

Research Article

Solid Waste Management and Its Health Implications on the Dwellers of Kumasi Metropolis, Ghana

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Abstract: Human activities create wastes. Whether wastes would pose risks to the environment and to public health depend on how they are handled, stored, collected and disposed off. The research sought to identify the approaches adopted by households to dispose off wastes; the perception of households on public health in relation to nearness to dumpsites; health related activities organized and challenges of managing wastes. Duase, Ohwim and Oti-Dompoase, all in Kumasi metropolis were studied to understand these issues. A total of 256 households were systematically sampled from 3,364 households at a 95% confidence level. It was found that 44.9% of the household respondents disposed off their wastes at the dumpsites within their respective residential areas; 26.9% at the central collection skip containers provided by KMA; 17.2%, in pits at their backyards; and 10.9% by burning. ZoomLion Ghana Ltd, ABC Waste Group, Meskworld Co. Ltd and Kumasi Waste Management Limited were responsible for managing waste within the study areas. Their operations however seem not satisfactory by the respondents. About 41.4% of the household respondents complained of the stench of the dumpsites which some of them even attributed it to the cause of numerous diseases in the communities such as catarrh, cough and chest pains. Diarrhea, intestinal worms, typhoid fever and cancer were perceived as diseases resulting from the wastes at the dumpsites. About 41.4% cited stench of the dumpsites to justify this claim while others link the poor management of waste to the causes of numerous diseases (catarrh, cough and chest pains, diarrhea, intestinal worms, typhoid fever and cancer) prevalent in the communities. The operations of the waste management companies were however found to be challenged by inadequate trucks and equipment, high operating cost, limited land availability for sanitary landfill and inadequate funding. Community participation in sanitation improvement programmes, separation of solid wastes at collection points, recycling of solid wastes and sensitization on how to dispose off waste and how to prevent waste related diseases have been recommended.

Keywords: Dumpsite, households, solid waste, waste management

INTRODUCTION

Human activities create wastes and it is the way these wastes are handled, stored, collected and disposed off, which can pose risks to the environment and to public health (Zurbrugg, 2002). Access to improved sanitation contributes to human health, dignity, security and wellbeing of people (Sida, 2012). On the other hand, poor sanitation is one of the most accurate indicators of health problems (Prasad, 2013). Due to rapid urbanization, environmental sanitation problems are at the heart of the woes of African countries. The proliferation of urban population comes with its rising demand for food and other essential services which in turn increases the waste generated daily by each household (Zhu *et al.*, 2008).

Generation rates for Africa are estimated to range from 0.3-1.4 kg per capita per day with an average of 0.78 kg compared to an average of 1.22 kg per capita for developed countries (Beukering *et al.*, 1999 cited in

Ojok *et al.*, 2013). Since the income levels of developed countries are far higher than developing countries, Ogunrinola and Adepegba (2012) expressed that the level of solid waste generated in developed countries is high and this is due to urbanization, production and consumption activities. Cointreau (2006) thus concluded that in absolute terms, countries with higher incomes produce more waste per capita.

Cities collect only 50-80% of refuse generated (Medina, 2010). This supports the argument raised by Firdaus and Ahmad (2010) that ineffective waste collection and management is a major problem to cities and countries. In India or Cairo for instance, refuse collection rate was estimated at 50% of generation, 33 % in Karachi and Yangon, 40%. Disposal of solid waste receives less attention than its collection as about 90 % of solid waste collected in cities ends up in open dumps (Cointreau, 2008). Most wastes are disposed off in open dumps, deposited on vacant land, or burnt by residents at backyards.

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At the center of the problem of inefficient waste collection and poor waste management is the high expenditure incurred in waste collection and management. Collection, transportation and disposal of solid waste pose a major cost component on developing countries. According to Medina (2010:2), waste management in most cases accounts for 30-50% of municipal operational budgets. Taking into consideration the various components of the budget, it becomes challenging for municipalities to devote huge amounts solely to waste collection and management (Eawag, 2008). Municipal solid waste management therefore continues to be a major headache for local governments in both urban and rural areas across the world (Wang *et al.*, 2011).

The effects of ineffective waste collection and poor waste management is countless. Insufficient collection and poor disposal practices generate serious health related problems to humans and the environment (Loboka *et al.*, 2013). In Sub-Saharan Africa for instance, poor disposal practices have aggravated health related problems (Zhu *et al.*, 2008). Abul (2010) found dumpsites to be in smelly and unsightly conditions. The negative effects are also found to be exacerbated during the summer where extreme temperature speeds up bacteria reaction and bio-degradation. In the view of Collivignarelli *et al.* (2004), if collection, disposal, recycling or treatment of solid waste is not done properly, it will lead to severe hazards, such as health risks and environmental pollution. Findings by Zhu *et al.* (2008) and Sharholy *et al.* (2008) confirm that poor waste collection practices and improper solid waste disposal contribute to local episodes of disease, regional water resource pollution and global greenhouse gases.

Boadi and Markku, (2005), also revealed that high incidence of diarrhea in children under six is inter related to food contamination by flies who had fed on wastes (Boadi and Markku, 2005). Hygiene related diarrhea alone is thought to cause 30,300 deaths per year and is considered one of the commonest outpatient cases (Domfeh, 2009). Another poor waste management practice has shown to be disposal of waste into water bodies. This contaminates the environment (Aibor *et al.*, 2006), contributes to floodings and serves as potential means to increasing transmission of communicable diseases; malaria, dengue and haemorrhagic fever, blood borne viruses such as hepatitis B and C, tuberculosis, yellow fever and West Nile Fever. The practice of 'water body-dumping' does not augur well for healthy population and productivity.

The World Health Organization (WHO, 2000) and United Nations Environmental Programme (UNEP, 1996) contended that residents who live closer to exposed and unmanaged waste dumps are subject to more bouts of cholera, an acute intestinal infection, skin diseases, blood and eyes cancer and respiratory infections. In a Joint Monitoring Programme for Water and Sanitation, conducted by United Nations Children Fund (UNICEF and Siaw, 2011), Ghana is said to have

an encouraging water supply of 75% and worse sanitation coverage of 18%, with less hope of improvement. All these unwanted issues aggravate health risk on people through solid waste.

Several works have been done on solid waste and its management (USEPA, 2002, 2006; WHO, 2005; City Council of Nairobi, 2010; Nair *et al.*, 2010; Hall and Anh, 2012; EEA, 2013). However, research on the health implications associated with solid waste and its management is negligible. Research on the health risks posed on waste workers, the health threats posed on those living near dumpsites and landfill sites, the different types of diseases and the frequency of occurrence on dwellers near and far from dumpsites have not been dealt with. It is from this basis that the research has been embarked on to investigate into solid waste management practices evident in Kumasi and their health implications on dwellers in communities (near and far) surrounding solid waste disposal sites. Municipal waste collection, disposal and management were the main focus of this research. Specifically, the research sought to:

- Identify the approaches adopted by households to dispose off waste in KMA
- Investigate into the perception of households on public health in relation to nearness to dumpsites
- Examine, (if there are any) the various health-related activities organized to reduce diseases emanating from dumpsites
- Identify the challenges in managing solid wastes

RESEARCH METHODOLOGY

Research approach and design: Both case study and survey research designs were adopted for the research. Case study research enabled the researchers to closely examine the phenomenon within a specific context. Zainal (2007) argues that in most cases, a geographical area and a specific number of individuals as the subjects of enquiry are needed for case study research. Baxter and Jack (2008), also state that case study is a research approach that facilitates exploration of a phenomenon within its context using a variety of data sources. The case study approach was used since the research concerned a context-specific situation in the Kumasi Metropolitan Area (KMA) and also the problem was studied within the framework of contemporary issues. KMA was selected due to the fact that the researchers are familiar with the area and it is where the Metropolis' officially managed landfill site (Oti-Dompoase landfill) is located. Two dumpsites and one landfill site were used for the research. These are: Oti-Dompoase Landfill (about 5,000 ha) located at Oti in the Asokwa sub-metro, Duase (2,000 ha) and Ohwim (3,500 ha) dumpsites located in the Asawasi and Bantama sub-metropolitan areas respectively. The Oti-Dompoase Landfill is the largest landfill which serves all areas in the metropolis and is located around

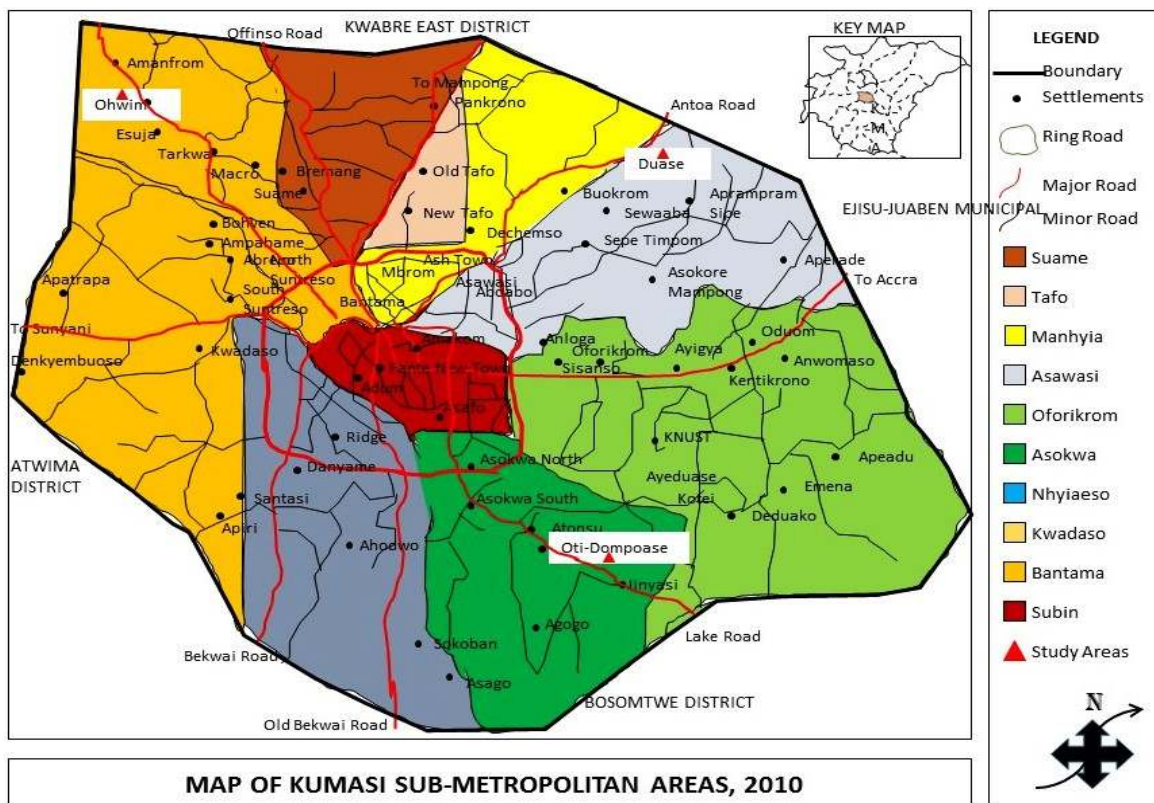


Fig. 1: Map of KMA showing the study dumpsite areas; Source: Adopted from KMA, 2010 and Authors' Construct, 2013

Adagya, Kuwait and Oti-Dompoase (KMA and MLGRD, 2006). The landfill is being managed by the Kumasi Metropolitan Waste Management Department (KWMD). For the purpose of this research, “dumpsites” was used to represent both the landfill and the two dumpsites. Figure 1 shows the study areas in the context of the metropolis.

Survey research was also used to gather information on the characteristics of the respondents as well as their opinions concerning solid waste management. It was appropriate to employ the survey method; it helped to describe concerns of a given population and uses a selected portion of the population from which the findings can later be generalized back to the entire population (Kraemer 1991 cited in Goh and Jay, 2011).

Materials used and sources: Both primary and secondary data were used for the research. Primary data were sourced from household residents in the study areas and institutions such as Waste Management Department of KMA, the Metro Environmental Health Unit, the Regional Health Directorate, waste workers and the five private waste management companies- Meskworld, SAK-M, ABC, Zoomlion and Anthoco. Secondary data were gathered from published documents related to waste management; annual reports from KMA concerning waste management and other waste related documents.

Sampling, data collection and analyses: There are 3,364 households (projected from the 2000 population) in the three communities under study. Out of the total households, 353 were selected at a significant level of 95%. A formula from Brewer and Miller (2003) cited in Dinye and Acheampong (2013) was adopted for the determination of the sample size. The formula is: $n = \frac{N}{1 + N(\alpha)^2}$, where n is the sample size (households selected/interviewed), N is the sample frame (total number of households) and α is the margin of error. Mathematically:

$$n = \frac{3364}{1 + 3364(0.06)^2} = \frac{3364}{13.1104} = 256 \text{ households}$$

Proportionally, 80, 128 and 48 households were selected from Duase, Ohwim and Dompooase, respectively. Table 1 depicts the total households for each of the communities and the sample selected from each of the communities.

In order to examine the different dimensions of health related problems from waste on the residents, each of the communities was clustered into two based on distance, that is, near the dumpsites (200 to 250 m) and far from the dumpsites (500 to 800 m). The selected residents were also equally divided between the two clusters for comparative purposes.

The simple random sampling procedure was applied to select the required number of households

Table 1: Sampled households by community

Dumpsite areas	Total households (2000)	Total households (2012*)	Sampled households	Near dumpsites	Far from dumpsites
Duase	442	1060	80	40	40
Ohwim	634	1680	128	64	64
Dompouse	568	624	48	24	24
Total	1644	3364	256	128	128

Ghana Statistical Service (2005) and Authors' Construct, 2013; *: The total households for the year 2012 was projected from the year 2000

from each cluster. The lottery method was used to carry out this procedure where all the houses within each cluster were put in a box and randomly drawing them one after the other till the sampled households were obtained. The houses were used for the random sampling because within each selected house, only one household was interviewed. Owing to the fact that multiple households lived in a house (often called compound houses), the researchers interviewed the first household they came across but chose another household in the event that the first household was not ready to answer the questions. The household heads were chosen to represent the entire households. Twenty waste workers at the dumpsites were accidentally selected on the day of the survey while the institutional respondents were purposively selected. Semi-structured questionnaires were used to interview the household heads. The researchers employed a face-to-face interview approach to obtain the required responses from the household heads and this accounted for a 100% response rate.

The data were synthesized, integrated and harmonized comprehensively to allow for a clear pattern of analysis and for ease of understanding. Both quantitative and qualitative or narrative methods were used for the analyses of the data gathered from primary and secondary sources. Quantitative data were coded, counted and processed using the Statistical Package for Social Sciences (SPSS) version 16 and Microsoft Excel and Word versions 2007. The researchers used both descriptive and inferential statistics to present the data. The analyzed data took the forms of simple frequency distribution tables, measures of central tendency, charts (i.e. simple bar graphs and line graph) and narrative summaries from the households' perspectives.

ANALYSES AND DISCUSSION

Bio-Data Analysis of Household Respondents: The bio-data of household respondents bother on age-sex characteristics, marital and employment statuses. Others include educational attainment, which altogether, to some degree, influence one's behavior including sense of hygiene and environmental cleanliness. About 45.2% heads of household were found within the ages of 26 and 36 and 43.3%, within 37-47 years. Only 11.5% of the household heads were beyond 47 years. The study discovered an emerging desire to settle with the nuclear family as the reason for the youthful dominance of household headship. In terms of gender, 64% of the household heads were males while 36% were females. The gender composition of respondents, in spite of the strong

emerging pro-women gender activism, is consistent with traditional and Christian beliefs that the man is the head. Concerning marital statuses of the household heads, 55.7% were married. This is followed by 21.1% who were single while 13% and 10.2% of the respondents were divorced and widowed respectively. This implies that majority of the respondents do not live alone but with other people either husband or children. A household of more than one person implies that there is a tangible waste generation rate in the household and as such waste management should also be of concern.

The Public Relations Officer of Zoomlion indicated that the participation rate of environmental sanitation and management is 42% to 58% in favor of the females. This implies that females have prior concern to waste management than their male counterparts partly due to the fact that they are mostly affected with sanitation related disease such as cholera and diarrhea as argued by the United Nations Environmental Programme (UNEP, 2004). Also, in the Ghanaian context, waste disposal is a traditional role of women. Table 2 illustrates a combined age, gender and marital statuses of the household respondents.

For the educational status of household heads, 40.9% had attained tertiary educational status. This is followed by 33.9 and 17.2% of the household heads who had attained Junior High and Senior High levels of education respectively. This shows that most of the respondents are literate enough to know and understand issues concerning waste generation, management and its health implications since it is relatively easier to educate an already educated person. Table 3 shows the education status of the household respondents.

Concerning the employment status of the respondents, 64.1% of the household respondents were employed but were engaged in different sectors of employment. Employment status and the sectors of employment are illustrated in Table 4.

People engage in economic activities to earn income to sustain them. About 40.1% of the heads of households earned monthly income less than Gh¢ 100.00 in the three communities with 19.9% near dumpsites and 20.2% far from dumpsites. This is followed by 21.1 and 19.1% of the respondents who received between Gh¢ 100.00 and Gh¢ 500.00 and Gh¢ 501.00 and Gh¢ 1,000.00 respectively per month.

The remaining 19.7% of the household respondents earned above Gh¢ 1,000.00 a month. Based on the national minimum wage of Gh¢ 4.48 per day (ModernGhana.com, 2012) and the UN per capita income of US\$1.00 per day (UN standard for poverty line), it could be said that the heads of households are

Table 2: Socio-demographic characteristics of the heads of households in the communities near and far from dumpsites

		Age groups (%)			Total
Communities	Location	26-36	37-47	48-60	
Duase	Near	7.4	6.60	1.6	15.6
	Far	6.6	7.00	2.0	15.6
Ohwim	Near	10.9	10.6	3.5	25.0
	Far	11.7	11.3	2.0	25.0
Oti-Dompoase	Near	4.7	3.50	1.2	9.4
	Far	3.9	4.30	1.2	9.4
Total		45.2	43.3	11.5	100.0
		Gender (%)			Total
Communities	Location	Male	Female		
Duase	Near	9.7	5.9		15.6
	Far	10.1	5.5		15.6
Ohwim	Near	16.8	8.2		25.0
	Far	15.2	9.8		25.0
Oti-Dompoase	Near	5.5	3.9		9.4
	Far	6.7	2.7		9.4
Total		64	36		100
		Marital status (%)			
Communities	Location	Married	Single	Divorced	Widowed
Duase	Near	8.50	3.1	2.0	2.0
	Far	8.90	3.5	2.0	1.2
Ohwim	Near	13.3	5.0	4.3	2.3
	Far	14.8	5.5	2.3	2.3
Oti-Dompoase	Near	5.50	2.0	1.2	0.8
	Far	4.70	2.0	1.2	1.6
Total		55.7	21.1	130	10.2

Field survey, June 2012

Table 3: Educational level of household respondents

		Educational level (%)				Total %
Communities	Location	Junior high	Senior high	Tertiary	No formal education	
Duase	Near	5.10	2.30	7.00	1.2	15.6
	Far	5.50	3.10	5.80	1.2	15.6
Ohwim	Near	8.20	3.90	10.9	2.0	25.0
	Far	8.90	4.70	9.40	2.0	25.0
Dompoase	Near	3.50	2.00	3.10	0.8	9.40
	Far	2.70	1.20	4.70	0.8	9.40
Total		33.9	17.2	40.9	8.0	100.0

Field Survey, June 2012

Table 4: Employment status and sectors of employment of household respondents

		Employment status (%)			Total (%)
Community	Location	Employed	Unemployed		
Duase	Near	9.70	5.9		15.6
	Far	10.2	5.4		15.6
Ohwim	Near	15.2	9.8		25.0
	Far	16.8	8.2		25.0
Dompoase	Near	5.50	3.9		9.40
	Far	6.70	2.7		9.40
Total		64.1	35.9		100.0
		Sectors of employment (%)			
Location		Agriculture	Industry	Commerce	Service
Near		2.8	11.3	24.6	11.3
Far		3.1	11.7	23.5	11.7
Total		5.9	23.0	48.1	23.0

Field survey, June 2012

not poor. Based on the different income levels, it could also be argued that the rate of waste generation would vary as stipulated by Cointreau (2006). Table 5 depicts the income levels of the household heads.

Perceptions on Dumpsites and its surroundings: The household respondents generally viewed the dumpsites as an unkempt environment. They described the condition as dirty, smelly and seriously filthy

Table 5: Monthly income levels earned by households (Gh¢) in the communities

Communities	Location	Monthly income (%)					Total
		<100	100-500	501-1000	1001-1500	>1500	
Duase	Near	6.2	3.1	2.3	2.0	2.0	15.6
	Far	6.6	3.5	3.5	1.2	0.8	15.6
Ohwim	Near	9.8	5.1	5.1	2.3	2.7	25.0
	Far	10.2	5.4	4.7	2.7	2.0	25.0
Dompoease	Near	3.9	2.0	1.5	1.2	0.8	9.40
	Far	3.4	2.0	2.0	1.2	0.8	9.40
Total		40.1	21.1	19.1	10.6	9.1	100.0

Field Survey, June 2012

Table 6: Heads of households' views on conditions and surroundings of dumpsites

Communities	Location	Views of households (%)				Total (%)
		Unightly	Dirty	Smelly	Seriously filthy	
Duase	Near	3.5	5.0	5.1	2.0	15.6
	Far	2.3	3.5	7.8	2.0	15.6
Ohwim	Near	5.5	7.8	9.0	2.7	25.0
	Far	3.9	5.5	11.7	3.9	25.0
Dompoease	Near	2.0	2.3	3.9	1.2	9.40
	Far	1.6	2.7	3.9	1.2	9.40
Total		18.8	26.8	41.4	13	100.0

Field survey, June 2012

among others, to portray how worrisome they were. Table 6 illustrates the views of the heads of household on the conditions and surroundings of the dumpsites.

Almost half (41.4%) of the household respondents complained of the stench of the dumpsites which some of them even perceived it to be the cause of numerous diseases in the communities such as catarrh, cough and chest pains. It was also perceived by the households that the filthy conditions of the areas have increased the presence of rodents and flies with accompanying diseases in their environment.

Solid waste disposal approaches: Wastes are generated in all activities of man, but whether wastes would pose risks to the environment and public health depends on the way they are handled, stored, collected and disposed off (Zurbrugg, 2002). It was discovered that majority (44.9%) of the household respondents disposed off their wastes at dumpsites in their respective residential areas while 26.9% disposed of their wastes at the central collection skip containers provided by KMA. It is interesting to know that 17.2% of the respondents disposed of their wastes in pits at their backyards despite the health risk of such practices. According to Boadi and Markku (2005), flies from these wastes dumped in the open pit at the backyards can contaminate food and pose health risk to the residents. Since the wastes are dumped openly, whether burnt or left in pits, they leave residue to pollute the environment and endanger public health. About 10.9% of the household respondents disposed off their wastes by burning but not all wastes are combustible.

Waste dumps, environmental pollution and public health:

Dumpsites in Kumasi: Dumpsites are the final disposal sites of solid wastes in Kumasi and they are a

repository of about 80% of waste generated in the Metropolis. The remaining 20% is collected by scavengers both males and females and informal recycling of hard plastics and bottles (KMWD, 2010). The main landfill in the Metropolis is at Dompoease in the Asokwa sub-metro. Dompoease landfill receives about 1,800 tons of waste daily through waste collection trucks and is only directly accessible to these trucks of waste collection companies who transport the municipal wastes in bulk to the landfill site. The Duase and Ohwim dumpsites on the other hand, are directly accessible to the residents. It was realized from the survey that the dumpsites were full of flies and bad odour filled the air. This was however not a surprise since dumpsites are noted for their smelly and unsightly conditions (Abul, 2010). A few scavengers were also observed at the landfill area sorting out solid wastes for recycling. A little over half (55.1%) of the household respondents had the desire to dump their wastes at these dumpsites directly but were discouraged by the unhealthy conditions. About 44.9% nonetheless, patronized the dumpsites. For the 44.9%, nearness to the dumpsites and low charges of between 30 pesewas and 40 pesewas were their motivation. The implication is that the patronage of the dumpsites could have been higher and other unwholesome means of disposing wastes such as in pits or by burning avoided/reduced, where dumpsites properly maintain.

Dumpsites and environmental pollution: With the exception of 7% of the household respondents who admitted that they had no idea as to whether the dumpsites pollute the environment or not, the remaining 93% admitted that the dumpsites had polluted the environment and this had been done through the addition of waste load on the environment as indicated by 18.9% of the respondents with the view that the

dumpsites had polluted the environment. Out of the 93% of the household heads who admitted that the dumpsites had polluted the environment, a little over half (52.9%) even had the perception that most of the ailments (specifically water and air-borne diseases) in the study areas were caused by the polluted environment resulting from the dumpsites. This means that the household respondents have fair understanding of the implications of environmental pollution. This perception of the respondents is in support of the findings of the research conducted by Aibor and Olorunda (2006) that most diseases are caused by environmental contamination through waste, though not scientifically proven in the case of the perception of the respondents. In addition to the above, 14.3% reported that the dumpsites constitute breeding place for rodents, disease vectors among others while 13.9% said the dumpsites had made the environment dirty.

Dumpsites and public health: Dumpsites pose diseases on residents staying near and far from the sites (Boadi and Markku, 2005). These diseases have causative agents; flies, mosquitoes and rats and were observed on waste heaps and around open dumps through the survey. The heads of households reported that in the beginning of the wet season when all the refuse are soaked with water, it becomes ideal for insect breeding and the population of flies increases tremendously and disease incidence increases correspondingly. A little over half (51.2% of which 26.2% lived near dumpsites) of the household respondents were of the perception that most of their ailments were caused by mosquito bites which resulted in malaria. Though mosquitoes are not bred from the heaps of wastes, as a result of the wastes, its surroundings have become bushy and a little downpour causes water stagnation and breeds mosquitoes. Also, 28.1% (12.9% near dumpsites and 15.2% far from dumpsites) said that their ill-health was caused by numerous flies around dumpsites that contaminate their environment and foodstuffs in the vicinity. They

indicated that decomposing organic materials had become breeding sites for pests, flies and vermin that enhance the likelihood of disease transmission. According to WHO (2009) these diseases are transmitted to humans from contacts with food or household items contaminated with rodent excreta. Rats find shelter and food in waste dumps, consume and spoil food, spread disease and inflict unpleasant bites. In addition, 12.1% (7% near dumpsites and 5% far from dumpsites) indicated and added that their sicknesses were mainly caused by rodents. Finally, 8.6% (5.1% near dumpsites and 3.5% far from dumpsites) indicated that their sicknesses resulted from other factors such as inhalation of smoke, dust particles mixed with unpleasant odour from waste combustion at the sites as well as all kinds of skin and body irritations. It can comparatively be seen that even for the causes of the diseases, the households who lived near the dumpsites were more prone to the causative agents than those who lived far from the dumpsites.

As contended by WHO (2000), residents who live closer to unmanaged dumpsites are exposed to lots of diseases. This implies that outbreak of diseases in communities surrounding dumpsites can be heightened or reduced depending on the management of the dumpsites. It was revealed from the survey that malaria was the most predominant disease perceived by the household respondents (69.2%). Though this figure is based on perceptions, it is 16.2% higher than the national figure of 53% (Boadi, 2005). Aside malaria, intestinal worms (10.2%), typhoid fever (5.8%), cancer (3.9%) and hepatitis (3.9%) were mentioned as the diseases the household respondents suffered from which they believed were the resultant of the dumpsites. A comparative analyses of the data revealed that the household respondents who lived near the dumpsites suffered more than those who lived far from the dumpsites. This confirms the argument of WHO (2000) and UNEP (1996) that residents living closer to dumpsites suffer from various waste related diseases. Figure 2 illustrates solid waste related diseases in the study areas as perceived by the household respondents.

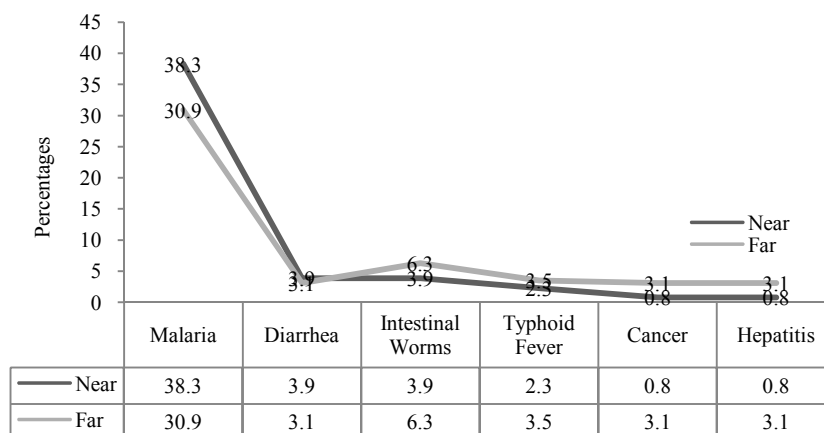


Fig. 2: Perceived solid waste related diseases in the study areas; Source: Field Survey, June 2012

Further enquiry revealed that women and children from these surrounding communities were perceived to suffer most from the open dumpsites. They suffered strong stench of smoke, dust and unpleasant odour surrounding the dumpsites that increase their vulnerability to solid waste related diseases. IRIN (2005) postulated that the rotten stench, leachate and pile up of uncollected waste have serious health consequences and is the main cause of transmission of typhoid, dysentery, cholera, diarrhea and water-related vector diseases (malaria, yellow fever, sleeping sickness) in the communities near dumpsites. According to the Kumasi Metro Health Directorate (KMHD, 2010), malaria constituted 53% of all reported cases from the study communities. Though, it was not confirmed from the KMHD that it was the result of the existence of the dumpsites that malaria cases had risen, the household respondents perceived that. With respect to other diseases, diarrhea recorded among the top Out-Patient Department (OPD) attendance in the communities. In addition to the above, intestinal worm infection incidences in Kumasi between 2008 and 2010 were significantly high from 24% in 2008 to 47% in 2009 and then dropped to 29% in 2010. These findings from KMHD were however not related to the existence of dumpsites but the household respondents perceived that within their communities, the diseases were as a result of the dumpsites.

It was realized that various preventive measures had been put in place by the household respondents to reduce the rate of waste related diseases infection on them (Table 7). Almost half (43%) of the respondents had adopted the use of Insecticide Treated Mosquito Nets (ITNs) while 10.2% proclaimed that the pregnant women in their households who attended ante-natal clinics were administered with ante-natal drugs such as Sulfadoxine-Pyrimethamine (SP). In addition, 16% of the respondents had adopted the use of Indoor

Residential Spraying (IRS) with insecticides while 7.9% used other measures such as the washing of hands with soap before eating and after using the toilet as one of the measures in prevention of intestinal worm infection and diarrhea. About 13% of the household respondents however admitted that all the above preventive measures were put in place as and when necessary. A critical look at these preventive mechanisms shows that the respondents were very much particular with malaria control because malaria was the prevalent disease in the communities which was perceived to be as a result of the dumpsites.

Health education programs on waste related diseases: All the heads of households indicated that education on waste handling and disposal was very essential to their health status. Almost two-thirds (64.1%) (18% at Duase, 32% at Ohwim and 14.1% at Dompouse) admitted that they had received no education on handling and disposal of waste. About 35.9% (10.2% at Duase, 19.1% at Ohwim and 6.6% at Dompouse) of heads of households had however received some kind of education on waste handling and disposal in their respective communities.

Health Programmes organized by Health facilities: Despite preventive measures adopted by the heads of households, some people still become infected with malaria. This has necessitated the need to organize periodic health related programmes by health facilities in the metropolis for the inhabitants and this happened to be patronized by the heads of households contacted. The motive for planning these programmes was to reduce the incidence of waste related diseases to the barest occurrence. Table 8 depicts the health educational programmes organized for the household heads according to the survey.

Table 7: Preventive measures adopted by heads of households in 2011

		Preventive measures adopted (%)						
Communities	Location	ITNs	IRS	MR	SP	ACTs	Others	Total %
Duase	Near	6.9	2.7	2.0	1.6	1.6	0.8	15.6
	Far	6.1	2.7	2.0	1.6	1.6	1.6	15.6
Ohwim	Near	14.1	3.5	2.7	2.7	0.8	1.2	25.0
	Far	7.4	4.3	3.9	2.3	4.3	2.7	25.0
Dompouse	Near	4.2	1.6	1.2	0.8	0.8	0.8	9.40
	Far	3.9	1.2	1.2	1.2	1.2	0.8	9.40
Total		42.6	16.0	13.0	10.2	10.3	7.9	100.0

Field survey, June 2012; KEY: IRS: Indoor residential spraying ITNs: Insecticide Treated Mosquito Nets; SP: Sulfadoxine-pyrimethamine MR: Multiple responses

Table 8: Public health programmers to household residents

		% Coverage		
Education level	Programmer	Near	Far	Total %
Junior high	Hand washing, ITNs, De-worming	6.20	5.90	12.10
Senior high	Hand washing, ITNs, De-worming	12.9	10.9	23.80
Tertiary	ITNs, ACTs Usage	18.0	21.1	39.10
No formal education	IRS, ITNs, Hand washing	7.80	5.90	13.70
Others (vocational)	Ante-natal, ACTs, ITNs	5.10	6.20	11.30
Total		50.0	50.0	100.0

Field Survey, June 2012

Table 9: Service delivery rating by heads of households

Community and waste management authority	Very satisfied	Satisfied	Normal	Unsatisfied	Very unsatisfied	Total %
Duase: Zoomlion	4.30	10.5	9.0	3.90	3.5	31.2
Ohwim: ABC	5.90	13.7	12.1	9.00	9.4	50.1
Oti-Dompoase: Meskworl	2.70	6.60	7.0	1.20	1.2	18.7
Total	12.9	30.8	28.1	14.1	14.1	100.0

Field Survey, June 2012

According to the Metro Health Environmental Unit Officer, the programme was conducted in consultation with the health administrators and the Metro Health Directorate in all the health facilities in the Kumasi Metropolis. The programme was arranged at all Out-Patient Department (OPD) centres in the various health facilities. A period of 5 to 15 min was devoted to educate patients on the need to sleep in the ITNs and the use of new improved malaria drugs. According to the Environmental and Sanitation Unit Officer, the programme was funded internally but had some support from USAID, Malaria Global Fund and the central government.

According to the health administrator at the Manhyia Poly-clinic for instance, all the participants embraced the programme with vigor which made it effective and operational. It was based on this programme that the household respondents had adopted the preventive measures as depicted in Table 9. Even though the health administrator did not provide data to support the comment made it can be concluded that such programmes can go a long way to reduce health risk posed on households by waste.

Solid waste management and associated challenges: Solid waste management companies in the study areas: It was discovered from the survey that waste management companies operated in the study communities. About 37.1% (12.9% near and 24.2% far from dumpsites) of the household respondents admitted that ZoomLion Ghana Ltd was responsible for waste collection in their community. While 33.9% indicated ABC Waste Group, 29% indicated that other waste companies such as KCL, SAK-M Co. Ltd, Anthoco Co. Ltd., Meskworl Co. Ltd and Kumasi Waste Management Limited were responsible for managing waste in their places of residence. This implies that final disposal of wastes as well as its management is done by these companies and the work that the households had to do was to bring their wastes to the collection points for the companies to transport them to the final disposal sites.

Heads of households assessed the performance of the three major waste companies: ZoomLion Ghana Ltd, ABC Waste Group and Meskworl. Almost a third (30.8%) of the household respondents was satisfied with the services they received from the waste companies while 12.9% said they were very satisfied. What happened to be a worry was that more than a quarter (28.2%) of the respondents was not satisfied

with the services of the waste companies. Some of the household respondents politely expressed this feeling by saying that the performance of the waste companies was “normal”. This implies that though the waste companies are doing their best in waste management, it is not up to the expectation of the household respondents. Table 9 depicts the views of the household respondents concerning the performance of the waste companies.

Role of Kumasi Waste Management Department (KWMD): According to the research development officer of KWMD, the major responsibility of the Department included solid waste management services to domestic premises, commercial or trade premises, industrial premises, street sweeping, grass cutting on pavements, drains or river cleansing when the needs arise, removal of dead remains and removal of bulky waste or electronic-waste (e-waste). She also asserted that it is the sole prerogative of the KWMD to designate final disposal sites and make sure that proper management approaches at dumpsites are adopted. In order to carry out the departments mandate they have entered into a partnership arrangement with private waste management companies to undertake waste management operations in the metropolis.

According to KWMD several metal bins measuring between 10-23 cubic were allocated at all the 150 communal collection sites while about 120 L plastic bins were supplied by all the private waste management companies to individual households which attract service cost. One major issue of concern that was observed during the survey was that there was no timely collection and transportation of wastes to the final disposal sites. Sometimes, the residents would dump their refuse on the ground for a long time before the bins and skip containers would be brought. When such situations occur, one would find out that the bins are empty but refuse are scattered around it. According to the Research Development Officer, the bins are not replaced right away because there are no extra bins for that purpose. Figure 3 and 4 shows waste collection points that had not been transported to the final disposal sites thereby posing health risk to the surrounding settlements.

Waste Workers Perspectives on Public Health and Waste Management: Since the issue of waste management is of universal concern, more groups of people are involved in their collection and management.



Fig. 3: House-to-house collection system in oti-dompoase
Source: Field Survey, June 2012



Fig. 4: Communal collection system at duase community
Source: Field Survey, June 2012

Due to this, a total of 20 waste management workers (35% waste collectors, 10% waste reloading workers, 45% workers at the dumpsites site and 10% supervisors) were contacted for the purpose of the research. The waste management workers admitted that waste collection in the metropolis and its environs was a tedious task due to the behavior of the people.

When waste management workers were asked about their opinion on the hazards of their occupation, one said "we are used to this and have become immune". This implies that they take the hazards attached to their work as a norm. The four perceived major health problems seriously affecting the waste management workers were respiratory infections (15%), eye infections (15%), Gastro-Intestinal Tract (GIT) infections (10%) and musculoskeletal injuries (20%). It was found that 15% had accidents which resulted in deep cuts and abrasions while mistakes and casualties constituted 25% of accidents cases and these group of victims claimed they resorted to the use of proper handling of equipment and machines.

At the dumpsites, it was observed that only 10% of workers were wearing protective working gears such as boots, overall and gloves. This is likely to make the workers more prone to solid waste related diseases. Those without the appropriate protective clothes said they were given during the recruitment period but they were worn out and had not been replaced by their employers but had been promised for replacement. This suggests that the health needs of the workers might not be important to the employers.

Challenges of solid waste management in the metropolis: Waste management is capital intensive. It requires heavy investment both local and international perspectives. An interview with the officials of the waste management companies revealed that they have limited resources compared to the required capacity to

effectively carry out their activities. According to the Research Development Officer of KWMD, inadequate trucks and equipment for waste management was another challenge in Kumasi Metropolis. A physical observation of waste storage containers in the sampled communities revealed that most of the communal collection centers were not disposed off frequently to the final disposal sites when these bins are in full capacity. This attitude towards waste management is likely to make the respondents more prone to solid waste related diseases. The study also revealed that the waste management companies had numerous problems in the delivery of their services. More specifically, the problems and challenges in dealing with waste delivery include:

- High operating cost of traditional waste collection and treatment systems according to a respondent from ZoomLion Ghana Limited.
- An economy that limits the viability of recycling or alternative waste treatment systems: According to KWMD, the waste collected is in most cases not recycled.
- Limited land availability for sanitary landfill activities due to competition and litigation of land uses. Even the land earmarked for the landfill operation is gradually being encroached upon.
- Inadequate funding as a result of inadequate fee collection, low fee rates, failing fund raising methods, difficult access to credit and marketing problems. According to the Research Development Officer, in many cases, fees for community-based waste services do not cover costs, because they are fixed by the government and do not take into account costs and taxes that have to be paid by the community service.
- Inadequate equipment and personnel. According to the Research Development Officer of KMA-WMD, the Metropolis is having a backlog of five equipment (8 existing but 13 required) to perform its operation to the optimum.

RECOMMENDATIONS

Waste is generated by everybody and as such, its management should not be the work of one group of individuals or institution. It is therefore recommended to city authorities and other waste related advocacy groups to:

- Create awareness and promote community participation in sanitation improvement programmes. When this is done, it will instill in residents the need to manage the waste they generate and will not rely on waste management workers to manage their waste for them. This will help reduce the risk of being infected with waste

related diseases since the waste will not be left untreated for a long time as it used to be.

- Ensure that supervision of environmental sanitation in the communities is stepped up with environmental health officers. Prosecution of environmental health offenders should serve as a deterrent to ensure that people behave appropriately with regards to household and community hygiene. They can also be agents of information flow for health education messages in the communities. This could contribute to erasing the perception from that dumpsites are the sole cause of the diseases they encounter in their communities.

In addition to the above, the residents in the Metropolis should be willing to pay waste collection fee that can be used to run waste collection operations. Residents should be educated that it is through the fee they pay that the machinery for waste collection and management are maintained. Some of the residents might try to avoid the fee by throwing their wastes in gutters and bushes around. To prevent these actions, fee reduction can be introduced for those who would separate their waste at the collection point. This would even entice the residents to always separate their solid wastes before disposal.

It is necessary for every individual to change their attitudes and behaviors towards solid waste management in order to protect the environment. The public education should be intended to take place at public and private schools, churches, mosques and at durbars and for a in community centers to help improve environmental sanitation. These approaches will conscientize the people to understand the implication of indiscriminate disposal of solid wastes and its health risks.

CONCLUSION

The perception of the heads of household respondents is that accumulation of solid waste in close proximity to residential areas constitutes a pathway to many diseases including malaria, typhoid fever, intestinal worm infections, cancer, diarrhea and hepatitis. The households adopted the use of skip containers, pit at backyard and burning of wastes as processes of disposing off their wastes. Improper management of these approaches affected the health status of the households. Household residents living near dumpsites were prone to more bouts of solid waste related diseases as a result of exposure to toxic pollutants from the open dumpsites. The physical observation of wastes at collection points in the sampled communities revealed that most of the collection centers were not collected on time from the households and exacerbated in the indiscriminate disposal of waste in the communities. Challenges faced by waste managers included; high operation cost, inadequate funding equipment and personnel. The

paper argues that's agitation should not be negotiable and/or compromised. Adherence to proper sanitary practices should be promoted at all cost to improve the health status of all household residents.

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