International Journal of Medicine Research
ISSN: 2455-7404; Impact Factor: RJIF 5.42
www.medicinesjournal.com
Volume 2; Issue 3; May 2017; Page No. 09-20

An assessment of open defecation among residents of Thika East Sub-County, Kiambu County, Kenya

*** Thiga Lucy Mumbi, Cholo Wilberforce**

School of Public Health, Mount Kenya University, Thika, Kenya

Abstract

Background: Human waste disposal is a highly sensitive, almost taboo topic across all cultures and circumventing this sensitivity has contributed to the failure of many programmes aimed at preventing the practice of open defecation (OD). Disappointingly, research shows that programmes aiming to prevent open defecation have limited success. This is because open defecation is associated with disgust that is elicited when people are closely confronted with human feces in public places and this contributes to its complex phenomenon. When communities have no access to safe human waste disposal facilities, the environment becomes a risky place where diseases are transmitted.

Objectives**:** The main objectives of the study were to determine the extent of open defecation among residents of Thika East sub-county and to determine the perceived effects of open defecation among the residents Thika East subcounty

Study Design and methods: The study employed a descriptive cross sectional design in which 20554 households and using Nassiuma (2000) formula ($n = NC^2/ C^2 + (N - 1) e^2$) a sample of 223 households were selected and structured questionnaire was administered to households heads selected using systematic random sampling. Both Random and systematic sampling methods were used to get the sample size of 223 households which participated in the study. A self-made standard questionnaire, FGDs and observation check list were used as the main tools for data collection. A pilot test was conducted to enable the researcher improve on reliability of the instrument. Quantitative data was coded and keyed into the computer using the Statistical Package for Social Science (SPSS) where analysis was done using inferential and descriptive statistics like frequency counts and percentages. A Chi-square test set at 0.05 level of significance was used to test the relationship and association between some variables. However, qualitative data was put under themes consistent with research objectives. The result of data analysis was then presented in frequency tables, pie charts and bar graphs.

Study Results: The study established that 23.3% of the sampled homesteads did not have latrines. This means that members of these households were either defecating in the fields, neighbor latrines or public toilets. The findings showed that among the 32 respondents with no formal education, 11(34.4%) of them were defecating in neighbors' toilet while 8 (25%) were defecating in the field. Out of the 57 respondents with Secondary education, 54 (94.7%) had their own latrines with only 3 (5.3%) defecating in their neighbors' latrines. This shows that respondents with no formal education were more likely to defecate in the field compared to those with primary, secondary and tertiary education.

Conclusion: Open defecation was a predominant norm practiced in most of the communities and it had negative effects towards human health, water and air pollution.

Keywords: open, defecation, thika, sub-county

Introduction

Elimination of waste is one of the basic needs of human beings. The term 'Defecation is defined as a bowel movement in which feces are evacuated through the rectum and anus. Open defecation is passage of stool in an open environment, and this practice is commonly practiced in high poverty areas where sanitation facilities are ignored. According to joint UNICEF and WHO [1], 15% of people in the world who practice open defecation have no toilet or latrine.[1] Open defecation therefore remains the predominant norm and poses one of the biggest threats to the health of not only children but also adults.

The practice of open defecation is common in Africa, and results in environmental degradation which directly affects the health and quality of life of millions of people, especially the most vulnerable people in the region [2]. It is believed that open defecation is a major cause of diarrheal diseases, which are the leading cause of morbidity and mortality among children in the world. The global impact of poor sanitation on child death and health is profound. Black and colleagues estimated that 10 million children die every year and that a fifth to a quarter of these deaths is due to diarrhea.[3] Disease early in life also has lasting effects on the health and human capital of children who survive[4]. In 2010, an estimated 2.5 billion people had no access to adequate sanitation and approximately 1.5 million under-fives' died from diarrheal diseases. Additionally, loss of earnings, because of ill health or need to care for others, has considerable impact on the socio-economic situation of millions among people.[5] In India for instance, according to India's 2011 census, nearly 50% population had no toilet at home. Furthermore, 2.4 million children die annually in India due to diarrhea caused by the extreme extent of open defecation. Estimates suggest that nearly 65 percent of India's population still defecate in the open. This result in a fecal load of 2 million metric tons per day, which finds its way into soil and water bodies, contaminating them with pathogens [3]. In Sub Saharan Africa, Even though the proportion of people practicing open defecation has decreased by 11% from 1990 to 2010, the absolute number of people practicing open defecation has

increased by 33 million over the same time period, due to population growth [1].

In 2010, open defecation was practiced by 8% of the urban population and 35% of the rural population in sub-Saharan Africa. In 2010, more than 2.5 billion people still lacked access to improved sanitation, which is defined by WHO as the sanitation facilities that hygienically separates human excreta from human contact [1].

Open defecation is a threat to water security, because when it rains, human waste in the open environment is washed into water bodies which are the main source of drinking water for both human and livestock. This inevitably leads to the outbreak of cholera, diarrhea and other preventable diseases claiming the lives of children and adults.The National Environment Sanitation and Hygiene Policy, Ministry of Health [6], notes that, as a basic human right, all Kenyans should enjoy a quality of life with dignity in a hygienic and sanitary environment. Approximately 80% of the hospital attendance in Kenya is due to preventable diseases [6]. About 50% of these illnesses are water, sanitation and hygiene related. The Kenya 1999-2004 Health Sector Strategic Plan identified environmental sanitation as one of the six essential priority health packages for implementation in the health sector. Similarly, the 2005-2010 Health Sector Strategic Plan identified sanitation as an important component in delivery of health care in all levels and age cohorts [6].

According to the Ministry of Water, Thika East sub County [6], access to safe water was at 36% with the main sources being rivers Athi and Thika. Open defecation poses a threat to contamination to these two rivers and the shallow wells being used as major sources of water in majority of the households.

Diarrheal and gastroenteritis ranks number 3 and accounts for 6.7% inpatient morbidity. On the other hand it ranks number 2 and accounts for 6.0% inpatient mortality in the sub-county [8]. The major goal of this current study is to assess the extent and perceived effects of open defecation among residents of Thika East Sub County. Discouraging the practice of open defecation is important for a number of reasons. First, good practices in elimination of human waste can reduce incidences of disease such as cholera, diarrhoea, and worm infections. Diseases related to open defecation causes many people to fall ill or even die, with children being the most vulnerable and consequently being the most affected [9]

Materials and Methods

Study Area

The study was conducted in Thika East Sub-county of Kiambu County. Thika East sub-county shares common boundaries with other sub-counties. These are: Juja, Gatanga, Maragua Masinga, Yatta and Matungulu. The sub-county covers an area of 413sq Km², population density of 187 with 4 divisions, 24 sub-locations and 151 villages. The total population is 78,844, with 38520 being males and 40324 females [8] and being a Kikuyu and Kamba community. Part of the sub-county is classified as semi arid with a high population being of casual laborers and with a 51% poverty index. Report from Ministry of Health[5] indicated that the total number of households with safe human waste disposal in the sub-county was 15593 (75.86%) and 4961 making a 24.13% households without safe human waste disposal. [6] Accessibility to safe water stood at 36% with River Athi and Thika River being the main sources of water.[8] The sub-county is generally hot with only an annual rainfall ranging from 500-2000mm. Road network is very poor because of the terrain, and very loose soil. The sub-county was chosen because it is familiar to the researcher and no similar study to the best of her knowledge has ever been conducted in the study area.

Study Design

A descriptive cross –sectional study design was used. The design was adopted because it gives a snapshot on actual situation at a point in time, it is cheap, quick and easy to analyze. Mugenda and Mugenda [10] observed that cross sectional survey design is concerned with gathering of facts or obtaining pertinent and precise information concerning the current status of a phenomenon and drawing of possible conclusions. Orodho and Kombo [11] advance that cross sectional survey design is reliable for collecting information about peoples' attitudes, opinions, habits or any of the variety of educational issues. The design thus enabled the investigators to establish the extent of open defecation among residents of Thika East sub-county.

Study Population

The study population was household heads from households in the ten selected villages of Thika East sub-county.

Sample Size Determination

The following formula by Maureen Nassiuma [12] was used to determine the sample size;

$$n = NC^2 / C^2 + (N - 1)\, e^2$$

Where

n = Sample size
N = Population (20544)
C = Coefficient of variation (30%)
e = Standard error (2%)

Nassiuma (2000) [12] asserts that in most surveys a coefficient of variation of between 21% $\leq$ C $\leq$ 30% and a standard error in the range of 2% $\leq$ e $\leq$ 5% is usually acceptable. A high coefficient of variation was used in the study to ensure that sample size was wide enough to justify the results being generated from study area. To minimize the degree of error a lower limit for standard error was used.

The study therefore took a coefficient variation of 30% (0.3) and a standard error of 2 % (0.02).

Hence

$$n = \frac{NC^2}{C^2 + (N - 1)\, e^2}$$

Where

$n = 20544 \times 0.3^2 / 0.3^2 + (20544 \times 0.02^2) - (1 \times 0.02^2)$
$n = 1848.96 / 0.09 + 8.2172$
$n = 1848.96 / 8.3072$
$n = 222.573$

The sample size was 223 households where simple random sampling was used to draw the required respondents according to the proportionate households in each of the selected villages.

To come up with the number of households to be interviewed per village the following formula was adopted

$$x = \frac{X * n}{N}$$

Where

N = Total number of households from all the selected villages in Thika East District

x = sample size (223)

n = Total number of households interviewed from each of the selected villages.

X = Total number of households from each of the selected villages

Sampling Frame

The sample frame was the 62 villages selected after an assessment on open defecation conducted in the sub-county in July 2012.[13]

Sampling Method and Procedure

Cluster sampling method was adopted to put the villages into clusters, each cluster representing a village. All the 62 villages were listed and 10 villages randomly selected. Cluster sampling was used because it is very feasible when dealing with large population. It also reduces the costs of travelling.

Systematic sampling method was adopted which involved the systematic selection of households from a complete list of all households within the sampling frame. This procedure was used because of its representativeness and that it also gave a fair way of selecting a sample from a given population since every household was given equal opportunities of being selected. Households were both the primary and ultimate sampling units. Systematic sampling method gave a statistical advantage in that it required a smaller sample size. Since sampling frame was ordered geographically, it made systematic sampling result in a more even geographic distribution of sampled households.

Workload and areas visited were more evenly spread among multiple data collection teams. Because of its unbiased selection and representativeness of the sample that was obtained by systematic sampling, it was reasonable to make generalizations from the results of the sample back to the population. The researcher intended to carry out the study in 10 villages which were selected through simple random sampling method from 62 villages. The names of all 62 villages which practice open defecation were written on small papers, folded and placed in a container. The container was thoroughly shaken to mix the papers. Ten of the research assistants each picked a paper one at a time, and read out the name loudly. The first ten names picked were the villages where research was conducted.

$$\text{Sampling interval } (k^{th} \text{ Number}) = \frac{\text{Number of households per village}}{\text{Sample size}}$$

Sampling interval was two decimal places.

Letter ‘k’ was selected to represent the sampling interval. Each household in the sampling frame was assigned a unique number between 1 and the total number of households in the sampling frame with no household having the same number.

After calculating the sampling interval, a random starting household was selected between 1and the sampling interval because of complexity. The sampling interval (k^{th} number) was then added to the random starting household to select the second household. The third household was selected by again adding to sampling interval (k^{th}) to the sum of the starting household plus the sampling interval. This was repeated until the end of the sampling frame was reached for all villages.

The selected households were then mapped out to facilitate data collection. A household replacement strategy for the households in which the household could not be located or where an appropriate respondent was not available was done through identifying the next household in the sampling frame as the replacement household in order to keep uniform application of this procedure. The first household to be included in the sample was randomly selected from the list of listed households in the selected villages and the number selected was within the sampling interval. The researcher was assisted by the local administration to locate the centre of each village. While at the centre, a pen was tossed and the direction to move was given by the pointed end of the pen.

Data Collection Tools

A self-made standard questionnaire, an observation checklist and focus group discussions tools were used. To ensure quality data collection of the study research assistants were trained.

Structured Questionnaire

This included a list of open and closed- ended sets of questions which were administered by the interviewer to the respondents and for the purpose of this study to household heads. This tool was preferred because data entry and tabulation could easily be done with many computer software packages. They were relatively simple to administer and could be analysed more 'scientifically' and objectively with reduced bias. Finally the method was relatively cost effective and large amounts of information collected from a large number of people in a short period of time through a standardized way.

Observation Check-List

This included a list of items and activities to be observed by the interviewer (method of excreta disposal, presence of human feces in the compound, type of latrine, hand washing facility and sources of water supply). Observation provided direct access to the social phenomena under consideration. The tool was preferred because took diverse forms, from informal and unstructured approaches through tightly structured, standardized procedures and yielded to associated diverse types of data, both qualitative and quantitative. It provided a permanent record of such events like behaviour, thus allowing further analysis or subsequent comparisons across time or location to be carried out. Therefore, observation effectively complemented other approaches and thus enhanced the quality of evidence available to the researcher.

Focus Group Discussion

A participatory rural appraisal technique was used to get awareness on impacts of the risk that open defecation presents and to reinforce a natural sense of disgust and shame

about this practice. The FGDs carried out a transect walk, calculated total feces produced in the village and medical costs. Four FGDs of twelve members were conducted with each having a moderator and a facilitator. The FGDs were drawn from the four divisions of Thika East sub-county. The FGDs comprised the CORPs, (where gender equity was very key) social workers, CHWs, MoW, Provincial Administration, youth leaders, people with disability. During the meeting the moderator promoted debate, by asking open questions. He also probed for details, moved things forward when the conversation was drifting or reached a minor conclusion. The moderator kept the session focused and deliberately had to steer the conversation back on course. He ensured that everyone participated and got a chance to speak.
The advantage of Focus Group Discussions is that interaction was made easier with a small group of participants. It was also used as a first step to identify potential problem areas allowing a more in-depth analysis to be planned. FGDs made the researcher to be able to clarify certain points with the participants. The FGDs accommodated people who are unable to read or write so long as they have the information.

Data Collection Procedure
After authority was granted by the relevant authorities' data collection was conducted. This was done in phases as follows.

i) Training of data collectors
To ensure that data collection was consistent and accurate, data collectors were trained. They were provided with clear instructions on how to use research instruments on interviews, focus group discussions, and observation data collection.
Pilot study was done prior to visiting the villages for actual data collection. A pilot study of 5% of the sample population was carried out in the neighboring Matungulu sub-county. Data collectors practiced using data tool methods and instruments. This was important because the practice in data collection helped to identify and eliminate problems that could have occurred. The practice exercises were made as realistic as possible. Data produced by the exercise and data collectors were analyzed. A feedback session with data collectors to discuss any challenges was held and determined solutions to challenges that arose during the exercise. The pilot tests results did not indicate that changes needed to be made to data collection approaches or instruments; thus no changes were made prior to actual data collection.

ii) Administration of questionnaires
On the actual dates of data collection, data collectors administered the questionnaire to the 223 sampled households.

iii) Focus Group Discussions
Participants in FGDs were communicated to through the office of the chief prior to actual data collection. All FGDs were conducted in one day though it was after completion of data collection in the sampled households.

Quality Control
Triangulation methodology was applied because several data collection methods were used in combination to ensure all necessary important data was not missed out and to verify some of the information that was gathered. Pilot data collection exercise was conducted on subjects outside the study sample to pre test the tools and allow for correction or adjustments before the actual exercise. To ensure reliability of the study health professionals and community health workers were trained to ensure quality data collection. Raw data from field was cleared at the end of each day minimized the call back error.

Data Analysis
Data collected from field was coded and entered into the computer for analysis using Statistical Package for Social Sciences (SPSS). As Martin and Acuna [14] observe, SPSS is able to handle large amount of data, and given its wide spectrum of statistical procedures purposefully designed for social sciences, it is quite efficient. Data collected was both quantitative and qualitative in nature. Quantitative data was analyzed using inferential statistics and descriptive statistics such as frequency and percentages. On the other hand, qualitative analysis considered the inferences that were made from the opinions of the respondents. This analysis was thematically presented in narrative form. The results of the analysis were then presented using frequency tables, bar graphs and pie charts.

Ethical Consideration
Permission to carry out the study was obtained prior from Mount Kenya University- Directorate of Research, the Ministry of Health, Local Administration and the individual respondents that took part in the study. The purpose and nature of the study was explained to the respondents through the language they understood (Kikuyu, Kamba and Kiswahili). The respondents were assured of confidentiality and privacy where the subjects' personal information rights and dignity were highly respected, no identifying information was coded and analyzed. The wishes of all respondents were respected and no respondent was coerced to participate, but as Kelly and Simpson [15] recommends the researcher maintained close consultation and inclusion of all participants throughout the research process. They were also assured that there were no risks or benefits they would be subjected to by participating in the study.

Results

Table 1: Distribution of the households by villages (n=223) $x = \frac{X x n}{N}$

Villages	No. of H/H	(N) Frequency (x)	Percent
Greystone	1053	45	20.2
Kilimambogo	770	33	14.8
Ndula	687	30	13.5
Githima	661	28	12.6
Munyu	578	25	11.2
Nginyi	397	17	7.6
Matathia	294	13	5.8
Thogoto	273	12	5.4
Kihiu camp	237	10	4.5
Gati-iguru	242	10	4.5
Total	5193	223	100.0

Greystone, Kilimambogo and Ndula were the villages with the highest number of respondents whereas Gatiiguru, Kihiu

and Thogoto registered the least number of respondents (Table 1).

Table 2: Demographic Characteristics of the Respondents (n=223)

		Frequency	Percentage
Gender	Male	112	50.2
	Female	111	49.8
Age of household heads	Below 25 yrs	3	1.3
	25-35 yrs	49	22.0
	36-45 yrs	63	28.3
	46-55 yrs	51	22.9
	56-65 yrs	43	19.3
	66-75 yrs	14	6.3
Education level	Non-formal	32	14.3
	Basic	121	54.3
	Secondary	57	25.6
	Tertiary	13	5.8
Occupation	Casual laborer	95	42.6
	Trader	52	23.3
	Farmer	48	21.5
	Civil servant	11	4.9
	Masonry	7	3.1
	Miner	5	2.2
	Commercial driver	3	1.3
	Housewife	2	0.9
	Total	223	100.0
Monthly income	Ksh 1,000-5,000	143	64.1
	Ksh 6,000-10,000	62	27.8
	Ksh 11,000-15,000	10	4.5
	Above Ksh 16,0000	8	3.6
	Total	223	100.0
Household size	One-five	133	59.6
	Six-ten	80	35.9
	Eleven-fifteen	10	4.5
	Total	223	100.0
Religion	Christianity	201	90.1
	Islam	14	6.3
	Traditional	8	3.6
	Total	223	100.0
Dwelling place	Owned	167	74.9
	Rented	56	25.1
	Total	223	100.0

Table 2 shows that, 112 (50.2%) of the study participants were males while 111 (49.8%) were females. This shows that there was almost equal gender balance during data collection which also indicates that there is a high percentage of female headed households. In terms of age, 49 (22.0%) respondents were aged between 25 and 35 years, (22.9%) were aged 46 - 55 years with only (6.3%) aged 66-75 years. This shows that most of the respondents were aged between 25 and 55 years. In relation to education level, majority 121 (54.3%) of the respondents had basic education, 57 (25.6%) had attained secondary education with only 13 (5.8%) attaining tertiary education. Thirty two (14.3 %) respondents had not attained any form of education. This concludes that majority (79.9 %) of the respondents had attained primary education and secondary education.

Majority (42.6%) of the respondents were casual laborers, 23.3% were traders while 21.5% were farmers. Other occupations mentioned by the respondents were masonry, civil servants, commercial drivers and miners. These results were confirmed through focus group discussions conducted in Kilimambogo, Munyu, Ndumago and Mitumbiri areas where majority of the participants reported that they were casual labourers and therefore their income level was low. Results revealed that majority 143 (64.1%) of the respondents had a monthly income of Kshs 1,000-5,000, 62 (27.8%) had an income of Ksh 6,000-10,000, 10 (4.5%) had an income of Kshs 11,000-15,000 while 8 (3.6%) respondents had a monthly income of above Ksh.16, 000. This shows that majority (64.1%) of the respondents were engaging in low income generating activities (Ksh1, 000 and 5,000).

With regard to household size, most of the respondents (59.6%) stated that their family size had one to five members, 80 (35.9%) had six to ten members with only 10 (4.5%) having eleven to fifteen members. Majority (90.1%) of the respondents were Christians, 6.3% were Islam with only 3.6% of the respondents indicating that they were attending traditional services. Among the 223 households, 167 (74.9%) were living in their own homes while 56 (25.1%) of them had rented houses.

Extent of open defecation among residents of Thika East sub-county

The first objective of the study was to determine extent of open defecation among residents of Thika East sub-county. To meet this objective, the data from the observation checklist was analyzed and tabulated as shown in Table 4.3.

Table 3: Results from observation check list (n=223)

Items	**Yes**		**No**		**No latrine**	
	F	**%**	**F**	**%**	**F**	**%**
Is there a latrine	171	76.7	52	23.3	0	0.0
Type of latrine	**Permanent**		**Semi-permanent**		**No latrine**	
	F	**%**	**F**	**%**	**F**	**%**
	53	23.8	118	52.9	52	23.3
Items	**Yes**		**No**		**No latrine**	
	F	**%**	**F**	**%**	**F**	**%**
Is it functioning	155	69.5	16	7.2	52	23.3
Are there feces and urine around the house	15	6.7	158	70.9	52	23.3
Are there feces and urine around the latrine	36	16.1	135	60.5	52	23.3
Is there a hand washing facility near the latrine	52	23.3	119	53.4	52	23.3
Do the family members wash their hands after latrine use	94	42.2	77	34.5	52	23.3

Is there water available for hand washing at the time of your visit	40	17.9	131	58.7	52	23.3
Is there soap or ash in the hand washing facility for hand washing	15	6.7	156	70.0	52	23.3
Do you observe fresh feces inside the latrine	54	24.2	117	52.5	52	23.3
Is the footpath to the latrine free from any barrier	157	70.4	14	6.3	52	23.3
Is there any type of water source within the compound	41	18.4	130	58.3	52	23.3

It was observed that 171 (76.7%) had latrines while 52 (23.3%) did not have latrines. Among the 171 households with latrines, 53 (23.8%) households had permanent latrines while 118 (52.9%) had semi permanent latrines. It was further observed that 155 (69.5%) households had functioning latrines while whereas in 16 (7.2%) homes latrines were not functioning. In relation to hygiene, 11.1% households had were feces and urine around the house. In addition, 53.4% of these households had no hand washing facility near the latrine and therefore majority of the family members were not washing their hands after visiting latrines (34.5%). Results further revealed majority (70%) of the households, did not have water and soap available for hand washing at the time of visit. This clearly shows that sanitation and the level of personal hygiene is very low in most of the households under area of study. These findings were supported by the focus group discussion participants (Mitumbiri, Ndumago, Kilimambogo and Munyu), who noted that in some households there were no latrines at all and for the families with the latrines most of them were temporary constructed and poorly kept. It was further noted that in some areas the soil is too loose leading to collapsing of the latrines especially during rainy seasons whereas other areas are rocky and hence members dig shallow pit latrines (Table 3).

Table 4: Approximate distance of the latrine from the house (n=223)

Distance in meters	Frequency	Percent
5-10	114	51.1
11-15	38	17.0
16-20	35	15.7
21-25	24	10.8
26-30	6	2.7
31 and above	6	2.7
Total	223	100.0

Table 4 shows that 114 (51.1%) respondents indicated that the approximate distance between respondents dwelling place and the latrine was 5-10 metres, 24 (10.8%) reported that it was 21-25 metres while 12 (5.4%) stated that the distance was 26 meters and above. Through observation, it was noted that from the (15.7%) sampled households the approximate distance between their dwelling place and the latrine was 1-3 metres, in 81 (36.3%) households it was 4-7 metres while in 55 (24.7%) it was over 7 metres. This shows that in most households the distance from the dwelling place and the latrine was convenient and therefore respondents were not expected to give distance as the factor encouraging open defecation**.**

Table 5: Distance between water source and the latrine (n = 223)

Distance in meters	Frequency	Percent
5-10	14	6.3
11-15	37	16.6
16-20	27	12.1
21-25	40	17.9
26-30	23	10.3
31 and above	82	36.8
Total	223	100.0

Table 5 illustrates that 6.3% of the respondents stated that the distance between water source and the latrines was 5-10 metres, 12.1% said that it was 16-20 metres, while 36.8% cited over 31 metres. Through observation, the researcher noted that from the 11.7% households the distance between water source and the latrine was 1-3 metres, from 4.0% households it was 4-7 metres, whereas from 2.7% households it was over 7 metres. This shows that the distance between water source and the latrines was very short in most of households which could lead to water contamination with the human excreta and consequently, leading to water borne diseases among the household members. Figure 4.1 shows calculation of open defecation among the community members from Mitumbiri, Munyu, Kilimambogo and Ndumago Villages

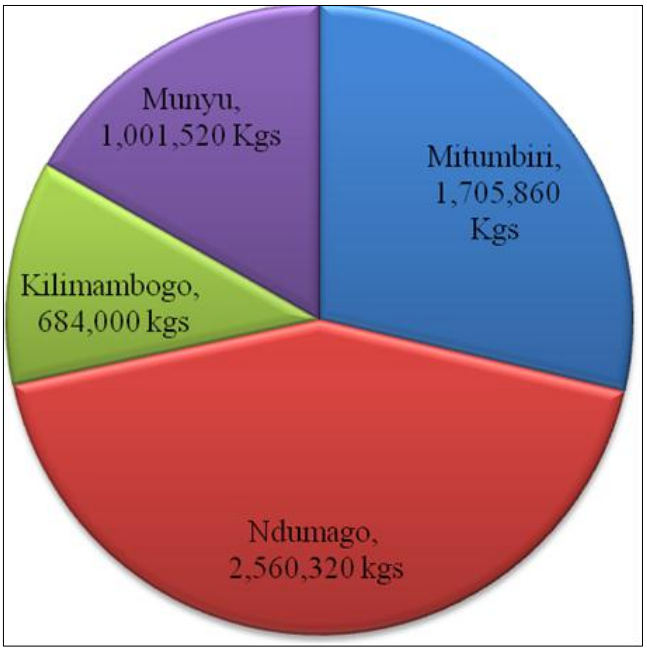

Fig 1: Extent of open defecation in the community (n=223)

Figure 1 shows that the amount of feces produced in Ndumago village within a year was 2,560,320 kgs, in Mitumbiri it was 1,705,860 kgs, in Munyu it was 10,001, 520 kgs while in Kilimambogo it was 684,000kgs. Comparing the results from the four villages, it emerges that Munyu had high rate of open defecation, followed by Mitumbiri, Ndumago and then Kilimambogo.

Table 6: Respondents' monthly income versus availability of latrine at home (n=223)

Monthly income	Is there a latrine		Total	Chi-square statistics
	Yes	No		
Ksh 1000-5000	93	50	143	χ^2 =30.320
Ksh 6000-10, 000	60	2	62	
Ksh 11, 000-15, 000	10	0	10	df =3
Above 16, 000	8	0	8	p=0.001*
Total	171	52	223	

*Significant at $p<0.05$ level;

As shown in Table 6, the respondents' monthly income had a great influence on the availability of latrines at their homesteads, (χ^2 =30.320; p=0.001 at p<0.05). The findings indicate that among the 143 respondents with a monthly income ranging from Kshs 1,000-5,000, 65.1% of them had latrines at their homes while 34.9% did not have. In addition 96.7% of the respondents earning kshs.6, 000-10,000, had latrines at their homes whereas 3.3% did not have latrines. The results also showed that all the respondents earning Kshs 11,000 and above had latrines at their homesteads.

Table 7: Respondents' monthly income across type of latrine (n=223)

Monthly income	Type of latrine			Total	Chi-square statistics
	Permanent	Semi-permanent	No latrine		
Ksh 1000-5000	29	64	50	143	χ^2 =34.227
Ksh 6000-10, 000	18	42	2	62	
Ksh 11, 000-15, 000	5	5	0	10	df=6
Above 16, 000	1	7	0	8	p=0.000*
Total	53	118	52	223	

*Significant at $p<0.05$ level

Chi-square test results revealed that respondents' monthly income had a significant influence on the type of latrine at respondents' homesteads, (χ^2 =34.227; p=0.000at p<0.05 level). In particular, majority of the respondents (143) with an income level of Kshs 1,000-5,000 had no latrines at their homes and those who had were semi permanent latrines. However, among the respondents earning Kshs 6,000-10,000 per month, 67.7% had semi permanent latrines while 29.1% had permanent latrines and 3.2% had no latrine.

Table 8: Hand washing facility and water availability (n=223)

Hand washing facility near the latrine	Available water for washing hands			Total	Chi-square statistics
	Yes	No	No latrine		
Yes	32	20	0	52	χ^2 =302.129
No	8	111	0	119	df=4
No latrine	0	0	52	52	
Total	40	131	52	223	Sig.=0.000*

*Significant at $p<0.05$ level

There was a was very significant association between availability of hand washing facility and the water near the latrine, (χ^2 =302.129; p=0.000). Of the 23.3% homesteads with hand washing facility near the latrine, 63.5% of them had available water for washing hand during time of visit while 37.5% did not have. However, among those without hand washing facility (119), 6.7% had available water for washing hands during time of visit while 93.3% did not have.

Table 9: Areas/places in which parents dispose children feces (n = 223)

	Frequency	Percent
In plastic bag	6	2.7
In the latrine	81	36.3
In rubbish pit	27	12.1
In the shamba	62	27.8
Use latrines	47	21.1
Total	223	100.0

As shown in Table 9; 2.7% respondents indicated that they disposed children feces in the plastic bags, 36.3% of the study participants used latrines, 12.1% used rubbish pit while 27.8% disposed in the shamba. This indicates that 42.6% respondents practiced crude damping of human excreta. This poses great environmental concerns because; these actions are the main causes of Cholera and diarrhea outbreak.

Perceived effects of open defecation

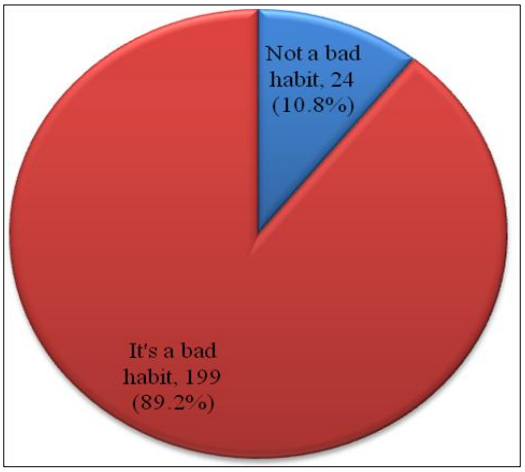

Fig 2: Respondents' view about open defecation (n=223)

Figure 2 shows that 89.2% respondents viewed open defecation as a bad habit while 24 (10.8%) of them felt that it was not a bad habit. This indicates that the level of perceived effect on open defecation is high.

Table 10: Respondents' view about open defecation versus education level (n=223)

Education level	Respondent view about open defecation		Total	Chi-square statistics
	Bad habit	Not a bad habit		
Non-formal	21	11	32	χ^2 =22.551
Basic	113	8	121	
Secondary	52	5	57	df =3
Tertiary	13	0	13	Sig.=0.000*
Total	199	24	223	

*Significant at p<0.05 level

Table 10 shows that there was a significant association between the perception of the respondents in relation to open defecation across their education level, (χ^2 =22.551; p=0.000 at p<0.05 level of significance). Specifically, results showed that majority of the respondents with primary, secondary and tertiary education viewed open defecation as a bad habit whereas a notable number (11) of respondents with no formal education felt that open defecation is not a bad habit. This clearly indicates that education level had a great impact towards open defecation.

Table 11: Effects of open defecation (n=223)

	F	%
Health hazards that lead to outbreak of diseases	105	47.7
Water pollution	49	21.2
Awful smells and flies menace within the environment (air pollution)	54	24.3
Exposing ones privacy	15	6.8

Majority of the respondents (47.7%) pointed out health hazards which lead to outbreak of diseases as one of the major effects of open defecation. Another effect that was raised by 24.3% of the respondents was awful smells and flies menace within the environment (air pollution). Further, 21.2 % of the respondents said that open defecation leads to water pollution while 6.8% of them felt that it is an act of exposing ones privacy. These findings were supported by focus group discussions which noted that air pollution, water pollution, food contamination from flies and cockroaches in houses were major effects of open defecation. Of concern was the awful smell and spread of disease that led to diarrhea and finally to death of infants that was associated with open defecation.

Health hazard being the major effects of open defecation, the study sought to find out whether any of the family members had suffered from diarrhea in the last 2 months.

Table 12: Households with members who suffered from diarrhea in the last 2 months preceding the survey (n= 223)

Households with members suffering from diarrhea	Frequency	Percent
Yes	38	17.0
No	185	83.0
Total	**223**	**100.0**

Table12 illustrates that among the 223 heads of households, 38 (17.0%) stated that they had members who were suffering from diarrhea. This clearly indicates that lack of hygiene and the sanitation facilities had a negative effect on people's health.

Table 13: Main water source for drinking and cooking (n=223)

Water source	Yes		No	
	F	%	F	%
Shallow well	95	42.6	128	57.4
Public water point	49	22.0	174	78.0
River	48	21.5	175	78.5
Piped water	24	10.8	199	89.2
Spring	11	4.9	212	95.1

Forty two point six percent of the respondents were getting water from the shallow well, 22.0% were getting from public water point, 48 (21.5%) were using water from the river, 10.8% were using piped water while 4.9% were using spring water. This shows that the major sources of water were shallow well, public water point and the river (Table 12).

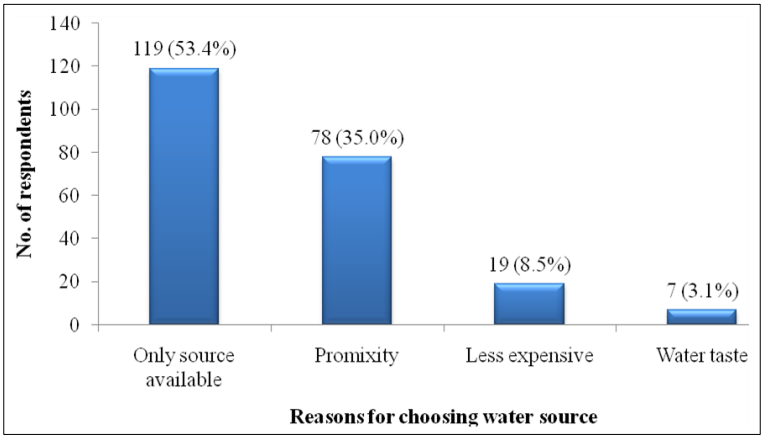

Fig 3: illustrates reasons for choosing the water source.

As shown in Figure 3, 53.4% of the respondents reported that scarcity of the different sources of water influenced them to use the only available water source. Seventy eight (3.1%) were influenced by the proximity, 19 (8.5%) were influenced by the water price while 7 (3.1%) were influenced by water taste. This shows that most of the households used the most convenient water source irrespective of the quality.

The investigators sought to identify whether study respondents had children aged less than five years. In response to this, 135 (60.5%) reported they have children less than 5 years of age while 88 (39.5%) stated that they did not have young children aged less than 5 years.

Table 14: Prevalence of diarrhea (n=223)

Prevalence	Frequency	Percent
Two weeks ago	4	1.8
Two months ago	14	6.3
Six months ago	2	.9
Can't remember	1	.4
They did not have diarrhea	114	51.1
No children less than 5 years	88	39.5
Total	223	100.0

Among the 135 respondents who indicated that they had children aged less than 5 years, 4 (1.8%) reported that they experienced diarrhea two weeks before the commencement of the study, 14 (6.3%) stated that they experienced two months ago, 2 (0.9%) stated six months ago while 1 (0.4%) indicated that he/she could not remember (Table 13).These results are in line with a previous survey done in Kenya's North Eastern province which found out that 16% of children less than 5 years of age had diarrhoea in the two weeks preceding the survey (KDHS, 2008).

Respondents Knowledge on Perceived Effects to Open Defecation

We assessed respondents' perceived knowledge on effects of open defecation in relation to hygiene, sources of the information and their perception towards the critical times of hands washing. The study further sought to identify some of the reasons hindering the act of washing of the hands in the community. The following are the results of this analysis. Of the 223 respondents, 90.1% of them have ever heard of a hygiene message whereas 9.9% of them stated that they have never heard any message in relation to hygiene. This reflects that knowledge on effect of open defecation in relation to hygiene was very high in the population under study. Also majority of the respondents (77.1%) perceived that poor child feces disposal lead to health problems such as Cholera, diarrhea and typhoid in the community.

When the study participants were asked the sources of information on hygiene, 63.0% of the respondents received hygiene message from the health workers, 18.7% received information through radio, 10.2% received through Television while 9.3% received from neighbours.

Table 15: Critical times for washing hands (n=223)

	F	%
After visiting the latrine	101	40.5
Before taking meals and feeding the child	82	37.1
Before preparing food	25	11.2
After cleaning a child's bottom	15	66

40.5 % of the respondents, cited that the most critical times for washing hands is after visiting the latrine, 37.1% felt that it should be before taking meals and feeding the child, 11.2% cited they wash their hands before preparing food while only

13.9% stated they wash hands after cleaning a child's bottom. This suggests that majority 40.5% respondents could not relate babies' feces with disease.

When asked about the reasons for not washing hands, it was found that ignorance was one of the major reason influencing people not to wash their hands. Further analysis showed that 37.7% the respondents were not willing to wash their hands while 30.6 % of them lacked the knowledge. Another factor that was cited by 17.4 % of the respondents was shortage of water whereas 11.9% felt that there was inappropriate placement of the hand washing facility in most of the households. Two point eight percent of the respondents cited they could not afford to by soap

Figure 4; Medical Bills for Treating Diseases caused by Poor Hygiene and Sanitation in the Four Different Communities

Figure 4.5 depicts cost of treating diseases caused by poor hygiene and sanitation reported by Munyu, Ndumago, Kilimambogo and Mitumbiri FGDs.

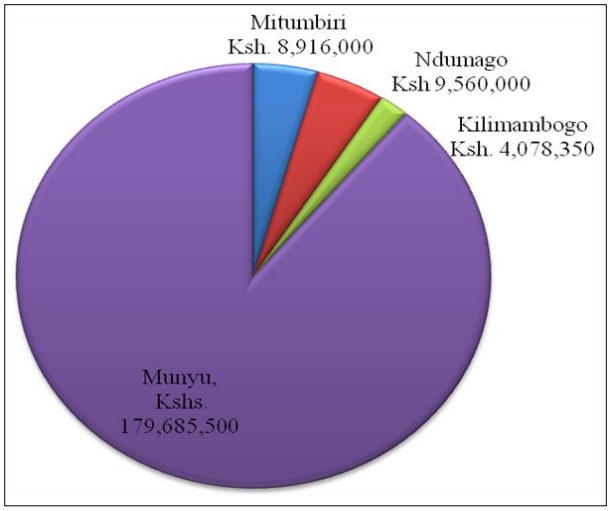

Fig 4: Cost of treating diseases caused by poor hygiene and sanitation in the community (n=223)

As shown in Figure 4.5, CORPS from Munyu found out that the approximate cost of treating diseases caused by poor hygiene and sanitation within the community annually was Ksh. 179, 685,500, in Ndumago the expenditure cost was Kshs 9,560,000, in Kilimambogo the cost was Kshs 4,078,350 and Mitumbiri it was Kshs 8,916,000.

Discussion

Extent of open defecation among residents of Thika East sub-county

From the study findings, it was apparent that out of the 223 households visited, 171 (76.7%) had latrines while 52 (23.3%) did not have latrines. This percentage was slightly higher than what the MOH-708, June 2012 reported (75.9%), though it is still below the central part of Kenya coverage which is at 91.1% (MOH-708 June, 2012). This also agrees with what Cairn Cross who found that even with 90% latrine coverage the remaining 10% can negate open defecation efforts where in this case coverage is at 76.7% with 23.3% remaining [16].

Among the 171 households with latrines, 53 (23.8%) households had permanent latrines while 118 (52.9%) had semi permanent latrines. In relation to hygiene, it was observed that in 36 (11.1%) households there were feces and urine around the house resulting to disgust associated with open defecation. In addition, 53.4% of these households had no hand washing facility near the latrine and therefore some of the family members were not washing their hands after visiting latrines (34.5%). Results further revealed that in most of the (70%) households, water and soap was not available for hand washing at the time of visit. This clearly shows that sanitation hygiene was not practiced in most of the households under area of study.

The major factors leading to this problem was lack of latrines in most of the homesteads which is brought by low monthly income, lack of hand washing facilities near the latrines and also lack of water during the time of visit. The study revealed that respondents' monthly income had a great influence on the availability of latrines at respondents' homesteads, (χ^2 =30.320; p=0.001 at p<0.05). The findings indicate that among the 143 respondents with a monthly income ranging from Kshs 1,000-5,000, 93 (65%) of them had latrines at their homes while 50 (35 %) did not have. The results also showed that all the respondents earning Kshs 11,000 and above had latrines at their homesteads. This shows that low level of income had a negative influence on households' sanitation hygiene.

In terms of the distance between water source and the latrine, 14 (6.3%) respondents reported that the distance was 5-10 metres, 27 (12.1%) said it was 16-20 metres, while 82 (36.8%) gave over 31 metres. Through observation, the researcher noted that from the 26 (11.7%) households the distance between water source and the latrine was 1-3 metres, from 9 (4.0%) households it was 4-7 metres, whereas from 6 (2.7%) households it was over 7 metres. This shows that the distance between water source and the latrines was very short in most of households which could lead to water contamination with the human excreta and as a result lead to water borne diseases.

It was established that in Ndumago village, the amount of feces produced within a year was 2,560,320 kgs, in Mitumbiri it was 1,705,860 kgs, in Munyu it was 1, 0001, 520 kgs while in Kilimambogo it was 684,000kgs. Comparing the results from the four villages, it emerges that Munyu had high rate of open defecation, followed by Mitumbiri, Ndumago and then Kilimambogo. This shows that open defecation was a predominant norm practiced in most of the communities and as a result poses threats to the health of not only children but also adults. This is because the high volume of calculated amount of feces from the four FGDs indicates that there is high contamination of underground water which is the main water source in the community by the 23.3 % who practice open defecation. The findings were in agreement with the results by Black and colleagues [3] who stated that according to India's 2011 census, nearly 50% population had no toilet at home and 2.4 million children die annually in India due to diarrhea caused by the extreme extent of open defecation. The estimates suggest that nearly 65 percent of India's population still defecate in the open. This results in a fecal load of 2 million metric tons per day, which finds its way into soil and water bodies, contaminating them with pathogens [3].

Perceived effects of open defecation

The study established that majority (89.2%) of the respondents viewed open defecation as a bad habit, with only 10.8% of them feeling that it was not a bad habit. There was a significant association between the perception of the respondents in relation to open defecation across their education level, (χ^2 =22.551; p=0.000 at p<0.05 level of significance). Results showed that majority of the respondents with primary, secondary and tertiary education viewed open defecation as a bad habit whereas a notable number (11) of respondents with no formal education felt that open defecation is not a bad habit. This clearly indicates that education level had a great impact towards open defecation. The main effects of open defecation were health hazards (79.8%), air pollution (41.3%) and water pollution (37.7%). Figure 5.2 illustrates effect of open defecation on water source.

Fig 5: Effect of Open Defecation on Water Sources

This conquers with what Donkor found that open defecation causes local water pollution and downstream river pollution which can eventually kill water living organisms thus causing overall environmental degradation [17]

Other effects noted through focus groups discussions included food contamination from flies and spread of diseases such as diarrhea that led to death of some infants. In addition to this, the study established most of the community members were utilizing a lot of money in treating water borne diseases. It was noted that the approximate medical bill for treating diseases caused by poor hygiene and sanitation within the community annually was Ksh. 179, 685,500, in Ndumago the expenditure cost was Kshs 9,560,000, in Kilimambogo the cost was Kshs 4,078,350 and Mitumbiri it was Kshs 8,916,000. This clearly indicates that sanitation related diseases exert a significant toll on the lives of people living in the community. This agrees with what a desk review carried out by the World Bank (WSP) in 2010 indicated that Kenya loses 27 billion annually due to poor sanitation which is an equivalent of 0.9% of the national GDP. In most rural public health facilities diarrhoea is ranked number three of the leading causes of outpatient attendance.[13] It was also noted that 80% of hospital attendance is due to preventable diseases and 50% of these diseases are water, sanitation and hygiene related.[5] Similarly, Prüss[18] estimated the disease burden from water, sanitation, and hygiene to be 4.0% of all deaths and 5.7% of the total disease burden occurring worldwide, taking into account diarrheal diseases, schistosomiasis, trachoma, ascariasis, trichuriasis, and hookworm disease.

Measures that could be employed to curb open defecation in the community

The established that majority of the respondents suggested that; government should build public toilets for the community members and provide sufficient water supply (74.0%), Government through ministry of health should organize civic education among community members to teach them on the importance of hygiene (60.5%), and local government should ensure that there is ample supply of clean water sources (50.7%). This would increase the number of people accessing sanitation facilities therefore improving cleanliness within the households and the community. These findings concurred with the results by Kar [19], who suggested that there is need to change community perception of sanitation facilities. This can be achieved through gathering the community together and explaining how open defecation results in feces movement to places where food is grown, children play, public areas, and water sources. The purpose is to trigger the community into rejecting open defecation, and empowering them to tackle the problem of open defecation. This promotes open defection free communities and provides integrated sanitation solutions that are religious, culturally, socially, economically and politically accepted. It caters for child friendly safer toilets and encourages hand washing hygiene practices.

Conclusion

Based on the study findings, the study concluded that open defecation was a predominant norm practiced in most of the communities in Thika east Sub County. The study established that 23.3% of the sampled homesteads did not have latrines, meaning members of these households were either defecating in the fields, neighbor latrines or public toilets. Regarding the effects of open defecation, the study concluded that open defecation had negative effects towards human health, water and air pollution. It also had economic impact on the community in the treatment of related diseases such as diarrhea. To curtail these problems, the study suggested that government through ministry of health should organize civic education among community members to sensitize them on dangers related to open defecation and also encourage on the importance of hygiene.Once open defecation is minimised, the diseases, shame and disgust associated with this practice will be eliminated, restoring dignity and the quality of life of the community. Both morbidity and mortality rates will also go down leading to improved quality good health and ultimately the economic wellbeing of the community.

Acknowledgement

The authors declare that Lucy Mumbi Thiga and Wilberforce Cholo contributed equally to the completion of this manuscripts and that there is no conflict of interest.

References

1. WHO/UNICEF. Progress on drinking water and sanitation report. New York: Joint monitoring programme for water supply and sanitation (JMP). 2012.

2. Kar K, Pasteur K. Subsidy or self-respect? Community led total sanitation. An update on recent developments. Supplement to Working pp 257, Brighton: Institute of Development Studies, University of Sussex. 2005.
3. Black *et al.* Effects of Rural Sanitation on Infant Mortality and Human Capital, India. 2003.
4. Almond Douglas, Janet Currie. Hand book of Labor Economics, Volume 4b Civil Rights, the War on Poverty, and Black-White. Cambridge, Massachusetts (United States). 2011.
5. Medische Antro Pologie. The power of shit Reflections on Community Led Total Sanitation in Nepal. 2012, 24(2).
6. Ministry of Health. National Environmental Sanitation and Hygiene Policy, Kenya. 2007.
7. Tayler K, Scott R. Sanitation policy: making it work. Waterlines. 2006; 25:25-26.
8. Kenya Demographic health Survey. 2008.
9. Tambekar DH, Wankhade SJ, Yadav SD, Tambekar SD. Correlation of antibiotics Resistance profiling of E. coli and source of fecal pollution in water, Pollution Research. 2008.
10. Mugenda OM, Mugenda AG. Research Methods: Quantitative and Qualitative Approaches. Acts Press Nairobi. 2003.
11. Orodho J, Kombo DK. *Research Methods*. Kenyatta University, Nairobi. 2002.
12. Maureen Nassiuma. Survey sampling: Theory and methods. Nairobi: University of Nairobi Press. 2000, 60.
13. Ministry of Public Health and Sanitation. National Health Sector strategic Plan2008-2012, reversing the trends. The Second Ed. Nairobi Kenya. 2008.
14. Martin K, Acuna C. SPSS for Institutional Researchers. Pennsylvania: Bucknell University Press: Lewisburg. 2002.
15. Kelly K, Simpson S. Journal of Advanced Nursing. 2001; 33(5):652-659.
16. Cairncross S. Sanitation and Water Supply; Practical Lessons from the Decade Water and Sanitation Discussion Paper Series. Washington DC: The World Bank. 2003, 9.
17. Donkor. A water and Sanitation Needs Assessment for, Kumasi Ghana. 2010.
18. Prüss A, Havelaar A. The Global Burden of Disease study and Applications in water, sanitation and hygiene. Fewtrell, L. and Bartramn J. (Eds). World Health Organization, Geneva. 2002.
19. Tambekar DH, Wankhade SJ, Yadav SD, Tambekar SD. Correlation of antibiotics Resistance profiling of E. coli and source of fecal pollution in water, Pollution Research. 2008.