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# Analysis of Improper Disposal of Solid Wastes in a Low-Income Area of Accra, Ghana

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**Abstract**

We examined the causes of poor sanitary condition in Gbawe, a low-income suburb of Accra, the capital city of Ghana in the current era of one of the worst epidemics of cholera in Accra which has been linked to improper disposal of wastes. This survey-based study identified improved and unimproved methods for disposal of household solid wastes. The likelihood of a person using an improved method of disposing solid wastes increased with increasing household income but it decreased with increasing number of household members. A conclusion arising from the study is the need for local government authorities to abolish the fees and charges imposed on users of public waste collection centres in order to encourage proper disposal of solid wastes. Indirect methods of financing local authorities such as increased levels of property taxes need to be explored to finance the development and maintenance of adequate numbers of public waste collection centres to encourage proper disposal of solid wastes by householders and the general public.

**Keywords:** Accra, Environmental economics, Environmental sanitation, Ghana, Improper disposal of wastes, Local government, Sanitation, Solid waste disposal, Wastes.

## 1. Introduction

The health status and productivity level of people are greatly influenced by the state of the environmental sanitation condition in which they live. Environmental sanitation is an important issue worldwide and an urgent problem in many urban centres of developing countries. This is the result of large increases in the numbers of people living in urban centers coupled with rising per capita incomes which have led to rising per capita generation of both solid and liquid wastes, and increasing levels of improperly-disposed wastes. Improper disposal of human wastes leads to the spread of diseases such as acute eye infections, cholera, diarrhoea, malaria and typhoid.

Sanitary condition in an urban center is critical in promoting quality of life, good health and tourism for economic growth and development. The driving forces behind the rapid urbanisation in developing countries today are a combination of rural-urban migration and natural increase within towns and cities themselves. Urbanization provides a lot of opportunities and benefits but it also results in some negative impacts. These negative impacts include declining quality of health of people due to the poor sanitary conditions, pressure on social amenities, and scarcity of land for constructing sanitation facilities. As noted by Chaplin (1999) and Songsore (2003), a key challenge facing many developing countries undergoing urbanization is the issue of solid waste management.

Solid waste constitutes a major source of environmental hazard. Environmental hazards accounts for an estimated 25 % of the total burden of disease worldwide. Nearly 35% of ill health problems in Sub-Saharan Africa are caused by environmental hazards (WHO, 2009). Disposal of solid waste was not a major problem at the beginning of civilization because the human population was small, lands were available in abundance for absorption of waste, and nearly all wastes were biodegradable (Tchobanoglous *et al.,* 1993). However, in the modern era of rapid urbanization, solid waste disposal and collection are common problems partly due to the non-degradable nature of many solid wastes.

Improper disposal of wastes is a common practice in many African countries. For example, Ayotamuno and Gobo (2004) in their study on sanitation in Nigerian cities pointed out that indiscriminate disposal of waste had become a common practice in many cities in the country. Most of the solid wastes were located close to markets and public places.

Uncollected wastes produce foul odor and constitute a source of environmental nuisance (Ofomata and Eze, 2001). Improper disposal of waste is caused by social, economic, behavioral (attitude) and political circumstances and expectation. Household's economic status influences their method of disposal of wastes. People with higher incomes are more likely to use improved methods of waste disposal. Weak enforcement of sanitation laws and pressure on existing sanitation facility can lead to improper disposal of wastes. Sule (1981) indicates that the major factors responsible for the poor sanitary condition of Nigerian cities are improper management of solid wastes and weak enforcement of laws.

According to United Nation Development Programme (UNDP) survey report, solid waste disposal is the second most pressing problem facing urban city dwellers after unemployment (Da Zhu *et al*., 2008). Solid wastes consist of solid material such as plastics and papers generated by households and other actors in the economy (Government of Ghana 2010). Miller (1988) defines solid waste as any useless, unwanted or discarded material that is not liquid or gas. In Ghana such wastes are disposed off either by burning, or disposed off into public dumps either into containers or open dump sites, or are buried indiscriminately or are routinely collected from homes by private operators.

In Ghana, as documented by the Ghana Statistical Service (GSS), based on the 2010 National Population and Housing Census, the most popular means of disposal of solid wastes by householders through using the public dump; either dumping in a container (23.8%) or dumping into open dump site (37.7%). Further, about 9.1% of households dump wastes indiscriminately into open fields, gutters and drains while another 10.7% of households burn their solid wastes. Only 14.4% (one in seven) households hire firms or individuals to collect their solid wastes from their homes to recognized and approved waste collection centres or landfills (GSS, 2013, p.392). Only dumping into public containers and collection of wastes from households can be considered improved methods (38.1%). Increasingly it has become a public policy in urban areas to charge householders who dump their solid wastes into public containers some fees.

Given the current population of Ghana of about 26 million as at December 2014, and a daily solid waste production of about 0.45 kg per person (Amoah, 2006), the daily aggregate production of solid wastes is about 11,700 tonnes. The estimates of the proportions of solid wastes not properly collected in Ghana are high; these include 61.9% by GSS (2013, p.392) and 60% to 75% by Anomanyo (2004). Based on these estimates, the levels of improperly collected solid wastes are currently between 7,020 to 8,775 tonnes daily. Improper disposal of wastes in Ghana is increasing with the increasing population and rapid economic growth. The problem of improperly collected solid wastes in Ghana is more pronounced in urban areas due to the fact much of the rapid economic growth is concentrated in the urban areas. Further, most of the goods consumed by urban dwellers produce waste products that are not biologically degradable.

Accra has been experiencing rapid urbanization. Data from Ghana Statistical Service (GSS) (2013) show that the population of Ghana was growing at a pace of 2.5 per cent per annum and the urban population accounted for about 50.9 per cent based on the 2010 Census. The Greater Accra region, which revolves around Accra, recorded the highest proportion of urban population of 90.5% (GSS, 2013, p.53). Improper solid waste disposal in low-income urban areas of Accra is generally high. A question that arises is why many householders in low-income areas of Accra resort to the use of improper means to dispose their solid wastes? We contend that a major reason for this improper disposal of wastes in these areas is the direct charging of residents for use of public waste dumps by local government authorities.

The direct charging for use of public waste collection dumps and waste collection centres in urban areas of Ghana was introduced with the emergence of structural adjustment programmes in Ghana in the 1980s. We assert that this has fuelled the improper disposal of solid wastes into open environments by low-income people who are not able to pay the fees. The improper disposal of solid wastes has led to choked gutters leading to perennial flooding occurrences during the rainy seasons in Accra and epidemics of cholera such as is currently being experienced in Accra (2013 and 2014).

The case study area for this study is Gbawe, a low-income area of Accra inhabited by a diverse group of people from different ethnic and social backgrounds representative of the population of Ghana. We examine the causes of poor sanitary condition in Gbawe in the current era of one of the worst epidemics of cholera in Accra which has been linked to improper disposal of wastes especially in low-income areas. The objectives of the study are to identify the major factors perceived by respondents as the causes of the improper disposal of wastes, to ascertain the various methods of disposal of wastes and to identify the factors that influence method of disposal of wastes by households.

## 2. Theoretical Framework Used in this Study

Why do rational people throw their solid wastes into open spaces that they know encourages the proliferation of diseases such as cholera, for which Accra is currently experiencing a major epidemic, which may affect them, their families and the general public? Economists argue that this type of human behavior can be analysed from the perspective of political economy whereby the three main inter-related components of society are accounted for. This view of political economy analysis is used by environmental economists. The three components of society are the Market, the Community and the State (Hayami, 1989; Hayami, 2009).

The Market describes the process of production and consumption of goods and services based on self-interested actions

of individuals. The behavior of individuals in throwing solid wastes into open public spaces and gutters creates negative impacts on society (negative externalities) given that the producers and consumers of the goods who generate the solid wastes are often not directly penalized for their actions. Rather it is the society, which owns these spaces, that suffers from the actions of consumers of the goods who dispose of their waste products into open spaces and gutters. This behavior exemplifies what economists call market failure. The self-interested behavior exhibited in unregulated markets by individual leads to bad societal outcomes.

When markets fail, interventions may come from the Community and/or the State to resolve the problems created by the self-interested actions of individuals. The Community is composed of non-State actors such as non-governmental organizations, religious groups and semi-voluntary structures linked through blood ties such as extended families and traditional chieftaincy institutions. Some community organizations may resolve the market failure resulting from the improper disposal of solid wastes by individuals through the imposition of rules or through the mobilization of communal labour to clean open spaces and environments. Other community organizations such as faith-based institutions, for example, Church-based groups may appeal to their followers to modify their self-interested behavior and dispose of their solid wastes generated from their homes properly using designated public waste collection centres or hiring private firms to collect their wastes through direct advice, preaching and sermons.

In modern history of Ghana, the mobilization of communal labour and local people for regular cleaning of open spaces and environment was common during the period from first self-government under British colonial rule from February 1951 to March 1957; and then the post-independence period from March 1957 to February 1966 when Ghana was governed by the Convention People's Party (CPP). The overthrow of the CPP government in February 1966 by the military heralded a decline in the use of communal labour for regular cleaning of open spaces and environments from February 1966 to December 1992 when the country experienced political instability characterized by military rule and short-lived civilian governments. This 27-year period encompassed the period of structural adjustment programmes from April 1983 to December 1992 enacted by the Government of Ghana with the support of the International Monetary Fund and the World Bank. This period saw the diminution of the State in the provision of social services including sanitation services (Anaman, 2006). Though there has been a return to constitutional democratic governance in Ghana since January 1993, the decline in the use of communal labour for various activities at the local level has persisted.

The third institutional component of society is the State or government which raises taxes as part of its functions for general development of a country with parts of these revenues used to create infrastructure bodies to deal with the market failure of individuals throwing wastes into open spaces. The government also enacts rules and laws related to the maintenance of hygienic environment which are enforced by various bodies. The establishment of government-operated waste collection centres sited at various vantage points in a locality can also undertaken by governments. These centres may charge individuals fees for disposing of wastes at these sites or may allow for free use for disposal of wastes. There is widespread government failure in enforcing sanitation byelaws in Ghana. Is this government failure related to the transactions costs involved in enforcing sanitation laws in many poor areas that have no good alternatives for waste disposal except dumping them into open spaces?

## 3. Methodology

### *3.1 Survey Sampling and Administration Procedures*

A scientific survey based on the multi-stage cluster sampling method of households was undertaken using home-based face-to-face interviews involving a questionnaire covering a period of six months from mid-December 2012 to mid-June 2013. Multi-stage cluster sampling involves listing and selecting of a sample of subjects from the primary sampling units (Anaman, 2014). The researchers used major road intersections to group houses in Gbawe town into clusters. The process of clustering houses around each major road intersection was done till all the areas of the town were covered. Through this process, the researchers created 20 clusters in Gbawe Main Town. The houses in each of the 20 clusters were numbered.

The population of numbered houses in Gbawe Main Town at the time of the survey was 1034. The optimal sample size for each cluster was based on the number of houses in each cluster as a proportion of the total number of houses in the entire town, Gbawe (1034) multiplied by the optimal sample size (120). The households in each cluster were selected randomly to ensure that each household stood an equal chance of being selected. This was done through the use of a random number generator program available from a standard scientific calculator. The optimal size of 120 households was determined was based on the Yamane (1973) formula assuming a 10% sampling error.

The study involved a survey that dealt with human subjects. We received consent from all the 120 respondents to ask them questions based on confidential face-to-face personal interviews. The survey was also conducted in a manner whereby the identities of respondents were kept confidential. In our presentation of the report we have avoided mentioning the names and addresses of respondents.

## 4. Results and Discussion

### *4.1 Socio-economic Characteristics of Survey Respondents*

Table 1 provides a summary of the socio-economic characteristics of the respondents who participated in the survey. Based on frequency analysis, 40.8% of the respondents were males and 59.2% were females. About 46% of respondents were married, 29% were single or not married while the remaining 25% were in informal marriage unions**.** About seven in 10 respondents were Christians; however about 11.7% of the respondents declared themselves as both Christians and followers of African traditional religions. About 10.8% of the respondents were Muslims. With regards to ethnicity, about 39.2% of the respondents were Gas (indigenes). However there were people from the other major ethnic groups in Ghana representing such as Ewes (17.5%) and Fantes (12.5%). Considering age, 33.3% of the respondents were in 30-39 age category while 32.4% were in the 40-49 age category.

Table 2 reports means, standard deviations and the ranges of figures of selected socio-economic characteristics of respondents. The mean age for the whole group of respondents was 38.1. The mean income of working respondents was 262.2 Ghana cedis per month. About two Ghana cedis were equivalent to one United States dollar during the time of the survey from January to June 2013. Respondents worked mainly as petty traders, food vendors, hairdressers, tailors and seamstress. The mean number of people living in homes was 8.9. The number of people living in a house was a likely variable to influence a household mode of disposing solid wastes. A household with more people generate a lot of wastes and are likely to pay more for the use of sanitation facility and vice versa.

Table 1. Summary of Socio-Economic Characteristics of Survey Respondents Based on Frequency Analysis

| Item | Percent frequency |
|---|---|
| Gender | |
| ➢ Female | 59.2 |
| ➢ Male | 40.8 |
| Marital Status | |
| ➢ Married | 45.8 |
| ➢ Single | 29.2 |
| ➢ Informal unions | 25.0 |
| Religion | |
| ➢ Christian | 70.8 |
| ➢ Christian and Traditionalist | 11.7 |
| ➢ Muslim | 10.8 |
| ➢ Traditionalist | 5.0 |
| ➢ Muslim and Traditionalist | 0.8 |
| ➢ Atheists | 0.8 |
| Ethnicity | |
| ➢ Ga | 39.2 |
| ➢ Ewe | 17.5 |
| ➢ Fante | 12.5 |
| ➢ Guan | 8.3 |
| ➢ Mole- Dagbani | 6.7 |
| ➢ Asante | 5.0 |
| ➢ Kwahu | 4.2 |
| ➢ Akuapim | 3.3 |
| ➢ Ga-Adangbe | 1.7 |
| ➢ Nzema | 1.7 |
| Age | |
| ➢ 20-29 | 21.6 |
| ➢ 30-39 | 33.3 |
| ➢ 40-49 | 32.4 |
| ➢ 50-59 | 10.8 |
| ➢ 60-69 | 1.7 |
| Educational attainment | |
| ➢ Junior high school | 28.3 |
| ➢ Senior high graduate | 16.7 |

| | |
|---|---|
| ➢ Some senior high school | 13.3 |
| ➢ Primary school | 11.7 |
| ➢ Diploma | 7.5 |
| ➢ Technical school | 6.7 |
| ➢ Higher National Diploma | 5.0 |
| ➢ No formal education | 4.2 |
| ➢ Bachelor's degree | 4.2 |
| ➢ Postgraduate degree | 2.5 |
| Occupation | |
| ➢ Self-employed/own business | 60.0 |
| ➢ Government sector employee | 18.3 |
| ➢ Artisan | 15.0 |
| ➢ Private sector employee | 2.5 |
| ➢ Farmers | 2.5 |
| ➢ Unemployed | 1.7 |

Source: Field survey, 2013.

Table 2. Summary of Socio-Economic Characteristics of Survey Respondents Based on Averages, Standard Deviations and Ranges.

| Item | Mean | Standard deviation | Range |
|---|---|---|---|
| Age of respondents in years | 38.1 | 8.8 | 24 to 61 |
| Total income of working respondents per month in Ghana cedis | 266.2 | 173.7 | 50 to 950 |
| Number of people in the house | 8.9 | 3.0 | 2 to 16 |

Source: Field survey, 2013

*4.2 Households' General Attitudes Concerning Environmental Sanitation*

Table 3 provides a summary of respondents' perceptions concerning improper disposal of waste in Gbawe. Respondents were asked to assess the general sanitary condition in the area and quantify the sanitary condition by indicating 1 as very poor, 2 as poor, and 3 as fair, 4 as very good and 5 as excellent. Respondents viewed the sanitary condition of the area as between poor and fair based on the average score of 2.9. They were also asked to quantify the level of seriousness of improper disposal of waste in Gbawe by indicating 5 as very serious, 4 for being serious, 3 for moderately serious, 2 as low and 1 for being not serious at all. Respondents viewed the problem as serious to very serious based on the average score of 4.5. The low coefficient of variation of the score reflected the near unanimity with regards to the generally poor sanitary condition and seriousness of the environmental sanitation problem of Gbawe.

Table 4 summarizes respondents' views on the causes of improper disposal of wastes in public places like roads, quarry pit, gutters, bushes, uncompleted buildings and other areas in Gbawe. Based on the average score of importance of 4.8 (out of a maximum score of 5.0), the most important cause of improper disposal of waste in public places was considered to be the attitude problem of people due to lack of care in proper disposal of wastes by householders. Attitude problem refers to the behaviour of people who throw household wastes at improper places without thinking about the consequences of their actions.

The second most important cause of improper disposal of wastes in public spaces and inappropriate places in Gbawe was the high fees charged by private waste collection service providers and managers of the public dump containers. This was assessed with a high mean score of 4.6. The managers of the public waste dump containers were appointed by the District Assembly. Householders who could not afford paying for these services end up disposing wastes indiscriminately in the community. The third most important cause identified was the weak enforcement of sanitation laws by the District Assembly. The average score was 4.4. This finding corroborates the observation by Sule (1991) that weak enforcement of sanitation laws is a factor responsible for improper disposal of wastes. Another major cause of improper disposal of waste was the inability of the District Assembly to provide adequate facilities for disposal of wastes. The average score was 3.4. Other causes identified included lack of adequate information on the disease burden of improper and unhygienic disposal of wastes and the distances of houses to the public wastes collection centers (refer to Table 4).

Table 3. Summary of Householders' Views on the General Sanitary Condition in Gbawe, Accra Based on Averages

| Item | Average score of importance | Standard deviation of score | Coefficient of variation of score *** |
|---|---|---|---|
| Assessment of general sanitary conditions | 2.9* | 0.9 | 0.31 |
| Level of seriousness of the problem | 4.5** | 1.0 | 0.22 |

Source: Field survey, 2013

*Notes*

*The scoring of general sanitary condition is based on 5 denoting that the sanitary condition is excellent, 4 very good, 3 fair, 2 poor, 1 very poor.

**The scoring of the level of seriousness of improper disposal is based on 5 denoting that it is extremely serious, 4 very serious, 3 moderately serious, 2 lowly serious and 1 not serious at all.

*** The coefficient of variation is defined as the standard deviation divided by the mean score and expresses the degree of unanimity of the householders with respect to the views expressed by them.

Table 4. Householders' Perceptions of the Importance of the Causes of Improper Disposal of Wastes in Public and Open Places Like Drains, Quarry Pit, Gutters, Bushes and Uncompleted Building in Their Area.

| Cause | Average score of importance | Standard deviation of score | Coefficient of variation of score |
|---|---|---|---|
| Attitude problem due to lack of care in proper disposal of household wastes by householders | 4.8 | 0.6 | 0.13 |
| High costs or fees charged by private/public companies to collect and dispose of household solid wastes | 4.6 | 0.8 | 0.17 |
| Weak enforcement of existing byelaws on sanitation. | 4.4 | 0.5 | 0.11 |
| Inadequate collection and disposal of wastes by municipal authorities | 3.8 | 0.9 | 0.24 |
| Lack of adequate information on the human costs of improper and unhygienic disposal of wastes | 3.4 | 0.9 | 0.26 |
| Increased in the number of people currently living in the area. | 2.8 | 0.8 | 0.29 |
| Long distances of houses to roadside community waste collection centers | 2.6 | 0.8 | 0.31 |

Source: Field survey, 2013

*Note:* The scoring is based on 5 denoting that item is extremely important, 4 very important, 3 moderately important, 2 of low importance and 1 not important.

Table 5 summarizes respondents' suggested measures to be undertaken by householders to tackle the market failure arising from improper disposal of wastes in public places in Gbawe. About 37.5% of respondents suggested that all householders must dispose their wastes at the public dump container and appropriate places designated by the District Assembly. Residents also needed to change their attitudes towards disposal of waste at improper places. This view was suggested by about 35% of respondents. About 10% of respondents suggested that all households must obey sanitation byelaws requiring the need for the government through the District Assembly to enforce existing sanitation laws.

Table 6 summarizes respondents' suggested measures to be undertaken by local and national government authorities such as the District Assembly and the Public Health Clinic (national government service) to tackle the market failure arising from improper disposal of wastes. About 16.7% of respondents suggested that the District Assembly must provide more public containers for the disposal of wastes. Further, more public toilet facilities were required. Other suggestions included the need to embark on educational outreach to educate residents on risks associated with poor sanitation and the need to organize regular clean-up exercises.

Table 5. Respondents' Suggested Measures to be undertaken by All Residents in Gbawe to Tackle the Market Failure Resulting from Improper Disposal Wastes in Open Places and Gutters

| Suggested measures | Percent Frequency |
|---|---|
| Resident should dispose waste at appropriate places in the area | 37.8 |
| Resident should change their poor attitude towards disposal of wastes | 35.3 |
| Residents must obey byelaws on disposal of wastes | 10.1 |
| Resident should check each other and the chief should also punish those who disobey sanitation laws | 6.7 |
| Resident must organize regular clean up exercise | 5.9 |
| Resident must educate each other about the effect of poor sanitary condition | 4.2 |

Source: Field survey, 2013

Table 6. Respondents' Suggested Measures To Be Undertaken By Government Authorities Such As Waste Management Department of The District Assembly and Public Health Clinic of The Ghana Health Service to Tackle The Market Failure Arising from Improper Disposal of Wastes.

| Suggested measure | Percent Frequency |
|---|---|
| Provide more sanitation facilities at appropriate places. | 16.7 |
| Provide more sanitation facilities and educate residents on risks associated with poor sanitation. | 15.0 |
| Organize regular clean up exercises. | 15.0 |
| Enforce existing laws dealing with improper disposal of wastes. | 13.3 |
| Punish residents who disobey byelaws on proper disposal of waste. | 11.7 |
| Enforce byelaws and provide more sanitation facilities. | 10.0 |
| Provide more sanitation facilities and reduce the fee charged for waste disposal. | 5.8 |
| Provide more sanitation facilities and educate residents to change their attitude. | 5.8 |
| Reduce the fee charge for disposal of wastes | 6.7 |

Source: Field survey, 2013

*4.3 Methods and Costs of Disposal of Household Solid Wastes*

Table 7 provides information on the various methods used by householders for the disposal of their solid wastes. About 30.8% of respondents burned and/or dumped their solid wastes in the public dump and containers; 18.5% burned and/or threw their wastes into the bush while 17.5% of respondents disposed their solid wastes into public dump and containers without burning them. About 10.8% of respondents only burned their wastes. Another 10% of respondents hired private waste collection firms to collect and dispose of their household solid wastes.

As shown in Table 8, about 58.3% of respondents paid some money for disposal of solid wastes from their homes. The remaining 41.7% did not pay any money for disposal of wastes choosing to use unimproved methods such as burning and dumping the wastes into the bush. Those who paid money to dispose of their solid wastes used either the public dump and containers or hired private firms to collect their solid wastes from their homes. The minimum amount paid by respondents for disposal of waste was 2 Ghana cedis (GHS) per month and the maximum amount paid was GHS15 a month. The average amount paid by respondents was GHS5.92 per month. About 78.4% of respondents who paid money to dispose of their solid wastes stated that charges for waste disposal were too high. This result suggested that there could be a relationship between the method of waste disposal and charges paid for disposal of wastes.

Another variable that often influences a household's method of waste disposal is the distance or time from a household to a proper sanitation facility. The average time from a house to the nearest public waste collection centre was about 13 minutes as shown in Table 8. Respondents also stated their reasons for choosing a specific method of disposal of solid waste. These included the lack of money to pay for hiring private firms to collect wastes from their homes necessitating dumping the wastes in the bushes, the relatively small amounts of wastes generated by those with relatively small household sizes and the use of bushes to dump wastes for those living close to the bushes.

Table 7. Methods of Waste Disposal by Respondents Based on Frequency Analysis.

| Item | Percent |
|---|---|
| Method of solid waste disposal. | |
| Burned and/or used public dumps or containers | 30.8 |
| Burned and threw them into the bush | 18.3 |
| Disposed of wastes in public dumps or containers | 17.5 |
| Burned the wastes only | 10.8 |
| Hired private firms to collect wastes from houses | 10.0 |
| Threw into the bush. | 5.0 |
| Bush and public dump | 4.2 |
| Bush and buried | 2.5 |
| Buried | 0.8 |

Source: Field survey, 2013

Table 8. Summary of the Amounts Paid by Households on Wastes and Distance to a Sanitation Facility based on Averages.

| Item | Average | Standard deviation |
|---|---|---|
| Monthly amount paid by household for solid waste disposal (GHS) | 5.9 | 3.9 |
| Distance to the nearest public dump container site or waste collection centre based on walking (minutes) | 13.2 | 7.0 |

Source: Field survey, 2013

*4.4 Logistic Regression Analysis of Factors Influencing Householders' Choice of Methods of Collection and Disposal of Solid Wastes*

A binary logistic regression model analysis was undertaken to determine socio-economic characteristics that significantly influenced the choice of householders using approved public waste collection centres and/or hiring private waste collection services to collect their solid wastes from their homes. The logistic regression model was as follows.

$$CHOICE = ß_0 + ß_1 HINCOME + ß_2 DISTANCE + ß_3 EDUCATION + ß_4 PHOUSE + U_i$$

Where CHOICE was a dummy variable with 1 representing householders disposing of their solid wastes into public dumps or using public waste collection centres and/or hiring private firms to collect wastes from their homes (considered to be improved waste disposal), and zero otherwise (unimproved waste disposal).

DISTANCE was the number of minutes from household to the nearest public waste collection centre.

HINCOME was total monthly household income of respondent.

EDUCATION was the level of formal education acquired by the respondent.

PHOUSE was the number of people living in the household.

$U_i$ was the error term initially assumed to have a zero mean and constant variance.

The results of the logistic regression analysis are summarized in Table 9. The model performed well with correct classification of about 80.7% of the observations as measured by the Count $R^2$. The degree of misclassification index was therefore 19.3%. Two independent variables were statistically significant in influencing the odds in favour of householder using public dump container/private waste collection services. These were HINCOME and PHOUSE. HINCOME was positively related to the dependent variable. PHOUSE was negatively related to the dependent variable.

As expected from economic theory, total household income was a highly significant variable in influencing the choice of improved disposal of solid wastes. Households with higher total monthly income were more likely to dispose their solid wastes using improved means such as approved public waste collection centres and/or hire private waste collection firms to collect wastes from their homes. This result corroborated the finding by Anaman and Jair (2000) that wealthier households were more likely to use improved waste collection services.

The number of people living in a household would reduce the probability that the household would dispose wastes at the public dump/hire private waste collection service. This was because an increase in the number of people living in a household would lead to an increase in the generation of wastes. Therefore householders who could not afford to pay for the disposal of their wastes were likely to resort to the use of unimproved disposal methods. This result points to policy intervention that may be required to assist households with many people with incentives to encourage them to properly dispose of their solid wastes generated within their homes. As shown in Table 9, the other two independent variables, LEVELEDU (level of formal education attained by respondent) and DISTANCE (distance from the house to a public waste collection dump or centre) were not statistically significant. This analysis suggested that the real underlying issue was not the distance from the home to the public waste collection centre but rather the fees charged by these centres for the disposal of wastes and the inability to pay those fees by households with relatively low incomes.

Table 9. Results of the Logistic Regression Analysis of Householders' Choice of Method for Collection and Disposal of Household Solid Wastes.

| Explanatory Variable | Parameter Estimate | Standard Error | Probability Level of Significance |
|---|---|---|---|
| Intercept | 0 .393 | 1.076 | 0 .715 |
| Hincome | 0 .007 | 0.002 | 0.000* |
| Phouse | -0.154 | 0 .091 | 0 .090* |
| Leveledu | -0 .133 | 0 .138 | 0.336 |
| Distance | -0 .051 | 0 .037 | 0 .175 |

*Notes:* Sample size was 120.

*Parameter was statistically significant at the 10% confidence level used for the study

The proportion of correct classification (Count $R^2$) was 80.7%.

## 5. Conclusions

This study involved an analysis of the disposal of solid wastes in Gbawe, a representative low-income area in Accra, Ghana. A multi-stage cluster sampling approach was used to randomly select 120 householders from Gbawe. About 59.2% of respondents were females while 40.8% were males. Concerning the first objective of establishing the factors perceived by householders as being responsible for the improper disposal of wastes, the results indicated that attitude problem due to lack of care in proper disposal of wastes, high fees charged at the public waste collection centres and by private waste collection service providers, and weak enforcement of sanitation byelaws by government authorities as the major factors.

The second objective of the study was to ascertain the various methods of waste disposal by householders. About 30.8% of respondents burned and/or dumped their solid wastes at public waste collection centres; 18.5% burned and/or threw their wastes into the bush while 17.5% of respondents disposed their solid wastes at public waste collection centres without burning them. About 10.8% of respondents only burned their wastes and 10% of respondents hired private waste collection firms to collect and dispose of their household solid wastes.

The third objective of the study was to determine the factors that influenced the household's choice of the method of collection and disposal of solid wastes. Logistic regression analysis was used to identify variables which influenced the householder's choice of improved solid waste disposal method. The significant factors that influenced the likelihood of using improved solid waste disposal method were total household income and the number of people in a household. The probability of using an improved method of disposing solid wastes increased with increasing household income but it decreased with increasing number of household members.

High fees charged by managers of public waste collection centres and private waste collection firms were cited as an important cause of the use of unimproved methods of waste disposal by respondents. Further the logistic regression analysis indicated that households with high number of people were less likely to use improved methods of waste collection and disposal. This particular result illustrates the market failure problem of poor people and those with low incomes who are unable to pay for proper disposal of wastes and resort to use of unimproved methods such as dumping into open spaces which contributes to increased incidence of diseases. Therefore the District Assembly (local government authority) should abolish the payment of fees and charges for use of public waste collection centres. This would encourage low-income households to properly dispose of their solid wastes. Financing and maintaining these public waste collection centres can be done through the payment of household property taxes and stricter enforcement of these payments shifting the burden of environmental sanitation to wealthier residents and landlords.

The increase in the number of public waste collection centres, their regular maintenance and regular transfer of the wastes from these collection centres to final disposal sites will encourage the proper disposal of household solid wastes as the distances from homes to these centres will be reduced. The District Assembly should also encourage a recycling programme at public waste collection centres to separate bottles and other useful products from household solid wastes which can be sold to commercial entities to raise money to manage the recycling programme and create jobs for the youth in the area.

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