Volume 9, Issue 10, October – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

Socioeconomic Factors and Knowledge of Teenage Mothers Associated with Diarrhea in Children Less than Five Years Old in Ndhiwa Sub-County, Homa Bay-Kenya

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Abstract:- Diarrhoea is the passage of loose, watery or liquid stools three or more times a day. Diarrhoea may be acute, persistent, or chronic and is often preventable and treatable. It is the second leading cause of mortality in children <5 years of age, resulting in approximately 1.7 billion cases globally and 525,000 deaths each year. The low- and middle-income countries account for about 90% of these deaths, with sub-Saharan Africa and South Asia reporting ~88%. In Kenya, over 50% of children <5 years hospital admission results from diarrhoeal related infections. In Ndhiwa Sub-County, diarrhoea is among the leading causes of hospital admission among children <5 years old. Although the causes of morbidity and mortality associated with diarrhoeal diseases in children <5 years including the mothers' socio-demographic and knowledge factors have been reported, the impact of these factors among teenage mothers remain largely unknown. With the proportion of teenage mothers estimated at 18 % in Kenya, and 33% in Homa Bay County, this study aimed to determine the socio-demographic factors and knowledge of teenage mothers associated with diarrhoea in children aged <5 years in Ndhiwa Sub-County, Homa Bay County. In this cross-sectional study a total of 320 teenage mothers were recruited using multistage sampling technique. Data were collected using semi-structured questionnaires and analyzed using SPSS software. Statistical significance was set at *P*≤0.050. Results from binary logistic regression model showed that the marital status of teenage mother; namely never married (*P*=0.016) or divorced (*P*=0.023) increased odds of diarrhoea in children, while mothers' occupation (fulltime student, *P*=0.027) significantly increased the odds of diarrhoea. Poor knowledge on general prevention of diarrhoea (*P*<0.001), rubbish dumping (*P*=0.010) and Rota/ measles vaccination (*P*<0.001) were associated with increased incidences of diarrhoea in children aged <5 years. In conclusion, these results show that the teenage mother's socio-demographic characteristics and knowledge childhood diarrhoea and prevention were associated with reported incidences of diarrhoea among children <5 years. The study recommends that the County Government of Homa Bay develop intervention measures to mitigate identified factors associated with increased incidences of diarrhoea cases in children aged <5 years of teenage mothers.

Keywords:- *Association, Diarrhoea, Socio-Demographic Factors, Knowledge.*

I. INTRODUCTION

Diarrhoea is responsible for the death of more than 90% of children less than five years in low and lower-middle income countries (1). Regionally, South Asia and sub-Saharan Africa accounted for 88% of deaths with the same age group (2). A study collected demographic and health survey datasets of 34 sub-Saharan African countries to determine the prevalence and associated factors of diarrhoea among under-five children in the region (3). The study showed that the overall prevalence of childhood diarrhoea morbidity in sub-Saharan Africa was 15.3% (3). Results found that maternal age, wealth index, maternal education, maternal occupation, age of child, time of initiation of breast feeding and time to get water source were significantly associated with diarrhoea (3). Therefore, intervention through health education and health promotion for mothers/caretakers who are poor, less educated, and young should be designed to prevent diarrhoea in the region (3).

A similar study targeted 39 LMICs in Africa, Asia and South America to assess the health inequities and clustering of fever, acute respiratory infection, diarrhoea and wasting in children under five (4). The indices of inequity evaluated included DHS wealth index quintiles, cost and distance as a determinant of access to health care my the children's mothers, and urban or rural residence (4). The study found that children in socially disadvantaged conditions were

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

disproportionately affected by these diseases, including diarrhoea (4).

Another study in Ethiopia aimed to identify factors associated with childhood diarrhoea at the individual and community levels. Secondary data was collected from the 2011 and 2016 Ethiopian Demographic and Health Survey (EDHS) (5). The study found that at the individual level, sex and age of the child, mother's employment status, and educational level, and the number of children less than five years were found to be significant factors associated with childhood diarrhoea (5). At community level, the contextual region was also a significant determinant of childhood diarrhoea (5). The study recommended that there was need to consider modifiable factors in the existing interventions to improve child health outcomes in the country (5).

A different study based in Kenya aimed at examining the socio-demographic, environmental and behavioural determinants of diarrhoea in children under five years. The study collected secondary data from the KDHS 2014 (6). The study found that increasing caregiver education, wealthier households and promoting hygienic behaviours in poor households were associated with reducing diarrhoea (6). The study recommended targeting children between 6–23 months who are the most susceptible to infection during diarrhoea prevention interventions (6).

Collectively, while existing studies provide valuable information on the prevalence and factors associated with childhood diarrhoea, significant gaps remain in understanding the broader socio-cultural, behavioral, and policy-related determinants. Addressing these gaps is crucial for developing comprehensive and context-specific strategies to combat childhood diarrhoea in the region.

- *Socio-Economic Factors and Prevention of Diarrhoea in Children Less than Five Years*

Children of teenage mothers' experience strong socioeconomic disadvantages, and their home environments have some greater risks, making their parenting behaviors not rated as favorably (7), and their children's health and development compromised (7, 8). Socio economic status includes maternal education and employment.

- *Maternal Education Status*

An earlier study showed that education provides knowledge necessary for diarrhoeal prevention practices such as good hygiene, feeding and weaning practices; hence children of mothers who are illiterate are more likely to suffer from diarrhoea compared to children of literate mothers (9, 10). Moreover, mothers with primary or secondary school education have been found to have more knowledge on diarrhoea prevention than those without any formal education, demonstrating that basic formal education is important in understanding of diarrhoea disease prevention (11). In another study, mothers with tertiary education were found to use Oral Rehydration Solution (ORS) more than those with no education; interestingly, majority of those who had no tertiary education were primiparas and teenagers (12). A strong association was found between educational status and appropriate practices regarding diarrhoea management, hence health education should be used as a tool to promote knowledge and good practice to reduce diarrhoea related morbidity and mortality in under-five children (13). From these studies, having a formal education have been shown to have an influence on knowledge about diarrhoeal disease management and prevention of children less than five years. Therefore, it is important to assess the influence of education to both knowledge and practices on diarrhoeal prevention in children less than five years.

- *Employment Status*

Employment status of caregivers is key in improving the general health status of children less than five years (14). Teenage mothers' involvement in paid work has been previously associated with more favorable child outcomes and living with a single mother and other adults predicts more negative outcomes (8, 15). Moreover, household income has also been identified as one of the determinants for diarrhoea in under-five children (16). Families with low income have been shown to have higher prevalence of under-five diarrhoea compared to families with higher income (17, 18). Low economic status households have been previously linked to high prevalence of Household Food Insecurity (HFI) and thus they experience a significantly higher prevalence of under-five diarrhoea (19, 20). Despite evidence linking caregiver employment and household income to child health outcomes, gaps remain in understanding how different types of employment (e.g., formal vs. informal) and employment conditions (e.g., stability, working hours) affect childhood diarrhoea rates. Additionally, there is limited research on the combined effects of caregiver employment and household income on diarrhoea outcomes. Therefore, it is important to look at the teenage mothers' employment status and family income influence on under five diarrhoeal prevention practices.

Various studies have found that mothers of diarrhoeal children have inadequate knowledge on the etiological factors, symptoms, and treatment of diarrhoea in addition to caring methods for diarrhoeal children (21, 22). Knowledge regarding the early signs and symptoms of diarrhoea can help in improving the situation hence preventing dehydration and subsequent deaths (23). Mother's and father's illiteracy is associated with higher risk of under-five diarrhoea as compared to literate mothers (24). Knowledge on diarrhoeal prevention and management approaches at home is poor among teenage mothers thus leading to high incidence of diarrhoea among children less than five years born to teenage mothers (25). Knowledge about signs of dehydration and the management approaches of diarrhoea at home was poor (25). Improving mother's knowledge while incorporating existing perceptions might lead in maintaining health, personal hygiene and cleanliness (26). Knowledge regarding the preventive measures is also inadequate among the mothers.

Previous research had indicated that 63.6% of mothers had good knowledge towards diarrhoea management and not its prevention (27). Knowledge on diarrhoeal prevention and management approaches at home was poor among teenage mothers, thus leading to high incidence of diarrhoea among

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

children less than five years born to teenage mothers (25, 28, 29). In Kenya, and specifically the western regions, the prevalence of teenage mothers is high (30, 31). Diarrhoeal episodes in children is also high (32). In Ndhiwa, significant knowledge gaps exist among teenage mothers regarding the causes, symptoms, and treatment of diarrhoea. Their understanding of early signs, dehydration prevention, and home management practices is poor, leading to high diarrhoea incidence among their children. Therefore, addressing these gaps is important, so as augment decision making about interventions among teenage mothers to prevent Diarrhoeal incidences in their children under 5 years.

II. METHODS

A. Study Site

The study was carried out in Ndhiwa Sub-County, Homa Bay County, one of the 47 Counties governments in the Republic of Kenya. Homa Bay County is located in the Southern part of Nyanza, along the southern shores of Lake Victoria. Ndhiwa Sub-County is one of the eight Sub Counties in Homa Bay County including Homa Bay Town, Kabondo Kasipul, Karachuonyo, Kasipul, Mbita, Ndhiwa, Rangwe and Suba (33). Ndhiwa lies on -0.72987 Latitude and 34.367117 Longitude (34). Ndhiwa Sub-County is a culturally homogeneous and has a distinct *dholuo* speaking clan, with farming as the main economic activity, and it has a total population of 218,136 (34). The other seven sub counties are also homogeneous with farming and fishing as the main economic activities.

B. Study Design

A community based cross-sectional study (35) that employed quantitative techniques was used to collect data on teenage mothers with children less than five years of age. The quantitative approach employed structured administered questionnaires. The study considered independent variables that included knowledge, attitude and practices of teenage mothers and investigated its association with the dependent variable (diarrhoea episode) in children less than five years of age.

C. Study Population

The target population was teenage mothers with children less than five years of age from Ndhiwa Sub-County.

D. Sampling Techniques

The study employed a two-stage cluster-sampling technique to estimate the sample size, selected by stages and sampling units at each stage being sub-sampled from the larger units chosen at the previous stage (36). Selections were made with the assistance of Sub-County Administrator, village heads and Community Health Volunteers (CHVs). From the villages, CHVs were used to help identify households with teenage mothers having children less than five years old.

E. Inclusion Criteria

Teenage mother taking care of children/child less than five years old. Teenage mother who gave informed consent/ascent were include in the study. Finally, teenage mother who were resident for the past six months prior to the study were included.

F. Exclusion Criteria

Teenage mothers who were mentally and seriously ill were not included. Finally teenage mothers who had hearing or speaking difficulty.

G. Data Collection Process

Data was collected from the respondents through administering structured questionnaires. To assure of reliability, a survey was conducted using 30 participants prior to actual data collection in Rangwe Sub-County, which has similar characteristics with the study population. This guided areas for revision, identification of any omissions, flow of information and facilitated checks to ensure that the structured questionnaires addressed the study objectives. Training of study data collectors was undertaken on questionnaire administration to eliminate bias. Additionally, 10% sample size buffer was considered to account for any attrition that would result from incomplete documentation or non-response. Test-retest method was used to test for reliability of data obtained from the pilot study, and hence allowed for further analysis of actual data collected from the samples study respondents. Reliability was noted as 0.86, which more than critical at 0.70, and hence considered acceptable.

H. Statistical Analyses

The pre-coded quantitative was analyzed using SPSS version 21.0. Demographic characteristics (household variables, marital status, level of education, and occupation) of the respondents were compared children with or without diarrhoea were compared using Chi square (χ^2) test. Similarly, the distribution of proportions between the independent variables (knowledge) and dependent variables (children with and without diarrhoea) were computed using the Chi square (χ^2) test. In order to determine the association between the independent variables (demographic and knowledge) and dependent variables (diarrhoea or no diarrhoea), a binary logistic regression model was utilized. For all analysis, statistical significance of the variables was tested was set at $P \leq 0.050$.

III. RESULTS

A. Characteristics of Teenage Mothers of Children Less than Five Years Old

The characteristics of households and teenage mothers of children who were less than 5 years of age were compared between those households reporting diarrhoea or no diarrhoea episodes (Table 1). Overall, the study revealed that 99 (30.9%) children out of 320 children in households participating the study were reported to have experienced episodes of diarrhoea 2 weeks preceding data collection (Table 4.1). Analyses revealed that majority (85.3%) of households were headed by males. Overall, the distribution of households heads differed significantly between those with children who experienced no diarrhoea episodes versus those who reported diarrhoea (P=0.004), with higher proportion

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

(23.2%) of children with diarrhoea recorded in female headed households, relative to male headed households. Further, majority of house hold heads were in formal employment. Overall, the occupation of house hold heads differed significantly between children who reported no diarrhoea episodes versus those who experienced diarrhoea (P<0.001).

More than three-quarter (76.3%) of teenage mothers were married. There are more children with diarrhoea episodes among teenage mothers who were never married or divorced (20.2% and 6.1%, respectively). Overall, the proportional distribution of marital status of the teenage mothers differed significantly between those with children who reported no diarrhoea episodes versus those who experienced diarrhoea (P=0.006).

Analysis of the level of education of the teenage mothers revealed that those who dropped out of primary school presented with the highest proportion of children with diarrhoea, followed by those who completed primary school (Table 4.1). Overall, the proportion distribution of levels of education among the teenage mothers differed significantly between those with children reporting with diarrhoea episodes relative to those with no reported diarrhoea (P<0.001).

Although high proportions on teenage mothers were operating business in the study population, the teenage mothers who were house wives (23.2%) or students (4.0%) had their children reporting more episodes of diarrhoea compared to those employed or unemployed (Table 4.1). Collectively, the proportion distribution of the teenage mothers occupation were different for the dependent variables (P=0.009).

The characteristics of children under 5 years of age of teenage mothers were analyzed and results are presented in Table 4.1. Overall, out of the 320 children of teenage mothers included in the study, 221 (69.1%) did not report any episodes of diarrhoea in the previous 2 weeks preceding data collection, while 99 (30.9%) of the children were reported to have experienced at least one bout of diarrhoea in the previous 2 weeks (Table 4.1). Results show that overall, there were more children who were female (n=256, 80%), than male (n=64, 20%) recruited into the study. Further, the male children presented with a significantly higher proportion of diarrhoea cases relative to their female counterparts (P=0.013). In addition, majority of the children included in the study were 2-2.9 years of age (30.6%), and those greater than 4 years representing the lowest proportion (13.1%). The overall distribution of the proportions of children ages differed significantly between those without and with diarrhoea episodes (P<0.001).

Table 1: Characteristics of the Households, Teenage Mothers and Children Less than 5 Years Old

	Characteristics	**Total**	**No Diarrhoea n (%)**	**Diarrhoea episodes n (%)**	***P* value**
	Number of Participants, n (%)	320 (100.0)	221 (69.1)	99 (30.9)	
	Characteristics of Household studied				
Gender of household head	Male	273 (85.3)	197 (89.1)	76 (76.8)	0.004
	Female	47 (14.7)	24 (10.9)	23 (23.2)	
Occupation of household head	Farmer /Trader/shop keeper	36 (11.3)	20 (9.0)	16 (16.2)	<0.001
	Formal Employment	142 (44.4)	115 (52.0)	27 (27.3)	
	Casual labour	90 (28.1)	57 (25.8)	33 (33.3)	
	House work	30 (9.4)	13 (5.9)	17 (17.2)	
	Retired	13 (4.1)	11 (5.0)	2 (2.0)	
	Other	4 (1.3)	1 (0.5)	3 (3.0)	
	Don’t know	5 (1.6)	4 (1.8)	1 (1.0)	
	Characteristics of the teenage mother				
Marital status	Married	244 (76.3)	176 (79.6)	68 (68.7)	0.006
	Never married	43 (13.4)	23 (10.4)	20 (20.2)	
	Widowed	24 (7.5)	19 (8.6)	5 (5.0)	
	Divorced	9 (2.8)	3 (1.4)	6 (6.1)	
Mother’s education level	None	27(8.5)	17(7.7)	10(10.1)	<0.001
	Primary dropout	79 (24.8)	42 (19.1)	37 (37.4)	
	Completed primary	56 (17.6)	36 (16.4)	20 (20.2)	
	Secondary dropout	45 (14.1)	29 (13.2)	16 (16.2)	
	Secondary	102 (32.0)	92 (41.8)	10 (10.1)	
	Tertiary/ University	10 (3.1)	4 (1.8)	6 (6.1)	
Mothers’ occupation	House wife	50 (15.6)	27 (12.2)	23 (23.2)	0.009
	Business	239 (74.7)	172 (77.8)	67 (67.7)	

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

	Student	5 (1.6)	1 (0.5)	4 (4.0)	
	Un employment	10 (3.1)	8 (3.6)	2 (2.0)	
	Employment	16 (5.0)	13 (5.9)	3 (3.0)	
	Characteristics of children aged <5 years				
Gender	Male	64 (20.0)	36 (16.3)	28 (28.3)	0.013
	Female	256 (80.0)	185 (83.7)	71 (71.7)	
Age	<1 year	43 (13.4)	19 (8.6)	24 (24.2)	< 0.001
	1 – 1.9 years	68 (21.3)	53 (24.0)	15 (15.2)	
	2 – 2.9 years	98 (30.6)	72 (32.6)	26 (26.3)	
	3 – 3.9 years	69 (21.6)	51 (23.1)	18(18.2)	
	> 4 years	42 (13.1)	26 (11.8)	16 (16.2)	

Data are Presented as Absolute Numbers and Proportion of Study Participants. Statistical Significance was Determined by Chi Square (χ^2) Test.

B. Association between Socio-Economic Factors of Teenage Mothers and Diarrhoea Outcome in Children Less than Five Years in Ndhiwa Sub-County, Homa Bay County, Kenya

Socio-demographic and economic factors associated with diarrhoea outcomes in children less five years old in Ndhiwa Sub-County, Homa Bay County, Kenya is presented in Table 2. In order to determine whether the social demographic characteristics of teenage mothers influenced diarrhoea outcomes among their children who were less than 5 years old, a binary logistic regression model was used to estimate the magnitude of strength of associations.

Analysis of the marital status of the teenage mothers revealed that teenage mothers who were single or never married had higher odds of having children who are less than 5 years of age present with at least 2 episodes of diarrhoea within the previous 2 weeks ([OR]=2.251;95% Confidence interval [95% CI], 1.162-4.360; *P*=0.016), relative to married teenage mothers (Table 4.2). Similarly, teenage mothers who were divorced had 5.176 times higher odds of having their children present with episodes of diarrhoea (OR=5.176; 95% CI, 1.259-21.285; *P*=0.023). However, being widowed did not have any influence on diarrhoea outcomes for children who were less than five years (*P*= 0.462).

Regression analysis of teenage mothers levels of education showed that those who had completed secondary school had a significantly decreased odds of their children who were less than five years old reporting with diarrhoea compared to those completed tertiary/university college (OR=0.072; 95% CI, 0.017-0.304; *P*<0.001). There were no associations between having teenage mothers with no education (*P*=0.217), or dropped out primary school (*P*=0.436), or completed primary school (*P*=0.158), or did not complete secondary school (*P*=0.163) and diarrhoea outcomes among their children who were less than 5years (Table 4.2).

Analysis of the types of employment that the teenage mothers engaged in revealed that those who were students presented with 17.3 times higher odds of their children reporting episodes of diarrhoea compared to teenage mothers who were in formal employment (OR=17.333; 95% CI,1.387-216.602; *P*=0.027). However, no association was seen between diarrhoea outcomes among children of teenage mothers who were unemployed (*P*=0.937), or housewives (*P*=0.062) or those who were operating various business (*P*=0.425).

Table 2: Association between Social Economic Characteristics of Teenage Mothers and Diarrhoea Outcome in Ndhiwa Sub-County, Homa Bay County

Characteristics	**No Diarrhoea n (%)**	**Diarrhoea episodes n (%)**	**Odds Ratio**	**95% CI**	***P* value**
Marital status of teenage mothers					
Married	176 (79.6)	68 (68.7)	Ref	-	-
Never married	23 (10.4)	20 (20.2)	2.251	1.162-4.360	**0.016**
Widowed	19 (8.6)	5 (5.0)	0.681	0.245-1.897	0.462
Divorced	3 (1.4)	6 (6.1)	5.176	1.259-21.285	**0.023**
Teenage mother's education level					
Tertiary University	27 (8.5)	17 (7.7)	Ref	-	-
None	79 (24.8)	42 (19.1)	0.392	0.089-1.735	0.217
Primary dropout	56 (17.6)	36 (16.4)	0.587	0.154-2.243	0.436
Completed primary	45 (14.1)	29 (13.2)	0.370	0.093-1.470	0.158
Secondary dropout	102 (32.0)	92 (41.8)	0.368	0.090-1.499	0.163
Completed secondary	10 (3.1)	4 (1.8)	0.072	0.017-0.304	**<0.001**
Teenage mothers' occupation					
Employment	50 (15.6)	27 (12.2)	Ref	-	-
Un employment	239 (74.7)	172 (77.8)	1.083	0.147-7.959	0.937

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

Student	5 (1.6)	1 (0.5)	17.333	1.387-216.602	**0.027**
House wife	10 (3.1)	8 (3.6)	3.691	0.935-14.571	0.062
Business	16 (5.0)	13 (5.9)	1.688	0.466-6.112	0.425

Binary logistic regression analyses were performed to assess the association between the marital status of teenage mothers, education level and occupation and diarrhoea outcomes. The likelihood that these factors would influence the children who are less than five years of age to present with diarrhoea of episode at least twice in 14 days is reported. Data are presented as odds ratios (OR) and 95% confidence interval (CI). Significant *P* values ($P \leq 0.050$) are shown in bold.

C. Knowledge of Teenage Mothers on Under-Five Diarrhoeal Prevention

The knowledge of teenage mothers on diarrhoea prevention in children who were less than five years old was analyzed and results compared among those without diarrhoea episode and those with diarrhoea (Table 3). Overall, more than three-quarter (n=251, 78.4%) of teenage mothers had good knowledge on prevention of diarrhoea, that was defined as those who had their children vaccinated against rotavirus and measles, reported early and exclusive breastfeeding for six at least months, had children on vitamin A supplementation, utilized clean and boiled drinking water, had functional toilet in their compounds, washed utensils and dried them on the rack and properly washed hands after using toilet. Overall, the proportion distribution of knowledge on diarrhoea prevention among the teenage mothers differed significantly between those with children reporting diarrhoea episodes relative to those with no documented diarrhoea ($P<0.001$).

Analysis of this individual variables showed that there as a higher proportion on teenage mothers who washed hands frequently (n=183, 57.2%), a large proportion of which recorded no episodes of diarrhoea (n=133, 72.2%). However, the overall distribution of the proportions between children without and with diarrhoea did not differ significantly ($P=0.106$). Similarly, a large proportion of study respondents showed good knowledge of dumping rubbish, which in turn significantly decreased ($P=0.009$) incidences of diarrhoea reported among children of teenage mothers. Additionally, majority of participants were aware and knowledgeable (79.1%) about vaccinations against measles and rotavirus. This knowledge resulted in significantly lower proportions of diarrhoea episodes relative to teenage methods who reported poor knowledge on rubbish dumping ($P<0.001$). A larger proportion of participants (66.9%) reported good knowledge on importance of drinking boiled and clean water, reporting significantly lower incidences of diarrhoea among those households ($P=0.008$). However, although majority of respondents reported poor knowledge on early and exclusive breastfeeding for at least 6 months (66.3%), the proportion distribution between the study groups did not vary significantly ($P=0.052$). Similarly, presence and usage of toilets did not seem to impact on reports on presence or absence or diarrhoea ($P=0.545$).

Table 3: Knowledge of Teenage Mothers on Under-Five Diarrhoeal Prevention in Ndhiwa Sub-County, Homa Bay County, Kenya

Knowledge on Diarrhoea prevention		**Total n (%)**	**No Diarrhoea n (%)**	**Diarrhoea episodes n (%)**	***P* value**
Number of Participants, n (%)		**320 (100.0)**	**221 (69.1)**	**99 (30.9)**	
Overall knowledge on diarrhoea prevention	Poor knowledge	69 (21.6)	35 (15.8)	34 (34.3)	**<0.001**
	Good knowledge	251 (78.4)	186 (84.2)	65 (65.7)	
Washing hands frequently	Poor knowledge	137 (42.8)	88 (64.2)	49 (35.8)	0.106
	Good knowledge	183 (57.2)	133 (72.2)	50 (27.3)	
Dumping Rubbish	Poor knowledge	74 (23.1)	42 (56.8)	32 (43.2)	**0.009**
	Good knowledge	246 (76.9)	179 (72.8)	67 (27.2)	
Rota and measles vaccination	Poor knowledge	67 (20.9)	34 (50.7)	33 (49.3)	**<0.001**
	Good knowledge	253 (79.1)	187 (73.9)	66 (26.1)	
Early and exclusive breastfeeding for six months	Poor knowledge	212 (66.3)	154 (72.6)	58 (27.4)	0.052
	Good knowledge	108 (33.8)	67 (62.0)	41 (38.0)	
Drinking clean and boiled water	Poor knowledge	106 (33.1)	42 (39.6)	64 (60.4)	**0.008**
	Good knowledge	214 (66.9)	157 (73.5)	57 (26.6)	
Digging and using Toilet	Poor knowledge	31 (9.7)	11 (35.5)	20 (64.5)	0.545
	Good knowledge	288 (90.3)	201 (69.8)	87 (30.2)	

Data are Presented as Absolute Numbers and Proportion of Study Participants. Statistical Significance was Determined by Chi Square (χ^2) Test.

D. Association between Knowledge of Teenage Mothers and Diarrhoea Outcome in Ndhiwa Sub-County, Homa Bay County Kenya

Analysis of the relationship between levels of teenage mother's knowledge on diarrhoea episodes among children less than 5 years was investigated using a binary logistic regression model (Table 4). The results showed that teenage mothers who had poor knowledge on diarrhoea prevention had 2.780 higher odds of their children developing diarrhoea relative to those who had good knowledge (OR=2.780; 95%

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

CI 1.604-4.818; *P*<0.001). Results show that lack of knowledge by teenage mothers on the frequency of hand washing did not predict diarrhoea episodes among children <5years (OR=1.481; 95% CI, 0.919-2.3871; *P*=0.107). Teenage mothers who had poor knowledge on rubbish dumping had higher odds of their children developing diarrhoea compared to those who had good knowledge (OR=2.036; 95% CI, 1.188-3.489; *P*=0.010). Teenage mothers with poor knowledge on measles and Rota virus vaccinations had 2.750 times higher odds of their children presenting with diarrhoea (OR=2.750; 95% CI, 1.579-4.791; *P*<0.001). Similarly, teenage mother's poor knowledge on drinking clean and boiled water increased the odds of their children presenting with diarrhoea (OR=1.808; 95% CI, 1.104-2.960; *P*=0.019). However, there was no relationship between reported episodes of diarrhoea among children and teenage mother's knowledge on early and exclusive breastfeeding for six months (*P*=0.530) or digging and using toilets (*P*=0.546) (Table 4).

Table 4: Association between Knowledge of Teenage Mothers and Diarrhoea Outcome in Ndhiwa Sub-County, Homa Bay County, Kenya

Knowledge on Diarrhoea prevention		**No Diarrhoea n (%)**	**Diarrhoea episodes n (%)**	**OR (95% CI)**	**P value**
Overall knowledge on diarrhoea prevention	Good knowledge	69 (66.3)	35 (33.7)	Ref	<0.001
	Poor knowledge	251 (57.4)	186 (42.6)	2.780 (1.604-4.818)	
Washing hands frequently	Good knowledge	137 (60.9)	88 (39.1)	Ref	0.107
	Poor knowledge	183 (57.9)	133 (42.1)	1.481 (0.919-2.387)	
Dumping Rubbish	Good knowledge	74 (63.8)	42 (36.2)	Ref	0.010
	Poor knowledge	246 (57.9)	179 (42.1)	2.036 (1.188-3.489)	
Rota and measles vaccination	Good knowledge	67 (66.3)	34 (33.7)	Ref	<0.001
	Poor knowledge	253 (57.5)	187 (42.5)	2.750 (1.579-4.791)	
Early and exclusive breastfeeding for six months	Good knowledge	212 (57.9)	154 (42.1)	Ref	0.530
	Poor knowledge	108 (61.7)	67 (38.3)	0.615 (0.376-1.007)	
Drinking clean and boiled water	Good knowledge	106 (71.6)	42 (28.4)	Ref	0.019
	Poor knowledge	214 (57.7)	157 (42.3)	1.808 (1.104-2.960)	
Digging and using Toilet	Good knowledge	31 (73.8)	11 (26.2)	Ref	0.546
	Poor knowledge	288 (58.9)	201 (41.1)	1.271 (0.584-2.765)	

Binary logistic regression analyses were performed to assess the association between knowledge of teenage mothers on prevention and diarrhoea outcomes. As such, the likelihood that these factors would influence the children who are less than five years of age to present with diarrhoea episode at least twice in 14 days is reported. Data are presented as odds ratios (OR) and 95% confidence interval (CI). Significant *P* values are shown in bold.

IV. DISCUSSION

Analysis of the social-economic factors of the teenage mothers showed that marital status was associated with diarrhoea episode in children less than five years old. Teenage mothers who were single or never married or divorced had more diarrhoea episode reported in their children who were less than five years old compared to teenage mothers who were married. Moreover, the proportion was high among divorced, never married, primary school drop outs and house wives, further compounded by a high proportion of teenage mothers in the Sub-County would explain the high incidences of diarrhoea among children aged less than 5 years.

In contrast, teenage mothers who had completed secondary school education reported significantly fewer episodes of diarrhoea among their children aged less than 5 years, demonstrating that basic formal education is important in understanding of diarrhoea disease prevention (11). The results parallel those of a previous study in Malawi that showed low education and poor knowledge about diarrhoea among mothers were associated with diarrhoea morbidity in the children (37). Similarly in this study, there was an observed increase in knowledge on diarrhoeal prevention with increase in level of education amongst teenage mothers, with secondary school completion having the highest. Therefore, this study confirms education influence on diarrhoeal preventions among children under five years of teenage mothers.

Employment status is key in improving the general health status of children less than years old (38). Teenage mothers' involvement in paid work has been previously associated with more favorable child outcomes and living with a single mother and other adults predicts more negative outcomes (8). This study found that teenage mothers who operate business were more knowledgeable on diarrhoeal prevention than teenage mothers without any work or who were students, with the later reporting more incidences of diarrhoea episodes within the last 2 weeks amongst their children aged less than 5 years. A regression model of the teenage mother's occupation showed that those who were students had their children reporting with episodes of diarrhoea relative to those with formal employment. These results parallel those of a previous study that identified an association between unemployment of mothers and diarrhoea diseases in their children (18). This study demonstrates that teenage mother employment is an important favorable factor

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

to knowledge children less than five years old diarrhoeal prevention.

Overall, more than three-quarter of teenage mothers had good knowledge on prevention of diarrhoea, which include; rotavirus vaccination, measles vaccination, early and exclusive breastfeeding for six months, vitamin A supplementation, drinking clean/boiled water, digging and using a toilet, washing utensils and drying them on the rack and proper handwashing after using toilet among others. A multivariate logistic regression analysis presented here showed that teenage mothers who had poor general overall knowledge on prevention of diarrhoea had their children present with 2.7 times higher odds of reporting with episodes of diarrhoea. In addition, poor knowledge on garbage dumping, Rota and measles vaccination, and drinking clean and boiled water were all associated with increased odds of children presenting with diarrhoea episodes within the last 2 weeks. These results conquer with previous studies that showed significant associations between diarrhoeal diseases and storage of household waste, evacuation of household waste in public streets, non-treatment of stored drinking water and use of shared toilets, poor sanitation/rubbish disposal (18, 37).

An earlier study showed that education provides knowledge necessary for diarrhoeal prevention practices such as good hygiene, feeding and weaning practices; hence children of mothers who are illiterate are more likely to suffer from diarrhoea compared to children of literate mothers (10). Moreover, mothers with primary or secondary school education have been found to have more knowledge on diarrhoea prevention than those without any formal education, demonstrating that basic formal education is important in understanding of diarrhoea disease prevention (11). Similarly in this study, there was observed increase in knowledge on diarrhoeal prevention with increase in level of education amongst teenage mothers, with secondary and tertiary having the highest. This correlated well with results presented here which showed that teenage mothers who had poor knowledge on methods for prevention of diarrhoea had their children present with more episodes of diarrhoea. Therefore, this study confirms education influence on under five diarrhoeal preventions among teenage mothers.

V. CONCLUSION

The teenage mothers' social economic characteristics including marital status (never married or divorced), and occupation (student) are associated with increased odds of their children under 5 years presenting with episodes of diarrhoea in the previous 2 weeks, while the level of education (competed secondary) significantly decreased diarrhoea among the children in Ndhiwa Sub-County, Homa Bay County, Kenya.

The overall poor knowledge of the teenage mothers on under-five diarrhoea prevention is associated with increased odds of their children presenting with diarrhoea episodes. Specifically, poor knowledge of dumping rubbish, Rota and measles vaccination, and drinking clean and boiled water were associated in increased incidences of diarrhoea in the children below five years of age in Ndhiwa Sub-County, Homa Bay County, Kenya.

VI. RECOMMENDATIONS

Implement programs to support teenage mothers, emphasizing the importance of completing secondary education. Provide accessible education on health and sanitation to reduce diarrhoea episodes among their children.

Enhance educational campaigns on proper waste disposal, the importance of vaccinations, and the necessity of drinking clean, boiled water to reduce diarrhoea in children under five.

ABBREVIATIONS

- AHO: Africa Health Organisation
- BCC: Behaviour Change Communication
- CDC: Centers for Disease Control
- CHVs: Community Health Volunteers
- CLTSs: Community Led Total Sanitation
- DHS: Demographic Health Survey
- EBF: Exclusive Breastfeeding
- EDHS: Ethiopian Demographics Health Survey
- GCP: Good Clinical Practice
- HFI: Household Food Insecurity
- HIV: Human Immunodeficiency Virus
- HIF: Hygiene Improvement Framework
- ICF: International Classification of Functioning
- KDHS: Kenya Demographics Health Survey
- KNBS: Kenya National Bureau of Statistics
- LMIC: Low- and Middle- Income Countries
- NIH: National Institutes of Health
- ORS: Oral Rehydration Salts
- UNESCO: United Nations Educational, Scientific and Cultural Organization
- UNICEF: United Nations Children's Fund, WHO: World Health Organization.

ACKNOWLEDGMENTS

We are grateful to the leadership of Ndhiwa Sub-County for granting permission for the study to be carried out. Special appreciation goes to teenage mother who participated in this study together with their children for making this study a reality.

- **Authors' Contributions:** EO, AB and CA planned the study and participated in all the areas. EO, AB CA and PK wrote the manuscript. All the authors reviewed the final manuscript and approved it for submission.

- **Funding:** None

- **Availability of Data and Materials:** The data are available upon reasonable request from the corresponding author.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT136

- **Ethics Approval and Consent to Participate:** The study was approved by the Maseno University Scientific and Ethical Review Committee # MSU/DRPI/MUERC/00835/20. Authorization to conduct this research in Ndhiwa Sub-county was obtained from Homa Bay Department of Health Services. All study participants provided written informed consent to participate in this study.

- **Consent for publication:** Not applicable.

- **Competing Interests:** The authors have declared that no competing interests exist.

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