



HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN TAMALE METROPOLITAN AREA, NORTHERN GHANA

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Abstract

This paper examined households' willingness to pay for improved solid waste management service in the Tamale Metropolitan Area in Northern Region of Ghana. The contingent valuation method (CVM) was used to identify the willingness to pay (WTP), while an ordered probit model was estimated to determine the factors influencing such willingness to pay. We found that a significant number of the respondents were willing to pay for the improved services, the amount ranging from GHC 2 to GHC 25 per monthly collection. Also, households' WTP were positive and significantly influenced by the sex, age, marital status and education of the household head as well as household income. A key policy implication of this result is that a flat rate cannot be charged across households. Poorer and uneducated households should be charged a lower rate than relatively rich and educated households.

Keywords: *Ordered probit model, Contingent valuation method, Willingness to pay, Ghana, households.*

Introduction

Solid waste management is one of the developmental challenges facing city authorities worldwide, especially in most developing countries (UNEP, 2013). Poor solid waste management, coupled with inadequate financial resources, has led to indiscriminate dumping of solid waste into open spaces and drainages, choking drains and causing flooding, environment pollution and public health issues (UNEP, 2013; Perera, 2003).

In Ghana, the problem of poor solid waste management is exacerbated by rapid urbanization and population growth which have increased solid waste generation, collection and disposal, and the cost of managing it (Oteng-Ababio, 2011). This has placed a huge financial burden on local authorities, making it difficult for them to manage solid waste sustainably (Crook and Ayee, 2006; Oteng-Ababio, 2010). The recent cholera outbreak (between 2014 to 2015) which affected 28,975 people and killed 243 Ghanaians (World Health Organization, 2015) as well as the 3rd June 2015 flooding in Accra which claimed over 160 lives and destroyed properties worth millions of Ghana Cedis (The Ghanaian Times, June 10, 2015:4) are a typical

reflection of poor solid waste management in Ghana. In addition, sanitation related diseases such as malaria, diarrhoea and typhoid fever account for 70% -80% of out-patient cases at health facilities in Ghana (MLGRD, 2010). However, various concepts have been developed over the years to provide the basis for improving solid waste management. But, these have not yielded the needed impact. The involvement of the private sector, through privatization and franchising in the 1990s (MLGRD, 1999) to provide solid waste management services, has not been able to solve the problem, even though the collection rate has increased by 25% (Oteng-Ababio, 2010).

In the case of Tamale Metropolitan Area, the Waste Management Department (WMD) of the Tamale Metropolitan Assembly was solely responsible for delivery of solid waste services in the metropolis up until 2002 where a franchise contract was signed with Sava Waste and five companies in 2005 (Oduro-Kwarteng, 2011). The involvement of the private sector in the delivery of solid waste services was to reduce the financial burden on the Assembly, increase cost recovery

and also provide effective and efficient solid waste services (Oduro-Kwarteng, 2011). But the involvement of the private sector has not resolved the solid waste menace significantly even though solid waste collection coverage has increased. The metropolis is still experiencing low sanitary conditions. The low sanitary condition experienced in the metropolis has partly been attributed to financial constraints. For instance, even though Tamale Metropolitan Assembly spent 42.8% (GH 1,711,984.2) of its revenue in 2010 on solid waste collection, transportation and disposal, it is still heavily indebted to private waste contractors (Puopiel, 2010). As a result of this, solid waste contractors do not have adequate financial resources to render quality services to their customers, while the service receiver on the other hand is unwilling to pay for poor services. Secondly, solid waste financing has become a heavy burden on local authorities because of the free services enjoyed by low to middle income areas for solid waste disposal (Puopiel, 2010). For a sustainable financing of solid waste management, it has been suggested that service users, especially households, who are the primary generators of a significant proportion of solid waste, should contribute to solid waste financing by paying for the solid waste they generate. It is against this backdrop that a study to investigate households' willingness or otherwise to pay for improve solid waste collection is worthwhile.

There are two levels of solid waste services in Tamale metropolis: House-to-house (HtH) and communal container centre (CCC). The HtH solid waste collection services operate in middle to high income areas with good accessible roads. Under this system, the residents pay directly to the private waste service provider. On the other hand, the CCC is operated in low to middle income areas where residents carry and dispose of their solid waste free of charge. Under this system, the Assembly pays for the disposal of the solid waste. However, the continuous payment or subsidization of solid waste services by the Assembly, especially for those using the CCC is not sustainable, because solid waste generation continues to increase, making it more expensive to manage. Hence the implementation and enforcement of the "polluter-pays-policy", where solid waste generators are required to pay fully for the disposal of the solid wastes they generate. This however, means that the collection process (e.g. in terms of the frequency of waste collection) would be improved by the private

company or the Assembly. The idea is that this would reduce the current financial burden on the Assembly and make available funds for other competing developmental needs of the metropolis. The objective of this current study was therefore to investigate households' willingness to pay for the improved services.

The issue of households' willingness to pay for improved solid waste management have been extensively researched into in most developing countries. But the findings from these studies are rather inconsistent and mixed. In most studies (Assa, 2013; Awunyo-Vitor, *et.al.* 2013; Afroz & Masud, 2011 and Rahji & Oloruntoba, 2009;), education and income have positive effects on WTP. However, while Alhassan & Mohammed (2013) and Oteng-Ababio (2010b) found that women were more willing to pay for solid waste services, Afroz, (2011) and Assa, (2013) found no statistically significant relationship between willingness to pay and gender in their studies in Bangladesh and Malawi respectively. Similarly, in the studies by Awunyo-Vitor, *et.al.* (2013), Assa (2013) and Afroz, (2011), older people were more willing to pay for improved solid waste services than younger people. In contrast, Rahji & Oloruntoba (2009), Amiga, (2002), Banga, *et.al.* (2011) and Hagos, *et.al.* (2012) found that younger people were more willing to pay for improved solid waste services.

Some of the above mentioned studies (Awunyo-Vitor, *et.al.*, 2013; Hagos, *et.al.*, 2012; Afroz, 2011) have found intrinsic variables (e.g. households' attitude towards solid waste), situational variables (e.g. distance to dumping site) and households' awareness of environmental quality as significant determinants of households' willingness to pay for improved solid waste management. For instance, Hagos, *et.al.* (2012) and Afroz, (2011) found that households' with greater awareness of environmental quality were more willing to pay for improved solid waste services than those with limited or no awareness in Ethiopia and Bangladesh respectively, while Awunyo-Vitor, *et.al.*, (2013) also found that the amount Ghanaian households were willing to pay for improved solid waste services increased with the distance to the dump site. From the above literature review, the determinants of WTP for improved solid waste management are location and time specific, therefore this study seeks to contribute to knowledge by also examining the factors which affect

household's WTP for improved solid waste management in Tamale Metropolitan area, Ghana.

The rest of the paper is organised as follows: materials and methods, followed by the discussion of the main findings and ends with the conclusion and policy implications

MATERIALS AND METHODS

Theoretical framework and specification of empirical model

Microeconomic consumer theory is the basic theory underlying individual preferences and decision making (Ben-Arkiva & Lerman, 1985). Consumer demand, as measured by the quantity of the solid waste management service consumed, is a function of the prices faced, real income and a set of consumer characteristics. The consumer is faced with a budget that defines the choice set and has to choose some quantities of goods and services that give the highest satisfaction for a given limited income. Most WTP studies adopt the CVM. The

CVM is employed to ask consumers about a current situation compared with an alternative one and their willingness to pay for the one they think would give them a higher net satisfaction. In the context of this study, consumers are asked their willingness or otherwise, to pay for an improved solid waste collection system and if they are willing how much they are willing to pay in excess of what they are paying currently. Thus the CVM stimulates a market for non-marketed goods and obtains a value for that good, contingent on a hypothetical market described during the survey. Owusu & Anifori (2013) stressed that consumers are allowed to value the product contingent on the market in order to solicit their WTP.

The CVM has its econometric basis in random utility model (RUM) (Thurstone, 1927; Mc Fadden, 1973). Like the probit model, the ordered probit model rests on the random utility model (Ferrara and Missions, 2011). In this approach, the utility of a choice consists of a deterministic component ($\beta'X_i$) and an error term (ε_i) which is independent of the deterministic components and follows a predetermined distribution. The ordered probit model is given as follows:

$$Y_i^* = \beta'X_i + \varepsilon_i \quad (1)$$

where X_i is the vector of explanatory variables influencing respondents choice, β' is a vector of parameters yet to be estimated, ε_i is the random error term assumed to follow a standard normal distribution (Greene, 2002) and Y_i^* is a vector of respondents' utility derived from consuming a particular good or services which is unobserved, but what is observed is Y and classified as:

$$Y = \begin{cases} 0, & \text{if } Y_i^* < \pi_1 \\ 1, & \text{if } \pi_1 < Y_i^* < \pi_2 \\ 2, & \text{if } \pi_2 < Y_i^* < \pi_3 \\ 3, & \text{if } \pi_3 < Y_i^* \end{cases} \quad (2)$$

Where π_1 , π_2 and π_3 are the classified threshold values, with the associated probabilities of the classified categories of the ordered probit model expressed below:

$$\begin{aligned} Pr(Y = 0|X, \beta) &= \Phi(\pi_1 - X'\beta) \\ Pr(Y = 1|X, \beta) &= \Phi(\pi_2 - X'\beta) - \Phi(\pi_1 - X'\beta) \\ Pr(Y = 2|X, \beta) &= \Phi(\pi_3 - X'\beta) - \Phi(\pi_2 - X'\beta) \\ Pr(Y = 3|X, \beta) &= 1 - \Phi(\pi_3 - X'\beta) \end{aligned} \quad (3)$$

where Φ is the standard normal cumulative distribution function which ensures that the predicted outcome of the model always lies between 0 and 1 (Greene, 2002).

Empirical model

From the above theoretical model the empirical model to be estimated to investigate the factors influencing households' willingness to pay for improved solid waste management services are stated as follows:

$$WTP = \beta_0 + \beta_1 Sex + \beta_2 Marital\ status + \beta_3 Age + \beta_4 Education + \beta_5 Income + \beta_6 Dependants + \beta_7 Tenancy + \beta_8 Awareness + u \quad (4)$$

Table 1 gives the description as well as the expected signs of the socioeconomic variables believed to influence households' willingness to pay for improved solid waste management in the study area.

Table 1: Variables use in the ordered probit model

Variables	Description	Expected sign
Sex	Dummy: 1=male and 0=female	-
Marital status	Dummy: 1=married, 0=otherwise	+
Age	Years	-
Education	Number of years in education	+
Household income	Household monthly income in GH Cedis	+
Dependants	No of persons depending on respondents	+
Tenancy	Dummy: 1= owner occupied and 0, otherwise	+
Awareness	Dummy: 1=Awareness of improved solid waste management and 0, otherwise.	+

Study area

The study was conducted in Tamale Metropolitan Area (TaMA), located in the Northern Region of Ghana with its capital in Tamale. Tamale metropolis was selected for the study because of rapid urbanization and expansion of the metropolis which has led to enormous increase in solid waste generation (Puopiel, 2010; GSS, 2012). According to the 2010 Population and Housing Census (PHC), the population of Tamale metropolis is estimated to be 371,352 with a higher proportion (80.8%) living in urban localities (GSS, 2012). It has a total estimated land size of 750 km sq., geographically lies between latitude 9°16 and 9° 34 North and longitudes 0° 36 and 0° 57

West and located within the Savannah woodland Region of the country.

Data collection and sampling method

A direct face-to-face interview was employed in this study to elicit information by using a structured questionnaire because it is the most reliable approach in contingent valuation studies (Carson *et al.*, 1996). Three-stage sampling was used to select the respondents for the study. At the first stage, Tamale metropolis was selected because apart from economic reasons, it is one of the fastest growing cities in Ghana and going through all the challenges of urbanisation and population pressure. At

the second stage, the communities were stratified into three strata based on the method of solid waste collection and/or disposal practiced. These were HtH solid waste collection (received in high and middle income areas); communal container centre (received by middle to low income areas); and others (i.e. improper solid waste disposal like dumping indiscriminately, burning, burying etc.) commonly practised in low income areas. This method ensured that all income groups and the various method of solid waste disposal were included, so that the samples represent the study population. One community was randomly selected from each stratum and these were Vittin Estates (HtH), Ghanasco (communal central container) and Nyohini (communal central container and others) making a total of three communities. Finally, systematic sampling was used to select households taking into consideration the population of the selected communities, resulting in the following household sample allocations: Vittin Estates (20), Ghanasco (40) and Nyohini (60), making a total of 120 respondents. Even though the unit of analysis was the household, the questionnaire was administered to the household head/spouse or any available adult.

Design of the questionnaire

The questionnaire had three sections. The first section included questions on household awareness of improved solid waste management, while the second section included questions on household WTP using contingent valuation. It described the current solid waste management method, problems and the new hypothetical solid waste management programme. The open-ended and iterative or bidding games approaches (Anaman and Lellyett, 1996) were used to elicit respondents' WTP, because it mimics the bargaining process that occurs in regular markets in developing countries like Ghana. The third section collected information on household socio-economic characteristics. The improved solid waste management programme had the following attributes: provide free waste bin for temporary storage of solid waste; house-to-house solid waste collection services; and change in collection frequency from irregular (current situation) to once weekly regular.

Contingent valuation questionnaire for Solid Waste management

In the iterative or bidding games format, households were asked to state the amount they were willing to pay and then higher bids were progressively offered until a maximum WTP was reached. After the description of the current situation of solid waste management in the study area, the new improved solid waste management programme was presented to the respondents. The respondents who were using the CCC (This is a new product for this category of service receivers because they were not having house-to-house collection service nor provided with free waste bins and were enjoying free services) were asked the following question:

“Implementing this new improved solid waste management programme involves cost; therefore, households are required to pay for this service. The payment vehicle is such that service recipients make direct payment to the service providers the same way they have been paying for other utilities like electricity, water etc. Would your household be willing to pay for this new improved solid waste management service given your budget constraints?”

While respondents who were using the HtH service were asked if they will be willing to pay more for the improved solid waste service (i.e. the service is improved because the collection frequency has improved from once irregular to once regular).

Households, who answered “yes”, were then asked to state the maximum amount of money they were willing to pay in Ghana Cedis. While respondents who answered ‘no’, were asked a follow-up question to establish their reasons for not wanting to pay.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of the households

As shown in Table 2, the sex distribution of the respondents was 45.8% male and 54.2% female. Majority of the respondents (35%) fell within the age bracket of 31-40 years and only 5.8% were more than 60 years. The average age was 37 years and ranged from 20 to 67 years. This suggests that the respondents are young

adults. On average, household size was 5.4 persons per household, ranging from 2 and 14. A greater percentage of the respondents were married (70.8%) while 36.7% had no formal education (36.7%). Also, the highest percentage of the respondents were traders (41.7%) and

1.7 % were unemployed. Most of the households (43.3%) had an income of less than GH 200 per month, and just 3.3% had income range of over GH 1,201 per month. However, 84% of the respondents were living in their own apartments.

Table 2: Socio-economic characteristics of Household heads

Characteristics	Frequency	Percentage
Gender		
Male	55	45.8
Female	65	54.2
Age		
16-20	1	0.8
21-30	36	30
31-40	42	35
41-50	23	19.2
51-60	11	9.2
more than 60	7	5.8
Education		
No formal education	23	36.7
Primary school	17	20
JHS	30	21.7
SHS/Voc./Tech. school	26	10.8
Tertiary education	24	10.8
Occupation		
Public sector	17	14.2
Private sector	19	15.8
Farmer	22	18.3

Trader	50	41.7
Unemployed	2	1.7
Butcher	10	8.3
Income		
Less than GH 200	52	43.3
GH 201-500	34	28.3
GH 501-800	15	12.5
GH 801-1,200	15	12.5
GH 1,201 and above	4	3.3
Marital status		
Married	85	70.8
Single	15	12.5
Divorced	6	5.0
Widowed	14	11.7
Owner occupancy		
Owner occupied	101	84.2
Rented from government	1	0.8
Rented from private	18	15.0

Source: Field survey, 2015.

Type of wastes and awareness/knowledge of solid waste management

The respondents were asked to rank from largest to lowest the type of solid waste generated by their households in a week. The survey revealed that plastic waste was generated in larger volumes with a mean value of 4.4 (Table 3). The second most generated solid waste was food waste (3.7), while glass (0.3) was the least generated solid waste in the study area. When asked who normally collects and disposes of

households' solid waste, the respondents identified wife/mother (47.9 %) and children (43.8 %) to be responsible for this household activity (Table 4). In terms of households' awareness/knowledge of improved solid waste management, 45% of the respondents indicated some knowledge on solid waste management. Among them (100%), the highest percentage of respondents (35.2 %) learned about solid waste

management on radio, followed by Television (31.5%), 20.4% from family members and 3.7% from the Assembly (Table 5).

Concerning the responses on households' willingness to pay for the improved solid waste management programme, most (76.7%) of the respondents were willing to pay showing that the respondents valued the benefits of improved management of solid waste in the

Tamale metropolis (Table 6). The households who were not willing to pay (23.3%) were probed further to establish their reasons for not willing to pay. Among them, 10% said they could not afford it because they were poor. Also, 10.8% indicated that it was the government's responsibility to improve solid waste management services, while the remaining 2.5% felt that they were satisfied with the current situation and that it did not need improvement.

Table 3: Ranking of household waste generated from highest to lowest volume.

Solid waste type	Mean value	Ranked
Food waste	3.7	2
Yard waste	2.9	3
Wood, grasses and leaves	1.7	4
Paper	1.0	5
Metals	0.50	6
Plastic	4.4	1
Glass	0.3	8
Textiles	0.4	7

Source: Field survey, 2015.

Table 4: Who usually collect and place the wastes for disposal?

Members	Frequency	Percentage
Husband/ father	5	4.1
Wife/mother	58	47.9
Child	53	43.8
House-help	5	4.1
Total		100

Source: Field survey, 2015.

Table 5: Knowledge and awareness of solid waste management

Response	Frequency	Percentage
Yes	54	45
No	66	55
Sources		
Television	17	31.5
Radio	19	35.2
Newspaper	5	9.3
Assembly	2	3.7
Family member	11	20.4
Total		

Source: Field survey, 2015.

Table 6: Comparison of positive WTP, valid zero WTP and rejection of contingent market.

Comparison of positive WTP, valid zero WTP and rejection of contingent market	Frequency	Percentage
Positive WTP (Yes)	92	76.7
Valid zero WTP	12	10.0
We are poor and we cannot pay	12	10.0
Rejection of the market	16	13.3
Proper management of solid waste is the responsibility of the government	13	10.8
We are satisfied with the current situation (it does not need improvement)	3	2.5
Total	120	100

Source: Field survey, 2015.

Factors influencing respondents' willingness to pay for improved solid waste management

The ordered probit regression model was estimated in this study to determine the factors which influence households' willingness to pay for improved solid waste management. To do this, the amounts that respondents were willing to pay were grouped into four categories as follows: No WTP (GH 0.00); Low WTP (GH 2.00-GH9.00); Medium WTP (GH10-GH17.00) and High WTP (GH18- GH25). The ordered probit model was used because the dependent variable is categorized and the ordering of the categories matters (Greene, 2002).

Mathematically, the relationship among the categories is as follows:

No WTP < Low WTP < Medium WTP < High WTP and were labelled 0, 1, 2 and 3 respectively. Thus:

$WTP = 0$ (No willingness to pay)

$WTP = 1$ (Low willingness to pay)

$WTP = 2$ (Medium willingness to pay)

$WTP = 3$ (High willingness to pay)

The ordered probit model was estimated using STATA Version 13. From the results in Table 7, the factors that significantly influenced households' willingness to pay for improved solid waste management in the study area were gender, marital status, age, educational status and

income. All of them have positive coefficients or marginal effects. Number of dependants, tenancy and level of awareness however were insignificant. The significance of the LR Chi-squared value shows that all the variables jointly determined the dependent variable. Also the Pseudo R squared value of 0.317, shows that the explanatory variables could explain about 32% of the variations in the dependent variable. This is good for a cross section study.

In Table 7, the coefficients as well as the marginal effects are reported. However, the model being an ordered probit, the marginal effects are more relevant. The positive marginal effect of the gender variable is 0.2726. This means that males had a 0.27 higher probability of paying for solid waste management than females. Similarly, respondents who were married had a 0.1 higher probability of paying for improved solid waste management services than single respondents. Furthermore, the relatively old respondents were more willing to pay for improved services than the young. However, the probability difference is about 0.01. Fourthly, respondents with higher education had a 0.02 higher probability of paying for improved solid waste management services than their counterparts who had little or no formal education. Lastly, richer respondents were more willing to pay for improved solid waste management than their poor counterparts; the difference in probability is about 0.24.

Table 7: Ordered Probit Regression Estimates

Explanatory variables	Coefficient	Marginal effect(dy/dx)	Std. err	t stat.	p-value
Sex	1.1187	0.2726	0.3207	3.49	0.000***
Marital status	0.4240	0.1033	0.1741	2.44	0.015**
Age	0.0318	0.0077	0.0132	2.40	0.016**
Educational status	0.0827	0.0201	0.0321	2.57	0.010***
Income	0.4332	0.1055	0.2377	1.82	0.068*
Dependents	-0.0652	0.0158	0.0929	-0.70	0.483

Tenancy	0.1220	0.0297	0.1699	0.72	0.473
Awareness	0.0029	0.0007	0.3139	0.01	0.992
LR chi-square	42.14***				
Pseudo R square	0.317				
Log likelihood	-75.9161				

* significant at 10 percent; **significant at 5 percent; *** significant at 1 percent.

In Table 8, the threshold parameters (π_1, π_2, π_3) are reported. These thresholds provide help in calibrating the differences in the individuals' willingness to pay for improved solid waste management services. Largely, the results confirm the ones in Table 7. For instance, the negative marginal effect of the gender variable in column 2 means that female respondents had a higher probability of not paying for the improved services, while the positive marginal effect in column 5 implies that the male respondents had higher probability of paying. Similarly, the marginal effect of the marital status variable in column 5 confirms the fact that married respondents had a higher probability of paying for the services than single respondents. Thirdly, while the marginal effect of the age variable in the second

column implies that the young respondents had a higher probability of not paying for the services, the marginal effect in the fourth column confirms that the relatively old had a higher probability of paying for the waste management services. The same line of argument can be advanced for educational status and income of respondents. In the case of number of dependants and tenancy the results are not conclusive, considering the fact that the sign of the marginal effects in both the second and third columns are positive. However, the positive marginal effect of the awareness variable in the third column suggests that those who were aware of the improved solid waste management services were more willing to pay the lowest amount than those who lacked awareness.

Table 8: Probit Regression estimates for each WTP internal

Explanatory variables	No WTP	Low WTP	Medium WTP	High WTP
Sex	-0.2862***	0.0729	0.1512	0.2234**
Marital status	-0.0837	-0.0731	0.0694	0.0989*
Age	-0.0093**	-0.0024	0.0091***	0.0022
Educational status	-0.0143	-0.0225**	0.0009	0.0320**
Income	-0.0422	-0.1233	0.1757	0.1354**
Dependants	0.0548*	0.1002***	0.0371	0.0340
Tenancy	0.0989**	0.1524**	0.0232	0.0497
Awareness	0.0486	0.1953*	0.0323	-0.0219
LR chi-square	24.98***	20.51***	16.37**	32.58***
Pseudo R square	0.266	0.198	0.430	0.401

Log likelihood	-34.463	-41.646	-10.767	-24.355
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Discussion

In this study, the fact that plastic waste was found to be the most generated solid waste in the study area does not come as a surprise. Oteng-Ababio (2011) noted that the composition of solid waste in Ghana has been changing rapidly in recent times due to various factors such as changes in lifestyles, improved standard of living and changes in consumption patterns. For instance, he found that the composition of solid waste in Tema shows a reduction of organic waste content from 73% (in 1989-1999) to 60% (in 2000-2009) and an increase in plastic waste from 3% to 8% within the same period. The results also confirm that of Puopiel (2010) who found plastic waste as the most generated solid waste in the Tamale metropolis.

Similarly, the findings that mothers/wives (47.9%) and children (43.8%) are the most responsible for the collection and disposal of households' solid waste is consistent with the traditional roles and norms in Ghana. In Ghana, traditionally, it is the role of women to keep the house clean and get actively involved in household-level solid waste management (Songore and McGranahan, 1998). Furedy and Lardinios (2000) and Noel (2010) stressed that this important role performed by women reinforces the relevance of gender in solid waste management in Africa. It is against this background that we thought that women rather would be willing to pay more for improved solid waste management services than the men. However, per the results of the study, men rather were willing to pay more. This is not implausible though, because first, men are generally richer than women and so other things being equal, they would have greater ability to pay for such services than women. Second, men are generally more into paid jobs than women and so they may not have the time to take care of their refuse, hence, their preparedness to pay more for some institutions to take care of the refuse. Along the same line of argument, a married person, an educated or a rich person, as a result of their busy schedules and their ability to pay, would be willing to pay more for improved solid waste management services than the single, poor or uneducated. Similarly, educated people for instance, understand the consequences of improper solid waste disposal and would therefore be willing to pay for

improved waste disposal services. The findings are consistent with that of a number of other studies (Rahji and Oloruntoba, 2009; Hagos, *et.al.* 2012; Ojok, *et.al.* 2012; Awunyo-Vitor, *et.al.* 2013; Alhassan and Mohammed, 2013). Furthermore, married people tend to have a larger family size and hence face higher risks of hygiene related diseases than the unmarried. Lastly, an old person who is more likely to live in his/her own house, would be willing to pay more for improved solid waste management services than a young person who is more likely to stay in a rented apartment. This finding is also in tandem with that of Assa (2013) but contradicts that of Hagos *et.al.* (2012), Banga, *et.al.* (2011) and Sumukwo, *et.al.* (2012), which argued that older people who had been disposing their solid waste for free for many years were less willing to pay for improved solid waste management services.

CONCLUSION AND POLICY IMPLICATION

The study used the CVM to elicit households' willingness to pay for improved solid waste management in Tamale Metropolitan area. An ordered probit regression model was then estimated to investigate the factors influencing such willingness. We found that a significant number of the respondents were willing to pay for the improved services, the amount ranging from GHC 2 to GHC 25 per monthly collection. The findings also show that households' WTP were positively and significantly determined by the gender, age, marital status and education of the household head as well as household income. A key policy implication of this result is that a flat rate cannot be charged across households. Poorer and uneducated households should be charged a lower rate than relatively rich and educated households. Lastly, informing the public about the availability of the improved services could result in the willingness to make some modest payment for the services.

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