ESTIMATING THE WILLINGNESS TO PAY FOR IMPROVED MUNICIPAL SOLIDWASTE MANAGEMENT IN NAIROBI, KENYA

EZEKIEL N. NDUNDA
Department of Environmental Sciences,
Kenyatta University,
P.O. Box 43844-00100, Nairobi,
KENYA
ndunda.ezekiel@ku.ac.ke http://www.ku.ac.ke

VIRGINIA K. MUIA
Department of Environment and Resource Development,
Chuka University,
P.O. Box 109-60400, Chuka,
KENYA
vkavuu@chuka.ac.ke http://www.chuka.ac.ke

Abstract: - The rapid accumulation of municipal solid waste in many developing countries has been linked to urbanization, population growth and low budgetary allocation for urban solid waste management. This study aims at determining the households' willingness to pay for improved solid waste management to reduce air pollution in Nairobi, Kenya. In order to undertake the study, the sample of 114 households around the Dandora dumpsite in Nairobi was randomly selected from Dandora, Babadogo, Kariobangi North and Korogocho residential areas that were purposively selected. The technique employed in the assessment is a stated preference approach called contingent valuation method. Double-bounded model was used to identify the factors that influence the households' willingness to pay for improved solid waste management. The results from this study show that the willingness to pay for households is significantly related to monthly income, gender of the household head, household size and education level of the household head. In addition, the results also reveal that gender of household head is negatively correlated with willingness to pay while monthly income, size of the household and education level of the household head are positively correlated with willingness to pay for improved solid waste management. The results of contingent valuation further reveal that the mean willingness to pay for improved solid waste management per household in order to reduce air pollution is Kshs. 237.14 per month. Therefore, there is need for policy makers to involve the urban households in managing municipal solid waste for sustainable environmental protection in the developing countries.

Key Word: - Air pollution, contingent valuation method, double-bounded model, hypothetical market, municipal solid waste, and willingness to pay.

1 INTRODUCTION

Air Pollution in Nairobi, the capital city of Kenya, is severe. Some of the key pollutants include: suspended particulates, sulphur dioxide, nitrous oxides, carbon monoxide and ozone. The main factors responsible for increased air pollution in the city are: population growth, industrial development, vehicular traffic, poor solid waste treatment. Many of the benefits provided by improved air quality in metropolitan areas do not have market whereby values can be observed directly. Better knowledge of the value of improved air quality will lead to informed decisions by the private and public sectors. The economic implications of managing urban air quality in alternative ways, including better solid waste treatment approaches, can then be taken into account.

Several approaches are available for the estimation the non-market values of air quality. These methods can be categorised into: stated and revealed preferences based on constructed hypothetical markets or existing markets (Boxall et al., 1996; Christie & Azevedo, 2002; Hanemann, 1994; Hensher, 1997; Lockwood & Carberry, 1998; Mitchell & Carson, 1989; Ryan, 2004; Ryan & Gerard, 2003; Ryan et al., 2008; Smith, 2003). Contingent valuation method is most commonly used method in the stated preferences methods. According to Bateman et al. (2002), many authorities entrusted with the employment of ecological policies are increasingly demanding analyses of environmental values. In the quantification of ecological values, the stated preference methods are often desired in evaluating non-market goods (Adamowicz et al., 1998; Bennett & Blamey, 2001; Hanley & Barbier, 2009; Hanley et al., 1998, 2001, 2003; Ndunda & Mungatana, 2013).

This study sought to identify the factors that influence the willingness to pay (WTP) for improved solid waste management in order to reduce air pollution in the municipalities using the contingent valuation technique. In addition, the study estimated the welfare effect of improved municipal solid waste management. This empirical study focused on the households adjoining Dandora dumpsite in Nairobi that has been affected by different characteristics of air pollutants.

2 MATERIALS AND METHODS

2.1 Description of the study area

The environmental valuation in this research involved the estimation of the impact of alternative solid waste treatment programs on non-market air quality values. The solid waste treatment program concerned is in Dandora, a dumpsite in Nairobi, which occupies about 30 acres of land and situated about 8 kilometres away from the city centre. The dumpsite receives over 2,000 tonnes of solid waste daily. Most solid wastes disposed in Dandora dumpsite include: industrial wastes (e.g. unused chemicals and raw materials, expired products and substandard goods); agricultural wastes (e.g. herbicides and fungicides); hospital wastes (e.g. packaging materials and containers, used syringes and sharps, biological waste and pharmaceuticals). Poor handling and disposal of solid waste may lead to environmental degradation, ecosystem destruction and numerous health risks. This study proposes a program that involves an improvement in solid waste treatment in Dandora dumpsite. The improved solid waste management to reduce air pollution would be at the expense of the Nairobi and affected households in the study area.

2.2 Sampling design and data collection

In order to obtain adequate information on solid waste management in Dandora dumpsite, this study relied upon focus group discussions and pilot survey of 28 respondents in four target residential areas neighbouring the dumpsite: Dandora, Babadogo, Kariobangi North and Korogocho. This assisted in the development of a questionnaire that was utilized in the pre-test survey. The pilot study was conducted in order to revise the questionnaire for appropriate interpretation of presented questions. Also, the pre-test survey provided important information for in the identification of the bid vector for development of the final contingent valuation questionnaire.

The revised questionnaire was used to collect survey data for the estimation of non-market air quality value of improved municipal solid waste management for reduction of air pollution. There were four sections in the questionnaire. The first section described some socio-demographic characteristics of the respondent. Second section of the questionnaire was devoted to identification of the positive and negative effects of improved solid waste treatment program to respondent. Contingent valuation question was presented in the third section of the questionnaire.

The survey data for this contingent valuation study was collected using the direct face-to-face interviews (Alfroz *et al*., 2011; Carson *et al*., 1996). Systematic random (Saunders *et al*., 2007) sampling method was used to obtain a representative sample of the target population in the study area. A sample of 114 respondents was interviewed in this study to estimate the willingness to pay for improved solid waste management.

2.3 Contingent market scenario

The contingent valuation method survey in this study described a hypothetical market scenario in order to elicit willingness to pay for improved solid waste management to reduce air pollution. Improved solid waste management for reduction of air pollution was clearly described to all the respondents prior to the interview. In the hypothetical market the institution entrusted with the responsibility of service delivery in solid waste management was presented "Nairobi Municipal Solid Waste Management Company." The sought fund was for setting up a program to purchase and maintain incinerators and also to construct landfills for efficient disposal of solid waste in order to minimize air pollution in the study area. The impact of this program and financial constraints were clearly explained to the respondents before the interviews were conducted in order to reduce hypothetical bias.

Once the contingent market was explained to respondents, they were initially asked whether they would be willing to pay for the improved solid waste management for reduction in air pollution. The respondents were asked to place a monthly monetary value for improvement of municipal solid waste management if they answered 'yes' to the participating question. However, the respondents who are reluctant to partake in the program were asked to provide reasons for their answer.

2.5 Data analysis procedure

In order to determine the measures of dispersion and also the measures of central tendency of the data, the computation of descriptive statistics was done in this study. The determinants of willingness to pay for improved solid waste management to reduce air pollution were analysed using the double-bounded (interval data) model. This model permits the efficient utilization of survey data for estimation of the willingness to pay for the program (Haab & McConnell, 2003; Verbeek, 2008). The explanatory variables considered for analyses included: monthly income, gender of the household head, age of the household head, household size and education level of the household head.

2.6 Theoretical model of the study

Economic valuation is based on welfare economics whereby individuals are driven by the utility maximization for goods and services (Nijkamp *et al*., 2008). The contingent valuation method is used to measure this economic concept of valuation by analysing survey data. Therefore, the objective of a contingent valuation study is to measure the monetary value of an individual for a given item.

Let scalar n denote the item under economic valuation, which may include some mix of commodities considered as a fixed set. The consumer has a direct utility function defined over the amounts of different market commodities, represented by the vector k and n, f(k, n). An indirect utility function consistent to this direct utility function can be written, g(m, n, p), where m is the vector of market prices of commodities and p is the income of the consumer. If we assume that f(k, n) is increasing and quasi-concave in k, then g(m, n, p) would fulfil the normal properties with respect to m and p. When the consumer regards n as a "good," both f(k, n) and g(m, n, p) shall be increasing in n. However, if the consumer regards n as a "bad," both f(k, n) and g(m, n, p) shall be decreasing in n. Lastly, if the consumer is indifferent to n, both f(k, n) and g(m, n, p) shall be independent of n. Consequently, the process of economic valuation entails the difference between a condition with the item, and one without it. Thus, what is valued is a change in n.

If n changes from n^0 to n^1; the individual's utility changes from $f^0 \equiv g(m, n^0, p)$ to $f^1 \equiv g(m, n^1, p)$. When the individual considers this change as a development: $f^1 > f^0$; when the individual considers it as a change for the worse: $f^1 < f^0$ and; when the individual is indifferent: $f^1 = f^0$. Hicksian measures represent the worth of this change to the consumer in monetary terms in two ways.

Firstly is the compensating variation V, which is denoted as:

$$g(m, n^1, p - V) = g(m, n^0, p) \qquad (1)$$

Secondly is the equivalent variation W, which is denoted as:

$$g(m, n^1, p) = g(m, n^0, p + W) \qquad (2)$$

Therefore,

$$\text{Sign}(V) = \text{Sign}(W) = \text{Sign}(f^1 - f^0) \qquad (3)$$

When the change is considered as an improvement, V > 0 and W > 0. In this state, V is measuring the agent's maximum willingness to pay to in order to secure the change, while W is quantifying the agent's minimum willingness to accept to give it up. In case the change is considered as being for the worse, V < 0 and W < 0. In this situation, V computes the agent's willingness to accept to tolerate the change, while W calculates the agent's willingness to pay to avoid it. When the agent is indifferent to the variation, V = W = 0.

In order to estimate the double-bounded model, we define y_i^1 and y_i^2 as the dichotomous variables that catch the reaction to the two closed (first and second) questions. The probability that respondent's answer to the first question is yes and that to the second question is no is denoted as:

$$\Pr\left(q_i^1 = 1, q_i^2 = 0 / x_i\right) = \Pr(y, z)$$

Consider the following assumption:

$$WTP_i\left(x_i, u_i\right) = x_i'\beta + u_i \ and \ u_i \sim N\left(0, \sigma^2\right)$$

The respective probabilities of all the cases are as follows:

When $q_i^1 = 1$ *and* $q_i^2 = 0$

$$\begin{aligned}\Pr(y,z) &= \Pr\left(s^1 \le WTP < s^2\right) = \Pr\left(s^1 \le x_i'\beta + u_i < s^2\right) \\ &= \Pr\left(\frac{s^1 - x_i'\beta}{\sigma} \le \frac{u_i}{\sigma} < \frac{s^2 - x_i'\beta}{\sigma}\right) \\ &= \Omega\left(\frac{s^2 - x_i'\beta}{\sigma}\right) - \Omega\left(\frac{s^1 - x_i'\beta}{\sigma}\right)\end{aligned} \quad (4)$$

Equation (4) is based on the following function:

$$\Pr\left(a_i \le X < a_j\right) = F\left(a_j\right) - F\left(a_i\right)$$

Hence, applying normal distribution symmetry we obtain:

$$\Pr(y, z) = \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^1}{\sigma}\right) x \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^2}{\sigma}\right) \quad (5)$$

When $q_i^1 = 1$ *and* $q_i^2 = 1$

$$\begin{aligned}\Pr(y, y) &= \Pr\left(WTP > s^1, WTP \ge s^2\right) \\ &= \Pr\left(x_i'\beta + u_i > s^1, x_i'\beta + u_i \ge s^2\right)\end{aligned} \quad (6)$$

Based on the Bayes rule, equation (6) becomes:

$$\Pr(y,y) = \Pr\left(x_i'\beta + u_i > s^1 \middle| x_i'\beta + u_i \ge s^2\right) * \Pr\left(x_i'\beta + u_i \ge s^2\right)$$

Since $s^2 > s^1$ by definition,

$$\Pr\left(x_i'\beta + u_i > s^1 \middle| x_i'\beta + u_i \ge s^2\right) = 1$$

Therefore,

$$\Pr(y,y) = \Pr\left(u_i \ge s^2 - x_i'\beta = 1 - \Omega\left(\frac{s^2 - x_i'\beta}{\sigma}\right)\right)$$

Using symmetry,

$$\Pr(y,y) = \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^2}{\sigma}\right) \quad (7$$

When $q_i^1 = 0$ *and* $q_i^2 = 1$

$$\begin{aligned}\Pr(y,z) &= \Pr\left(s^2 \le WTP < s^1\right) = \Pr\left(s^2 \le x_i'\beta + u_i < s^1\right) \\ &= \Pr\left(\frac{s^2 - x_i'\beta}{\sigma} \le \frac{u_i}{\sigma} < \frac{s^1 - x_i'\beta}{\sigma}\right) \\ &= \Omega\left(\frac{s^1 - x_i'\beta}{\sigma}\right) - \Omega\left(\frac{s^2 - x_i'\beta}{\sigma}\right) \\ &= \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^2}{\sigma}\right) - \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^1}{\sigma}\right)\end{aligned} \quad (8)$$

When $q_i^1 = 0$ *and* $q_i^2 = 0$

$$\begin{aligned}\Pr(z,z) &= \Pr\left(WTP < s^1, WTP < s^2\right) = \Pr\left(x_i'\beta + u_i < s^1, x_i'\beta + u_i < s^2\right) \\ &= \Pr\left(x_i'\beta + u_i < s^2\right) \\ &= \Omega\left(\frac{s^2 - x_i'\beta}{\sigma}\right) \\ &= 1 - \Omega\left(x_i' \frac{\beta}{\sigma} - \frac{s^2}{\sigma}\right)\end{aligned} \quad (9)$$

In order to estimate for β and σ using the maximum likelihood method, the following function (based on equations (5, 7, 8 & 9) should be maximized:

$$\sum_{i=1}^{N}\left[d_i^{yz}\ln\left(\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^1}{\sigma}\right)-\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^2}{\sigma}\right)\right)+d_i^{yy}\ln\left(\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^2}{\sigma}\right)\right)+\right.$$
$$\left.d_i^{zy}\ln\left(\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^2}{\sigma}\right)-\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^1}{\sigma}\right)\right)+d_i^{zz}\ln\left(1-\Omega\left(x_i'\frac{\beta}{\sigma}-\frac{s^2}{\sigma}\right)\right)\right] \quad (10)$$

Where d_i^{yz}, d_i^{yy}, d_i^{zy} and d_i^{zz} denote indicator variables, which have the value of either one or zero based on the individual's appropriate incident. In one of its four portions, each individual contributes to the logarithm of likelihood function. This information is then used for the estimation of WTP in the contingent valuation method.

3 RESULTS AND DISCUSSION

3.1 Descriptive statistics

Once the missing and inconsistent valuation responses were eliminated, a total of 114 (95 percent) questionnaires were a reliable and representative sample of the target population for this study around Dandora dumpsite in Nairobi. The descriptive statistics of key socio-economic characteristics of the respondents are presented in Table 1. According to the survey data, respondents in the study area are averagely aged 36.10 years. This shows that many urban households are headed by middle-aged individuals in the study area. The mean education level of household heads in the study area is 14.25 years. This implies that the respondents interviewed are literate and hence able to clearly conceptualize air pollution matters in the study area.

The survey data from this study shows that the average household has 4 members. This compares well with related studies in the area. According to the study, the average monthly income per household was found to be Kshs.14253.51. The mean initial and high bids stated by the respondents are Kshs.242.11 and Kshs.248.25 respectively. This is realistic since the average bids are below the monthly income for each respondent. Results of the descriptive statistics for gender in the sample surveyed shows there are 66.67 percent male headed households in the study. Also, 72.81 percent of the interviewed household heads in the study area are married. The results of the survey data show 40.35 percent of the interviewed households have formal employment. This Implies that most of the household heads in the study area rely on informal employment for livelihoods.

Table 1: Description of explanatory variables

Variable	Mean	Std. Dev.	Description
Age of the household head (years)	36.10	9.89	Continuous
Education level of household head (years)	14.25	4.24	Continuous
Size of the household	3.82	1.16	Continuous
Monthly income (Kshs)	14253.51	4705.02	Continuous
Initial bid (Kshs)	242.11	71.82	Continuous
High bid (Kshs)	248.25	112.28	Continuous
Percentage			
Gender of the household head	66.67		Dummy, 1 if male and 0 otherwise
Marital status of the household head	72.81		Dummy, 1 if married and 0 otherwise
Employment status of the household head	40.35		Dummy, 1 if employed and 0 otherwise

Air pollution awareness among the respondents in this study was assessed as shown in Table 2. According to the results, 98.24 percent of the interviewed respondents attributed persistent bad odour in the around their residential area to poor solid waste disposal in Dandora dumpsite. This foul smell may be linked to unregulated burning and also decomposition of poorly disposed solid waste. The results of this study show that 92.10 percent of respondents agree that poor solid waste management has affected visibility. The smoke from uncontrolled burning of poorly sorted solid waste and also resultant smog may be attributed to the impaired visibility.

The results of this study show that 100 percent of interviewed respondents agree that there is high morbidity rates among household members due to exposure to polluted air around the dumpsite. Open burning of solid waste may lead to emissions of water vapour, carbon dioxide, sulphur oxides, nitrogen oxides, soot, volatile organic compounds, hydrocarbons, dioxins, furans, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons.

Table 2: Air pollution awareness analysis

Characteristics	Awareness	Proportion	Std. Error
Persistent bad odour due to poor disposal of air pollution by the solid waste in the dumpsite	Strongly Disagree	0.88	0.009
	Disagree	0.88	0.009
	Unaware	-	-
	Agree	11.40	0.030
	Strongly Agree	86.84	0.032
Poor air visibility due to smoke from the uncontrolled burning of solid waste in the dumpsite	Strongly Disagree	-	-
	Disagree	4.39	0.019
	Unaware	3.51	0.017
	Agree	71.05	0.043
	Strongly Agree	21.05	0.038
High morbidity rates among household members due to exposure to polluted air around the dumpsite	Strongly Disagree	-	-
	Disagree	-	-
	Unaware	-	-
	Agree	6.14	0.023
	Strongly Agree	93.86	0.023
High rate of corrosion, discoloration, and overall damage to metallic materials because of the exposure to acidic smoke residues in the dumpsite	Strongly Disagree	1.75	0.012
	Disagree	2.63	0.015
	Unaware	6.14	0.023
	Agree	77.19	0.040
	Strongly Agree	12.28	0.031
Degradation of water quality due to acidic rain caused by air pollution around the solid waste dumpsite	Strongly Disagree	-	-
	Disagree	1.75	0.012
	Unaware	9.65	0.028
	Agree	36.84	0.045
	Strongly Agree	51.75	0.047

Also, vehicles involved in transportation of solid waste emit the following air pollutants: carbon monoxide, nitrous oxides, sulphur dioxide, particulate matter and volatile organic compounds. These emissions are likely to cause diverse health effects on the population living around the dumpsite. Numerous epidemiological studies show that exposure to polluted air results in severe health effects like increased mortality, cardiovascular and respiratory morbidity on residents.

Also, 89.47 percent of respondents agree that there is high rate of corrosion, discoloration, and overall damage to metallic materials because of the exposure to acidic smoke residues in the dumpsite. When plastics containing chlorine (e.g. Polyvinyl chloride) are burned in the dumpsite, acidic hydrogen chloride may be discharged. Lastly, 88.59 percent of respondents in the study area acknowledge that there has been degradation of water quality due to acidic rain caused by air pollution around the solid waste dumpsite. Air pollution from point, fugitive and mobile sources may affect health of fauna and flora in urban and peri-urban settings. This occurs when toxic air pollutants are dissolved in water hence degrading water and soil resources around the dumpsites.

The respondents who elicited positive willingness to pay for this program to lower air pollution through improved solid waste management were asked to provide reasons for their backing. Reasons presented (Table 3) for the support this program are: it will reduce air pollution in the neighbourhood (20.0 percent); it will protect the surrounding ecosystem against degradation (21.11 percent); it will ensure improved visibility for residents in the area around (15.56 percent); it will eliminate the foul smell emanating from the dumpsite (17.78 percent); and it will lower the risk of respiratory infections from poor solid waste disposal (25.56 percent).

Table 3: Reasons for supporting the program to manage air pollution

Reason for supporting the program	Proportion	Std. Error
It will reduce air pollution in the neighbourhood	20.0	0.0424
It will protect the surrounding ecosystem against degradation	21.11	0.0433
It will ensure improved visibility for residents in the area around	15.56	0.0384
It will eliminate the foul smell emanating from the dumpsite	17.78	0.0405
It will lower the risk of respiratory infections from poor solid waste disposal	25.56	0.0462

Also, the respondents who did not elicit willingness to pay for improved solid waste management program to minimize air pollution through were interviewed for their reasons (Table 4). The presented responses are: it is not worth the support (8.33 percent); I cannot afford it (37.50 percent); it will only protect Dandora residents (8.33 percent); I worry about corruption in the proposed program (8.33 percent); I am planning to relocate (16.67 percent) and; it is the responsibility of county government (20.83 percent).

Table 4: Reasons for not supporting the program to manage air pollution

Reason for supporting the program	Proportion	Std. Error
It is not worth the support	8.33	0.058
I cannot afford it	37.50	0.101
It will only protect Dandora residents	8.33	0.058
I worry about corruption in the proposed program	8.33	0.058
I am planning to relocate	16.67	0.078
It is the responsibility of county government	20.83	0.085

3.2 Econometric estimation using the double-bounded model

Survey data in this study was analysed for multicollinearity, whereby the Variance Inflation Factors (VIFs) were used to eliminate the affected independent variables. The VIFs were obtained by regressing each independent variable as a “dependent” variable against the other explanatory variables (Maddala, 2000). All the independent variables for which $VIF_i > 0.5$ was considered as a robust evidence that the assessment of the factors was being influenced by multicollinearity.

The estimation of determinants of willingness to pay for improved solid waste management in Dandora dumpsite, this study employed the double-bounded model (Table 5). This model ensures an efficient use of survey data in the evaluation of willingness to pay. According to the results, the gender dummy is statistically significant ($p < 0.10$) in estimating WTP for improved solid waste management. The negative coefficient of gender coefficient suggests that female headed households are more willing to pay than male headed households. As expected the education is statistically significant ($p < 0.05$) and positive effect on the WTP for improved solid waste management. This positive coefficient of the education variable shows that the educated household heads are more willing to pay for improved solid waste management than the less educated.

Size of household has a statistically significant ($p < 0.05$) impact on the WTP for the program on improved solid waste management. The positive household size coefficient implies that heads of large households are more willing to pay for improved solid waste management than those of small households. The results show that the coefficient of monthly income is statistically significant ($p < 0.05$) and positive. This suggests that the higher the monthly income for a household head the more he is willing to pay for improved solid waste management.

Table 5: The factors that influence willingness to pay for improved solid waste management

Explanatory variable	Coeff.	Std. Err.	t-Test
Age of the household head (years)	-2.054	1.580	-1.30
Gender of the household head	-52.383*	29.614	-1.77
Education level of household head (years)	8.427**	4.121	2.04
Size of the household	48.427***	10.269	4.72
Monthly income (Kshs)	0.007**	0.003	2.09
Constant	-74.516	112.855	-0.66
Wald chi-square	64.15		
Log likelihood	-159.25791		
Number of observations	114		

***, ** and *, Significant at 1, 5 and 10% level respectively.

The mean WTP value and its confidence interval at 95 percent in this study used Delta method (Wald Procedure) for analysis of the improved solid waste management. The estimated value of mean WTP for in the study area is Kshs.237.14 (Table 6). Most of the solid waste generated in Nairobi County is dumped in Dandora dumpsite. Thus, every household in the county should participate in safe handling and disposal of the generated solid waste in order to protect the livelihoods of people living near the dumpsite. Therefore, based on the mean WTP the county can generate Kshs. 229.67 million shillings every month towards improved solid waste management.

Table 6: The estimated mean willingness to pay for improved solid waste management

Variable	Value	Std. Err.	t-Test
Mean WTP (Kshs/household)	237.14 (213.94 - 260.35)***	11.84	20.03
Total number of households	968, 477	-	-
Estimated Total WTP (in million Kshs)	229.67 (207.19 - 252.14)***	11.47	20.03

Confidence intervals at 95%, calculated using delta method, are given in parentheses
***, ** and *, Significant at 1, 5 and 10% level respectively.

4 CONCLUSION AND POLICY RECOMMENDATIONS

The findings of this study show that majority of respondents (78.95 percent) are willing to pay for improved solid waste management in Dandora dumpsite. According to the estimations, the average willingness to pay Kshs. 237 per month ($2.8 based on the current exchange rate of Kshs. 85 per dollar). Thus, the residents of Dandora, Babadogo, Kariobangi North and Korogocho residential areas in Nairobi consider the improved solid waste management an economic good. The elicited mean WTP reflects desire by respondents for improvement from the current solid waste management approach. Based on results from the double-bounded model used in this study, the relationship between stated WTP and the selected independent variables is consistent with economic theory.

The results from double-bounded model compares well with related studies in other developing countries. As anticipated, education level of household head, size of the household and, monthly income had positive and statically significant effect on the willingness to pay for improved environmental quality through better solid waste management. However, gender of the household head had a statistically significant but negative effect on the willingness to pay for improved solid waste management. This study findings show that an average monthly tax of Kshs. 237 per household, which corresponds to mean WTP per household, is acceptable to most of the residents of Dandora, Babadogo, Kariobangi North and Korogocho in Nairobi. Respondents expect reduced air pollution as a result of paying the fees for improved solid waste management in Nairobi. Therefore, contingent valuation method is important in the estimation of statistical models, relevant for policy makers and urban planners, in determination of optimal taxes for sustainable solid waste management in Nairobi.

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