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Knowledge and Perception of Pupils on Health and Environmental Risk of Open Defaecation: A case Study in the First Cycle Schools in Eastern and Volta Regions of Ghana

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Abstract

Open defaecation remains major public and environmental health concerns and has attracted global attention in recent time. This study explores the knowledge and perception of pupils on health and environmental risk of open defaecation. Self-reported data were collected from 400 school pupils using questionnaires, focus group discussions and in-depth interview. Results of the study shows high knowledge level (89.8%) among the pupils. Pupils' knowledge of environmental risks was fairly high (52%). Knowledge of health risks was, however, low among greater number (53%) of the pupils. Open defaecation shows statistical significant association with health risk (χ^2 =65.062, p=0.002), environmental risk (χ^2 = 44.961, p=0.006) and pupils level of perception of environmental risk (χ^2 = 36.887, p=0.045). The Ministry of Education must introduce courses into the school curriculum to help pupils acquire adequate knowledge on health and environmental consequences of open defaecation.

Keywords: Knowledge, perception, health & environmental risks, open defaecation, first cycle school pupils, Eastern, Volta, Ghana.

1. Introduction

Open defaecation has attracted global concern in recent times. Global statistics indicates that 1.1 billion people of the world's population defaecate in the open (WHO/UNICEF, 2012) and a large proportion of these live in Africa and Asia. This situation is most severe in sub-Saharan African countries, where 63% of the population lacks access to basic sanitation facilities. One billion of this number representing 75% live in rural communities in East Asia and sub-Saharan Africa (WHO/UNICEF, 2013). Open defaecation has declined considerably in all developing regions to 17% in 2012 from 31% in 1990. Southern Asia, the home to two thirds of the world's open defecators, saw the largest decline of 27% points, from 65% in 1990 to 38% in 2012. South-eastern Asia, Northern Africa and Latin America and the Caribbean also recorded great reduction in open defaecation. Open defaecation in sub-Saharan Africa saw a decline of 11% points between 1990 and 2012 (WHO/UNICEF, 2008). Despite significant declines of little over one billion people in open defaecation since 1990, this still represents 15% of the world's population practicing open defaecation due to increasing population (WHO/UNICEF, 2013). The majority of this people estimated at 949 million (71%) lives in rural areas (WHO/UNICEF, 2013). As at 2015, the MDG sanitation target year, the proportion of people still defaecating in the open has declined from 24% to 14% between 1990 and 2012 (WHO/UNICEF, 2016). Despite this decline, open defaecation is still a major problem globally, though some countries and regions have made remarkable progress in reducing the practice.

In the case of Africa, open defaecation is highest in Eastern Africa where 33% of the population used no sanitation facility. Eastern Africa, however saw a 25% decline in open defaecation since 1990 from 44% to 33% indicating that one in four people in Africa still practice open defaecation (WHO/UNICEF, 2008) largely as a result of poverty and inability to build separate toilets and the issues of space and land as well. Despite this decline in open defaecation the number of people without improved sanitation facilities had increased from by 159 million, from 430 million in 1990 to 589 million people in 2006 due to population growth (WHO/UNICEF, 2008).

In sub-Saharan Africa, though the proportion of open defaecators has reduced by 11% from 1990 to 2010, the absolute number of people practicing open defaecation has actually increased by 33 million

over the same period due to population growth (WHO/UNICEF, 2012). In 2010, 8% and 35% of the urban and rural population respectively practiced open defaecation in sub-Saharan Africa (WHO/UNICEF, 2012). A study conducted by Water Aid in 34 sub-Saharan African countries to estimate open defaecation prevalence for 2005, 2010 and projection for 2015 indicates that 22 out of 34 countries, had between 1% and 9% reduction in open defaecation prevalence. Nine countries, however, had no reduction or an increase in open defaecation. Eleven of the sub-Saharan African countries had greater than 50% open defaecation prevalence in 2005. Based on the 2000–2010 open defaecation trends, 6 out of 34 countries are expected to reach equal to or less than 10% open defaecation by 2015 (WA, 2013). At present, open defaecation prevalence within the sub-Saharan Africa sub-region stood at 8% in the urban areas and 35% in rural areas (WHO/UNICEF, 2015). The number of people practicing open defaecation has actually increased in sub-Saharan Africa, and the region now accounts for a greater share of the global total than in 1990. At current rates of reduction, open defaecation will not be eliminated among the poorest in rural areas by 2030 according to WHO/UNICEF, (2015). The post 2015 sustainable development goal which aims at eliminating open defaecation by 2030, needs to strengthen strong global partnerships among government through formulation of viable sanitation policies with increasing budgetary allocations that can make this happen.

On Ghana's perspective, for the past three decades, open defaecation continues to be a serious health and environmental problems in Ghana and its prevalence rate according to water aid Ghana (WAG) (2013) has increased to 23% in 2010 from 19% in 1990, indicating that the number of Ghanaians engaged in daily open defaecation has increased from 4.8 million to over 5.7 million same periods. With the country's current population of 24,658,823 (≈25 million) (GSS, 2012), the actual number of Ghanaian practicing open defaecation daily is now 5,743,100 (WSP, 2013). The 2006 multiple indicator cluster survey (MICS) indicates that as much as 4 million Ghanaian representing 20% of its population in all the ten regions still practice open defaecation. While the national average figure, according to the report, is 24%, the practice is largely observed in the Upper East, Upper West, and Northern regions with percentage proportion of 82%, 79% and 73%, respectively (GSS, 2012). A research by Water Aid Ghana involving 2,864 households drawn from 78 communities indicated that respondents who practice open defaecation in Tamale Metropolis, Gushiegu, Wa East, and Kwahu North have percentage points of 30%, 90%, 64% and 29% respectively. The open defaecation prevalence in Ghana since 2011 stands at: rural (32%), urban (6%), and national (18%) (WHO/UNICEF/JMP, 2013).

A survey conducted by WHO/UNICEF (2014) showed that 82% of the 1.1 billion open defaecators in the world live in just ten countries including Ghana. For Ghana to attain improve sanitation status and end open defaecation behaviours, massive behaviour change education, budgetary allocation and investment in sanitation infrastructural at the national, community, school and individual level are needed in addition to insights into the current barriers to uptake of sanitation. Copland (2010) estimates that Ghana will take 500 years to eliminate the open defaecation practices due to the slow pace at which strategies, laws and interventions are being implemented.

The global burden associated with open defaecation cannot be underestimated. Open defaecation spreads a myriad of faeco-oral diseases including cholera, typhoid, parasites, hepatitis, diarrheal diseases and polio. Aggregate figures across Africa and globally points to sanitation-related diseases, as the second greatest killer of children–more than the aggregate effects of AIDS, malaria and measles (WHO/UNICEF/JMP, 2008). Food and water contaminated with faecal matter cause up to 2.5 billion cases of acute diarrhea among children, resulting in 1.5 million deaths (Bill and Melinda Gates Foundation, 2011;WHO/UNICEF, 2004; UNICEF/WHO 2008). Hundreds of thousands of children die from diseases related to open defaecation each year and those who survive are left stunted, both physically and cognitively (Spears, 2013; Fink *et al*., 2011; Humphrey, 2009; & Feachem *et al*., 1983). Global statistics reports indicates that faecal contamination of the environment resulting from open defaecation has also been identifies as the major cause of 1,800 cases of cholera affecting children aged 0-5 years in Ghana annually (WHO, 2005; UNICEF, 2012). Early childhood diarrhea resulting from open defaecation does not only contribute significantly to undernutrition, wasting and reduced long-term cognitive development of children in schools (Spears, 2012a), but it also results in intermittent school dropout (Pelletier *et al*., 1995). Open defaecation kills babies, impedes the physical and cognitive development of surviving children, and reduces the human capital of Ghana's workforce. According to Liu *et al.*, (2012), an estimated 801,000 children younger than 5 years die from diarrhea diseases annually, mostly in developing countries. This amounts to 11% of the 7.6 million deaths of children under the age of five and means that about 2,200 children are dying every day as a result of diarrhea diseases (Liu *et al.*, 2012). In India for example, it was

reported that 600,000 under-five children died due to diarrhoea resulting from unsafe sanitation conditions, and inadequate hygiene practices (UNICEF, 2010). Lack of improved sanitation facilities has resulted in the death of over 6,000 children in developing countries each day (UNDP, 2006) and approximately 84% of these deaths are children under age 5. Children from sub-Saharan Africa are five hundred times more likely to die from diarrhoeal disease caused by contamination of water sources by faecal matter than a baby from the developed world (WHO, 2005). These rates, however, are not representative of the real problem, as most cases of diarrhea are addressed at the household level and not the clinic (Liu *et al.*, 2012). According to Bartram *et al.*, (2005) far more people suffer from poor sanitation and water supply than by war, terrorism and weapons combined.

Besides diarrhoea cases, open defaecation also causes stunting in children. According to Case and Paxson (2008), physical height has its origins in early childhood development and found to be more pronounced in poor countries where environmental threats to health are more important than they are in rich countries, relative to genetics (Martorell *et al*., 1977; Spears, 2012b). Two existing literatures indicate that early-life exposure to faecal germs in the environment reduces children's subsequent height. First, medical and epidemiological literatures have documented the mechanisms linking open defecation to poor health and early life human capital accumulation. Humphrey (2009) documents that chronic but subclinical "environmental enteropathy"—a disorder caused by repeated faecal contamination which increases the small intestine's permeability to pathogens while reducing nutrient absorption-could cause malnutrition, stunting, and cognitive deficits, even without necessarily manifesting as diarrhea (Petri *et al.*, 2008; Mondal *et al.*, 2011). A recent multiple-country study, for example, found that diarrhoeal diseases, caused by poor sanitation accounted for 25% of stunting in children up to 24 months (Checkley *et al.*, 2008). According to Ghana Demographic Health Survey, 1 in 5 children under five in Ghana are stunted due to exposure to persistent faecal matter. Official statistics by the Ghana Health Service indicates that about 80% of all outpatients' attendance are cases of faecal and water related diseases (UNICEF/WHO, 2008; Ghanaian Daily Graphic, 2009).

Asides the health implications, open defaecation also has economic and social costs. According to WSP poor sanitation costs Ghana 420 million cedis each year, equivalent to US$290 million (WSP/WB, 2010). This sum is the equivalent of US$12 per person in Ghana per year or 1.6% of the national gross domestic product (GDP). In reality, the economic implications of a cholera outbreak go beyond the immediate health system response; there are also costs related to productivity loss and premature death, diverting expenditures from other essential items and leading to losses in trade and tourism revenue (WSP, 2012). Ghana loses 420 million Cedis each year due to poor sanitation (WSP, 2012). Apart from its financial burden on the Ghana's economy, open defaecation also has considerable social costs. Loss of dignity and privacy and risk of physical attack and sexual violence may not be easily valued in monetary units, but these issues are the reality when sanitation facilities are either inadequate or not available (WSP/WB, 2010). Diarrhoea, resulting from poor sanitation, causes many school children to miss days from school (WSP/WB, 2010).

Besides its public health concern, open defaecation seriously compromised environmental cleanliness and safety. In regions where a large proportion of the population is not served with adequate sanitation, sewage flows directly into streams, rivers, lakes and wetlands, polluting the coastal and marine ecosystems and fouling the environment (UN, 2003). The greatest perceived impact of faecal matter on aesthetics is the fact that it generates pungent smells and defaces visual appearance of the environment, particularly in towns and cities (UN, 2003). According to UNICEF (2012) open defaecation leads to methane and carbon dioxide generation, which eventually leads to global warming thus contributing significantly to economic losses (WB, 2010). Open defaecation also reduces the aesthetic beauty of an area and is one of the major causes that hinder growth in tourism (UNICEF, 2012). The sewage dumped into the seas, rivers, streams and dams increases their nitrogen contents resulting in eutrophication leading to the loss of fish and other species, and destroying coral reefs (UNDPI, 2002). In the developing world as a whole, around 90% of sewage is discharged untreated into surface water bodies polluting them and affecting plant and aquatic life (UNDPI, 2002).

Problem of faecal matter disposal resulting from open defaecation alone contributes about 20% of sanitation challenges in Ghana (WSP/WB/JMP, 2010). Though they have toilet facilities, pupils in the first cycle schools defaecate in the open. The main reasons large number of people including school children still defaecating in the open is that large sections of Ghanaian population are not convinced of the need to stop open defaecation because of lack of adequate knowledge of health and environmental risks associated with open defaecation. The role of knowledge and perception in environmental protection and sustainability

has been documented in several studies (Ford, 2004; Cullen, 2001; Stevenson, 2007; Haigh, 2006; Hart, 1997. However, limited studies have been conducted across first cycle schools in Ghana to measure the knowledge and perception level of pupils on the risks of open defaecation on health and the environment. Understanding this can contribute significantly to development of appropriate strategies that will help move such open defaecators to sustainable toilet use. It is against this background that this study was designed to explore the knowledge and perception of pupils on health and environmental risks associated with open defaecation in one understudied population—pupils in the first cycle schools in the Eastern and Volta regions of Ghana.

2.Material and Methods

2.1 Study Area

Figure 1 below shows the location map of the study areas. The study was conducted in eight public first cycle schools selected from eight communities which comprised four rural and four urban. These communities were drawn from the Volta and Eastern regions of Ghana. Residents of these communities are from multi-cultural ethnic groups comprising Ewes, Moshi, Guan, Akuapem, Ga-Dangme and Akans, with the former and the later constituting the dominant ethnic groups in the communities selected from the Volta and the Eastern Regions respectively. The major economic activities of the respective study communities comprised the following: Kofisah and Akuffokrom (crop farming & quarrying); Begoro and Oboaho (crop farming and livestock rearing) Keta and Kedzi-Havedzi (fishing, and livestock farming); Akatsi and Monome (crop farming, gari' processing, and charcoal production). Sources of water common to these communities are streams, rivers, bore holes, and wells. Common communal sanitation facility used in these communities is the KVIP latrine. Few households used the pit latrine, and water closets. Each of these communities has at least one first cycle school with functioning KVIP toilet facility ranging from two to seven sitter capacities. Irrespective of age and sex, these toilets are used by both pupils and teachers. The enrolments of these schools ranged from 200-400 pupils.

The study communities were selected using both purposive and simple randomization sampling techniques. The purposive technique was used because, to satisfy the inclusion criteria, the community must benefited from community-led-total sanitation (CLTS) program and also have at least a first cycle public school with functional toilet facilities. In situations where a community has more than one first cycle public schools, the simple randomization technique was employed in the selection process. The selection of the eight schools was based on the same principles used in the selection of the study communities. In the selection of the six classes purposive sampling technique was employed. This selection was based on the fact that the pupils in these classes can read and write and also be able to express themselves using the English Language. Figure 1 below shows the location map of the study areas.

2.2 Study Design

The study was school-based cross-sectional survey which sought to explore the knowledge and perception of pupils on health and environmental risk of open defaecation practices in the first cycle schools selected from four rural and four urban communities in the Eastern and Volta Regions of Ghana. The study employed questionnaires, focus group discussions and in-depth interview guides to collect self-reported data from pupils. The items on the questionnaire, FGD and IDI guides were adapted from 2010 PHC instruments. The instruments were first piloted with 20 pupils in non-selected first cycle schools to test their reliability and validity. This was followed by administration of the questionnaire to 400 randomly selected respondents by researcher supported by two trained research assistants recruited from Nsawam-Adoagyiri Environmental Health Department. The focus group discussion was also administered to 192 respondents randomly selected from pupils who reported defaecating in the open to gather data on knowledge and perception of health and environmental risks associated with open defaecation practices. The in-depth interview was also conducted (with 24 pupils) to solicit their views and opinions on health and environmental risks of open defaecation. In all, the study was specially designed to explore the knowledge and perception of pupils on health and environmental risk of open defaecation practices. Quality control measures such as the need for independent completion of the questionnaires and freedom of participation or withdrawal from the study were followed. Special efforts were also made to minimize methodological, personal and social desirability biases.

Four focus group discussions (FGDs) comprising two for female pupils and two for male pupils were conducted in each of the eight studied schools to assess the knowledge and perception level of health

and environmental risks of open defaecation practices. Each FGD consisted of 6 to 9 pupils. The FGD was conducted on class level basis (JHS & Primary levels). The reason was to create homogenous target populations (in terms of age and sex), to encourage the group to express their opinions, share their beliefs, perceptions and views more freely about the subject without fear or intimidation of being judged by others. Also, conduisive and accepting environment was created for participants in order to put them at ease allowing them to thoughtfully discuss issues under consideration and in their own words and add meaning to their opinions. During each FGD session, the participants discussed the health and environmental risk of open defaecation behaviours. English language was the main language used during the FGDs. However, where participants deemed it more convenient to use the local dialect instead of the English, they were encouraged to do so. Where local dialect was used, this was transcribed into the English language before using them in the data analysis. Each item on the FGD guide was read to participants and discussed extensively by the participants until a consensus is reached. The FGD sections were audiotaped using digital audio-recorders with participants consent.

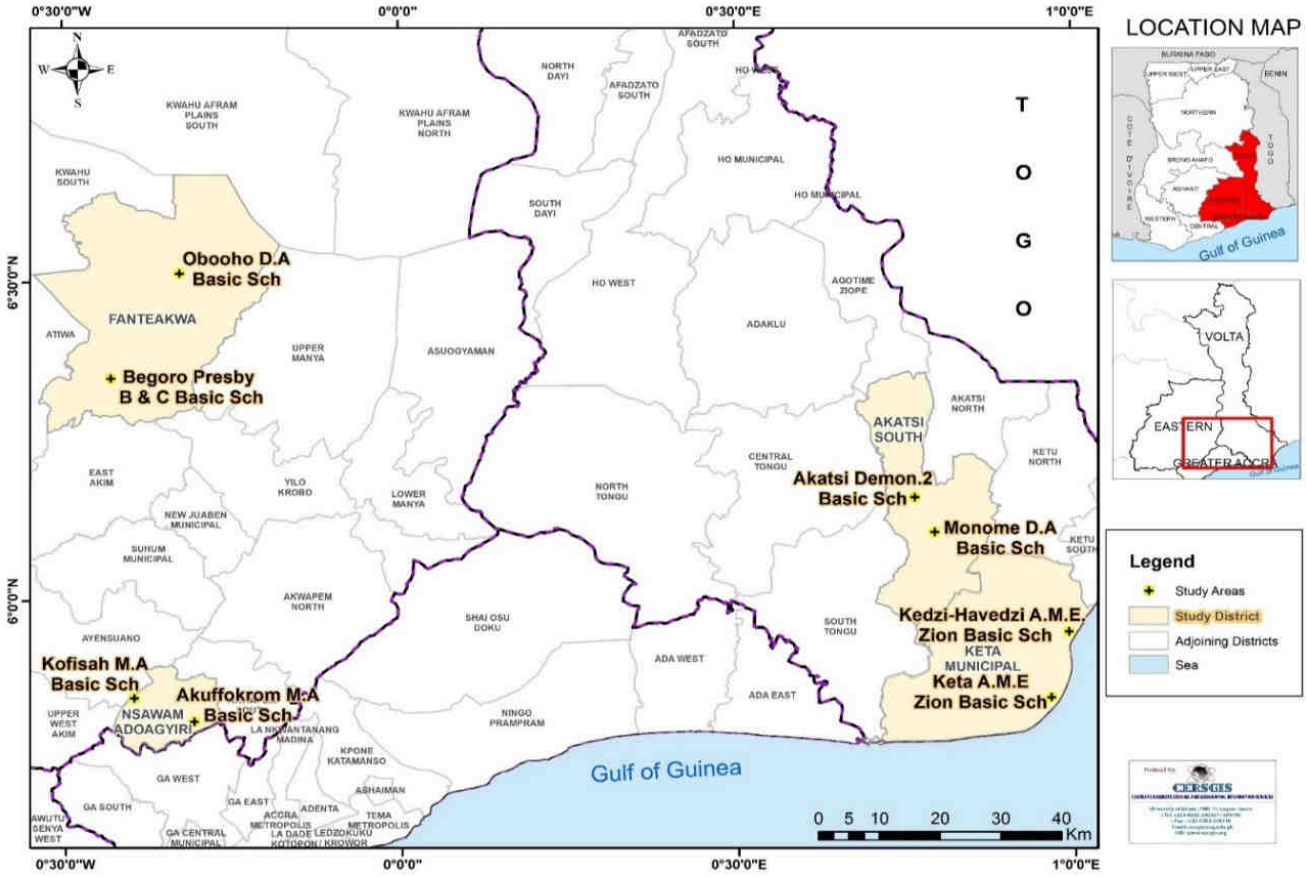

Figure 1: Location map of the study communities and the schools

During the data gathering process, qualitative field notes captured on daily basis on subtle events, conversations and interviews during group discussions were analyzed after the day's work. The rationale is to keep track of important issues that cropped up in the days work and prepare adequately for the next day. It is also to look for consistencies and inconsistencies between knowledgeable informants and find out why focus group discussants agree or disagree on important issues. Ethical issues in relation to FGDs were strictly adhered to throughout the administration process. In all, data on 192 participants were gathered from the FGD sessions. On average, each FGD session lasted between 45-60 minutes.

The in-dept interview (IDI) session was conducted to assess individual opinions and views on health and environmental implication of open defaecation practices. The interview section was conducted on one-on-one basis and in the convenient locations decided on by each interviewee. English language was used during each interview section. The interviewees were briefed about the objectives of the study. The questions on the interview guide were asked and interviewees provided answers to them. In some cases, further probing questions were asked to elicit further explanations to responses provided by the interviewees. Ethical issues such as consent for photographing, audio recording of participants' voices were strictly adhered to throughout the interview process. The duration for the interview was between 20-30 minutes for each interviewee. In all, 24 pupils (i.e. 3 from each study school) took part in the interview. The IDI sections were audiotaped using digital audio-recorders.

3. Data Analysis

Statistical package for social sciences (SPSS) version 20 (IBM) software (SPSS Inc. Chicago, IIIinois, USA) was used to analyze the data. The researcher reviewed all the forms completed each day, checked for completion, and other errors. The data collected on each variable using the questionnaires were then coded and entered into the SPSS software version 20 (IBM) after they have been cleaned and checked for completeness and consistencies against the items on the questionnaire guide. Descriptive statistical test was then conducted to estimate both socio-demographic characteristics of study participants and level of knowledge and perception of participants on health and environmental risk of open defaecation practices. Associations between open defaecation and pupils' knowledge and perception of health and environmental risk was also determined using Qi-square. Relevant statistical tables were generated using Microsoft Excel Software version 10.

The data collected using the focus group discussions (FGDs) and the in-depth interview (IDI) were first transcribed verbatim into Microsoft Word for Windows and then analyzed using thematic analytical procedures. The coding of the transcripts was done manually to identify consistent themes that propped up during the FGDs. Views and opinions that came out most were considered the groups' main opinions. These were further analyzed in detailed. This further detailed analysis involved two basic levels including manifest and latent descriptive analyses. During the manifest analysis, descriptive account of the data (what study participants said) was carried out dwelling most on what was actually said, documented or observed with nothing read into it and nothing assumed about it. Also, during the interpretive stage, descriptive analysis was carried out extensively dwelling on what was meant by the responses, what was inferred or implied. Relevant illustrative quotes that reflected group opinions were identified and used to support the detailed descriptive analyses of the final themes.

Ethical Clarence Certificate No. ECBAS 035/15-16 to undertake the study was given by Ethical Committee for Basic and Applied Sciences (CBAS), University of Ghana. A verbal assent was obtained from parents and appropriate guardians of participants before they were used in the study. Verbal informed consent was also provided by all study participants to participate in the study.

4. Results

Table 1: Socio-demographic Characteristics of Study Participants

Participants Demographic Characteristics	Frequency (N=400)	Percentage (%)
Sex Distribution		
Male	200	50
Female	200	50
Age Distribution(Year)		
9—13	183	45
14—18	217	55
Class/Level)		
Primary 4—6	192	48
JHS 1—3	208	52
Religious Affiliation		
Christianity	356	89
Muslem	36	9.0
Traditional	8	2.0
Locality Type		
Rural	200	50
Urban	200	50
Ethnic Affiliation		
Ga—Dangme	55	13.8
Ewe	216	54.0
Akans (Fante &Asante)	61	15.2
Akuapem	61	15.2
Others (Moshi & Guan)	7	1.7

Table 2: Pupils Knowledge of Environmental Risks of Open Defaecation Practices

Variable Category	Category Choices	Frequency	Percentage (%)
Environmental effects of open defaecation	Undesirable	208	52
	Desirable	172	43
	Don't know	20	5
	Total	400	100

There was association between pupils knowledge and environmental risk of OD: $\chi^2 = 44.961$, $p=0.006$

Table 3: Pupils Knowledge of Health Risks of Open Defaecation Practices

Variable Category	Choice Category	Frequency	Percentage (%)
Open defaecation has bad effects on health	Unlikely	212	53
	Don't know	48	12
	Likely	140	35
	Total	400	100

There was association between pupils' knowledge and environmental risk of OD: $\chi^2 = 65.02$, $p=0.002$.

Table 4: Pupils General Knowledge of Risks of Open Defaecation Practices

Variable Category	Choice Category	Frequency	Percentage (%)
Open defaecation	Bad practice	359	89.8
	Don't know	27	6.9
	Good practice	14	0.4
Total responses		400	100

There was association between pupils knowledge and risk of OD: $\chi^2 = 55.906$, $p=0.018$

There was significance association between pupils' perception and bad effects of OD: $\chi^2 = 64.275$, $p=0.004$.

Data in Table 1 above describes the demographic characteristics of study participants. From the data, it is evident that percentage distribution of male and female participants in the sample was the same. The participants ages ranged between 9 and 18 years and their educational levels comprised 192 (48%) from primary 4-6 grades and 208 (52%) from Junior High grades 1-3. The data also indicates that majority of the study participants were Ewes (54%) and Christianity forms the dominant religious group (89%) in the sample.

The data in Table 2 shows that more than half (52%) of the pupils have good knowledge about the negative effect of open defaecation behaviour on the environment.

Also, data in Table 3 indicates that the overall knowledge level of pupils on health risks associated with open defaecation was, however, low among the greater number (53%) of pupils. It is also evident that over 89% of the pupils have adequate knowledge of the negative consequences of open defaecation practices (Table 4).

The result in Table 5 also submits that pupils have high level of perception of bad effect of open defaecation practices and the level of perception vary slightly from one study area to another with schools from Keta recording the highest perception (95%) of bad effect followed closely by schools from both Nsawam-Adoagyiri and Fanteakwa with 91% each and schools from Akatsi (82%) being the least.

Statistical test showed significant association between open defaecation and pupils' knowledge of health risk (χ^2=65.062, p value =0.002), and environmental risk (χ^2 = 44.961, p value = 0.006). Association was also found between open defaecation and pupils level of perception of environmental risk (χ^2 = 36.887, p value = 0.045).

Results of Focus Group Discussions (FGDs)
The two major themes identified from the FGDs relate to personal convenience and personal health and environmental risks.

Key quotes that relate to personal convenience included the following:
"…No scent in the bush"— (A female pupil, FGD, Kofisah M.A. Basic School).
"One experiences good ventilation."— (A male pupil, FGD, Monome D.A Basic School).
"You feel very comfortable to defaecate." — (A male pupil, Kedzi-Havedzi A.M.E Zion School).
"There is no scent in the bush so I go there; I get some neatness in the bush"—(A female pupil, FGDs, Oboaho, D.A. Basic School).

Key quotes that relate to personal health and environmental risks included the following:
"You don't contract diseases from friends who also use the toilet." — (A female pupil, FGD, Begoro Presby Basic School).
"…open defaecation is bad because we eat the faeces ourselves."— (A male pupil, FGD, Monome D.A Basic School).
"It pollutes drinking water sources, gives us diseases and destroy the environment" — (A female pupil, Kedzi-Havedzi A.M.E Zion School).
"Flies carry diseases from the bush into our homes and contaminate our foods and water." — (A female pupil, Keta A.M.E. Basic School).

Results of In-depth Interview (IDI)
The two major themes identified from the IDI relate to personal and public health and environmental risks.

Key quotes that relate to personal and public health included the following:
"...open defaecation can bring about diseases to us."— (Male pupil, IDI, Kofisah M.A. Basic School).

"It is not good because we eat the faeces ourselves when we defaecate in the bush; this is because rain water washes the faeces into water bodies and contaminate them and when we drink water from the water bodies, we drink the faeces"—(A female pupil, IDI, Begoro Presby Basic School).
"When snails are at the place where you defaecate, they would eat the faeces and when we eat the snails, we also eat the faeces."— (Male pupil, IDI, Kofisah M.A. Basic School).

"..It is not good because if you finish defaecating and you don't have any material to clean your anus, you are therefore forced to use leaves and you don't know whether the leaf is good or bad"—(Female pupil, IDI, Akuffokrom M.A. Basic School).

"*Sir, it is true because when flies step on the faeces, and then step on our food, we eat the faeces when we eat the food."*— (Female pupil, IDI, Akatsi Demonstration 2 Basic School).

"Animals feed on the faeces and eating the animals means eating the faeces."— (Male pupil, IDI, Akuffokrom M.A. Basic School).

"It is true because the animals there also eat the fresh of the grass so hunting them and eating them make us eat our faeces as well."— (Male pupil, IDI, Kofisah M.A. Basic School).

I don' feel comfortable in the bush because the farm owner can do me something bad on seeing me." (Male pupil, IDI, Kofisah M.A. Basic School).

"What make it difficult for me is that if I defaecate in the bush it can give diseases in many ways." (Male pupil, IDI, Begoro Presby Basic School).

Key quotes that relate to environmental health included the following:
"…It is not good because it destroys the environment."— (Male pupil, IDI, Kofisah M.A.

Basic School).

"…It pollutes our drinking water sources" — (A male pupil, IDI, Kedzi-Havedzi A.M.E Zion School).

5. Discussion

5.1 Pupils' Knowledge and Perception of Health and Environmental Risk of Open Defaecation

The knowledge and perception of health risks of open defaecation behaviour has been documented in various studies (Madeleen, 2000; Hathi *et al*., 2014; & Spears *et al*., 2014). Knowledge of risks associated with open defaecation was found to be significant determinant of open defaecation practices. This was observed in this study where statistical association exists between pupils knowledge and environmental risk of open defaecation: $\chi^2 = 44.961$, p-value = 0.006; pupils knowledge of health risk of open defaecation: $\chi^2 = 65.02$, p-value = 0.002, and pupils' general knowledge and risk of open defaecation: $\chi^2 = 55.906$, p-value = 0.018. This was also reported in both the FGDs and the IDI results.

The results of the present study reveal that the greater number of pupils (53%) are unaware of the health risk associated with open defaecation practices. This was also evident in FGDs sections where pupils attached more preference to open defaecation than toilet use. For example, a female pupil from Oboaho D.A Basic School said: *"There is no scent in the bush so I go there; I get some neatness in the bush*". Also, a male pupils from Kedzi-Havedzi A.M.E Zion Basic School narrated his experience: *"You feel very comfortable to defaecate in the bush."*

These findings indicate that pupils' knowledge of faecal-oral transmission routes was low. Pupils' knowledge of health risk of open defaecation was found to be significant: $\chi^2 = 65.02$, p value < 0.05. This can be very dangerous because school environments are high populated and any outbreak of faeco-oral diseases such as typhoid, cholera, diarrhoea, hepatitis, trachoma can easily spread among the school population and cause high health impacts. This finding supported earlier study by Hathi *et al*., (2014); Spears *et al*., (2014) who reported that pathogens are more easily transmitted in high population density environments where knowledge about health risk associated with open defaecation is low and this increases the public health risks and human capital costs. Also, people in such high density environments are much more exposed to faecal pathogens, a situation that can culminate in diarrheoa prevalence through oral routes (Shuval *et al.*, 1986).

In Ghana, the first cycle schools are high population density environments and if traditional open defaecation is practiced in such a highly populated environment, it can result in spread of faeco-oral diseases, thus increasing out-patient population and its associated health and social costs. Similarly, an outbreak of diseases in the school can also extend to the homes, and the community. Study by Aiello *et al*., (2008) demonstrated that infections which children contract in schools will lead to infections in up to half of their household members and that 88% of diarrheal diseases are caused by inadequate sanitation and inappropriate hygiene (Bill and Melinda Gates Foundation, 2011; WHO, 2008). They further stressed that the consequences of open defaecation for infant mortality and child height are worse where population density is high compared to where it is low (Aiello *et al*., (2008). Similar study by Spears (2012) reported that even very modest improvements in open defaecation rates in rural India have statistically detectable effects on infant mortality, child height, and child cognitive achievement. Avoidance of open defaecation depends, to a greater extent, on pupils' knowledge and awareness of quantum of health and environmental risks associated with the practice. There is also suggestive evidence that improving sanitation through avoidance of open defaecation can decrease stunting (Spears, 2012).

6. Conclusion and Recommendations

In conclusion, the findings of the study revealed that open defaecation with its attendant clinical records is being reinforced in the first cycle schools with nobody even bothering to do anything to overcome it. Regardless of pupils' high level of knowledge about environmental risks associated with the open defaecation practices, they perceive nothing wrong with the practice and still continue to do it. The open defaecation practice is therefore seriously being nurtured in the first cycle schools and the practice is largely due to lack of adequate knowledge of its attendant medial problems and environmental consequences. Hence the target of attaining the 2030 SDG 6 is becoming very hard to realize unless pupils are given adequate knowledge on the consequences of open defaecation practices on health and environment as well. The bad effects of open defaecation on health and the environment as discussed above has placed the open defaecation practices in the first cycle schools at certain pedestrian level that merits urgent public attention. A lot need to be done to increase pupils' knowledge and awareness of environmental and health risks associated with open defaecation practices and the need to use toilets.

First, teachers in the first cycle schools must increase their sanitation and health education in their classrooms teaching and learning contexts to motivate and encourage toilet use among the pupils and in the school. They should identify pupils' sanitation behaviours, and where needed, reinforce existing positive ones while trying to modify or change those that favour open defaecation practices. Also, school population-wide strategies comprising shifting responsibilities of tackling the open defaecation challenges from pupils to the MOE and GES, thereby acknowledging that lack of sanitation courses in the school curriculum to increase pupils' knowledge on health and environmental risks associated with open defaecation strongly contribute significantly to open defaecation practices among the pupils in the first cycle schools. Executing this strategies can help avoid high levels of open defaecation practices currently observed in the schools.

Second, in order to promote sustainable toilet use in the first cycle schools, awareness of negative consequences of open defaecation must be created among the pupils. Study showed that raising awareness and improving environmental knowledge among school pupils helps encourage sustainable toilet use (MDWS, 2011). This also underscores the fact that the key to eliminating open defaecation is to give young children health education on bad effects of open defaecation and make them develop the habit of using toilets. Third, sanitation stakeholders must ensure that toilet provided for the school children are appropriate to their age, and meet their defaecation preferences. This can be done by involving them in every aspects of the toilet type selection and construction processes. Involving them in the process would offer hope for sustainability, because as the children grow, they will continue to implement better sanitation practices that influence their own children and community to do the same. All these will help break the inter-generational cycle of open defecation behaviours. Since children listen to their teachers more than other personalities, encouraging and motivating teachers to instil sustainable toilet use in the pupils can yield greater and most effective impacts and with less cost. Achieving the desire goal the activities for training of teachers should be allocated a greater portion of the sanitation budget.

The ministry of local government and rural development and Ghana Education Service must ensure that the qualities of school toilets resonate with the benefits pupils associated with open air defaecation practices. This constitutes one surest way to move pupils from open defaecation practices to sustainable toilet use.

7. Limitations and Areas for Further Studies

This study is without limitations. The first limitation had to do with reliance on self-report measures as the main source for gathering data. This may be biased by social desirability. The second limitation is that collecting accurate data on sensitive and private issues such as open defaecation behaviour presented many challenges as pupils were not willing to divulge some sensitive information the study required. Finally, the study suggests investigating the pupils' knowledge and perception of risks of open defaecation practices with larger samples for better generalization of the findings. Future efforts must be largely tailored towards these areas of research. Nonetheless, the study has churned out relevant knowledge and perception of pupils on health and environmental consequences of open defaecation practices in the first cycle schools.

Conflict of Interest

The authors declare that they have no competing interest.

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References

Aiello, A.E., Larson, E.L., Sedlak, R. (2008). Personal health. Bringing good hygiene home. American Journal of Infection Control. 36(10 Suppl):S152-65. Publication Ltd, Accra, Ghana.

Bartram, J., Lewis K., Lenton R., Wright A. (2005). Focusing on improved water andsanitation for health. Lancet. 365:810–2.

Bill and Melinda Gates Foundation. (2011): Website: www.gatesfoundation.org/global-development/water-sanitation-hygiene.

Case, Anne, Paxson, Christina, 2008. Stature and status: height, ability, and labor market outcomes. J. Polit. Econ. 116 (3), 499–532.

Checkley, W., Buckley, G., Gilman, R. H., Assis, A. M., Guerrant, R. L., Morris, S.S., Mølbak, K., Valentiner-Branth, P., Lanata, C. F., Black, R. E., Malnutrition, A. T. C. & Network, I. (2008). Multi- Country Analysis Of The Effects Of Diarrhoea On Childhood Stunting. International Journal Of Epidemiology, 37, 816-83

Colopy, C. (2012). How No-Flush Toilets Can Help Make a Healthier World. Yale Environment 360.

Culen, G.R. (2001). The Status of Environmental Education with Respect to the Role of Responsible Environmental Behavior. In H.R. Hungerford, W.J. Bluhm, T.L. Volk & J.M Ramsey (Eds.) Essential Readings in Environmental Education (37-47). Champaign, IL: Stipes Publishing, LLC.

Feachem, R., Mara, D.D., & Bradley, D.J. (1983). Sanitation and disease: Health Aspects of Excreta and Wastewater Management. John Wiley & Sons.

Fink, G., Gu¨nther, I., & K. H. (2011). The effect of water and sanitation on child health: Evidence from the demographic and health surveys, 1986 - 2007. International Journal of Epidemiology 40 (5), 1196–1204.

Ford, M. (2004). Environmental Education in the Condor Bio reserve: Current Status andRecommendations for Future Work. Journal of Sustainable Forestry. (18) 2/3, 257-275.

Ghanaian Daily Graphic (2005). Many homes have no toilet facilities –CWSA, 2009.

GSS. (2012). 2010 Population and Housing Census Provisional Results: Summary of Findings. Ghana Statistical Service, (GSS), Accra, Ghana.

Haigh, M.J. (2006). Promoting Environmental Education for Sustainable Development: The Value of Links between Higher Education and Non-Governmental Organization Journal of geography in Higher Education. (30) 2, 327-349.

Hathi, P. (2014): “Place and Child Health: The Interaction of Population Density and Sanitation Behaviour in Developing Countries”, RICE Working Paper.

Hathi, S., Haque, Pant, L., Coffey, D., & Spears, D.(2014). Place and child health-the interaction between density and sanitation in developing countries. Technical report, Policy Research Working Paper 7124 World Bank Group, November, 2014.

Humphrey, Jean H. (2009). Child undernutrition, tropical enteropathy, toilets, and hand washing." The Lancet, 374: 1032 (35).

Kov, P., Sok., H., Roth, S., Choeun, K., Hutton, G., & World Bank (2008). Water and Sanitation Program. Economic impacts of sanitation in Cambodia. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/06/26/000334955_20080626064337/Rendered/PDF/442950WSP0KH0v1mic0impacts01PUBLIC1.pdf.. (Accessed on April 21, 2016).

Liu, L., Johnson, H. L., Cousens, S., Perin, J., Scott, S., Lawn, J. E., Rudan, I., Campbell, H., Cibulskis, R., Li, M., (2012). Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. The Lancet 379 (9832), 2151 (2161).

Madeleen, W.S. (2000). The International Symposium on Ecological Sanitation 30-31 October 2000 Bonn. Germany: IRC International Water and Sanitation Centre; Public Awareness and Mobilisation for Eco-sanitation.

Martorell, R., Yarbrough, C., Lechtig, A., Delgado, H., & Klein, R.E. (1977).Genetic-environmental interactions

in physical growth. “ActaPdiatrScand, 66: 579.

MDWS. (2011). Success Stories - IEC on Sanitation. Ministry of Drinking Water Supply, Government (MDWS), Government of India.

Mondal, D., Juliana, M., Alam, M., Liu, Y., Dai, J., Korpe, P.,M Lei Liu, R., Haque, & William, A., Petri, Jr.(2011). Contribution of Enteric Infection,Altered Intestinal Barrier Function, and Maternal Malnutrition to Infant Malnutrition in Bangladesh." Clinical Infectious Diseases.

Pelletier, D.L., Frongillo, E.A., Jr., Schroeder, D.G. & Habitat, J.P. (1995).The effects of malnutrition on child mortality in developing countries.

Petri, W. A., Jr., Miller, M., Henry, J., Binder, M., Levine, R. D., & Richard, L.G. (2008). Enteric infections, diarrhea, and their impact on function and Development."Journal of Clinical Investigation, 118(4), (12661290).

Shuval HI, Adin A, Fattai B, Rawitz E, Yekutiel P (1986). Waste Water Irrigation in Developing Countries: Health Effect and Technological Solution. Technical Paper Washington, DC: World Bank

Spears, D. (2013). How Much International Variation in Child Height Can Sanitation Explain?; Water and Sanitation Program (WSP), World Bank: Washington, DC, USA.

Spears, D. (2014). “Increasing Average Exposure to Open Defaecation in India, 2001– 2011”, RICE Working Paper (www.riceinstitute.org).

Spears, D. (2012a). Effects of Rural Sanitation on Infant Mortality and Human Cap-ital: Evidence from a Local Governance Incentive in India." working paper, Princeton University Research Program in Development Studies.

Spears, D. (2012b). “Sanitation and Open Defecation Explain International Variation in Children’s Height: Evidence from 140 Nationally Representative Household Surveys.” RICE working paper. Available at www.riceinstitute.org

Stevenson, R.B. (2007). Schooling and Environmental Education: contradictions in purpose and practices Environmental Education Research. 13(2), 139-153.

UNDPI. (2002). Fact sheet on the United Nations International Year of Water 2003. Published by the United Nations Department of Public Information—DPI/2293B—December 2002. h?p://www.un.org/events/water/ factsheet.pd.

UN (United Nations) (2003). Water: a matter of life and death. DPI/2293B.

UNDP. (2006). Human Development Report, 2006. Beyond scarcity: power, poverty and the global water crisis. United Nations Development Programme New York: (UNDP). Available at: http://hdr.undp.org/en/media/HDR06-complete.pdf (Accessed January 24, 2016).

UNICEF/WHO (2008). A Snapshot of Sanitation in Africa, Unicef/WHO Joint Monitoring Programme, Prepared For The AfricaSan+5 Conference in Durban, South Africa, February.

WHO and UNICEF (2004). Meeting the MDG Drinking Water and Sanitation Target: A Mid Term Assessment of Progress. WHO/UNICEF JMP for Water Supply and Sanitation, the World Health Organization, 2004, Geneva, Switzerland.

UNICEF. (2012). Progress on drinking water and sanitation: 2012 update. United Nations Children’s Fund (UNICEF). Water Supply and Sanitation. WHO: Geneva, Switzerland.

UNICEF. (2010). Progress on Sanitation and Drinking Water: 2010 Update. United Nations Children’s Fund. Water Supply and Sanitation. WHO: Geneva, Switzerland.

WAG. (2013). 'Her right to education: How water, sanitation and hygiene in schools Determines access to education for girls', London: Water Aid.

WHO/GHA. (2009). The Global Health Atla, Cholera Cases (2005-2009. World Health Organization. (WHO) & Global Health Atlas. (GHA). Available online: http://apps.who.int/globalatlas).

WHO. (2008). The global burden of disease: 2004 update. Geneva: World Health Organization. WHO: Geneva, Switzerland.

WHO. (2005). Water for life: Making it happens. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland, http://www.who.int/water_sanitation_health/monitoring/jmp2005/en/index.html.

WHO/UNICEF/JMP. (2015). 25 YEARS Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland and UNICEF: New York, USA.

WHO/UNICEF/JMP. (2014). Progress on Sanitation and Drinking-water: 2014 Update. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. 1–78. https://doi.org/978 92 4 1507240. WHO: Geneva, Switzerland and UNICEF: New York, USA.

WHO/UNICEF/JMP. (2013). Progress on Sanitation and Drinking-water: 2013 Update. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland and UNICEF: New York, USA.

WHO/UNICEF/JMP. (2012). Report of on Technical Consultation on the Measurability of Global WASH Indicators for Post-2015 Monitoring. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland and UNICEF: New York, USA.

WHO/UNICEF/JMP. (2010). Progress on Sanitation and Drinking-water: 2010 Update. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland and UNICEF: New York, USA.

WHO/UNICEF. (2008). Progress on Drinking Water and Sanitation: Special Focus on Sanitation. World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation. WHO: Geneva, Switzerland and UNICEF: New York, USA Also available on: www.sanitation.org (accessed on 24 June, 2014).

WSP/WB. (2013). "Kenya Onsite Sanitation: Market Intelligence." Water and Sanitation Program (WSP), World Bank (WB). IFC (International Finance Corporation), & Ministry of Health, Kenya. Nairobi, Kenya.

WSP. (2011). Achieving and sustaining Open Defecation Free Communities: Learning from communities in East Java, Water and Sanitation Program (WSP). Research Brief.

WSP/WB/JMP.(2010). Economic Impacts of Poor Sanitation in Africa. Water and Sanitation Program (WSP) & World Bank (WB). Available online at www.wsp.org

WSP. (2012). Ghana Country Profile: Economic Impacts of Poor Sanitation in Africa, March. Water and Sanitation Program (WSP).