

# Examining the Status of Water, Sanitation and Hygiene in Primary Schools of Kawangware Slums in Dagoretti Sub-County, Nairobi County, Kenya

<sup>1</sup>Negassa Chali, <sup>1,2</sup>Kariuki John., <sup>1</sup>Some Eliab

<sup>1</sup>School of Public Health, Mount Kenya University

<sup>2</sup>Ministry of Health, Afya House, Kenya

**Abstract:** *This study attempted to answer the availability of adequate safe water supply, the availability of adequate sanitation facilities in the 21 schools and the proportion of hygiene awareness, practice and attitude among the pupils drawn and interviewed from the 6 schools. The study employed a cross-sectional survey, multistage cluster, with computer aided random sampling technique. Questionnaires and observation were used to collect data. After analysis of collected data; only 28.6% had adequate water supply as per WHO standard ( $p=0.0003$ ) with no Point of Use Water Treatment (PoUWT) practiced and very few 31.3% ( $p=0.000$ ) Drinking Water Points (DWP). 42.8% ( $p=0.0002$ ) and 19% ( $p=0.0008$ ) Schools satisfied the minimum standard of latrine to pupils' ratio for boys and girls respectively; only 27.5% boys 35% girls toilets were found to be clean. Hand Washing Facilities (HWFs) were available in 52.5% of the schools accounting to only 11.5% expected to be there ( $p=0.0000$ ). Hygiene education was reported available in 95.2% of the schools but only 9.5% could correctly respond to the 4 knowledge based questionnaires, 18.5% to 9 practice based and 44.4% rated the School Water, Sanitation and Hygiene (SWASH) facilities in their schools as satisfactory and good. In general, the study indicates a lot is to be done both in the hardware (SWASH facilities) and in the software (awareness creation) aspects of the general SWASH program in the whole Dagoretti sub-county.*

**Keywords:** Water, Sanitation, Hygiene, Status, Diarrhea, Standard

## 1. Introduction

Water is a basic necessity for life on which all living things; man, animal and plants depend for survival. However, for millions of people particularly children, the water they drink can also be a source of persistent illness, leading to an early death. Globally, a child dies of diarrheal disease every 40 seconds<sup>1</sup>. This big load of disease is attributed to inadequate access to safe water and sanitation facilities (Curtis and Cairncross 2003). Access to adequate and safe drinking water supply and sanitation service is vital to human health and is one of the most efficient ways of improving human health (Clasen et al., 2010). According to UNICEF, an assessment done in 51 least developed and low-income countries, confirmed that, an average of 49% schools do not have access to safe water, and 55% schools do not have access to adequate sanitation facilities (UNICEF, 2011).

As a means to achieve the Millennium Development Goals (MDGs), the secretary general with the United Nations millennium project devised an approach that emphasis institutions such as schools and health care facilities for accelerated implementation and called this "Vision 21". One of the main targets addressed in vision 21 was that all schools equipped with provision of water supply, sanitation and hygiene including hand washing facilities and 80% of school children get educated on hygiene by 2015 (WSSCC, 2000).

Similarly, the other UN organ UNICEF also envisages ensuring all schools have access to adequate child friendly, gender and disability considerate water and sanitation structures including hand washing facilities and hygiene education programme (UNICEF, 2006). To these effect,

WHO also developed an international standard for schools in low income countries in order to determine the minimum requirements (Adams et al., 2009) and Kenya national guidelines by (MOPHS/MOE, 2009) was developed and put into action with the aim of providing adequate and safe water, sanitation and hygiene services to all schools in the republic of Kenya. This ensures the understanding of good sanitation habits retain it and pass to other people as children are believed to serve as change agents in their homes and communities (MOPHS/MOE, 2009).

The Kenya National Environment and Sanitation Policy (NESP) envisages that by 2015, every school will have segregated clean toilets and hand washing facilities for both boy and girls with an expected goal to reduce the incidence of sanitation related diseases (MoH, 2007)

According to the recent Kenya Demographic and Health survey only 63 percent Kenyans get drinking water from improved sources with clear inequality between urban and rural residents. In Urban areas approximately 91% households have access to improved water sources and 30% to improved sanitation facilities compared to their rural counterparts where only 54% have access to water supply and 20% have access to improved sanitation facilities (KDHS, 2010). The Kenya demographic Health Survey (KDHS) did not capture data on Schools water and sanitation, and hence a gap as to getting nationwide coverage data. Unlike KDHS report, UNICEF in its study conducted in 49 low income countries reported that 51% among the schools had access adequate water and 45% had adequate sanitation facilities (UNICEF, 2012). The Social Intelligence Report (SIR) assessed 12 schools in Kisumu also revealed that only 25% boys and 8% girls toilets

satisfied the minimum standard (District Planning Office, 2011) as quoted by Waga (2013). Similarly, four years down the line, instead of improving, the coverage drastically dropped to 59% for water supply in the urban and 32% for sanitation facilities in both urban and rural (WATER.ORG 2014; WASH plus/ USAID 2013). In general, this inconsistent information about WASH indicated a gap in providing reliable information and hence justified this study.

## 2. Literature Survey

Globally diarrheal diseases cause an estimated 801,000 deaths per year in developing world; mostly among children under 5 years of age (Liu, et al., 2012). The majority of these deaths happen in sub-Saharan Africa where 1 in 8 children die before reaching the age of 5 years. Compared to developed countries the death toll is about 17 folds higher. In developed countries only 1 out of 143 children die before turning age of 5 years old<sup>2</sup>. The major contributing factor to this burden is inadequate access to clean water and sanitation facilities<sup>3</sup>.

The assessment data from 51 least developed countries and other low-income countries such as the sub Saharan Africa recorded an average of 49% schools do not have access to safe water, and 55% schools do not have access to adequate sanitation facilities<sup>2</sup>. Access to safe drinking water and adequate sanitation services is vital for human health<sup>4</sup>. Its realization is most challenging and may require many years, billions of dollars and involves several stakeholders<sup>5</sup>.

To facilitate this, World Health Organization (WHO) developed international standards and guidelines (WHO, 2009). As a prerequisite for developing countries, Kenya adopted the WHO guidelines and prepared its own national guidelines in the same year<sup>8</sup> which were put into action with the aim of providing adequate and safe water, sanitation and hygiene services to all schools.

In Kenya, the introduction of free Primary Education in 2003 resulted in about 40% increase in the number of pupils in primary schools. This resulted in strained basic resources such as water, sanitation and hygiene facilities as there was no preparation made in term of upgrading facilities beforehand<sup>6</sup>. To overcome the prevailing problem of poor access to WASH facilities, the Kenya National School Health Policy (KNSHP) was developed. The Policy focused on enhancing WASH access and quality in schools by creating a healthy and child friendly environment for teaching and learning<sup>7</sup>.

In 2007, the Ministry of Health (MOH) in its National Environment and Sanitation Policy (NESP) envisaged that by 2015, every School will have hygienic toilets and hand washing facilities separate for boys and girls. However, this ambitious plan doesn't seem to be materialized. According to Waga's (2013) study that quoted the Social Intelligence Report (SIR) Kisumu West covering 12 schools revealed that only 25% and 8% of schools met the recommended minimum ratios of latrine: pupils<sup>8</sup>. The general study done by WATER.ORG (2014), WASH Plus/USAID (2013) also revealed that only 59% of urban populations have access to

adequate water supply while the coverage of sanitation is 32% for both urban and rural<sup>9</sup>.

## 3. Problem Definition

School Water Sanitation and Hygiene was given due attention globally as well as nationally. However, what has been done so far in Kenya and the developing countries such as the Sub Saharan Africa seems to be not matching what had been anticipated in the MDG and national goal. As indicated above the figures were not consistent indicating there is a huge information gap in regard to documenting the coverage. Thus, this study aimed to document the current SWASH status in Dagoretti sub-county, Nairobi city focusing on Kawangware slum. This is to establish reliable information and also to leave a mark so that similar but country wide assessment can be done in the future in order to establish where Kenya stands in regard to SWASH coverage.

## 4. Materials and Methods

The study employed descriptive cross-sectional study. Quantitative and qualitative methods were used to collect data in order to achieve the aim of the study. Data was collected using both structured questionnaire and observations. Data was collected from the head teachers of all the 21 public primary schools found in the sub county regarding the existence of SWASH facilities, services and usage methods. Data was also collected from 357 out of 365 sample size pupils were randomly selected using multi stage cluster sampling techniques with the application of computer aided random sampling from the 6 public primary schools located in Kawangware slums out of the 21 schools found in the sub-county. Descriptive statistics was used using measures of central tendency at 95% confidence level. Data was presented using frequency table and percentages. The data was analyzed using MS EXCEL and STATA in which Student t-test was used to measure the significance of difference between the observed and expected number of Water, Sanitation and Hygiene facilities was there as per the set WASH standard.

## 5. Results

### Characteristics of respondents

A total of 587 staff (teachers, support and volunteers) was reported available in 21 public primary schools in the sub-county out of which 172 (29.3%) were male and 415 (70.7%) were female staff. There were a total of 454 teachers, 119 (26.2%) male and 335 (73.8%) female. The population of both male and female teachers varied from school to school with a mean of 6 male and 16 female teachers.

Concerning support staffs, the females were in total more than the males. Volunteers were available only in 9 schools out of the 21 schools assessed at a range of 1-3 with a mean of 2 whereas the number of female volunteers ranged from 1-5 with a mean of 3 volunteers per school in the 9 primary schools.

From records, a total of 20,455 pupils 10,137 (49.6%) boys and 10,318 (50.4 %) girls were found in the 21 public primary schools in Dagoretti sub-county. It was also observed that the number of pupils' increased consistently as the class increased (as you go up from pre-unit to class 8) up to class 7 the highest pick, with a slight drop at class 8.

**Availability of adequate and safe water**

Water was available in all the 21(100%) of public primary schools in the sub-county, with 52.4% and 4.8% schools get water exclusively from piped and borehole water respectively. The rest 33.3% and 9.5% schools get their water supply from Tap water supplemented by borehole and rainwater harvest respectively (Table 1).

Water was reported available at the homes of all the 357 (100%) pupils sampled, with the main source being piped water (60.8%), followed by vendors or water kiosk (20.4%), borehole (13.4%), rivers (2.8%) and springs (2.5%).

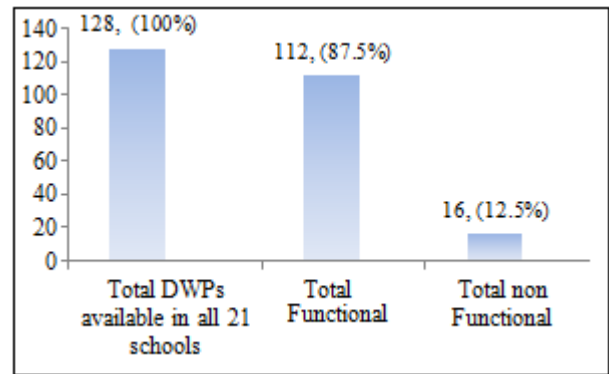
**Table 1: Sources of Water used at school/home**

Type of sources used	Number responded	%
<b>Sources of water used at School: n=21</b>		
1. Borehole only (Exclusive)	1	4.8
2. Tap water only (Exclusive)	11	52.4
3. Tap water supplemented by borehole =7,	7	33.3
4. Tap water supplemented by rain water harvesting	2	9.5
<b>Total (any of the above)</b>	<b>21</b>	<b>100.00%</b>
<b>Sources of water reported used at Home: n=357</b>		
1. River	10	2.8
2. Spring	9	2.5
3. Piped Water	217	60.8
4. Borehole	48	13.4
5. Vendors	73	20.4
<b>Total</b>	<b>357</b>	<b>100.0%</b>

**Availability and Functionality of Drinking Water Points (DWP)**

In the 21(100%) of the schools DWPs are available with a varied number. A total of 128 DWPs were available, out of which 112 (87.5%) were functional and 16 (12.5%) were not functional at the time of assessment in all sampled public primary schools in the sub-county.

Concerning the functionality of the 128 DWPs available DWPs, only 112(86%) was found to be functional with the numbers varying between functional and non-functional in each school (Table 4.6). Generally, schools in study area averaged 6 DWPs ranging from 1-19 with Mode being 4, median 4. The main reasons for non-functionality of DWPs at the time of assessment has been due to breakdown or lack of maintenance of water points (56%), followed by temporary water supply disruption from the source (33%), and disconnection/breakdown at source of water supply 11% (Figure 1).



**Figure 4.1: Number and functionality of available DWPs**

**Adequacy of water supply in schools**

Out of the total of 21 schools, 13 (61.9%) reported water is always available for drinking in DWPs all the times.

Regarding the provision of adequate drinking water supply to school children, 12 (57%) of the schools responded the supply was adequate while 26% out of the 357 pupils responded that the water supply they get while at school was adequate for their needs.

Volume (quantity) wise, 5(23.8%) schools reported that they use approximately 40m<sup>3</sup> of water every month, and 4(19%) schools using approximately 60 m<sup>3</sup> of water every month. Three (14.3%) schools reported to consume 120 m<sup>3</sup> and another 3(14.3%) consumed 100 m<sup>3</sup> per month. Similarly 2(9.5%) schools uses 90 m<sup>3</sup> and another 2(9.5%) schools used 30m<sup>3</sup>. The remaining two schools each accounting 4.8% used water in volumes of 88 m<sup>3</sup> and 90 m<sup>3</sup>.

**Water quality and treatment**

In total, 20(95.2%) schools reported to have not practiced any sort of Point of Use Water Treatment (PoUWT) methods, while the remaining one school reported to use a chemical called Water guard<sup>®</sup> for disinfecting water tanks every three months. The two main water sources (pipe and borehole) both assumed to be safe as both are from and managed by the Nairobi City County Water and Sewerage Company (NCWSC). Although the use of rain harvesting has been documented in one school, it was confirmed by the school management that the source is only used to supplement water requirement for cleaning activities.

According to the assessment done to know if the pupils are aware of any treatment method applied to make drinking water safe at home, the highest number of respondents 343 (96.1%) answered "Yes" confirming that one or more ways of PoUWT is used at home, while 14(3.9%) said "No" not aware if their parents do anything to make water safe for drinking. In addition, the method used for making water safe for drinking was also evaluated through the use of multiple answer questionnaires and majority reported boiling as the main method.

## 6. Statistical analysis of Drinking Water at school

### a. Water Volume versus pupils demand

As shown in table 2 and table 3 below, descriptions related to the provision of water supply for each primary school in the Sub-county have been summarized and presented. Concerning school water demand a standard that recommends 5 liters/child/day have been adopted for this study as a primary standard to determine the status of drinking water provided to the schools. The volume of water that each school said to have used in a month against the expected volume of water was quantified based on 5 liters/child/day in schools that use dry sanitation (pit latrines) and for those schools using flush toilets an average of 15 lit/child/day was used (as prescribed 10-20 lit/child/day in the standard) in addition to the usual 5lit/pupil/day for drinking and cleaning purpose. As a result, only 19%, 4/21 schools met the standard in the sub-county showing a great variation between the provision and demand of water. The result, as calculated the volume was 73lit/child/month instead of the anticipated 110liters/child/month in schools using dry sanitation and 440liters/child/day in those using flush toilets according to

the minimum standard. Similarly, the t-test result have also confirmed that the difference between the observed water supply to the school and the anticipated amount against the standard showed significant difference ( $t=-33695$ ,  $df=20$ ,  $p=0.0015$ ).

### b. Water points versus pupils number

According to the result of the study, none of the schools met the minimum standard. The study showed that DWPs were ranged from ratio of 1:60 to 1:540 with an average ratio of 1:164 compared to 1:50 as a minimum standard devised by the researcher. This shows a clear big difference between the observed and expected DWPs. The statistical t-test result have also confirmed the strongest significance ( $t=-8.391$ ,  $df=20$ ,  $p=0.0000$ ).

**Table 2:** The quantity of water versus number of pupils as per SWASH standard for day schools

- 1) Where dry sanitation or pit latrine are used  $5\text{lit}/\text{child}/\text{day} = 5\text{lit} \times 22 \text{ days} = 110 \text{ liters}/\text{child}/\text{month}$ .
- 2) Where flush toilets are used an additional 10-20 or average  $15\text{lit}/\text{child}/\text{day} + 5\text{lit} = 20\text{lit} \times 22 \text{ days} = 440 \text{ lit}/\text{child}/\text{month}$

Rank	Primary Schools	Total Number of pupils	Schools Monthly use in M3	Total in liters	5Lits/ child/ day (for Dry sanitation)	Additional for flush toilet 15lit+5lit x22days/month =440 L	5Lx22 school days a month	Total consumption/ month	Standard
1	Dr. Muthiora	363	60	<b>60,000</b>	5	-	110	<b>39,930</b>	Above
2	Gatina	715	90	<b>90,000</b>	5+15	20	440	<b>314,600</b>	Below
3	Ndururua	1,053	120	<b>120,000</b>	5	-	110	<b>115,830</b>	Above
4	Jamhuru	902	100	<b>100,000</b>	5+15	20	440	<b>396,880</b>	Below
5	Mutungu	845	100	<b>100,000</b>	5	-	110	<b>92,950</b>	Above
6	Joseph Kangethe	500	60	<b>60,000</b>	5	-	110	<b>55,000</b>	Above
7	Kabira	1,119	120	<b>120,000</b>	5	-	110	<b>123,090</b>	Below
8	Kagira	430	40	<b>40,000</b>	5	-	110	<b>47,300</b>	Below
9	Mukarara	914	80	<b>80,000</b>	5	-	110	<b>100,540</b>	Below
10	Kawangware	1,225	100	<b>100,000</b>	5+15	20	440	<b>539,000</b>	Below
11	Riruta HGM	1,194	80	<b>80,000</b>	5	-	110	<b>131,340</b>	Below
12	Riruta Satellite	1,867	120	<b>120,000</b>	5	-	110	<b>205,370</b>	Below
13	Gitiba	1,073	60	<b>60,000</b>	5	-	110	<b>118,030</b>	Below
14	Nembu	723	40	<b>40,000</b>	5	-	110	<b>79,530</b>	Below
15	Kirigu	792	40	<b>40,000</b>	5	-	110	<b>87,120</b>	Below
16	Mbagathi	1,266	60	<b>60,000</b>	5	-	110	<b>139,260</b>	Below
17	Ruthimitu	865	40	<b>40,000</b>	5+15	20	440	<b>380,600</b>	Below
18	Kinyanjui	1,680	88	<b>88,000</b>	5+15	20	440	<b>739,200</b>	Below
19	Shadrack Kemalel	1,080	40	<b>40,000</b>	5+15	20	440	<b>475,200</b>	Below
20	Dagoretti Muslim	883	30	<b>30,000</b>	5	-	110	<b>97,130</b>	Below
21	Toi	966	30	<b>30,000</b>	5+15	20	440	<b>106,260</b>	Below
	<b>Total</b>	<b>20455</b>	<b>1498</b>	<b>1,498,000</b>			<b>110</b>	<b>4,384,160</b>	<b>3xbelow</b>

**Table 3:** Table showing observed and expected Number of DWP.

Rank	School	Total number of Pupils	DWP Present	Expected number of DWP	Present DWP to Pupils Ratio
1	Toi	966	16	20	1:60
2	Mbagathi	1266	19	26	1:66
3	Gatina	715	10	15	1:71
4	Dagoretti Muslim	883	12	18	1:73
5	Joseph kangethe	500	4	10	1:125
6	Nembu	723	5	15	1:144
7	Kinyanjui	1680	10	34	1:168
8	Ruthimitu	865	5	18	1:173
9	Kirigu	792	4	16	1:198
10	Mutungu	845	4	17	1:211
11	Kagira	430	2	9	1:215

12	Jamhuru	902	4	18	1:225
13	Kawangware	1225	5	25	1:245
14	Riruta Satellite	1867	7	38	1:266
15	Kabira	1119	4	23	1:279
16	Mukarara	914	3	19	1:304
17	Ndurarua	1053	3	21	1:351
18	Gitiba	1073	3	22	1:357
19	Dr. Muthiora	363	*1	8	1: 363
20	Riruta HGM	1194	3	24	1:398
21	ShadrackKimalel	1080	2	22	1:540
<b>Total(overall average)</b>		<b>20455</b>	<b>126</b>	<b>418</b>	<b>1:163</b>

Note: \*1 -is number nominated for those schools that do not have a single HWF in order to arrive at the ratio.

## 7. Availability of adequate Sanitation

### Facilities

Most of the schools have flush toilets for both male and female teachers (staff) while the pit latrines are most often used by pupils. There were a total of 480 toilets for pupils in all 21 schools. 131(27.3%) were pit latrines for boys and 172(35.8%) for girls. The remaining 73(15.2%) were flush toilets for boys and 104(21.6%) for girls. The four pupils who said they do not have any latrine at home later on in the interview reported using their neighbour's toilet. In general all the school children assessed used latrines and none of them mentioned going to the bush or practicing Open Defecation (OD).

In the 21 schools assessed, all latrines have been observed to have been made of smooth cemented floor that is easy to clean. A total of 72.5% boys' toilets and 65.2% girls' toilets were dirty at the time of inspection. However, only 8% of male staff and 16.7% of female staff toilets were dirty. In all 21(100%) of the schools, the school cleaners were responsible for carrying out latrine cleaning. The frequency of cleaning the toilets varies from school to school.

### Sanitation facilities verses pupil ratio

The assessment done on sanitation facilities also shown the number of toilet to pupils ratio ranged between 1: 17 to 1: 114 for boys with an overall average of 1:50. The sanitation coverage in regard to facility pupils ratio was very low and below the recommended standard of 1:50 for boys except in 42.8%, (9/21) of the schools complied with the minimum standard. However, in overall average the ratio satisfied the recommended standard at 1:50. On the other hand, the ratio of toilet ranged 1:16 to 1:103 for girls with an overall average of 1:38. Only 14.3% (3/21) of schools satisfied the minimum standard concerning girls toilet. When the total number of toilets available in the sub-county is checked against the number, the difference have been shown to be statistically significant ( $t=-4.3115$ ,  $df=20$ ,  $p=0.0002$ ) and ( $t=-36720$ ,  $df=20$ ,  $p=0.0008$ ) for boys & girls toilet respectively (Table 4).

**Table 4:** Observed and Expected number of toilets by gender according to SWASH standard (Ratio recommended by SWASH standard is 1toilet +1Urinals to50 (1:50) for Boys and 1:25 for Girls)

	School	Gender	Number	Observed number of toilet	Expected number of toilets	Ratio	Standard
1	Riruta HGM	Boys	575	7	19	1:82	Below
		Girls	619	10	25	1:62	Below
2	Kagira	Boys	226	4	7	1:57	Below
		Girls	204	4	8	1:51	Below
3	Ruthimitu	Boys	440	6	14	1:74	Below
		Girls	425	15	17	1:29	Below
4	Dr Muthiora	Boys	169	10	5	1:17	Above
		Girls	194	10	8	1:20	Above
5	Kirigu	Boys	405	10	13	1:41	Above
		Girls	387	6	15	1:65	Below
6	Gitiba	Boys	522	10	17	1:52	Below
		Girls	551	15	22	1:38	Below
7	Gatina	Boys	348	17	11	1:21	Above
		Girls	367	19	15	1:19	Above
8	Kabiria	Boys	570	10	19	1:57	Below
		Girls	549	10	22	1:55	Below
9	Mutungi	Boys	432	13	14	1:33	Above
		Girls	413	15	17	1:28	Below
10	Ndurarua	Boys	508	8	17	1:64	Below
		Girls	545	8	22	1:68	Below
11	Riruta satellite	Boys	907	8	30	1:114	Below
		Girls	960	10	38	1:96	Below
12	Kinyanjui	Boys	837	17	28	1:50	Within
		Girls	843	29	34	1:29	Below
13	Dagoretti Muslim	Boys	432	14	14	1:31	Above
		Girls	451	22	18	1:21	Above
14	Mbagathi Road	Boys	614	10	20	1:62	Below
		Girls	652	12	26	1:55	Below
15	Nembu	Boys	341	7	11	1:49	Above
		Girls	382	11	15	1:35	Below
16	Mukarara	Boys	469	8	16	1:59	Below
		Girls	445	12	18	1:37	Below
17	Jamhuri	Boys	428	4	14	1:107	Below
		Girls	474	16	19	1:30	Below
18	Toi	Boys	495	16	17	1:31	Above
		Girls	471	16	19	1:30	Below
19	Shadrack Kimalel	Boys	531	10	18	1:54	Below
		Girls	549	16	22	1:35	Below
20	Kawangware	Boys	609	6	20	1:101	Below
		Girls	616	6	25	1:103	Below
21	Joseph kangethe	Boys	279	9	9	1:31	Above
		Girls	221	14	9	1:16	Above
Total		Boys	10137	204	348	1:50	Within
		Girls	10318	276	422	1:38	Below

**Hand washing facilities verses pupil ratio**

A total of 47 HWFs were available within or near the toilets in 11(52.4%) schools and the rest 10(47.6%) schools did not have. The type of HWF used in all the 11 schools is sink and tap running water. Out of the 47 HWFs available, 32(68%) were functional and 15(32%) were not functional at the time of the assessment.

The distribution of the 47 total numbers of HWFs available in 11 schools, 6(54.5%) schools had 5 HWFs and 5(45.5%) schools had 3 HWFs both at the mean of 2.3 and standard deviation (S.D) of 2.00. Regarding functionality, 32 (68.1%) out 47 HWFs in a total of 9 schools were functional. The reasons for non functionality of these HWFs were also evaluated in the 5schools identified to have this problem. As a result 4( 80%) blamed on breakdown or lack of maintenance and 1(20%) school said did not have water in the HWFs due to shortage or lack of water supply on the day of assessment.

Concerning the availability of soap for hand washing, a high number 14(67%) of schools indicated that the soap is never available while the remaining 7(33%) suggested that the soap is sometimes available. However, soap was not found in any of the schools visited for washing hands.

**Hand Washing Facilities (HWFs) versus Pupil ratio**

HWFs to pupils' ratio is indicated to be very low with the ratio in the range of 1: 102 to 1: 1194 indicating none of the schools in the sub county satisfied the assumed standard of 1:50 HWF by the researcher (Table 5). The t-test analysis also showed that there is a significant statistical difference between HWFs available and required (t=-11.4993, df=10, p=0.0000) in all the 21 schools assessed (Table 5).

**Table 5:** Table showing observed and expected Number HWF.

	School	Total number of Pupils	HWF Present	Expected number of HWF	Present HWF to Pupils Ratio	Standard
1	Gatina	715	7	14	1:102	Below
2	Ndurarua	1053	7	21	1:150	Below
3	Ruthimitu	865	5	17	1:173	Below
4	Gitiba	1073	5	21	1:214	Below
5	Shadrack Kimalel	1080	5	22	1:216	Below
6	Kinyanjui	1680	6	34	1:280	Below
7	Jamhuri	902	3	18	1:300	Below
8	Dr. Muthiora	363	0	7	N/A	N/A
9	Kabira	1119	3	22	1:373	Below
10	Kagira	430	0	9	N/A	Below
11	Mukarara	914	2	19	1:457	Below
12	Joseph Kangethe	500	0	10	N/A	N/A
13	Riruta Satellite	1867	3	37	1:622	Below
14	Nembu	723	0	14	N/A	N/A
15	Kirigu	792	0	16	N/A	N/A
16	Mutungu	845	0	17	N/A	N/A
17	Dagoretti Muslim	883	0	18	N/A	N/A
18	Toi	966	0	19	N/A	N/A
19	Riruta HGM	1194	1	24	1:1194	Below
20	Kawangware	1225	0	25	N/A	N/A
21	Mbagathi	1266	0	25	N/A	N/A
	<b>Total</b>	<b>20455</b>	<b>47</b>	<b>409</b>		

**Hygiene awareness and Practice**

All schools but one (95.2%) provided hygiene/health education. An evaluation as to whether health education had been given in the last two weeks for classes 1-8 revealed that, class three recorded the highest number of responses on receiving health education (57.1%) .

All the 21(100%) public primary schools in the sub-county also indicated that they have a specific school cleaning day once a week on Fridays. However, on the contrary, all the 21(100%) primary schools found in Dagoretti Sub-County did not have incinerator. All solid wastes from the schools also disposed-off in open pit and burned the same way in all 21(100%) of the schools studied. The assessment also found out 20(95.2%) schools does have WASH Club (Table 6). A total of 17 (81%) schools provide sanitary pads to the girls of age in their respective school while 4(19%) have no such service (provision) in their schools (Table 6).

The number of waste bins for disposal of sanitary pads for girls varied between 4 to 10 waste bins for all the 7(33.3%) schools reported to have flush toilets for girl pupils. These seven schools with flush toilets for girls have a total of 104 toilets and only 27(26%) of the toilets had waste bin for disposal of sanitary pads in varied numbers with Ruthimitu primary school lacking even one sanitary waste bins.

**Pupils hygiene Knowledge, Attitude and practice**

A total of 144 (40%) pupils reported that they wash hands before eating and after visiting latrines; 107(30%) pupils suggested that they wash hands after cleaning or changing diapers, whereas 55 (15.4%) after doing cleaning work or changing babies diapers and 51(14.3%) before handling or preparing food (Table 6). Regarding the question asked for the reasons why hands are washed before eating 240(67.2%) responded that it is necessitated to prevent themselves from diseases, while 47(13.2%) said to simply feel clean with no more reason attached and 2(0.6%) for those that believe it is just a tradition to wash hands before eating (Table 6).

The majority 172(48.2%) of the pupils were able to provide at least two correct diseases that can be prevented by using latrines while 76(21.3%) of the pupils provided one correct answer to the question on diseases that can be prevented when using latrines. The rest of the respondents 109(30.5%) did not provide any relevant response to the question (Table 6). similarly, for the question asked to mention at least one disease or health condition that can be prevented by wearing shoes, only 135(37.8%) of the students suggested either hookworm or jiggers correctly whereas the rest 222(62.2%) of the pupils did not provide any relevant response to the questions.

Out of the 178 who washed their hands after visiting the toilet, a total 148(83.1%) of them washed their hands using only water. While, 29 (16.3%) used water and soap for washing the hands and only1 (0.6%) pupil used water and ash as a method of washing hands after visiting the toilet. The reasons suggested for not washing hands indicated that 40(22.3%) forgot to wash hands, 60 (33.5%) rushing, when 73(40.8%) blamed on absence of HWF.

The majority (60.8%) of the pupils had eaten fruits the day before while their homes, (9.5%) of the students came with

fruit and ate while at school on the day of the interview while 9% of the students did eat sometimes back at home but could not remember the exact date eaten fruit last. A total of 243 (68%) of the students reported that they washed the fruits before they ate while 112(31.4%) did not wash their fruits at all and 2(0.6%) have not responded. About 62(17.4%) pupils suggest that they ate pilled or ready to eat fruits, 24(21%) could not wash the fruit they ate due to lack of water while 9(7.9%) of the pupils was very hungry and had to eat the way it was.

Big number of pupils, 174(48.7%) suggested that they had become sick in the past two weeks; whereas 183 (51.3%) of the respondents did not become sick within the same period. Out of the 174 sick, those suffered from stomach aches were 59(34.0%), followed by coughs 48 (28.6%), headaches 42(24.0%), diarrhea 24(13.8%) and 1 (0.6%) responded to have suffered from malaria at the time of assessment. Among the 174 pupils who were sick, only 71 (40.80%) pupils sought treatment for their medical conditions. Among

those who sought treatment, 38 (53.5%) were treated in Hospitals, 14 (19.7%) in Health Centres, 10 (14.0%) in Clinics, 7(10.0%) in Chemists and 2(2.8%) at Dispensaries.

On the contrary the reasons provided by those that did not go to seek treatments, 42(40.7%) bought over the counter medicine to manage their medical conditions, while 37 (36.0%) felt that they were not very sick for them to seek treatment while 24 (23.3%) of the pupils said lack of money as a barrier for the failure to seek medical attention.

A total of 177(49.6%) pupils responded that they brush their teeth once a day, 124 (34.7%) pupils brush twice while the rest 56(15.7%) respondents said they do not even brush their teeth every day (Table 6). Similarly, 193 (54.1%) pupils suggested that they take a shower on a daily basis and 78(21.8%) suggested taking a shower twice a day. However, 54(15.1%) pupil said they shower every other day while 19(5.3%) showers twice a week and 13(3.6%) showers only once a week (Table 6).

**Table 6:** Availability of SWASH Services and Level of Hygiene awareness and practice

<b>HYGIENE EDUCATION, ENVIRONMENTAL SANITATION MATERIAL AND SERVICES AVAILABILITY n=21</b>	<b>Yes (n)</b>	<b>%</b>
Provision of hygiene education by schools	20	95.2
Availability of specific school cleaning day	21	100
Availability of WASH or health club	20	95.2
Provision of sanitary pads for school girls of age	17	80.9
Availability of solid waste disposal pit	21	100
Availability of incinerator at the schools	21	0
<b>Cumulative percentage</b>		<b>78.6</b>
<i>Health education is given regularly by school - Attitudinal -by pupils, n=357</i>	212	59.4
<i>School compound always clean to ensure child friendly school- Attitudinal -by pupil, n=357</i>	189	53
<b>KNOWLEDGE n=357</b>		
Knowledge on critical times of washing hands (attempted to answer 2 or more)	158	44.3
Importance why hands are washed before eating	240	67.2
Importance of latrine in disease prevention	248	69.4
Importance of wearing shoes in disease prevention	135	37.8
<b>Cumulative percentage</b>		<b>54.7</b>
<b>PRACTICE n=357</b>		
Washed hands after visiting toilet	178	49.9
Eaten and Washed fruit before eating (n=185)	71	38.4
Sought treatment after becoming sick (n=174)	71	40.8
Brushed teeth at least daily	201	56.3
Showered at least every other day	325	91
Always wore shoes	331	92.7
Always wore clean uniform	245	68.6
Cut short and managed hair properly	273	76.5
Cut short and managed figure nails properly	305	85.4
<b>Cumulative percentage</b>		<b>69.9</b>

## 8. Discussion

The findings of the study were discussed guided by the specific objectives, conceptual framework and the literature review upon which the study was based.

### Availability of adequate and safe water

#### Availability

Water was available within the compound in all the 21 (100%) schools covered by the study in the sub county. Out of the 21 schools, 20 (95.2%) schools got their water from municipality pipe water connection supplemented by

borehole, rain water harvesting or pupils carrying their drinking water from home. Only 1(4.8%) school got its water exclusively from borehole within the school compound. The response by school managements further showed, water was always available for use by children in 61.9% of schools across the sub county. This is comparable with the study done in 62 primary schools in rural Kenya in which 64% schools reported water was always available in their schools for drinking and washing purposes<sup>16</sup> (Alexander et al., 2014). However, the finding showed that the current achievement of 61.9% in the sub county is by 8% short of the ambitious Kenya National School Strategic Implementation plan (KNSHSIP 2011-2015) that anticipated improving the coverage from 50% to 70% in 2015<sup>11</sup>.

### **Adequacy**

Although 66.6% (14/21) school managements believed the water supply they get was adequate, the volume of water reported by the same management was appeared to be far below adequate. According to the calculation done based on the volume water recorded to be used verses the number of pupils in each schools, only in 28.6%, (6/21) schools satisfied the national guidelines and international standard. This finding is markedly low compared to the study done in the rural part of Western Kenya, Maseno division in which Waga reported 60.8% of the schools had adequate water supply<sup>8</sup>. Although the figure contradicts the general fact that rural areas are underserved compared to urban, the marked variation from Waga's finding may be attributed to the fact that this study was done in low income urban area of Nairobi and not representative of the general urban.

### **Quality/Safety**

Regarding water quality, none of the 21 schools surveyed in the sub-county applied any method of Point of Use Water Treatment (PoUWT) to ensure drinking water quality supplied to their pupils. All the schools reported to have relied on the Nairobi City Water and Sewerage Company (NCWSC) water treatment and management for the safety of water supplied to their schools. This finding indicates Kenya national School Health Strategy Implementation Plan (KNSHIP, 2010-2015) that targeted the realization of PoUWT in 50% of the schools nationwide before the end of 2015 was not a success<sup>11</sup>.

On the contrary, according to the response from 357 pupils interviewed to know if there is any drinking water treatment done at home, 96.1% pupils responded saying their parents/guardians did treat their drinking water in different ways. The main method used being boiling followed by use of chemicals such as Water Guard<sup>®</sup>.

This finding is very encouraging and indicative of high level of awareness at the community level in regard to the importance of home based water treatment in the prevention of waterborne diseases. It also resembles with Clasen's study in which 98.6% and 95.3% in Uzbekistan and Mongolia respectively reported to have their water boiled before consumption. The finding is also remarkable achievement compared to the same study by Clasen in 17 Africa region in which the lowest 4.9% families all reported boiling water as a method of home based water treatment<sup>4</sup>.

### **Availability of adequate sanitary facilities**

A total 480 toilets were available for the 21 primary schools in the sub-county instead of a total of 616 toilets expected based on the standard. There was a big difference between the available and expected numbers of toilets based on the set standard for both boys and girls. Nine (42.8%) schools had sanitary facilities for boys according to the minimum standard ( $t=-4.3115$ ,  $df=20$ ,  $p=0002$ ). Similarly 4 (19%) had toilets for girls as per the standard ( $t=-3.6720$ ,  $df=20$ ,  $p=0.0008$ ). This showed the number of existing latrines in all the schools is far below the number expected to be enough according to the standard. On average, latrines available in the 21 schools were 1:50 for boys indicating that available toilets were enough if they were evenly distributed and the corresponding numbers of urinals were also

available as per the density of pupils in each school. The average toilets available for girls were calculated to be 1:43 instead of 1:25 showing about two times below the standard. This finding is better compared to the study done by Mathew et al., (2011) whose study in Nyanza province indicated about two and three times below the standard with one toilet serving ninety pupils 1:90 boys and 1:75 girls respectively<sup>12</sup>. The finding is also better in contrast to 1:71 and 1:45 boys and girls respectively in Kajiado district as reported by Gisore (2013)<sup>13</sup>.

The study further revealed the failure of a plan to provide adequate sanitation facilities in 70% of schools as per Kenya National School Health strategy implementation plan 2010-2015<sup>7</sup>.

The study has also established that, HWFs were available in only 52.4% or 11 schools with varied number of HWFs. However, none of the schools had enough number of HWFs signifying the need of many more facilities for use the intended service by school children. The difference between observed and expected number HWF was highly significant ( $t=-8.391$ ,  $df=20$ ,  $p=0000$ ). It was also revealed that none of these HWFs had soap for proper hand washing in the entire schools across the sub-county. The study done by Jordanova in Nicaragua, recorded relatively better result in the use of soap in the practice of hand washing. The study reported that only 19% of schools had HWFs and 26% had soap at HWF<sup>14</sup>. Furthermore, a study done by Gisore in Kajiado central, Kenya, also revealed the better presence of HWFs in 55% of the schools and availability of soap/ash in 5% the schools studied<sup>13</sup>.

Concerning the cleanliness of the toilets only 27.5% boys' toilet and 35% of girls toilet were classified as clean observed by the researcher. Furthermore, out of the 357 pupils interviewed, only 18.8% said their school toilets were always clean. The findings of this study is better compared to the cross sectional study done in 62 Primary schools in rural Kenya in which it was reported that only 16% of the toilets visited were clean and structurally sound<sup>1016</sup>. On the contrary, Waga's study in Maseno division, Kisumu County reported much better use of 58% clean toilets as responded by pupils<sup>814</sup>. Similarly, in Kajiado Central Gisore also reported that 55% of toilets he studied in 20 schools were clean. In general it is worth noting that Alexander et al., Waga and Gisore's study were done in rural Kenya and in areas where water is believed to be scarce resource such as in Kisumu and Kajiado counties.

### **Hygiene awareness and practice**

Health/hygiene education was available in 95.2% of the primary schools with all the schools (100%) having a specific school cleaning day once a week. Likewise 95.2% of the schools had WASH/ Health club in their schools and 80.9% had provision of sanitary pads for school girls of age.

Moreover according to the Knowledge and practice test done on 357 pupils, on aggregate 9.5% pupils managed to correctly answer all knowledge based questionnaires administered along with 18.5% correctly responded to a set of 9 questions asked on healthy practice they were expected to adopt. This finding clearly showed that there is significant



variation with the study done in India that reported an increase in mean knowledge score of personal hygiene from 53.86% to 77.54% after health education was conducted in an interventional study on school going children<sup>15</sup>. However, the big variation was believed to be due to the different study designs employed. The study done in India was interventional and this one was cross-sectional.

## 9. Conclusions

Pupils deserve healthy learning environments with access to satisfactory WASH facilities. However, over 70% public primary schools in Dagoretti sub-county had critical water supply shortage as per the WHO international and national standards and guidelines, lack of PoUWT at all schools except in one, very low number of DWPs and HWFs was observed.

Critical shortage of Sanitation facilities for both boys and girls, poor cleanliness of toilets, shortage of sanitary pad waste bins in girls flush toilets and Poor Solid Waste Disposal (SWD) management mainly resulting from lack of incinerator.

Health education was present in all the 21 schools, but, the knowledge and practice test conducted on pupils participated in the study indicated a low proportion of health education retention and behavioural change.

In general, SWASH facilities were below the standard with low hygiene awareness and practice. This indicates, there is a lot to be done both in the hardware (SWASH facilities) and in the software (awareness creation) aspects of the general SWASH program in the whole Dagoretti sub-county.

## 10. Recommendation

- 1) Government of Kenya (GOK) through MoE to increase and ensure the provision of adequate SWASH facilities
- 2) MoH to start the basic water quality monitoring test twice a term as stipulated in the guidelines.
- 3) A well designed research to check the status of drinking water quality in the study area and in the whole of Nairobi to know the quality status of the water supplied by Nairobi City County Water and Sewerage Company (NCWSC).
- 4) MoE to employ more cleaners dedicated to cleaning school toilets.
- 5) MoE to employ health educators to deliver health messages on regular basis.
- 6) MoE/MoH to initiate research to identify conducive detergent to solve soap theft that discouraged schools from providing soap for hand washing.
- 7) MoH/MoE to establish a unit dealing with M&E to ensure compliance; at least at sub-county level
- 8) MoE/MoH to launch similar country wide status assessment to know the status where Kenya is standing in regard to SWASH coverage.

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