

Household Willingness to Pay for solid Waste Disposal Services in Urban Ghana: The Kumasi Metropolis Situation

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Abstract

Solid waste management has become inevitable in the global developmental processes. Thus, the sustainability of funds to manage solid waste is paramount, and it is contingent on the willingness of people to pay for improved solid waste disposal services. The paper, therefore, examined the factors that influence the willingness to pay for solid waste disposal in the Kumasi Metropolis. A sample size of 394 households was chosen using a simple random sampling technique. Logit regression was used to estimate the impacts that respondents' perceptions of certain variables had on residents' willingness to pay for waste disposal services. These variables were: the effectiveness of bye-laws, the quality of services, income, education, awareness of health hazards of indiscriminate waste disposal, areas of residence and some socio-demographic variables. The study revealed that payment for solid waste disposal was not uncommon in the study area. The study found that area of residence, effective bye-laws, level of education and income were statistically significant regarding willingness to pay for solid disposal services. However, household size and respondents' awareness of health hazards of indiscriminate waste disposal did not have any effect on respondents' willingness to pay for improved solid waste services. Following from these results it is recommended that local government authorities should effectively implement the sanitation bye-laws and re-institute the sanitation court to deal with cases of improper solid waste disposal.

Key Words: Solid Waste Disposal, Willingness to Pay, Socio-demographic factors, Bye-laws, Sanitation court

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Ghana Journal of Geography Vol. 8(2), 2016 Pages 1-17

Introduction

Solid waste management has become inevitable in the global developmental processes. Increased consumption patterns and associated solid waste generation has created a daunting challenge for city authorities in developing countries. For instance, in Ghana solid waste management has become a complex issue that has been a major feature on the priority list of successive governments, local authorities, and international donors in recent years. Generally, existing public facilities including sanitary facilities are inadequate to serve the user population, and the sheer volume of municipal solid waste generated in the country's urban centers is overwhelming (Oteng-Ababio, 2013). The escalating problem of solid waste disposal in Ghana is due to various factors. Problems such as rapid urbanization, financial malpractices of local authorities, and lack of proper planning and management of equipment for solid waste disposal have together exacerbated the already intractable problem of solid waste disposal (Barbereyie, 2009).

It is a fact that the provision of waste management services in any large city is an expensive undertaking that makes huge demands on the finances of local governments (Pacione, 2005). Apart from making investments in capital equipment, money is also required for the day to day operational cost of the service in the procurement of fuel, spare parts and working gear (Barbereyie, 2009). It is clear that to make waste management efficient, local governments and other service providers should have a reliable and sustainable means of obtaining funds to cover the costs of the service. In line with this, it is very important and timely to look at the possibility of cost sharing by households, and to do this the question of demand needs to be analysed for improved solid waste management (Aggrey and Omortor, 2010).

It is also important to know that the sustainability of funds to manage solid waste is contingent on the willingness of people to pay for improved solid waste disposal services. In Ghana, the Local Government Act (Act 462) has made the various district assemblies responsible for managing waste and sanitation (MLGRD, 1999). Unfortunately, most assemblies have under-performed in this direction. Currently, about 50% of most assemblies' recurrent budget (plus government subvention) is spent on waste collection and transportation, with little focus on its treatment and proper disposal (Oteng-Ababio, 2010). In spite of devoting such a large portion of their income to waste collection, most MMDAs still remain heavily indebted to their private contractors.

The Kumasi Metropolitan authorities fund their solid waste management services from a range of sources including government grants, internally generated revenue, specific waste levies and user-fee charges (Oteng-Ababio, 2011). Some recently identified (but yet to be exploited) sources include carbon financing, which is a potential revenue source if projects are designed to reduce emissions of methane, carbon dioxide or other greenhouse gases, and the extended producer responsibility (EPR) mechanism, which is a means of transferring to producers some part of the environmental cost of the end-of-life management of their products (UN – Habitat, 2009).

Admittedly, users' willingness to pay for solid waste disposal services is paramount in sustaining the funding of solid waste disposal services. Therefore, the thrust of this study was to examine the factors that influence the willingness of people to pay for improved solid waste disposal services.

Factors influencing the willingness to pay for improved solid waste disposal services in urban areas

Various studies have shown that people are willing to pay for a better waste disposal services. However, their willingness to pay for such services depends on many socio-demographic factors. Addai and Danso-Abeam (2014), in their analysis of the household's willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana, maintained that age, household size and income maintain an increasing function with consumers' willingness to pay for an improved solid waste management system. Besides, they found females to have a positive influence on consumers' Willingness to Pay and males to have a negative influence on consumers' Willingness to Pay. Again, Ojok *et al.* (2012) assert that sex significantly influences households' willingness to pay for solid waste disposal services. Afroz *et al.* (2009) also stated that variables like household expenditure, quantity of waste generated and level of education also have a significant influence on consumers' Willingness to Pay. Addai and Danso-Abeam (2014), Amfo-Otu *et al.* (2012) and Aggrey and Douglason (2010) all hypothesised that the higher people's level of education, the more they would appreciate the consequences of mishandling solid waste, and the more they would be willing to pay in order to avoid the risk of being victims of an unclean environment. Afroz *et al.* (2009) also emphasised that education relates to a better understanding of the problem of solid waste and hence Willingness to Pay for waste disposal services. All these findings empirically show that there is a positive correlation between educational levels and consumers' Willingness to Pay for improved solid waste disposal services.

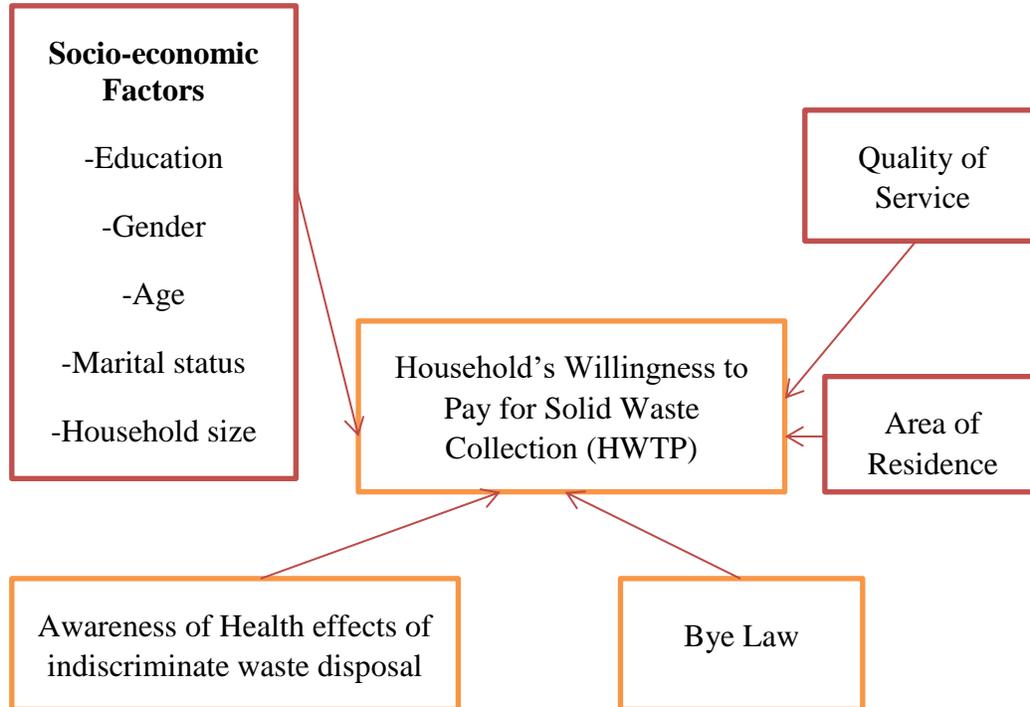
Various results have also shown that age influences the Willingness to Pay for solid waste disposal services. Ekere *et al.* (2010) and Afroz *et al.* (2009) pointed out that holding all other factors constant, older people are willing to pay more than younger people. This means that older citizens make more mature decisions related to assessing health and environmental issues, possibly due to their age, leading them to express a high Willingness to Pay value. Aggrey and Douglason (2010), however, indicated that age negatively affects Willingness to Pay for waste management. They further observed that older people might consider waste collection as the government's responsibility and could be less willing to pay for it, while the younger generation might be more familiar with cost sharing and could be willing to pay.

Household size is another factor that influences Willingness to Pay for waste management. Addai and Danso-Abeam (2014) pointed out that the more the number of people in the household, the more the household will appreciate a clean environment. Besides, Tamura (2005), in analyzing the individual attributes of the demand for solid waste collection in Accra, found that the more income people have, the more willing they are to pay for solid waste collection. This implies that there is a positive correlation between income and people's willingness to Pay for solid waste disposal

services. The quantity of waste generated by a household also influences Willingness to Pay for waste disposal services. Aggrey and Douglasson (2010) pointed out that the higher the generation of waste, the more the household faces the challenges of waste disposal and the greater the willingness to pay.

Satisfaction with waste collection services further influences Willingness to Pay for improved waste management. People who are more satisfied with waste collection services are willing to pay more than dissatisfied people (Afroz *et al.*, 2009 and Kassim and Ali, 2006). This clearly shows that their willingness to pay for waste disposal services is dependent on the quality of services they get. Oteng–Ababio (2010) accentuates this view by establishing that how much people are prepared to pay for their desired improvement depends on the amount they are made to pay, their level of education and kind of employment. With this in mind, the city authorities must take into consideration the socio-economic background of people in an attempt to levy them for using solid waste disposal facilities. Awunyo-Vitor *et al.* (2013) also buttress this assertion that the amount of money people are willing to pay depends on the improved waste disposal services they get and the amount they are asked to pay. Ekere *et al.* (2010) further emphasized that the location of the household is significant and explained the reason for households’ willingness to pay for solid waste management. These causal variables have been illustrated in Figure 1.

Figure 1: A model for the causal links of Households’ Willingness to Pay for Improved Solid Waste Disposal Services



Source: Authors’ own Construct, 2015

From the empirical studies, the following hypotheses were tested in this study:

1. H₁: Education level significantly influences households' willingness to pay for solid waste collection services.
2. H₁: Age significantly influences households' willingness to pay for solid waste collection services.
3. H₁: Marital status significantly influences households' willingness to pay for solid waste collection services.
4. H₁: Household size significantly influences households' willingness to pay for solid waste collection services.
5. H₁: Income level significantly influences households' willingness to pay for solid waste collection services.
6. H₁: Area of residence of households significantly influences households' willingness to pay for solid waste collection services.
7. H₁: Bye-Laws significantly influence households' willingness to pay for solid waste collection services.
8. H₁: Perceived service quality significantly influences households' willingness to pay for solid waste collection services.
9. H₁: Awareness of health implications of indiscriminate disposal of solid waste significantly influences households' willingness to pay for solid waste collection services.

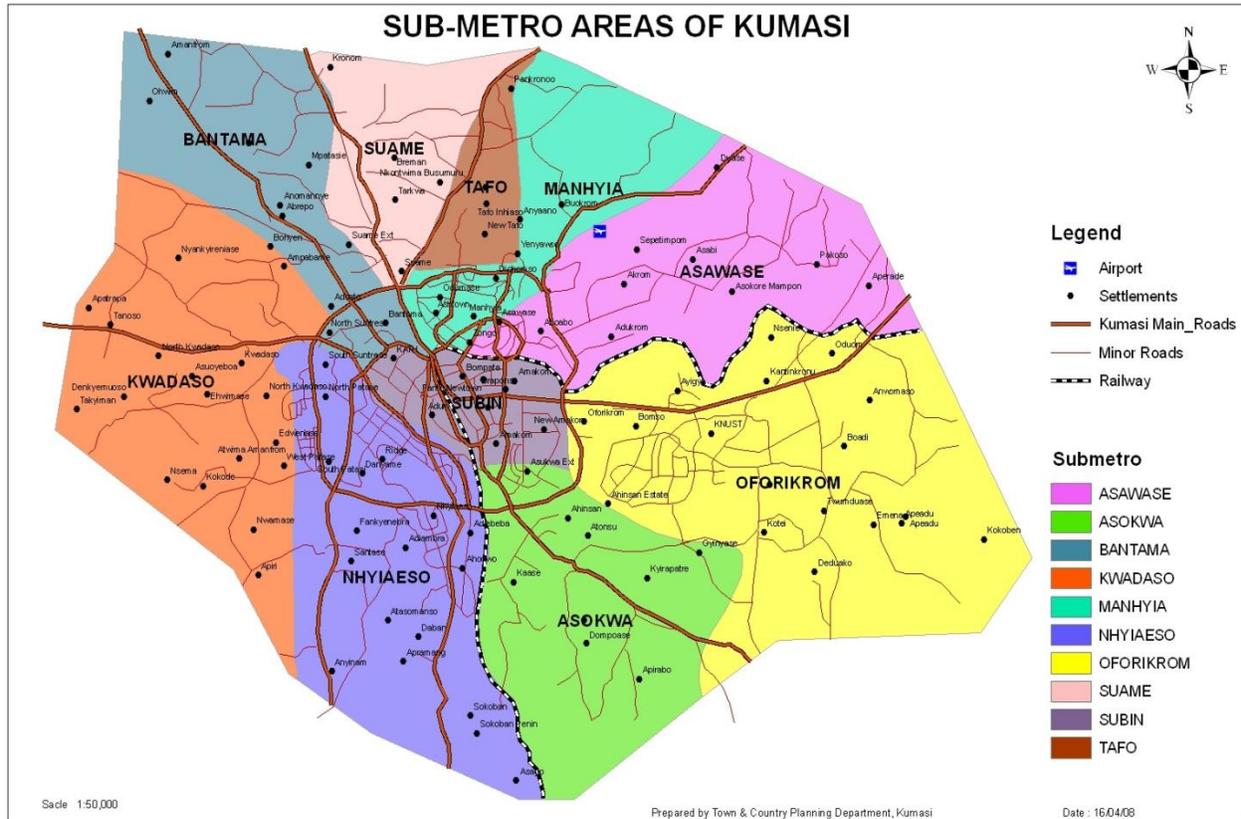
Materials and methods

Description of the Study Area

The study was conducted in Kumasi in 2015. Kumasi is located in the transitional forest zone, about 270km north of the national capital, Accra. Kumasi is bounded to the north by Kwabre District, to the east by Ejisu Juabeng Municipal District, to the west by Atwima Nwabiagya District and to the south by Bosomtwe-Atwima Kwanwoma District.

The unique centrality of Kumasi as a traversing point from all parts of the country also makes it a special place for many to migrate to. Kumasi has a population of 2,035,064 with a growth rate of 5.3% p.a (GSS, 2012). The administrative map of Kumasi Metropolitan Area is presented in Figure 2.

Figure 2: Map of Kumasi Metropolis



Source: Kumasi Metropolitan Assembly, 2015.

Solid Waste Management in Kumasi

Solid waste generated by residents in the Metropolis currently stands at 1500 tons (KMA WMD, 2015) per day, reflecting a per capita generation of 0.6kg with a population of 2,035,64 million (GSS, 2012). A significant volume of this solid waste is generated by the market centers in the Metropolis.

Kumasi has two main methods for collecting and disposing of solid waste substances generated by residents. The methods are the house-to-house collection and the communal collection point. The house-to-house collection method is carried out by a compactor truck that moves from house-to-house to collect garbage. A communal collection point on the other hand has a central container placed at a vantage point within the community; community members commute there to empty their waste into the container. Payments for communal collection services do experience some setbacks due to inadequate interface between service providers and beneficiary but with the introduction of the “Pay as You Dump” concept, this misunderstanding has been settled. In addition to these methods, others use alternative methods. It is a cause for concern that about 10 percent of the households dump their refuse in open spaces. This may be attributed to the inability of some households to pay the amount charged for either house-to-house collection or for dumping

at the communal refuse site. This dumping of waste in open spaces partly explains the poor and filthy environmental condition of certain communities in the Metropolis and the attendant risks of the outbreak of communicable diseases.

Data collection and sampling techniques

The study adopted both qualitative and quantitative methods. A multi stage sampling technique was employed to select different residential locations, households and respondents to inform the study. The study used a cluster sampling technique to select six communities to reflect the different residential locations in the municipal area. The study area was stratified into new locations (new sites) and old locations (old sites). The study used the structure and the description of houses to determine the locations. The new locations were areas considered in the KMA as residential areas with estate houses whilst the old locations were characterized by compound settlements (KMA, Town and Country Planning Department, 2015). The study then selected three communities each from new and old locations, on the basis of convenience. Ahodwo, Danyame and Nhyiaeso were selected as new locations whilst Tafo, Kwadaso and Aboabo were selected for old locations. The study used primary data and the data were gathered with structured questionnaire and informal conversations. Due to the unplanned nature of the Kumasi Metropolitan Area, and also the lack of a household sample frame, the systematic sampling design was adopted to select respondents for questionnaire survey and beginning from one every third house was visited and questionnaires were administered to householders. Questionnaires were administered to gather information on respondents' demographic characteristics and their perceptions of the effectiveness of bye laws, quality of waste collection services, among others. Informal conversations held for both men and women within the different residential locations solicited information on participants' perceptions of the quality of solid waste collection services provided and their willingness to pay for solid waste disposal services. Quantitative data provided trends and patterns on how some demographic variables such as place of residence influenced the willingness of respondents to pay for solid waste collection services. Qualitative data captured the reality and experiences of participants regarding the quality of service offered by the different service providers in the Kumasi Metropolitan Area. The population of households for the communities selected for the questionnaire survey is shown in Table 1.

Table 1: Population of Households in the Selected Communities in the Kumasi Metropolis

Communities	Population of Households
Tafo	11,092
Aboabo	6,696
Kwadoso	4,484
Ahodwo	2,113
Danyame	1,094
Nhyiaeso	1,883
Total	27,462

Source: KMA, Town and Country Planning Department, 2015

The study adopted Gomez and Jones (2010) as in equation 1 to calculate the sample size. In all, 394 households were selected from the study areas. On the basis of proportional representation, 159 households, 96 households, 64 households, 30 households, 16 households and 29 households were sampled from Tafo, Aboabo, Kwadaso, Ahodwo, Danyame and Nyiaeso respectively. Therefore, 319 respondents were from old sites and 75 respondents were from new sites.

Descriptive statistics such as frequency distribution tables were used to describe the socio-economic characteristics of respondents. Logit regression was used to estimate the relative impacts of residents' perceptions of the effectiveness of bye laws and the quality services, their awareness of health hazards of indiscriminate waste disposal, areas of residence and some socio-demographic variables on residents' willingness to pay for waste disposal. The socio-demographic factors considered were sex, education, income, religion, household size and marital status. Four respondents each (including 2 females and 2 males) were engaged in informal conversations in each of the communities selected for the questionnaire study. Data obtained from informal conversations are presented in summaries supported with quotations which explained trends and relationships revealed by the questionnaire data.

Model Specifications

In this survey, the Binary Logit model was estimated. The model measures the probability that residents are willing to pay for waste disposal or not. The logit model has been used in similar studies such as Awunyo-Vitor *et al.* (2013), Oteng-Ababio (2010), Afroz *et al.* (2009), Adepoju and Salamonu (undated), Chuen-Khee and Othman (2002). Many of these studies provided evidence that households are willing to pay a significant amount for the provision of better solid waste disposal services. It must, however, be stated here that other discrete-choice models such as probit, weibit, bivariate, ordered, and multinomial, among others, could have been equally used in this study (Aggrey and Douglason 2010). However, the Logit model was used in this study because the dependent variable was binary. This logit model is used for prediction of the probability of occurrence of an event by fitting data to a logistic function (Amfo-Otu *et al.*, 2012). The Logit model is specified below.

$$P_i = \Pr(y_i = 1) = \frac{e^{x\beta}}{1 + e^{x\beta}}$$

Based on the above formulations, the model was therefore stated mathematically as:

Xβ for the model:

$$WTP = \beta_0 + \beta_1QS + \beta_2BL + \beta_3HE + \beta_4A + \beta_5MS + \beta_6E + \beta_7HS + \beta_8R + \beta_9Y + \beta_{10}RA + \mu_0$$

Where,

WTP = Willingness to pay for waste disposal (1 for Yes; 0 for No)

QS = Quality of services consideration (perception on quality of waste disposal services provided by both private companies and Waste Management Department, KMA) [1 for good quality service; 0 for poor quality services]

BL = Bye laws (perception on effectiveness of bye law on sanctioning of indiscriminate waste disposal) [1 for perceived effective bye laws; 0 for perceived ineffective bye laws]

HE = Health effect of waste (perception of effects of poor waste disposal [1 for awareness of health effects of indiscriminate waste disposal; 0 for unawareness of health effect of indiscriminate waste disposal])

G = Gender (1 for male; 0 for female)

A = Age (years)

MS = Marital status (Single, married, divorced and widowed but single was a controlled variable)

Y = income (average monthly income)

E = Educational level (no formal education, basic education, secondary education and tertiary education but no formal education was the controlled variable)

HS = Household Size (number)

RA = Areas of Residence (1 for new sites; 0 for old sites)

$\mu_{0...10}$ = Stochastic term (include all omitted variables that can influence the dependent variables)

The variables used in the model have been empirically proven to influence willingness to pay for solid waste disposal services in other studies in different geographical areas: age (Aggrey and Douglason, 2010, Afroz *et al.*, 2009), household size (Addai and Danso-Abeam, 2014, Awunyo-Vitor *et al.*, 2013, Oteng-Ababio, 2010 and Tamura, 2005), quality of service (Oteng-Ababio, 2010, Afroz *et al.*, 2009, Kassim and Ali, 2006), income level (Addai- Danso-Abeam, 2014, Tamura, 2005), gender (Addai and Danso-Abeam ,2014), educational level (Aggrey and Douglason, 2010, Afroz *et al.*, 2009). The study, moreover, introduced additional variables (area of residence, bye laws and awareness of health effect of indiscriminate waste disposal).

Results and discussions

Socio-demographic Characteristics of Respondents

The socio-demographic characteristics distribution of respondents is shown in Table 2. Females accounted for the majority with 61.2%, and this is due to the fact that women are mostly in charge of waste disposal in various homes. As a result, the study focused more on women and in cases where both spouse were available, women were considered. Most of the respondents (47.0%) were within the age range of 41 to 50 years whilst 9.6% were below 30 years. The age distribution of respondents indicates economic active population. This implies that respondents can work to earn income to pay for waste disposal services. All except 13.2% of the respondents had some formal education; 25.7% had tertiary education. This suggests that the respondents can understand and appreciate the importance of paying for waste disposal services. The household size distribution showed that 49.0% of the respondents had between 3 and 5 household members, 26.9% had below

3 members and 24.1% had above 5 members. The average household size of respondents (3.9) was higher than the metropolis' average household size of 3.8 (GSS, 2012). This suggests that respondents would generate more waste and this calls for effective waste disposal services in their communities. The responses on income distribution showed that 28.9% had average monthly income below GH¢250 and 14% had average monthly income above GH¢1000. The rest had average monthly income between GH¢250 and GH¢1000. When the average monthly income of respondents was compared to the lower and upper poverty lines in Ghana, it was noticed that the respondents were not poor. This implies that the respondents would be able to pay for waste disposal fees.

Table 2: Socio-demographic Characteristics Distribution of Respondents

Socio-demographic Variable		Frequency	Percentage	Mean
Sex	Male	153	38.8	42.7
	Female	241	61.2	
Age	≤30	39	9.8	42.7
	31-40	112	28.4	
	41-50	185	47.0	
	51-60	58	15.0	
	≥60	52	13.2	
Education	No formal education	97	24.6	25.7
	Basic education	144	36.5	
	Secondary education	101	25.7	
	Tertiary education	52	13.2	
Household Size	≤3	106	26.9	42.7
	3-5	193	49.0	
	≥5	95	24.1	
Average Monthly income (GH¢)	≤250	114	28.9	569
	250-500	137	34.8	
	500-1000	86	21.8	
	≥1000	57	14.5	
Total		394	100.0	

Source: Field Data, 2015

Factors Influencing the Willingness to Pay for Solid Waste Disposal Services

The Logit regression results are shown in Table 3. An interpretation of the coefficients is done by exponentiating the coefficients and interpreting them as odd ratios.

The results showed that respondents were thirty two times ($e^{3.466} = 32.0084$; $p=0.009$) more willing to pay for waste disposal services when they perceived the services to be of good quality than when solid waste disposal services are perceived to be poor. Thus, respondents appear to be

willing to pay for solid waste disposal services if services were of good quality, as expressed by these respondents:

Why will I not pay for my waste to be collected? I will and even pay more if the waste collection company will provide us with proper waste storage containers, come to collect the waste from our homes once a week per the agreement they made with us and on time instead of once every two weeks or a month, giving excuses that their vehicle broke down.....meanwhile, the waste collection service providers charge the same fee even if they come to collect the waste once in a month. (Respondent, New Sites).

There is only one container which gets full up quickly and overflows with waste because the container is not emptied by the KMA immediately it is full. Residents dump their waste around the full up container which is bad. If KMA will charge residents a fee so that two containers are provided or the container is emptied immediately it is full, I will be and I know most people living here will be willing to even pay more for their waste to be collected by waste collection vehicles from their home. (Respondent, Old Sites).

The basic reason for these responses was that they wanted value for money for the services they were paying for. This is not different from the views of Oteng-Ababio (2010), Afroz *et al.* (2009) and Kassim and Ali (2006) that when people are given better services, they will be willing to pay more for solid waste disposal services.

Table 3 shows that respondents are seventeen times ($e^{2.838} = 17.0816$; $p=0.024$) more willing to pay for waste disposal when they perceive bye-laws on waste management to be effective than when bye-laws are perceived not to be effective. The basic reason respondents gave was the fear of being prosecuted in sanitation courts should they flout the bye-laws, as expressed by these residents:

Why will I not dump anywhere, after all it is cheaper because I will not pay any amount and moreover nothing will be done to me.....but if I am arrested and prosecuted at KMA sanitation court for dumping at prohibited places I will fear to dump anywhere next time and will resort to patronizing waste management services available. (Respondent, New Sites).

If people are arrested, sent to court and fined heavily for dumping waste into gutters, which later cause flooding, they will refrain from doing so but for now no one is enforcing any laws on sanitation. (Respondent, Old Sites).

Respondents explained that when bye-laws are effectively enforced, it will force them to pay for solid waste disposal services. This is because should a person contravene any of the bye-laws, he or she would be sent to the sanitation court to be prosecuted.

From Table 3, area of residence significantly influences people's willingness to pay for waste disposal. Respondents in the new sites were eight times ($e^{2.118} = 8.3145$; $p=0.016$) more willing to pay for waste disposal services than those in old sites. This is because respondents in the new sites

received better services (timely collection of waste by waste companies, adequate provision of waste bins) than those in the old sites. Besides, respondents in the New Sites had strong economic backgrounds and so they were better able to pay for solid waste disposal services than those in the Old Sites. And as earlier revealed (refer to Table 3), when people are more satisfied with waste disposal services, they will be willing to pay more. This finding supports that of Ekere *et al.* (2010) in a similar study conducted in the Lake Victoria Crescent Region in Uganda.

Income had a significant positive impact on willingness to pay for waste disposal services. Respondents were four times ($e^{1.336}=3.8038$; $p=0.015$) more willing to pay for their waste disposal services with an increase in income. This confirms the views of Awunyo-Vitor *et al.* (2013), Oteng-Ababio (2010) and Adepoju and Salimonu (undated). This implies that holding other variables constant, a proportionate increase in income will lead to a more than proportionate increase in willingness to pay for waste disposal services.

Educational level is critical in willingness to pay for waste disposal services. The willingness to pay for waste disposal services was not statistically significantly different between respondents with no formal education and those with basic education ($e^{1.416}=4.1206$; $p=0.124$), or between respondents with no formal education and those with secondary education ($e^{0.088}=1.0920$; $p=0.055$). However, there was a statistically significant difference in willingness to pay for waste disposal services between respondents without formal education and respondents with tertiary education. Respondents with tertiary education were four times ($e^{1.297} = 3.6583$; $p=0.033$) more willing to pay for waste disposal services than respondents without formal education. This is because respondents with tertiary education had jobs and so could easily generate income to pay for solid waste disposal services as compared to those with no formal education. This is consistent with findings from other studies that people with higher education are better able to understand and appreciate waste disposal services and so they would be more willing to pay for solid waste disposal services (Addai and Danso-Abeam, 2014, Aggrey and Douglasson, 2010 and Oteng-Ababio, 2010).

However, the respondents who perceived indiscriminate disposal of solid waste as harmful were 6 times ($e^{1.821}=6.1780$; $p=0.217$) insignificantly willing to pay for solid waste disposal services than those who did not perceive indiscriminate disposal of solid waste as harmful. Demographic characteristics with emphasis on sex ($e^{-2.091}=0.1236$; $p=0.241$), household size ($e^{-0.489}=0.6132$; $p=0.582$), and marital status (married: $e^{-0.373}=0.6887$; $p=0.480$; divorced: $e^{-21.001}=7.5750$; $p=0.999$; widowed: $e^{-45.760}=1.3387$, $p=0.999$) and religion ($e^{0.204}=1.2263$; $p=0.81$) did not significantly matter in the respondents' willingness to pay for waste disposal services. The findings on impact of demographic characteristics on willingness to pay for solid waste disposal services contradict studies by Addai and Danso-Abeam (2014) who concluded that gender significantly influences willingness to pay for solid waste disposal service. Addai and Danso-Abeam (2014), Awunyo-Vitor *et al.* (2013), Oteng-Ababio (2010) and Tamura (2005) reported that household size significantly influences the willingness to pay for solid waste disposal services, but this study found otherwise.

The Cox and Snell's R^2 and Nagelkerke's R^2 were obtained to measure the strength of the association between the dependent variable (willingness to pay for solid waste services) and the explanatory variables. These two estimated R^2 s were found to be high, accounting for 0.589 for Cox and Snell's R^2 and 0.825 for Nagelkerke's R^2 , indicating the high explanatory power of the model. The Omnibus test of the model coefficients shows the Chi-square test- statistic for testing the null hypothesis that all the coefficients of the predictors are equal to zero (0) is $\chi^2 = 97.853$ with a significant level of 0.001, indicating that the logit regression model was meaningful in the sense that the dependent variable is related to each specified explanatory variable and the overall model is statistically significant. This is presented in Table 3.

Table 3: The SPSS Logit Regression Result

Explanatory variables	Coefficient	P- value
New Site	2.118	0.016
Quality of Services Perception	3.466	0.009
Bye-laws Effectiveness Perception	2.383	0.024
Hazardous Effects of Waste Perception	1.821	0.217
Sex	-2.091	0.241
Average Monthly Income	1.336	0.015
Christian	0.204	0.813
Basic Education	1.416	0.124
Secondary Education	0.088	0.055
Tertiary Education	1.297	0.033
Household Size	-0.489	0.582
Married	-0.373	0.480
Divorced	-21.061	0.999
Widowed	-45.760	0.999
Constant	-2.360	0.000
Cox and Snell R-square=0.589: Nagelkerke R- square=0.825: Chi-square=97.853: P-value=0.001		

Source: Field Data, 2015: *Binary Logit statistic is significant at the 0.05 level*

Quality of Services Provided by Solid Waste Service Providers

Table 4 indicates that the majority (58.1%) perceived solid waste collection services provided by their service providers to be of good quality, with 41.9% indicating otherwise. Clients of informal waste collectors (Kayabola) perceived services provided to them as being of good quality (80.6%), with the remaining perceiving the services not to be of good quality (19.4%). Clients of solid waste private companies perceived the services they received as being of good quality (60.0%) and not to be of good quality (40.0%). Respondents who resorted to WMD of KMA perceived the services they received to be of good quality (44.5%) and not to be of good quality (55.5%). The quality of solid waste disposal service respondents received was statistically significantly influenced by mode of collection [χ^2 ($df=2$; $N=394$)= 45.548 ; $=P<0.01$]. Informal conversations with residents

confirmed the trend as shown above on how they perceived the quality of waste management services that are provided in the two different areas of residence:

In this community we are provided with communal containers by KMA and when the container is full people dump on the ground and it takes KMA days to pick up overflowing container.....the flies, rodents etc. is a threat to public health, with this you can see that the quality of the communal container service by KMA is very poor. (Respondent, Old Sites).

Over here we have the private waste collector. They have provided us with free plastic waste collection bins. The company tries to collect our refuse right from our door step at least once every week. Even if they do not come on the day they should come, we keep the refuse safe in containers, polythene bags or sacks and they normally come the following week for them....they normally inform us if their vehicle breaks down so we are aware and store the waste properly until they come for it. Because we know they will surely come for the waste we keep them and we do not throw them on the streets and gutters. So far I can say it has kept the area clean and their services are good because they are mostly reliable. The only problem is that we do not separate rubber and cans from food waste. (Respondent, New Sites).

The Kayabola boys come to collect our waste in the morning and they are very reliable and cheap. The service is in the form of 'pay as you go' you pay them then they collect the refuse. We do not pay monthly so if they do not come we do not pay. But because that is the source of income for the Kayabola boys they always come to collect the waste. (Respondent, Old Sites).

As a result, respondents who patronized both informal and formal private waste collection services have confidence in their service providers. They, therefore, perceived the service provided them as being of good quality compared to those who patronize the service provided by the Metropolitan Assembly (KMA).

Table 4: Quality of Solid Waste Collection Services and Service Providers

Waste Collection Service Providers	I receive quality service		Total	P-value
	No	Yes		
Informal waste collectors(Kayabola)	25 (19.4%)	104 (80.6%)	129(100.0%)	0.000
Private companies	18(40.0%)	27 (60.0%)	45(100.0%)	
WMD (KMA)	122 (55.5%)	98 (44.5%)	220 (100.0%)	
Total	165(41.9%)	229(58.1%)	394 (100.0)	

Source: Field Data, 2015: *Chi-square statistic is significant at the 0.05 level * Result is based on Fisher's exact test

Although the informal private waste collectors do not have the necessary equipment and protective gear for their work, as long as they are reliable and their fee is cheaper, clients perceive their services as being of good quality. However, clients of formal private waste collection companies

perceived the service to be of good quality because they were informed of changes to their service at specific points in time and provided with waste collection containers. Thus, a majority of them were satisfied with the service and were willing to pay more for further service improvement and even suggested separation of organic and inorganic waste to enable recycling. Clients of KMA's communal container service linked their dissatisfaction to the environmental and health hazards created as a result of delays in emptying overflowed containers.

Conclusion and recommendations

The study employed the Logit regression model to estimate the relative impacts of residents' perception of effectiveness of bye-laws, quality of services, awareness of health hazards of indiscriminate waste disposal, areas of residence and some socio-demographic variables on residents' willingness to pay for waste disposal services. The results provide a basis for the setting of waste disposal fees by urban authorities given the willingness of a majority of households to pay for such services. The study found that payment for solid waste disposal services was not uncommon among the respondents.

The study further found that perceptions of the quality of the waste collection services provided were linked to the mode of waste collection. The majority of the respondents who had their waste collected from their homes by informal and formal private waste collection service providers considered it to be of good quality compared to those who patronized the communal container waste collection service provided by the Kumasi Municipal Assembly (KMA).

The majority of the respondents were also willing to pay for waste disposal services, particularly when such services are considered to be an improvement on existing ones. Bye-laws, education levels, quality of service, income and area of residence of respondents were discovered to be determinants of household Willingness to Pay for solid waste disposal services in the Kumasi Metropolis. Effective implementation of the sanitation bye-laws and also a re-institution of the sanitation courts to apprehend offenders for improper solid waste disposal must be given a critical attention by the government. In setting solid waste collection fees, urban authorities should pay urgent attention to location and income of residents. It is also recommended that concerted programmes facilitating private investors in waste disposing at the New Sites be intensified; while the Waste Management Department takes control in the old sites so that the payment for this service would be made affordable to encourage those households that are willing to pay in all the areas. In addition, public education campaigns through the mass media could also be adopted in order to properly inform the citizens about the need to patronize the services of solid waste disposal companies, since education has been found to be statistically significant with the willingness to pay for solid waste disposal services.

References

- Addai, N. K. & Danso-Abbeam, G. (2014). Determinants of willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana
- Adepoju, A. A. & salimonu, K. K. (*undated*). Household Willingness to Pay for Improved Solid Waste Management in Osun State, Nigeria
- Afroz, R., Hanaki, K. & Hasegawa-Kurusu, K. (2009). Willingness to pay for waste management improvement in Daka city, Bangladesh. *Journal of Environment Management* 90 (2009) 492-502
- Aggrey, N. & Douglason, G.O. (2010). Determinants of willingness to pay for solid waste management in Kampala City. *Current Research Journal of Economic Theory*, 2(3), 119-122.
- Amfo-Otu, R., Debrah W.E., Adjei K. P. & Akpah-Yeboah, S. (2012). Willingness to pay for solid waste collection in semi-rural Ghana: Logit estimation. *International Journal of Multidisciplinary Research* Vol. 2 Issue 7, July 2012, ISSN 2231-5780
- Awunyo-Vitor, D., Shaibu, I. & Jasaw, G.S. (2013). Urban Households' Willingness to Pay for Improved Solid Waste Disposal Services in Kumasi Metropolis, Ghana. *Hindawi Publishing Corporation Urban Studies Research* Volume 2013, Article ID 659425, 8 pages <http://dx.doi.org/10.1155/2013/659425>
- Baabereyir, A. (2009). Urban environmental problems in Ghana: a case study of social and environmental injustice in solid waste management in Accra and Sekondi Takoradi. *PhD Thesis* submitted to the School of Geography, University of Nottingham.
- Ekere, W., Mugisha, J. & Drake, L. (2010). Willingness to pay for sound waste management in urban and peri-urban areas of the Lake Victoria crescent region Uganda. Second RUFORUM Biennial Meeting 20-24 September 2010, Entebbe, Uganda.
- Ghana statistical service. (2012). 2010 Ghana Housing and Population Census Report. Summary Report of final results. Accra: Ghana Statistical Service Ghana statistical service.
- Gomez, B. & Jones, J. P. (2010). *Research Methods in Geography: A Critical Introduction*. A John Wiley & Sons, Ltd., Publication, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom.
- Kassim, S.M. & Ali, M. (2006). Solid Waste Collection by The Private Sector: Households' Perspective-Findings From A Study In Dar Er Salaam City, Tanzania. *Habitat International*, 30, 301-309.

- MLGRD (Ministry of Local Government and Rural Development). (1999). *National Environmental Sanitation Policy*. Accra: Ministry of Local Government and Rural Development.
- Ojok, J., Koech. M.K., Tole M., & OkotOkumu, J. (2012). Households' Willingness to Pay for Improved Municipal Solid Waste Management Services in Kampala, Uganda. *Science Journal of Environmental Engineering Research* ISSN: 2276-7495
- Oteng-Ababio M. (2013). Unscripted (in) justice: unequal exposure to ecological hazards in Metropolitan Accra. *J of Environ and Plan A* 45(5):1199–1218
- Oteng-Ababio, M. (2011). Governance Crisis or Attitudinal Challenges? Generation, Collection, Storage and Transportation of Solid Waste in Ghana. *Integrated Waste Management – Vol. 1*
- Oteng-Ababio, M. (2010). Solid waste management in Ghana: Willingness to pay for improved services. *Ghana Journal of Geography Vol. 2*.
- Oteng-Ababio, M. (2009). Private sector involvement in solid waste management in the Greater Accra Metropolitan Area in Ghana. *Waste Management and Research, Vol. 20, No.4 PP 322 - 329*
- Pacione, M. (2005). *Urban Geography. A Global Perspective*. 2nd. Edition. London and New York. Routedge, Taylor & Francis Group
- Tamura K. (2005). *The demand for solid waste collection in Accra (Ghana)*. Unpublished MA Dissertation submitted to the Faculty of the Centre for International Studies of Ohio University.
- United Nations Centre for Human Settlements (UN-HABITAT) (2009). *Collection of Municipal Solid Waste in Developing Countries. UN-HABITAT*.