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Households' Knowledge, Attitudes, and Practices towards Municipal Solid Waste Disposal

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Abstract

Household waste contributes significantly to municipal solid waste (MSW) generation rates globally. This study evaluates households' knowledge, attitudes, and practices (KAP) towards MSW disposal in the Wa Municipality, Ghana. The study applied both qualitative and quantitative research methods. Questionnaires and interviews were used to obtain information on households' MSW handling practices and attitudes towards MSW disposal. 211 households responded to the questionnaires. The study showed that majority of the households' respondents in the Wa Municipality (40.8%) store their mixed unsorted waste in closed containers. Also, the study indicated that the most widely used method of solid waste (SW) disposal in the Wa Municipality was by burning, with 32.2% households resorting to this option. Furthermore, the study indicated that there was low knowledge of households towards waste reduction and source separation; 83.9% of the

household respondents did not sort their waste for collection and did not practice waste reduction. By conducting investigations under some demographic characteristics, the study found a very weak correlation between demographic variables and KAP, however, age was associated with waste disposal (p-value = 0.003 < 0.05). The study, therefore, recommends that the municipal authorities should intensify education and the enforcement of waste disposal regulations for the attainment of sustainable household waste management in the Wa Municipality and Ghana in general.

Keywords: Households, Knowledge, Attitudes and Practices, Municipal Solid Waste, Disposal.

1.0 Introduction

Municipal solid waste management (MSWM) is a global challenge and the situation is worse in urban areas of developing countries (Asante-Darko, Adabor and Amponsah, 2017; Ferronato *et al.*, 2018). Between 30% and 55% of solid waste (SW) generated within most cities in low and middle-income countries is not collected, but illegally dumped on streets and open spaces (Srivastava *et al.*, 2015; Wilson and Webster, 2018). This affects local community sustainability, as they lead to public environmental problems, including the release of toxic chemicals, emissions of pollutants and odour, and leachate contamination of ground and surface waters (Cao and Wang, 2017; Olapiriyakul, 2017; Ngamsang and Yuttitham, 2019). The effects of such environmental problems are long-term, and in some cases, irreversible.

It is common for municipalities to spend 20 to 50% of their available recurrent budget on solid waste management (SWM), while 30 to 60% of all the urban SW remains uncollected and less than 50 percent of the population is served (Sakijege, 2019). This compels municipal authorities to focus waste collection services in the high-income residential areas where the residents are more vocal in complaints about poor collection services to the detriment of poor and slum dwellers (Palfreman and Rhyn, 2015; Eduful and Shively,

2015; Kubanza and Simatele, 2018). Like most environmental hazards, deficiencies in waste management unduly affect poorer communities as waste is often not collected or dumped on land near slums.

Due to the increasing rate of MSW generation, and awareness and regulations for effective waste management, various institutions have got involved into one or more aspects of SWM chain (Nabegu and Mustapha, 2015; Ravindra and Mor, 2019). Accordingly, public participation is a wholly accepted crucial element for the success of any waste management programme including source reduction and recycling. The public (households) must be made aware of the relationship between managing MSW and protection of human health, and the environment (Fuss, Vasconcelos Barros and Poganietz, 2018). Thus, there is a need for the continuous evaluation of waste management systems to identify possible areas that require improvements.

Effective MSWM requires substantial investment, while the continuous maintenance and use of waste management infrastructure and equipment entail costs incident on individuals, households, communities, and government (Abdulredha *et al.*, 2018). Usually, households like their wastes to be collected and taken away to a disposal site and would be willing to pay for this service either through a conservancy tax or as a user charge because they do not like the waste to accumulate either inside or outside the house since it would be a health hazard. However, the household may not be paying the full cost of SWM which includes the ultimate disposal of the waste.

In Ghana and other developing countries, urban sprawl has exhausted the capacity of existing traditional disposal sites to the extent that wastes must be transported greater distances to sites outside many urban areas. This leads to irregular collection of waste in poor residential areas who mostly rely on communal containers for their waste collection. As a result, most middle and low-income household dwellers often complain of unsatisfactory or unreliable waste management services, and often resist paying any charges for waste management and instead resort to illegal dumping and burning of their

waste. This paper assesses the knowledge, attitudes and practices of households towards MSW disposal in the Wa Municipality in Ghana.

2.0 Methods

The study applied both qualitative and quantitative research methods. Questionnaires and key informants' interviews were used to obtain information on households' MSW handling practices and attitudes towards MSW disposal in the Wa Municipality. Fifty (50) households each in compound-house, semi-detached, and single-unit dwellings (totalling 150) formed the households sample size. The researchers applied systematic sampling in selecting the 50 uniform households in the various residential dwellings, as a systematic sample is obtained by selecting items at uniform intervals. Though this households sample size was small, as the Wa municipality's household population was 102,264 (Ghana Statistical Service, 2014), it was "big enough" to be of scientific and statistical significance (Torrecilla and Romo, 2018; Hanna, 2019).

However, during the data collection using stratified random sampling, two hundred and eleven (211) households residing in compound-house (low-income), semi-detached (middle-income), and single-unit (high-income) dwellings in the Wa municipality responded to the questionnaires. This number exceeded the initially planned household sample size of 150 since there was a good response to the households' questionnaire. Table 1 shows the sampled residential areas based on the residential typology/income level in the case study area. The data was organised, classified and analysed in themes as well as visual presentation in the form of tables/charts.

Table 1: Household respondents

Residential Typology/Income Level	**Name of Residential Area**	**Number of Questionnaires Administered**	**Average Household Size** (Ghana Statistical Service, 2014)
Compound-house dwelling (low-income)*	• Dondoli • Kambale • Kpaguri • Konta	104	6.4
Semi-detached Dwelling (middle-income)*	• Dobile Quarters • SSNIT Flats • Degu Quarters • Kpaguri Estates	64	5
Single-unit dwelling (high-income)*	• Jdzedayiri – Tampalepani Residential Area • Xavier Residential Area • Xavier Extension • Airport Residential Area	43	5.4
Total		**211**	**5.6**

*High-income area: per capita daily consumption above $20 (the houses are often detached single buildings with a large compound either paved or grassed)

*Middle-income area: per capita daily consumption of between $4 and $20 (residential areas are characterized by flats or bungalows and often occupied by more than one household)

*Low-income area: per capita daily consumption below $4 (areas with poor social services and amenities)

3.0 Results and Discussion

Household waste contributes significantly to MSW generation rates globally. For instance, household waste constitutes over 50% of MSW in Ghana (Miezah *et al.*, 2015; Ramachandra *et al.*, 2018). Thus, this study evaluated households' knowledge, attitudes, and practices (KAP) towards waste storage, source separation, waste disposal practices, and willingness to pay for SWC services in the Wa Municipality, Ghana. Also, the study

analysed the relationship between demographic variables (age, gender, and education) and KAP toward MSW disposal. 211 households were sampled for this study.

3.1 Households MSW Handling Practices and Disposal

The fieldwork showed that majority of the households' respondents in the Wa Municipality (40.8%) store their mixed unsorted waste in closed containers, such as bins, whereas, 8.1% resorted to other storage methods such as storing the waste in a pit and subsequently burning to reduce the volume of the waste. The MSW storage methods are shown in Figure 1.

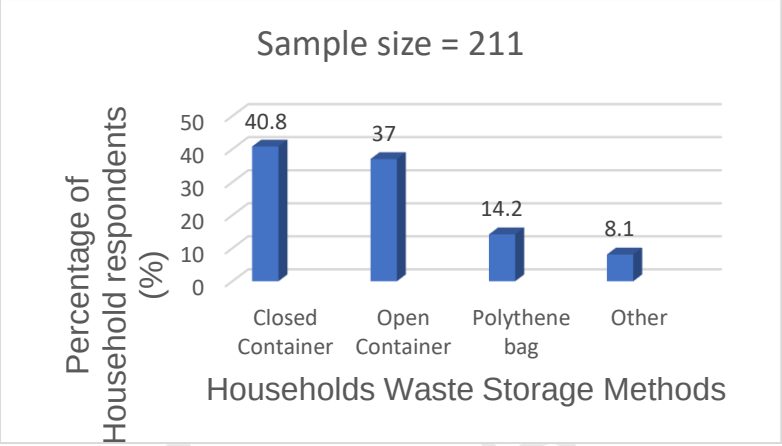

Figure 1: Households MSW storage methods

The fieldwork for this study also indicated that the most widely used method of SW disposal in the Wa Municipality was by burning, with 32.2% households resorting to this option; 30.8% of households depended on communal collection which constitutes the second widely used method of SW disposal; and only 16.6% of households relied on house-to-house waste collection service for their waste disposal, as shown in Figure 2.

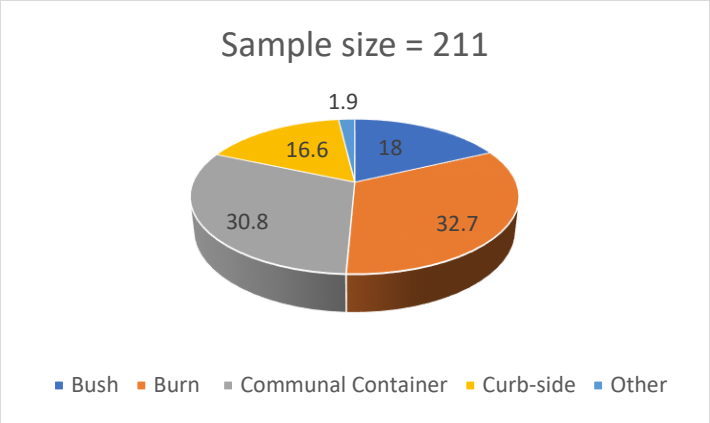

Figure 2: Households waste disposal methods in the Wa Municipality

These MSW disposal methods showed an improvement in MSW disposal methods in the Wa Municipality from the 2010 population and housing census, which indicated that 44.6% of the households in the Wa Municipality were provided with communal container for the disposal of their SW, but 24% of households' actual resorted to the communal containers for their SW disposal; as high as a proportion of 17.6% of households dumped their SW indiscriminately; 4.3% of households relied on house-to-house waste collection service (Ghana Statistical Service, 2014).

3.2 Demographic characteristics of respondents

Majority of the respondents were male (56.4 %) out of the 211 respondents sampled. Most (48.3 %) of the respondents were also between 21 – 30 age group, as indicated in Table 2. On the educational level of the respondents, the majority (62.6 %) of respondents had attained tertiary education, as shown in Table 2. This is an indication that most of the residents in the Wa Municipality are highly educated and could be easily educated on sustainable waste management practices. Additionally, 65.4 % of the respondents resided in low-income residential areas; this is because the Wa Municipality is more rural with multiple households residing in single-unit buildings (popularly called compound houses).

Table 2: Demographic characteristics of respondents

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	119	56.4
Female	92	43.6
Age (years)		
10 – 20	26	12.3
21 – 30	102	48.3
31 – 40	61	28.9
41 – 50	15	7.1
50 and >	7	3.3
Educational Level		
None	13	6.2
Basic	22	10.4
Secondary	44	20.9
Tertiary	132	62.6
Income Level		
Low	138	65.4
Middle	63	29.9
High	10	4.7

3.3 KAP on MSW Disposal

The results from this study showed that there was low knowledge of households towards waste reduction and source separation, though these are essential for sustainable waste management. 83.9% of the household respondents did not sort their waste for collection and did not practice waste reduction. These respondents stated varied reasons for their lack of interest in separation and waste reduction, including in no order: inadequate storage bins, lack of education on waste separation and reduction, no organised recycling and composting programmes, and non-enforcement of and non-compliance with policies and laws on waste reduction/separation. Only 16.1% of the respondents did sort their waste for disposal, however, not because of their knowledge of waste separation or reduction, but because they separated dry waste from wet waste for easy burning.

However, 45.8% of the household respondents who did not sort their waste were willing to sort their waste if they were provided with multiple bins. Presently, in the Wa Municipality and Ghana in general, only house-to-house collection service beneficiaries

are provided with a single closed container for waste storage (see plate 1 (a) and (b)), while those who cannot afford to pay for the house-to-house collection service (mostly, low-income and compound-house dwellers) or are not covered by this service, provide their own waste storage containers, usually open containers, as shown in plate 2 (a) and (b). On the contrary, 54.2% of the household participants who did not sort their wastes were still not willing to sort their wastes and practice waste reduction.

(a) (b)

Plate 1: Closed containers for waste storage by house-to-house service beneficiaries

(a) (b)

Plate 2: Waste storage containers by low-income residential dwellers

On willingness to pay for waste collection, 60.3% of the respondents who did not pay for the waste collection were willing to pay for effective waste collection, whereas, 39.7%

were still not willing to pay for the collection of their waste. Their unwillingness to pay for waste collection could be attributed to their satisfaction level as the majority of the respondents (40.4%) were unsatisfied with SW collection in their localities. Only 5.3% of the respondents were very satisfied with SW collection (most of whom were the house-to-house collection service beneficiaries). Figure 3 illustrates the households' satisfaction levels with waste collection service provision in their localities.

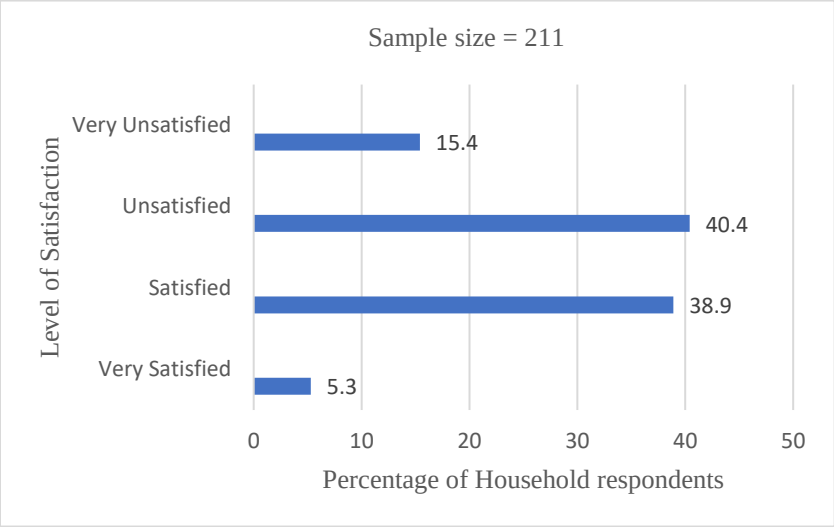

Figure 3: Households satisfaction level with waste collection services

3.3.1 Correlation between KAP and demographic characteristics of respondents

By conducting investigations under some demographic characteristics, this study found a very weak correlation between demographic variables (age, sex, and education) and KAP in households as shown in Table 3.

Table 3: Correlation of demographic characteristics and KAP

Question	Demographic Variable	Correlation coefficient (r)	p-value
Q_7 (MSW storage)	Age	-0.047	0.495
	Sex	-0.140	0.042
	Education	-0.069	0.318
Q_8 (MSW disposal method)	Age	0.137	0.046
	Sex	0.132	0.056
	Education	-0.008	0.914
Q_{11} (Source separation)	Age	0.184	0.008
	Sex	0.099	0.151
	Education	-0.027	0.699
Q_{18} (Willingness to pay for MSW collection)	Age	-0.013	0.118
	Sex	0.145	0.080
	Education	0.001	0.993
Q_{19} (Satisfaction with MSW collection)	Age	-0.030	0.664
	Sex	-0.020	0.779
	Education	-0.049	0.479

Age, sex, and education had a very weak negative correlation with household's waste storage type, despite that sex had a highly significant relationship with the SW storage method as $p = 0.042 < 0.05$, as indicated in Table 3.

For the relationship between MSW disposal method and age, sex, and education; age and sex had very weak positive correlations with MSW disposal method, whereas education had a very weak negative correlation with MSW disposal method, however, age had a moderate significance on MSW disposal method: $p = 0.046 < 0.05$, sex had a low significance on MSW disposal method with $p = 0.056 > 0.05$, and Education had no significance on MSW disposal method, as $p = 0.914 > 0.05$.

Similarly, age, sex, and education correlated poorly with source separation of waste, yet age strongly influence household sorting of waste, as $p = 0.008 < 0.05$; sex and education did not influence household sorting of waste significantly, as $p = 0.151 > 0.05$ and $p = 0.699 > 0.05$ respectively. On household's willingness to pay for MSW collection services, age correlated poorly negatively, whereas, sex and education correlated poorly positively with households' willingness to pay for MSW collection services. Correspondingly, age,

sex, and education did have any influence on willingness to pay for waste collection as their p-values were all greater than 0.05.

Also, this study found out that age, sex, and education of households correlated poorly negatively with their satisfaction level with waste collection and did not also have any significance on their level of satisfaction with waste collection activities (age, sex, and education had p = 0.664, p = 0.779, and p = 0.479 respectively, all of which are greater than 0.05).

The impact of demographic variables on KAP of SWM is well known (Kontokosta *et al.*, 2018; Lee, 2018), however, the dependency of demographic variables on KAP has not been established. Thus, this study supports other researches, who indicated that demographic variables correlate poorly with KAP (Babaei *et al.*, 2015; Yezli *et al.*, 2019).

3.3.2 Chi-Square Tests between KAP and demographic characteristics of respondents

To deduce the significance of the relationship between KAP and demographic characteristics, the researchers also calculated the Chi-Square Statistics of demographic characteristics and KAP.

The study revealed that age is not associated with the resident's KAP towards MSW disposal in terms of waste storage and waste sorting, however, age is related to how respondents disposed of their waste. The p-values obtained for age and waste storage methods was 0.392, and 0.115 for age and sorting of waste. These p-values are above the 0.05 significance level, as indicated in Tables 4 and 5. However, 0.003 (< 0.05 significance level) was the p-value obtained for age and waste disposal method, as shown in Table 6.

Table 4: Age and waste storage method Chi-Square Test

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	12.706[a]	12	.391
Likelihood Ratio	14.547	12	.267
Linear-by-Linear Association	.030	1	.862
N of Valid Cases	211		

a. 9 cells (45.0%) have expected count less than 5. The minimum expected count is .56.

Table 5: Age and sorting of waste Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.422[a]	4	.115
Likelihood Ratio	10.634	4	.031
Linear-by-Linear Association	3.079	1	.079
N of Valid Cases	211		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 1.09.

Table 6: Age and waste disposal method Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	36.243[a]	16	.003
Likelihood Ratio	33.483	16	.006
Linear-by-Linear Association	6.844	1	.009
N of Valid Cases	211		

a. 15 cells (60.0%) have expected count less than 5. The minimum expected count is .13.

Similarly, the study indicated that sex does not have significance on respondents' KAP on MSW disposal. The study obtained p-values of 0.441 for sex and waste storage, 0.111 for sex and waste disposal method, and 0.195 for sex and willingness to sort waste. These p-values are above the 0.05 significance level, as shown in Tables 7, 8 and 9. However, the researchers during the fieldwork observed that women, particularly, girls between the ages of 10 – 20 were predominately responsible for SW disposal in the Wa Municipality.

Table 7: Sex and Waste Storage Method Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.698[a]	3	.441
Likelihood Ratio	2.761	3	.430
Linear-by-Linear Association	.808	1	.369
N of Valid Cases	211		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.41.

Table 8: Sex and Waste Disposal Method Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.512[a]	4	.111
Likelihood Ratio	7.544	4	.110
Linear-by-Linear Association	5.072	1	.024
N of Valid Cases	211		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.74.

Table 9: Sex and Sorting of Waste Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.677[a]	1	.195
Likelihood Ratio	1.713	1	.191
Linear-by-Linear Association	1.669	1	.196
N of Valid Cases	211		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.39.

Furthermore, the results on educational level and KAP equally showed that educational level is not related to KAP as 0.338, 0.257 and 0.226 (all > 0.05 significance) were the p-values obtained for education level and waste storage method, education level and waste disposal method, and education level and sorting of waste respectively, as shown in Tables 10, 11 and 12, respectively.

Table 10: Education Level and Waste Storage Method Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.159[a]	9	.338
Likelihood Ratio	12.747	9	.174
Linear-by-Linear Association	.000	1	.988
N of Valid Cases	211		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is 1.05.

Table 11: Education Level and Waste Disposal Method Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.716[a]	12	.257
Likelihood Ratio	18.382	12	.105
Linear-by-Linear Association	.148	1	.701
N of Valid Cases	211		

a. 10 cells (50.0%) have expected count less than 5. The minimum expected count is .25.

Table 12: Education Level and Sorting of Waste Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.348[a]	3	.226
Likelihood Ratio	6.414	3	.093
Linear-by-Linear Association	.191	1	.662
N of Valid Cases	211		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.03.

4.0 Conclusion

The study showed that there was low knowledge of households towards SW disposal practices such as waste reduction and source separation, though these are essential for sustainable waste management. The study also supports other researches that indicated that demographic variables correlate poorly with KAP. The study proposes the provision of multiple waste bins to encourage households to sort their MSW for collection and disposal, the education of households on sustainable MSW disposal practices and the adequate enforcement of waste disposal regulations for the attainment of sustainable household waste management in the Wa Municipality and Ghana in general.

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