing place in the household is among the predictor to childhood wasting in rural areas; however not significant after multivariate logistic regression. In this study also,

there was no association between availability of handwashing facilities with wasting in both rural and urban areas. Evidence for a beneficial relationship between a place for handwashing and wasting is not clear. Previous studies suggested that availability of handwashing place in the house was significantly associated with reduced childhood illnesses like diarrhoea [32], while other studies did not find any association [22]. In this study, 44.3% of the subjects were found to have handwashing facilities, among them, 63% in urban and 38.8% in rural areas (Table 1). Sometimes, however; the presence of these facilities does not necessarily result in handwashing, but its absence would minimises opportunities for the handwashing behaviour [22]. Obviously, interventions to improve handwashing practice may worth the rural areas to reduce infant and young childhood illnesses which ultimately prevent incidences of wating [29].

In consistent with other studies done in several countries [18, 21, 23], this study support the fact that children living in the household where there is improper disposal of children stool are more likely to get wasting. It is known that improper stool disposal and absence of latrines are strongly associated with diarrhoea and infections particularly for the young children which results to wasting [21]. As it has been reported in Indonesian children, the unsafe disposal of child feces was strongly associated with an increased odds of childhood diarrhea [23]. This might be explained by the fact that young children ussually like to spend time in the courtyard area and hence may easily have contact with the feces or with soil that has been contaminated by feces [20]. Also child feces left open in the environment can also provide breeding sites for flies, which are known vehicles of diarrheal pathogen transmission [33]. Therefore, authorities may look at various means to improve toilets and good waste disposal in rural and urban areas for the betterment of the children.

There are some limitations of this study that needs to be considered. We analysed cross-sectional data, possibly the actual causal association between inapropriate WASH practices and increase risk of wasting can not be directly established. The mother's/ head of the households reported personal practices which were determined based on self-recall and reported data which may not be the actual practice. But, despite these limitations, assessing the WASH factors with childhood wasting using large representative survey data is an important step in enriching the relevant evidence based decisions, and developing multisectoral interventions for infant and young child health.

Conclusions

Despite disappointing evidence regarding sanitation's impacts on wasting in this study, we find relatively strong associations between wasting and handwashing; time to get drinking water; and unsafe disposal of children stool. Although there are more factors contributing to wasting, these are among the significant contribution to wasting regarding water, sanitation and hygiene in Tanzania. This study justifies the importance of interventions for WASH, specifically targeting on promotion of nutrition and disease prevention in Tanzania especially in rural areas. Further investments in intervention and research in WASH are still very much needed to strenghtern evidence based decisions.

Declarations

Ethical consideration

The permission to do this study was given by DHS program. Since we only used secondary data, personal consents was not required, as well as no any personal identity was being identified from the data files. The data were completely anonymous.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

Contributions

AGK analysed the data, did the interpretations, and wrote the first draft of the manuscript. JEN and MS contributed to the interpretations and writing and critically revised the manuscript. All authors contributed to and approved the final version of the manuscript before submission.

Consent for publication

Not applicable for this study

Availability of data and material

Data for this study are freely available upon request from the DHS portal (www.dhsprogram.com).

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Tables

Table 1: Baseline characteristics of the subjects based on acute malnutrition (Wasting) between Rural-Urban; Tanzania Demographic and Health Survey 2015

Variables	Urban		Rural		Total	
	All	Wasting	All	Wasting	All	Wasting
	n(%)	*n*(%)	*n*(%)	*n*(%)	*n*(%)	*n*(%)
Zones						
Central Zone	134(6.6)	6(4.5)	878(12.7)	40(4.6)	1012(11.3)	46(4.5)
Coastal Zone	523(25.9)	25(4.8)	581(8.4)	21(3.6)	1104(12.4)	46(4.2)
Lake Zone	431(21.4)	15(3.5)	2036(29.4)	93(4.6)	2467(27.6)	108(4.4)
Northern Zone	205(10.2)	7(3.4)	815(11.8)	52(6.4)	1020(11.4)	59(5.8)
Southern Highlands	320(15.9)	6(1.9)	875(12.6)	40(4.6)	1195(13.4)	46(3.8)
Western Zone	155(7.7)	2(1.3)	675(9.8)	34(5)	830(9.3)	36(4.3)
Zanzibar	248(12.3)	13(5.2)	1061(15.3)	85(8)	1309(14.6)	98(7.5)
Household Head age (years)						
15-24	85(4.2)	4(4.7)	278(4)	16(5.8)	363(4.1)	20(5.5)
25-34	680(33.7)	17(2.5)	1858(26.8)	89(4.8)	2538(28.4)	106(4.2)
35-44	664(32.9)	29(4.4)	2269(32.8)	115(5.1)	2933(32.8)	144(4.9)
Above 45	587(29.1)	24(4.1)	2516(36.4)	145(5.8)	3103(34.7)	169(5.4)
Household head gender						
Male	1634(81.1)	67(4.1)	5887(85.1)	310(5.3)	7521(84.2)	377(5)
Female	382(18.9)	7(1.8)	1034(14.9)	55(5.3)	1416(15.8)	62(4.4)
Household Wealth						
Rich	1710(84.8)	65(3.8)	1543(22.3)	94(6.)	3253(36.4)	159(4.9)
Middle	135(6.7)	4(3)	1610(23.3)	89(5.5)	1745(19.5)	93(5.3)
Poor	171(8.5)	5(2.9)	3768(54.4)	182(4.8)	3939(44.1)	187(4.7)
Handwashing Place						
Available	1773(87.9)	68(3.8)	5347(77.3)	266(5)	7120(79.7)	334(4.7)
Not available	243(12.1)	6(2.5)	1574(22.7)	99(6.3)	1817(20.3)	105(5.8)
Handwashing facilities						
Water and soap	1270(63)	50(3.9)	2685(38.8)	138(5.1)	3955(44.3)	188(4.8)
Water only	440(21.8)	16(3.6)	2452(35.4)	122(5)	2892(32.4)	138(4.8)
No any facilities	306(15.2)	8(2.6)	1784(25.8)	105(5.9)	2090(23.4)	113(5.4)
Time to get drinking water						
Water in the house	1092(54.2)	38(3.5)	954(13.8),	58(6.1)	2046(22.9)	96(4.7)
Water less than 30min	448(22.2)	21(4.7)	2452(35.4)	146(6)	2900(32.4)	167(5.8)
Water above 30min	476(23.6)	15(3.2)	3515(50.8)	161(4.6)	3991(44.7)	176(4.4)
Type of sanitation						
Improved+	1396(69.2)	53(3.8)	1162(16.8)	72(6.2)	2558(28.6)	125(4.9)
Unimproved	559(27.7)	19(3.4)	4482(64.8)	212(4.7)	5041(56.4)	231(4.6)
No Facility	61(3)	2(3.3)	1277(18.5)	81(6.3)	1338(15)	83(6.2)
Sources of drinking water						
Protected++	1724(85.5)	59(3.4)	3539(51.1)	210(5.9)	5263(58.9)	269(5.1)
Unprotected	292(14.5)	15(5.1)	3382(48.9)	164(4.8)	3674(41.1)	179(4.9)
Disposal of children stool** n=7468						
Properly disposed	1302(17.4)	38(2.9)	3984(53.3)	210(5.3)	5286(70.8)	248(4.7)
Improperly disposed	258(3.5)	20(7.8)	1924(25.8)	126(6.5)	2182(29.2)	146(6.7)
Children Characteristics						
Age of Children (months)						
0-5	233(11.6)	22(9.4)	742(10.7)	76(10.2)	975(10.9)	98(10.1)
6 to 23	682(33.8)	20(2.9)	2242(32.4)	159(7.1)	2924(32.7)	179(6.1)
24-59	1101(54.6)	32(2.9)	3937(56.9)	130(3.3)	5038(56.4)	162(3.2)
Gender						
Male	1030(51.1)	40(3.9)	3451(49.9)	210(6.1)	4481(50.1)	250(5.6)
Female	986(48.9)	34(3.4)	3470(50.1)	155(4.5)	4456(49.9)	189(4.2)
Place of Birth						

Health facility	1763(87.5)	63(3.6)	3706(53.5)	184(5)	5469(61.2)	247(4.5)
At home	235(11.7)	10(4.3)	3094(44.7)	176(5.7)	3329(37.2)	186(5.6)
Other places	18(0.9)	1(5.6)	121(1.7)	5(4.1)	139(1.6)	6(4.3)
Size at Birth*	**n=5505**					
Above 2.5	1668(30.3)	61(3.7)	3489(63.4)	159(4.6)	5157(93.7)	220(4.3)
Below 2.5	119(2.2)	6(5)	229(4.2)	22(9.4)	348(6.3)	28(8)
Diarrhoea						
YES	304(15.1)	13(4.3)	782(11.3)	57(7.3)	1086(12.2)	70(6.4)
NO	1712(84.9)	61(3.6)	6139(88.7)	308(5)	7851(87.8)	369(4.7)
Symptoms of ARI*	**n=8717**					
YES	89(1)	4(4.5)	230(2.6)	14(6.1)	319(3.7)	1318(5.6)
NO	1858(21.3)	67(3.6)	6540(75)	216(3.3)	8398(96.3)	283(3.4)
Fever in the past 2 weeks						
YES	368(18.3)	15(4.1)	1232(17.8)	80(6.5)	1600(17.9)	95(5.9)
NO	1648(81.7)	59(3.6)	5689(82.2)	285(5)	7337(82.1)	344(4.7)

*Missing or non-reported cases existed in the sample

** 1469 mothers who have children between 24-59 months did not report on children stool disposal

+ Improved sanitation facilities included a flush toilet, piped sewer system, septic tank, flush to pit latrine, ventilated improved pit latrine, pit latrine with slab and composting toilet.

++ Protected water sources including piped water, a public tap or standpipe, tube well or borehole, protected dug well, protected spring and rainwater.

Table 2: Crude and Adjusted Odd Ratios of Water, Sanitation and Hygiene factors in relation to Wasting between Rural, Urban in Tanzania, TDHS 2015/16

	Rural (n =6921)		Urban (n =2016)		Total (n = 8937)	
	Crude	Model[a]	Crude	Model[a]	Crude	Model[a]
	OR (95 % CI)	AOR (95 % CI)	OR (95 % CI)	AOR (95 % CI)	OR (95 % CI)	AOR (95 % CI)
Handwashing Place						
Available	Ref.	Ref.	Ref.		Ref.	
Unavailable	1.28(1.01-1.63)*	1.23(0.96-1.56)	0.63(0.27-1.48)	—	1.23(0.99-1.56)	—
Handwashing facilities						
Water and soap	Ref.		Ref.		Ref.	
Water only	0.97 (0.75-1.24)	—	0.92(0.52-1.63)	—	1.0(0.8-1.26)	—
No any facilities	1.15 (0.89-1.5)		0.66(0.31-1.4)		1.15(0.9-1.46)	
Time to get water						
Water in the house	Ref.	Ref.	Ref.		Ref.	Ref.
Water less than 30min	0.98(0.71-1.34)	0.98(0.71-1.34)	1.36(0.79-2.35)	—	1.2 (0.96–1.6)	1.19(0.9-1.5)
Water above 30min	0.74(0.54-1.01)	0.74(0.54-1.01)	0.9(0.49-1.66)		0.94 (0.73–1.2)	0.87(0.61-1.13)
Type of sanitation						
Improved	Ref.	—	Ref.	—	Ref.	—
Unimproved	0.75(0.57-0.99)*		0.89(0.53-1.49)		0.93(0.75-1.17)	
No Facility	1.02(0.74-1.4)		0.86(0.2-3.6)		1.3(0.97-1.7)	
Sources of drinking water						
Protected	Ref.		Ref.		Ref.	
Unprotected	0.85(0.68-1.05)	—	1.53(0.85-2.73)	—	0.99(0.81-1.2)	—
Disposal of stool						
Properly disposed	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Improperly disposed	1.26(1-1.58)*	1.28(1-1.59)*	2.8(1.6-4.89)**	2.8(1.59-4.89)**	1.46(1.18-1.8)**	1.5(1.2-1.83)**

**$P < .01$, *$P < .05$; [a]Adjusted for diarrhoea, fever and Acute Respiratory infections (ARI)

CI, confidence interval; OR=Odds ratio, AOR=Adjusted Odds ratio; Ref=reference category;

Not retained in the final model

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