Original Research

Impact of sanitation improved school latrine on latrine-related practices, perceptions attitude and occurrence of diarrhoea in children in Mwea Division, Kirinyaga District, Central Kenya

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Abstract

Background: School latrines in Mwea irrigation regions are unsanitary and unhygienic. School children who are the end point users of the latrines are exposed to the unhygienic conditions of the latrines and are likely to contract sanitation related diseases. School children have their outlook on the sanitation of the school latrines and they can play an important role towards programmes for improvement of sanitation in the school latrines.

Objective: To determine children's perception attitude and practices about the school latrines in relation to their health experiences.

Methods: A self-administered questionnaire was conducted from 215 Grade Three children in three primary schools in Mwea Division of Central Kenya. Questions about washing hands after latrine use, cleaning of latrines, avoiding use of latrines and perceptions about dirty latrines in relation to occurrence of diarrhea were asked. Occurrence of diarrhoea was based on child's recall of the experience during the one week preceding the day of the test.

Results: Diarrhoea was experienced by 23% of children occuring more often in boys (29%) than in girls (17%). Children who perceived school latrine to be dirty developed diarrhoea (29%) more often than those who did not (18%). Diarrhoea occurrence was reported more frequently by children whose response was negative for washing hands after latrine use (28%) than those who did (15%). Children who felt that cleaning school latrines was a punishment developed diarrhoea (41%) more often than those who did not (18%). On the other hand, there was no significance difference in occurrence of diarrhoea in association with avoidance of usage of school latrines, cleaning of school latrines, and willingness to clean the school latrines.

Conclusion: The school children have given a low rating of the sanitatary condition of the school latrines. They are the end point users of school latrines and their outlok on the condition of the latrine in relation to their health is important for implementation of disease intervention measures.

Introduction

Faecal contamination is one of the most serious environmental health problems in poor countries mainly due to poor or lack of latrines in the communities and schools and it is associated with high morbidity and mortality especially in diarrhoeal diseases[1]. Diarrhoea could be bacterial, viral or parasitic in origin and latrines could provide a good source for the associated pathogens[2]. Soil transmitted helminths (STH) and *Schistosoma mansoni* are co-endemic in Mwea rice growing area region in Mwea Division, Central Kenya[3].

Unpublished data on sanitation of school latrines in the Division (I. Mwobomboia) reported more than 50% of the schools in the Division to be poor and unhygienic. Similarly there was a positive correlation between high infection rates and poor latrine sanitation in school (N. Muhoho. Personal Observation). It was therefore important to initiate a latrine improvement programme on community participation basis as part of integrated parasite interventions [4,5].

Although children are the end point users of the school latrines, they are usually ignored in terms of their desires to have good sanitation facilities. Although there are numerous studies on the importance of improved latrine sanitation [6-8] not much data is available on pupil perception, attitude and practices on the latrines in association with health effects on children, which is the subject of this study. The current paper therefore examines children's perceptions, attitude and practice before and after introduction of sanitation improved latrines and assesses the association of the children's responses with occurrence of diarrhoea in Kirogo, Kangai and Nyangati Primary schools where the model improved sanitation latrines were constructed.

Materials and Methods

Site of study: The study was conducted in Mwea Division where soil transmitted helminths infections and intestinal schistosomiasis are co-endemic. Poor sanitation in school latrines was partly associated with transmission of

the infections. There are three school zones in the Division, namely, Mutithi, Murinduko and Thiba zones, respectively and the pattern of infection was examined according to the school zones for the purpose of this study.

Study design: School latrine improvement programme was initiated as one of the strategy for integrated parasite interventions in the region. It was necessary to construct a "Showcase" model latrine in each of the three School Zones in the Division for other schools to emulate. Kirogo Primary School in Thiba School Zone, Nyangati School in Murinduko, zone and Kangai School in Mutithi school zone were selected for the showcase latrines. These schools were selected on the basis of high infection rates in the school children, poor sanitation of the latrines and easy access from the main road for the purpose of transportation of construction materials. Kangai Primary School was situated about a kilometer from the nearest stream from where the children drew water for the school use, Kirogo school was about 500 meters from the primary water canal while a water furrow ran just adjacent to the school latrines in Nyangati school(Figure 1).

Figure 1: Children playing in the canal water which is just adjacent to the school latrines

The study on the responses of the children before and after introduction of the model latrines was done for Kirogo and Kangai with a sample of 165 school children due to some technical problem that resulted in a total destruction of the structure in Nyangati school a week before handing it over to the community (It is appreciated that the community came back and put up another structure- Figure 2).

Figure 2: School latrine before and after introduction of sanitation improved latrines

The model latrines were constructed on the basis of shared responsibility where the community provided labour while material support and advice on construction came from the collaboration of the Japan International Cooperation Agency (JICA) and the government of Kenya.

Characteristic of the model latrine: The design of the model latrine was such that it must be a permanent structure made of stone block and cement, it must have hand washing water facilities, easy to maintain sanitation wise and one that meets the government recommended pupil/toilet ratio of 30:1 plus a urinal for boys and 25:1 for girls. To slow down or to prevent filling up of the latrine, the biodigester "Effective Microorganism" or EM was to be used to digest the solids and allow grey water to soak underground. EM is locally available in the agro-vet shops [9]. Grey water can also be used for farming in the school gardens.

Questionnaire study: The questionnaire was set up to assess the children on their perception, attitude and practices on the latrine and in relation to their health. A sample of 215 Grade 3 (9 – 12 years) children, 97 boys and 118 girls; 81 in Kirogo, 81 in Kangai and 53 in Nyangati schools were recruited and tested using a self administered questionnaire under the supervision of the class teacher two months before introduction of the model latrine. The children were also asked to recall if they had diarrhoea in the last one week preceding the test. Comparisons were made for association of the children's responses and the occurrence of diarrhoea.

Data analysis: Data entry was performed in Microsoft Excel (version 10). Statistical analysis was conducted with Epi Info (Version 3.2.2, CDC). Analysis for the frequency of latrine use was computed using t –test. P-value was calculated using Mantel-Hanszel of Fisher exact test

Results

Table1 is the pattern of *schistosoma mansoni* and STH infections, sanitation state of the school latrines and the pupil/ toilet ratio (per latrine doors) in Kirogo, Kangai and Nyangati school. The three schools had a deficit of 71 toilets shared between them. Sanitation of the latrines in the three schools was characterized as "very dirty" for Kirogo and Kangai schools but dirty in Nyangati.

Table 1: Model sanitation improved school latrines in three School Zones in Mwea Division, Kenya

School zone/School	No. of pupils		Infection rates			Latrine	Toilet/pupil Ratio		No. of toilets
	Boys	Girls	Total	STH	*S.mansoni*	Sanitation	Boys	Girls	required
Murinduko zone									
Nyangati	217	226	443	36.8	31.6	Dirty	21.7	22.6	13
Mutithi zone									
Kangai	507	451	958	28.8	41.3	Very dirty	63.4	43.1	34
Thiba zone									
Kirogo	363	323	686	22.5	94.4	Very dirty	45.4	53.8	24
Total short									71

Table 2 is the association of children's perception attitude and practices and diarrhoea occurrence in the three model latrines in the study area. In total, 22% of the children (45 out of 215) reported to have had diarrhoea in the week preceding the test. Boys demonstrated significantly higher association than the girls (29% vs. 17%, $p < 0.05$). Hand washing after using school latrines, feeling that the latrines were dirty (15% vs. 28%, $p < 0.05$), perceptions that school latrines were dirty (29% vs. 18%, $p < 0.050$) and the feeling that cleaning of school latrines was a punishment (18%, $p < 0.001$) significantly influenced diarrhoeal occurrence in children. However, there was no significance associated with occurrence of diarrhoea and the practice of cleaning of the school latrines, avoiding use of school latrines and children's willingness to clean school latrines.

Table 2: Association of variables with diarrhoeal occurrence in children on standard three model schools- Kirogo, Kangai and Nyangat schools in Mwea Division, Kenya

Variables	(n=215) (%)	Diarrhoeal occurrence association (%)	P-value Odds ratio (95%CI*)
Sex			
Boys	45.1	29	0.037
Girls	54.9	17	1.99 (1.04-3.81)
1. Do you wash your hands after using the school latrine?			
Yes	41.4	15	0.024
No	58.6	28	0.45 (0.22-090)
2. Do you feel school latrine is dirty?			
Yes	41.9	29	0.05
No	58.1	18	0.53 (0.28-1.01)
3. Do you think school latrine has any problem?			
Yes	89.0	28	0.145
No	21.0	18	1.72 (0.90-3.28)
4. Did you clean the school latrine anytime in this month?			
Yes	19.5	75.3	
No	80.5	24.7	1.11 (0.50-2.46)
5. Are you willing to clean the school latrine?			
Yes	75.3	20.4	0.949
No	24.7	79.5	0.98 (0.47-2.05)
6. Is cleaning school latrine a punishment?			
Yes	20.4	40.9	0.001
No	79.5	17.5	3.25 (1.59-6.68)
7. Did you have diarrhoea in this last week?			
Yes	45.0		
No	17.0		

Table 3: Perceptions, attitude and practice before and after introduction of sanitation improved school latrines

Variables	Percentage of "Yes" answer (n=154)		Odds Ratio (95%CI)	P-value**
	Before	After		
Washing hands after latrine' use in school	27.9	85.7	15.49 (8.43-28.69)	0.000
Having cleaned school latrine	13.6	94.8	115.58 (46.52-298.57)	0.000
*Frequency of school latrine' use	1.85 (0.97)	2.95 (1.16)	-	0.011
Avoidance of school latrine	42.9	1.9	0.03 (0.01-0.09)	0.000
Perception of any problems in school latrine	88.3	2.6	0.00 (0.00-0.01)	0.000
Perception for cleanliness of school latrine				
Clean & fair	60.4	99.4	100.35	0.000
Dirty	39.6	0.6	(14.66-1981)	
Perception of "cleaning school latrine is punishment"	18.2	0.6	0.03 (0.00-0.21)	0.000
Diarrhoea in last week	27.3	7.1	0.21 (0.09-0.44)	0.000

*Mean of frequency (standard deviation) and statistical analysis based on t-test
**P-value was calculated with Mantel-Hanszel or Fisher exact test

Because children were referring to school latrines of their own, analyses were also done based on individual schools (Not in the table). Diarrhoea occurrence was recorded more often in Kangai school (35%) followed by Kirogo school (21%) and only 6% of children in Nyangati school. Nyangati school had the highest proportion of hand washing (87%) while this was 35% in Kangai School and 19% in Kirogo. Nyangati school also had the highest proportion of children cleaning school latrines (42%) vs. 15% and 10% in Kangai and Kirogo schools, respectively and the highest proportion of children feeling that cleaning school latrines was punishment (32%) compared to 20% in Kangai school and 14% in Kirogo respectively.

Pre-test and post-test analysis of children's perceptions, attitude practice and experience of diarrhoeal episodes was done in Kirogo and Kangai, involving 154 children, 74 girls and 80 boys, only (Table 2). Eleven of 165 children registered were excluded from the study because of absenteeism. Mean age was 10.3 (SD 2.0, 7-14) for boys and 10.0 (SD 2.0, 7-15) for girls. Questionnaire data collected two months after introduction of the sanitation improved latrine demonstrated significant improvement in all parameters tested. Only 2.6% of the children reported any type of problem in the new latrine as opposed to 88.3% recorded pre-test. There was a 75% reduction in the recalled incidence of diarrhoea episode, 27.3% -pre-test vs. 7.1% -post test, respectively.

Discussion

Children are never consulted in the matters of school latrine and sanitation despite the fact that they are the end point users. The findings in this study gave poor ratings of school latrines by the children and there was significant association of children's responses with the occurrence of diarrhoea. The data after two months of using the new sanitation improved latrine demonstrated a remarkable shift of the children's perceptions, attitude and practices, in a way saying they got what they always desire.

First stage of the study looked at the children's outlook of unsanitary latrines in association with diarrhoea as an indicator of health problems, looking at the data of the three model schools, namely Kirogo, Kangai and Nyangati primary schools (215 children). The second stage of the study compares the perceptions, attitude and practice before and after introduction of the model latrines in Kirogo school and Kangai school (154 children) due to a technical problem experienced in Nyangati school. Flash rain storm water caused a diversion of the irrigation canal water into the latrine under construction and completely destroyed the structure, to the utter disappointment of the parents. Nevertheless, the parents came back and contributed for the second structure (Figure 1).

Study on occurrence of diarrhoea was based on child's recall of the experience of the week preceding the study and no laboratory or clinical investigations were required.

There was a clear association of children's perceptions and attitude about unsanitary latrines and their recall of diarrhoea occurrences. There are reports that unsanitary school facilities could be potential sources of hepatitis A outbreaks and other diseases[10]. School children in the current study painted a grim picture of the latrines and the data gave significant association with diarrhoea occurrences in children, which was higher in boys than girls, 29% and 17%, (95%CI) 0.0371.99 (1.04-3.81) p<0.05. Dirty unsanitary latrines could cause contamination of hands resulting in diarrhoeal related diseases. In the present study, failure to wash hands (58.6% of the children) and feeling that the latrines were dirty(41.95% of the children) ware significantly associated with reports of diarrhoea occurrence. 27.8% vs. 14.6% and 28.9% vs. 17.6, P< 0.05). However, there was no significant association of occurrence of diarrhoea in children who avoided using school latrines and those who did not (27.7% vs. 18.2% P < 0.05) probably because of reduced frequency of visits to the unsanitary latrines. Poor sanitary conditions of school latrines make children avoid using school latrines and this would have health implications [11]. By avoiding using the school latrines during the school days, the child increased the risks of urinary tract infection and constipation [12-14]. In this study, improved school latrines increased the frequency of latrine use while the number of children avoiding using the facility declined.

The association between stool disposal and child diarrhoea has been investigated in a number of epidemiological studies. Defecation near home or in living areas was associated with an increased incidence of diarrhoea [15-17]. Pathogen positive diarrhoea was reported to increase by 63% in families where children's stools were inadequately disposed. Such pathogens could be the source of bacterial viral or parasitic pathogens [18]. Any of these pathogens could be associated with the diarrhoea reported in our study.

Open defecation around the latrines and mounds of faeces on the toilet floor were a common observation in the study latrines in the current study especially those used by lower classes. Floor of most of such toilets were also soiled with mound of faeces apperent. Such soiled floors obviously forced some children to defecate around the periphery of the structure (no data shown). The other observation was that, the boys' latrines were more dirty than those of girls hence higher risks of contracting diarhoea.

Comparison of data before and after the introduction of the sanitation improved school latrine demonstrated a significant improvement in all study parameters post-test where 88% of the children reported to have no complaints about the toilets. This was a new learning experience in the children and it is hoped that the school could develop a mechanism to sustain latrine sanitation. Poor sanitation and inadequate access to safe water adversely affect the health and socioeconomic development of communities [19] especially when parents would have to lose working time to take care of the health of the child. Diarrhoea episodes during childhood and adolescence can eventually lead to lower fitness and decreased productivity as an adult [20].

Dirty latrines, and open holes in the latrine walls could make children avoid using the facility, especially girls [11,21]. A large number of children reported to avoid usage of the latrine and this corresponded with the number of those who reported the latrines to be dirty as well as those who reported to experience diarrhoea before introduction of the model latrines (42.9 vs. 1.9, 95% CI (0.03 (0.01-0.9) P<0.005).

When the data was considered according to individual schools Nyangati school, had the highest level of usage of hand washing water and this could be explained by the proximity of the canal water to the latrines. This water was not part of the latrine but it was readily available to the children for washing hands after latrine use and washing latrines. Constant washing of hands could also reduce diarrhoeal incidence.

Notation

Due to some unavoidable circumstances JICA pulled out from the project just before we could bring sanitation education to the community and it was not possible to roll out the model latrine initiative to other schools. Not much has changed since in the sanitation of the school latrines. I coordinated the programme and we were in the right direction to mobilize the community. The community was willing and ready to effectively play its part through the board of school management and the support of the government. A successful programme could lead to rolling out a national programme where the government and other donors as well as the local community would be involved. It did not happen, to the disadvantage of the child.

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