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Original Research Article

Caregiver sociodemographic factors associated with adherence to zinc treatment of childhood diarrhoea, Kirinyaga county, Kenya

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ABSTRACT

Background: Zinc supplement is critical for managing childhood diarrhoea. However, adherence to zinc treatment remains low in low-resource settings. This study determined the association between zinc utilization for treatment of diarrhoea among children below five years old and caregivers' sociodemographic factors in Kirinyaga County, central Kenya.
Methods: A cross-sectional study was conducted from February to March 2025, involving 223 caregivers and 25 healthcare workers across four hospitals.
Results: Only 20% (45/223) of children in this study received zinc treatment for the recommended period of 10–14 days. Low adherence to zinc treatment was associated with caregiver level of education and employment status ($p<0.05$). Lack of IMNCI training (96%; 24/25) among health workers was observed, despite most of them having access to the IMNCI guidelines.
Conclusions: Findings of this study underscore the need to sensitize caregivers on the benefits of zinc supplements in management of childhood diarrhea. These efforts should be complemented with periodic health worker training on guidelines that support effective management of childhood diarrhea in Kirinyaga County, particularly the IMNCI protocol.

Keywords: Diarrhoea, Zinc treatment, Medication adherence, Sociodemographic factors, Caregivers, Kenya

INTRODUCTION

Diarrhea remains one of the leading causes of childhood morbidity and mortality worldwide. Despite significant advances in child survival, diarrheal disease continues to account for approximately 1.7 billion episodes and over half million deaths annually among children under five years of age.[1] It is not only a major cause of death but also contributes to malnutrition, impaired growth, and delayed cognitive development.[1] The burden of diarrheal disease is greatest in low- and middle-income countries, particularly in Africa, where poor sanitation, unsafe water, and limited access to healthcare exacerbate vulnerability.[2]

In Kenya, diarrhea remains a major public health concern, ranking as the third leading cause of death among children under five.[8] The Kenya National Bureau of Statistics estimates that each child experiences three diarrheal episodes annually, with rotavirus being a key causative agent.[22] According to the 2022 Kenya Demographic and Health Survey, about 1,300 children die daily due to diarrheal illness in Kenya.[8]

Diarrhea is caused by a wide range of pathogens transmitted mainly through the fecal–oral route. These include bacterial agents such as Salmonella, Shigella, Escherichia coli, and Campylobacter species, viral agents such as rotavirus, norovirus, and adenovirus, and

protozoal parasites such as Giardia and Cryptosporidium.[3,4] In children under five, rotavirus and E. coli are the most common etiological agents, while parasitic infections occur more frequently among older preschoolers.[5] The epidemiologic patterns of diarrhea are strongly shaped by hygiene practices, crowding, water quality, and environmental sanitation, with transmission also possible through contaminated fomites and food.[6,7]

Zinc supplementation, in combination with oral rehydration salts (ORS), is the cornerstone of diarrhea management.[1] This dual therapy prevents dehydration, shortens illness duration, reduces recurrence, and lowers hospitalization and mortality.[9,10] However, despite WHO recommendations for zinc supplementation alongside ORS, adherence remains suboptimal in many parts of Kenya. Only 40% of children with diarrhea receive zinc, while just 32% receive both ORS and zinc in Kenya.[8] In Kirinyaga County, zinc utilization is comparatively low, with only 38.9% of children receiving zinc, 33.1% receiving ORS with zinc, and 18.2% receiving the recommended package of ORS, zinc, and continued feeding.[7] Studies in Kirinyaga have also reported diarrhea prevalence as high as 23% among children under five, further highlighting the urgency of addressing treatment gaps.[11] The low uptake of zinc supplementation in Kirinyaga underscores the need to promote use of zinc in management of childhood diarrhea.[12]

Therefore, this study aimed to determine the association between zinc utilization in treatment of diarrhea among children below five years old and caregivers' sociodemographic factors in Kirinyaga County, central Kenya. Findings from this study will help avert diarrhea-related deaths and severe disease in Kenya enroute to realization of sustainable development goal on child health (SDG 3.2).

METHODS

Study design

The study used descriptive cross-sectional study design. This design was chosen to help determine the prevalence of zinc utilization and to analyze how caregivers' sociodemographic factors relate to treatment adherence.

Study site

The study was conducted in Kirinyaga County, central Kenya, located south of Mount Kenya (Figure 1). The county covers approximately 1,478.1 km², with coordinates at latitude 0.5930°S and longitude 37.215°E. Approximately 610,411 people reside in the area, with children under five years old accounting for 10% of the population.[13] Kirinyaga County has five sub-counties, namely Kirinyaga East, Kirinyaga West, Mwea East, Mwea West, and Kirinyaga Central. Wang'uru is the largest town, while Kutus serves as the county headquarters. The county experiences two rainy seasons with short rains occurring between October and November and long rains between March and May.[15] Agriculture, particularly rice cultivation, is the main economic activity, and surface water (wells and rivers) is the primary sources of water for both domestic and agricultural use. The prevalence of diarrhea in the Kirinyaga county is 31.8% and only 50% of children with diarrhea seek health care attention.[14]

Study participants

In this study, a total of 230 caregivers of under-five year old children with diarrhea were recruited from February to March 2025 and 25 healthcare workers directly involved in the care of children with diarrhea. Diarrhea was defined in this study as passage of at least three loose within 24 hours.[10] The study recruited caregivers of children who visited four public hospitals (Kerugoya County Referral Hospital, KCRH) and three sub-county hospitals (Kimbimbi, Kianyaga, and Sagana) in Kirinyaga County (Figure 1) due to childhood diarrhea with either no dehydration or had some dehydration. Caregivers of children below five years old without diarrhea, as well as severe dehydration and/or in shock, were excluded from the study. In addition, the study enrolled healthcare workers involved in the management of childhood diarrhea in the aforementioned hospitals to assess health system related factor influencing zinc utilization such as IMNCI training of healthcare workers.

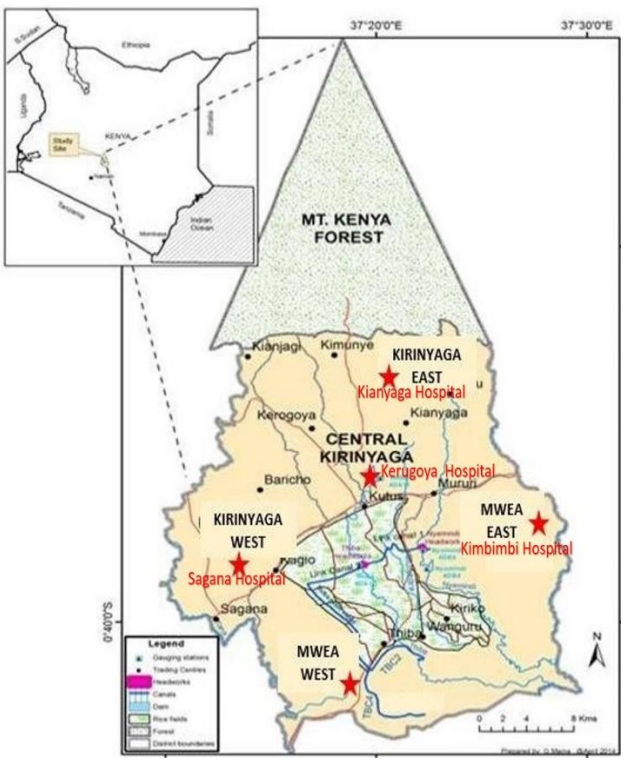

Figure 1: Map of Kirinyaga county, Kenya showing location the study sites.

Red stars indicate study sites, with an inset showing the county's location within Kenya.

Data collection

A structure questionnaire was administered to caregivers of children with diarrhea to determine sociodemographic factors associated with zinc utilization for the management of diarrhea. The sociodemographic factors investigated in this study were age, relationship to child, level of education and occupation. All children with diarrhea received dispersible zinc tablets to be administer at home by a caregiver for a period of weeks. Children aged between six and 11 months received 10 mg zinc tablets, while children aged between 12 and 59 months received 20 mg tablets (Cosmos Company, Kenya). The duration (days) and level of zinc utilization was recorded on day 14 after being enrolled to the study. In addition, the study also collected data on health system-related factors and healthcare worker Integrated Management of Newborn and Childhood Illness (IMNCI) protocol training barrier in Kirinyaga County using a self-administered questionnaire. Instrument reliability was confirmed via the test-retest method, with Pearson's correlation coefficient ≥0.70 considered acceptable.

Ethical consideration

Ethical approval for this study was provided by Mount Kenya University Ethical Review Board (MKU/SERC/ 4771) and the National Commission for Science, Technology and Innovation (NACOSTI/P/254/ 16473). Authority to conduct the study in Kirinyaga County health facilities was granted by the County Chief Officer of Health. Written informed consent was obtained from all participants prior to enrollment to the study. Participation in the study was voluntary and participants were free to withdraw from the study at any stage. Confidentiality of data was strictly maintained.

Data analysis

Data were analyzed using SPSS Version 24. Level of zinc utilization was calculated as the proportion of children receiving zinc as recommended. Associations between determinants and zinc utilization were applying the Chi-square test. Logistic regression was applied to examine the relationship between zinc utilization and potential predictors, including the level of zinc use among children, caregivers' sociodemographic characteristics, and hospital-level barriers to effective IMNCI training. Statistical significance was set at $p<0.05$.

RESULTS

A total of 223 out of 230 caregivers (97%) who completed follow-up were recruited to the study, with 7 being lost to follow-up. The mean age of the caregivers of children with diarrhea was 29 years old (± 9 SD). Most of the caregivers (39.3%, 85/223), were between 25 and 34 years old, followed by 35–44 years old (30.9%, 60). The mean age of children was 2 years old (±1 SD). Mothers comprised 96% (214) of caregivers, while both fathers and guardians accounted for 4% (Table 1). The level of education of caregivers of children visiting the four hospitals in this study varied significantly ($p=0.01$; Table 1). Most caregivers (108/223, 48%) had secondary school level of education whereas caregivers with primary and tertiary levels were 15 (6.7%) and 49 (22%), respectively. 51(22.9%) caregivers had no formal education in this study (Table 1). Sagana Sub-County hospital had the highest proportion of caregivers (17/223, 6%) without formal education. The level of employment of caregivers in study varied significantly ($p=0.001$) among different hospitals, with most caregivers either being employed (92/223 41.2%) or self-employed (47/223, 21%). Most unemployed caregivers were visited in Sagana Sub-County Hospital (Table 1) in this study.

Twenty percent (20%; 45/223) of children in this study completed the recommended 10–14-day zinc treatment course (Table 2). The level of zinc utilization for 49% (110/223) of most children was between one to five days while the remaining 30% (68/223) received zinc for six to nine days. KCRH had the highest number of children discontinuing zinc treatment early, with 58%.[49] of caregivers stopping zinc treatment between day one and five post hospital visits whereas Kimbimbi Sub-County hospital demonstrated moderate adherence, with 24%.[14] of children completing zinc treatment for the recommended 14 days. Sagana Sub-County hospital had the lowest adherence, with only 10%.[4] of caregivers administering the full zinc regimen (Table 2). 47.8% variation in the duration of zinc treatment in the study was statistically significant ($R=0.691$, $p<0.001$; Table 3). Level of education of caregivers was observed to be strong positive predictor (Beta=0.784, $p < 0.001$) of zinc treatment among children with diarrhea in this study (Table 4). On the other hand, the employment status (Beta=-0.196, $p < 0.001$) and cost of zinc supplement (Beta=-0.204, $p=0.002$) were negatively predictor duration of zinc utilization in this study (Table 4). Thus, suggesting that employment and cost of zinc supplement are barriers to zinc utilization in this study (Table 4).

In this study, 96% (24/25) of healthcare workers reported they had not been on IMNCI protocol (Table 1). Only one healthcare worker, a nurse, in the study was reported being trained. However, access to IMNCI protocols was relatively high, with 76% (19/25) of healthcare workers having access to a soft copy version of IMNCI guidelines (Table 6). However, actual use was limited with 15 healthcare workers (60%) reporting that they never referred to the IMNCI chart booklet during management of childhood diarrhea (Table 5).

Table 1: Demographic characteristics of caregivers of children with diarrhea attending four hospitals in Kirinyaga county, Kenya.

Characteristic		Number of caregivers (n = 230)				Total (%)	P value
		Kerugoya (KCRH) (n=84)	Sub-county hospitals				
			Kimbimbi (n=68)	Kianyaga (n=42)	Sagana (n=39)		
Median Age in years		32	27	27	30	-	0.15
Age in years	15-24	12 (14%)	09 (13%)	14 (33%)	13 (33%)	48 (21)	0.025
	25-34	33 (39%)	26 (38%)	14 (33%)	12 (31%)	85 (37)	
	35-44	26 (31%)	16 (24%)	08 (19%)	10 (26%)	60 (26)	
	Above 45	13(16%)	07 (10%)	06 (14%)	04 (10%)	30 (13)	
Relationship to child	Mother	82 ((8%)	56 (82%)	38 (91%)	38 (97%)	214 (93)	0.023
	Father	01(1%)	00 ((0%)	04 (10%)	00(0%)	05(2)	
	Guardian	01(1%)	02 (3%)	00 (0%)	01 (3%)	04 (2)	
Level of Education	No formal education	21(25%)	05 (7%)	08 (19%)	17 (44%)	51 (22)	0.001
	Primary	06 (7%)	07 (10%)	01 (2%)	01 (3%)	15 (7)	
	Secondary	45 (54%)	30 (44%)	16 (38%)	17 (44%)	108 (47)	
	Tertiary college/university	12 (14%)	16 (24%)	17 (41%)	4 (10%)	49 (21)	
Occupation	Unemployed	28 (33%)	14 (21%)	18 (43%)	24 (62%)	84 (37)	0.001
	Self-employed	15 (18%)	13 (19%)	15 (36%)	04 (10%)	47 (20)	
	Employed	41(49%)	31 (46%)	09 (21%)	11 (28%)	92 (40)	

Caregiver characteristics by hospital (total n = 230); P values indicate differences between groups.

Table 2: Level and duration of zinc utilization among under-five year old children with diarrhea in four public hospitals in Kirinyaga county, Kenya.

Characteristics		Duration of zinc use in days (n=223)			Total (%)	P-value
		1-5 (n=110)	6-9 (n=68)	10-14 (n=45)		
Hospitals	KCRH	49 (58%)	23 (27%)	12 (14%)	84 (37.7)	0.028
	Kimbimbi	27 (47%)	17 (29%)	14 (24%)	58 (26.0)	
	Kianyaga	16 (38%)	11 (26%)	15 (36%)	42 (18.8)	
	Sagana	18 (46%)	17 (44%)	04 (10%)	39 (17.4)	
	Total	110 (49%)	68 (30%)	45 (20%)	223 (100.0)	
Age group in years	15-24	25 (52%)	19 (40%)	04 (8%)	48 (21.5)	0.030
	25-34	42 (49%)	21 (25%)	22 (26%)	85 (38.1)	
	35-44	24 (40%)	19 (32%)	17 (28%)	60 (26.9)	
	Above 45	19 (63%)	09 (30%)	02 (7%)	30 (13.5)	
	Total	110 (49%)	68 (30%)	45 (20%)	223 (100.0)	
Level of Education	No formal education	39 (76%)	12 (24%)	00 (0%)	51 (22.9)	0.0001
	Primary	12 (80%)	03 (20%)	00 (0%)	15 (06.7)	
	Secondary	58 (54%)	49 (45%)	01 (1%)	108 (48.4)	
	Tertiary	01 (2%)	04 (8%)	44 (90%)	49 (22)	
	Total	110 (49%)	68 (30%)	45 (20%)	223 (100)	
Occupation	Unemployed	48 (57%)	23 (27%)	13 (15%)	84 (37.7)	0.0001
	Self-employed	18 (38%)	07 (15%)	22 (47%)	47 (21)	
	Employed	44 (48%)	38 (41%)	10 (11%)	92 (41.3)	
	Total	110 (49%)	68 (30%)	45 (20%)	223 (100)	

Table 3: Model fit statistics for zinc utilization regression analysis.

Model	R	R square	Adjusted r square	Std. error of the estimate	Change statistics				
					R square change	F change	Df1	Df2	Sig. f change
1	0.691	0.478	0.456	0.57734	0.478	21.685	09	213	0.000

Regression model fit for zinc utilization (total n=223); r^2 =0.478, p<0.001.

Table 4: Association between zinc utilization and caregiver's sociodemographic factors among under-five children with diarrhea in four public hospitals, Kirinyaga County, Kenya.

Predictor variable	B (Unstd.)	Std. error	Beta (Std.)	T-value	P-value
(Constant)	1.802	0.260	-	6.919	<0.001
Hospital	0.065	0.037	0.092	1.777	0.077
Age of caregiver	-0.018	0.041	-0.022	-0.431	0.667
Level of education	0.581	0.047	0.784	12.455	<0.001
Employment status	-0.172	0.050	-0.196	-3.419	<0.001
Relationship to child	-0.029	0.134	-0.011	-0.213	0.832
Cost of zinc supplement	-0.121	0.038	-0.204	-3.207	<0.002
Transportation costs	0.006	0.011	0.027	0.520	0.603
Preference for traditional remedies	0.007	0.045	0.009	0.165	0.869
Biggest challenge in using zinc	0.082	0.066	0.065	-	-

Relationship between caregiver demographics and zinc use (total n = 223); p < 0.05 indicates significant predictors.

Table 5: IMNCI protocol implementation status among healthcare workers (n=25).

Question	IMNCI protocol implementation status among healthcare workers (n=25)		
	Response options	**Frequency (N)**	**Percentage (%)**
Recent IMNCI protocol training	Yes	01	04
	No	24	96
	Total	25	100
Time since last training	One month ago	00	00
	Three months ago	00	00
	Six months ago	00	00
	One year ago	25	100
	Total	25	100
Access to IMNCI protocol of november 2022	Yes	19	76
	No	06	24
	Total	25	100
Protocol availability (if yes)	Available	19	76
	Not available	06	24
	Total	25	100
IMNCI pediatric protocol format	Soft copy	25	100
	Hard copy	00	00
	Total	25	100
Frequency of protocol reference	Never	15	60
	Sometimes	06	24
	Often	04	16
	Total	25	100
Regular IMNCI supervision	Yes	01	04
	No	24	96
	Total	25	100
When last supervision was done	In the last 1 year	01	04
	Never	24	96
	Total	25	100

DISCUSSION

Zinc remains the cornerstone for the management of childhood diarrhea owing to the tremendous impact it has had in the management of diarrhea among children below five years old. It is linked to the decline reduction of the duration and severity of diarrhea.[20] In spite of this, adherence to zinc treatment is still low, especially in low- and middle-income countries such as Kenya.[16] This study, therefore, aimed to determine the association between caregivers' sociodemographic factors and zinc utilization among under-five-year-old children with diarrhea in Kirinyaga County, Kenya.

This study reveals poor adherence (20%) to zinc treatment among childhood diarrhea in Kirinyaga County, Kenya. Most children (80%) did not complete the recommended 10 to 14-day treatment course, with caregivers discontinuing zinc treatment within the first week of treatment.[12] These findings are lower than the level of zinc adherence reported in in Northwest Ethiopia and India which observed that adherence to zinc at 34.45% and 63.7%, respectively.[30] Our study also observed variation in adherence to zinc treatment among the health facilities in the study. Early discontinuation of zinc treatment (one to five days) was prominent in Kerugoya County Referral hospital, while Sagana Sub-County hospital recorded the lowest adherence, with very few caregivers completing the full course. In contrast, Kimbimbi Sub-County Hospital showed relatively better adherence compared to the other facilities. Variation of adherence to zinc supplementation observed in this study is congruent with previous studies conducted in Ethiopia, Bangladesh and India.[18,31,16] Our study and previous studies suggest different factors may be influencing adherence to zinc adherence within and between different countries.[24]

In particular, our study observed that caregivers' social demographic factor influences use of zinc supplement in management of diarrhea among children below five-year-olds in Kirinyaga County Kenya. Age of Caregiver was significantly associated with zinc treatment. In this study young caregivers aged between 15 and 24 years old were observed to be more likely to discontinue zinc early, whereas older caregivers (35–44 years) demonstrated higher completion rate. These findings are consistent with previous studies conducted in Nigeria and India.[24-26] Thus, indicating that older caregivers exhibit better treatment compliance unlike younger caregivers, which could contribute to early discontinuation and suboptimal home management of diarrhea.

Our study also revealed that caregivers' level of education was associated with the use of zinc supplements in the management of diarrhea. In fact, education level was observed to be a strong predictor of zinc utilization in the current study. Caregivers with tertiary-level education had better adherence to the recommended 10–14-day course of zinc treatment than caregivers without formal education. These findings corroborate previous reports linking caregiver education with improved child health outcomes, adherence to treatment protocols, and knowledge of home-based management practices.[16-20] Efforts to promotes caregiver education through zinc-promotion programs such as the POUZN project in Nepal have been shown to improve the likelihood of proper use of zinc.[30] This implies that caregiver's education is key in promoting proper zinc administration in childhood diarrhea.

Employment status and economic factors also played a key role in the current study. In this study, self-employed caregivers had the highest adherence to the recommended zinc treatment period. This is plausibly due to flexible work schedule that provide more time to take care of children with diarrhea than employed caregivers and unemployed.[10] This is likely due to competing obligations at the workplace among employed caregivers and financial constraints experienced by unemployed caregivers. Cost of zinc may also undermine its use, particularly in resource-limited areas including rural settings in Kenya. This phenomenon has been reported in other low-income settings.[22]

The WHO and UNICEF have established guidelines complement efforts for effective management of childhood diarrhea, particularly the IMNCI protocol.[10] To promote and sustain effective management of childhood diarrhea, healthcare workers are expected to receive periodic training on IMNCI protocol.[1-10] However, this study reveals that training of healthcare workers on IMNCI protocol has largely not been conducted in the four hospitals in this study. This could affect utilization of IMNCI protocol and reverse gains in averting child mortality and morbidity in Kirinyaga County, Kenya and beyond.[12] Variation in counseling, healthcare worker training, follow-up practices, and zinc availability could contribute to training and utilization of IMNCI protocol as reported in previous studies.[19,23,27] This underscores the importance of strengthening health system support, ensuring consistent supply chains, and harmonizing caregiver counseling across facilities.

Taken together, our study demonstrates low zinc supplement utilization for management of childhood diarrhea in Kirinyaga County, Kenya, which is associated with caregivers' age, level of education and employment status. Our findings underscore the need to promote awareness among caregivers on the importance of zinc supplement is management of childhood diarrhea. These efforts should be complemented by regular training of healthcare workers on IMNCI protocol. Addressing, these gaps will be crucial for effective management of childhood diarrhea and other peadiatric diseases in Kenya.

Study limitations

Several limitations in this study were encountered. The research was cross-sectional where data was captured at a

single point in time. This limited the ability to establish clear links between caregiver factors and zinc adherence. The findings also relied on caregivers precisely recalling treatment over a 14-day period. This self-reporting carried a social desirability bias, which could have influenced the adherence rate observed. The study focused on four hospitals in Kirinyaga County, which may not have reflected the situation in other regions. Only 25 healthcare workers were studied. While this provided a clear look at local hospital practices, it limited the ability to generalize the findings across all hospitals in Kirinyaga County

CONCLUSION

This study reveals a significant gap in the management of childhood diarrhea in Kirinyaga County, evidenced by a low rate of caregiver adherence to zinc treatment. The link between caregiver sociodemographic factors and treatment adherence highlights the social determinants that act as barriers to effective zinc utilization in Kirinyaga County. Lack of IMNCI training among healthcare workers is a major systemic barrier in the delivery of effective zinc utilization and diarrhea management among children under five. This leads to IMNCI protocol underutilization Strengthening policies among health workers and providing caregiver education are essential in bridging this gap and improve zinc utilization and management among children under five in Kirinyaga County.

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