

# Pseudo Panel Analysis of Waste Disposal and Household Health Expenditure in Ghana: The Role of Institutions

Bismark Osei

University of Ghana, Department of Economics, P. O. Box LG 1181, Legon, Accra, Ghana

Email address: [bismarkosei84@yahoo.com](mailto:bismarkosei84@yahoo.com)

Augustine Adu Frimpong

Southern University and A & M College, Department of Public Administration/Policy

Email: [afaugustine@yahoo.com](mailto:afaugustine@yahoo.com)

Samuel Kwaku Adjei

West African Examinations Council, Ghana

Email address: [skadjei30@gmail.com](mailto:skadjei30@gmail.com)

## Abstract

This study analyzed the effect of waste disposal on household health expenditure in Ghana by using Pseudo Panel technique to inform policy. It further analyzed the role institutions play in dealing with waste disposal and household health expenditure in Ghana. Numerous empirical studies have been carried out on waste disposal. However, these empirical studies did not focus on examining the effect of waste disposal on household health expenditure in Ghana. The study employs pseudo panel constructed from repeated cross sectional data from Ghana Living Standard Surveys (5, 6 & 7) to achieve this objective. The System Generalized Method of Moments (GMM) is employed to estimate the model. Results from the study indicates that, improper solid waste disposal leads to the spread of diseases like malaria, cholera, diarrhoea, dengue and others. This leads to the increase in the health expenditure of these households. However, when solid waste disposal is interacted with institutions (Faith Based Organizations), it reduces household health expenditure. The study recommends that, government institutions should complement the efforts of these Faith Based Organizations (FBOs) to help achieve higher positive outcome.

**Keywords:** Solid waste disposal, liquid waste disposal, household health expenditure, pseudo panel, institutions

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## 1. INTRODUCTION

Waste disposal has been a major challenge for many countries all over the world. According to the World Bank, the global total waste generated was 2.01 billion tonnes which translates into 0.74kg of waste generated on average per person per day in 2016 (World Bank, 2016). Among Sub-Saharan African (SSA) countries, the issue of waste disposal is a perennial problem. Statistics from United Nations Environment Program (UNEP) indicates that in 2015, municipal solid waste generated in Sub-Saharan African (SSA) countries stood at 81 million tonnes (UNEP, 2015). This is expected to grow to 244 million tonnes by 2025 (UNEP, 2015). The sadden part of the story is that, average waste collection rate is only 55% (44.55 million tonnes) among these countries (Farida et al., 2019; Preker et al., 2016; Rafiq et al., 2015; Wang et al., 2019). In Ghana for instance, average waste collection rate is ranging between 35%-40% (Wang et al., 2019). Whiles in countries like Kenya, Mauritius, Rwanda and Cote Divoire average waste collection rate is relatively better ranging between 52%-55% (Wang et al., 2019). Nearly half of these waste remains in the cities, towns, open fields, storm water drains, rivers and others. This leads to the spread of waste-related diseases like malaria, diarrhoea, cholera, dengue and other diseases.

The spread of these diseases increases the health expenditure not only for governments but more also households. Households spend on medical drugs, hospital bills, transportation to health centers and others, this adversely affects their finances. With the low minimum wage paid in Ghana, this poses a challenge to their standard of living. Statistics from International Labour Organization (ILO) in 2017, indicates that on average 47% of workers in Sub-Saharan African (SSA) countries earn below the minimum wage when compared with 18%-23% of workers from Asia pacific countries (ILO, 2017). Monies they could have channeled to other economic activities to improve their standard of living end up in this unnecessary health expenditure. This indeed adversely affects these economies, which calls for urgent need for authorities to deal with this problem.

This perennial problem cannot be channeled only to government but various institutions in the society has a major to play towards tackling this problem. Institutions like Faith Based Organizations (FBO), Civil Society Organizations (Non-Governmental Organizations, foundations, think tanks and others), waste management companies and others have important roles to play towards achieving this. Especially, on the part of Faith Based

Organizations (churches and mosques) through constant training and impacting knowledge in their members on proper waste disposal will help to reduce this problem and household health expenditures. This is because 80%-88% of the population of Ghana belongs to these FBOs. Hence, their ability to carry out this function will help a lot.

This study is of much relevance because according to the United Nations Employment Program (UNEP) report of 2015, Ghana is among the countries in Sub-Saharan Africa (SSA) experiencing poor waste disposal. This unpleasant development which exert adverse effect on households' health expenditure has not been fully examined in the literature. Hence, this study will reveal to governments and others stakeholders, the exact adverse effect of this development on household health expenditure and the appropriate measures to implement to tackle the problem. In addition, the important roles that need to be played by institutions is also highlighted. In order to enlighten various institutions; Faith Based Organizations (FBOs), Civil Society Organizations (CSO) and others. The major roles they have to play to help deal with the problem have also been highlighted in this study.

## 2. LITERATURE REVIEW

This section of the study focuses on both theoretical and empirical reviews to help enhance our understanding on the subject matter.

### 2.1 Theoretical review

The theory of waste and value in health expenditure was developed in 2012 by Fernández-Solís and Rybkowski. According to the theory, examining the relationship between waste disposal management and the value of its health expenditure has become a daunting task in the construction industry. This theory developed by Fernández-Solís and Rybkowski (2012) examines this relationship between these two variables in the construction industry on three scales; owners (strategic), middle managers (logistics) and field personnel (tactical).

The theory highlighted that, enhancing production process will enable workers to understand the needed approaches towards improving production process. This will lead to reduction in waste generation to reduce health expenditures. According to Fernández-Solís and Rybkowski (2012), this will help both managers and owners to appreciate the value of improving production process in order to cut down waste in the construction industry. According to the theory, there is the need to ensure consistent and reliable standard process towards improving waste management in the industry. Moreover, the issue of ensuring transparency in these health expenditures helps workers to cut down waste generation.

Consistently, enhancing the synergistic value of the production process, efficiency of workforces, installation of health facility mechanical system, proper institutional framework and promoting labour force collaboration. These are key components towards achieving reduction in waste generation and health expenditures in the construction industry. There is the need for proper production process and technological progress. This will help generate the needed money for the implementation of effective waste management practises in the industry.

This theory is relevant for the study because it highlights on key strategies needed to ensure cutting down on waste disposal. This is a key component towards improving waste management and reduction in health expenditure. These strategies include; efficiency of workforces, proper production process and technological progress, installation of health facility mechanical system and proper institutional framework. These are the right ingredients according to the theory to help achieve that goal. However, the theory failed to identify the level of investment in research needed to achieve this goal of waste and health expenditure reduction.

### 2.2 Empirical review

This section examines existing empirical studies that have been carried out on the subject matter.

Akmal and Jamil (2021) evaluated the effect improper waste disposal has on heterogeneous households' health expenditure in Pakistan. The study employed cross-sectional quantitative dataset from the residents of Rawalpindi and Islamabad with the use of multistage random sampling for analysis. These heterogeneous households were grouped into two; those that live near the dumpsite (within a range of 100 meters to 500 meters' radius) and those that live far away from dumpsite (more than 500 meters away). The result indicated that, households living within 100 meters from dumpsites are more vulnerable to diseases like malaria, dengue and asthma when compared with those living more than 500 meters away. The study's inability to identify the needed strategies that should be used by local environmental bodies. Towards helping to meet the rising demand for proper waste management services was identified as its weakness.

Farida et al. (2019) examined achieving budget effectiveness by reducing health expenditure through proper waste management practises. In 2016, West Pasaman Regional General Hospital contracted a third party (PT Noor Annisa Kemikal) to help the hospital achieve proper waste management practises. This study examined the proper ways this hospital can use to achieve budget effectiveness by reducing their health expenditure on solid medical waste disposal. The study employed time series data from 2000 to 2018 for the analysis. Findings of the study indicated that, the hospital can internally address this problem by making use of sterilization system with advanced technology to cut down on solid medical waste generation. The usage of this system by the hospital will reduce their health expenditure by IDR. 168,890,000 per year. This will help the hospital towards achieving budget

effectiveness consistently. Development of advanced solid medical waste recycle system needed for achieving budget effectiveness was not well activated by the study. This was identified as the weakness of the study.

Preker et al. (2016) focused on examining health care expenditure caused by waste disposal from pollution which affects soil and water bodies among Lower Middle Income Countries (LMICs). The study employed upper and lower bounds model for the estimation. With the use of datasets on Burden of Disease (BOD) and total cost of health care among these countries. Findings of the study indicated that, annual health expenditure incurred due to waste disposal (caused by pollution) was estimated at US\$130 billion in 2013. Again, the study identified that, 14% of this health care expenditure found in the lower bound model was due to diseases like cancer, chronic respiratory and cerebrovascular illnesses. The relevant evaluation technique for assessing the effectiveness of public health and environmental programs to help prevent this problem was not properly examined by the study. This was identified as the weakness of the study.

Siqueira et al. (2016) focused on examining the effect of poor waste management services on healthcare expenditures using data collected from the metropolitan region of Porto Alegre, Brazil. The study employed cross sectional data and linear probability model for the analysis. Findings of the study indicated that, improper waste disposal resulted in the spread of diseases like diarrhoea, malaria, yellow fever and skin diseases. This led to a higher mortality rate and health expenditures, especially among the aged. The study failed to identify the effective strategic role that needs to be played by privately-owned environmental bodies to deal with the situation. This was identified as the weakness of the study.

Rego et al. (2004) examined the effect of garbage disposal on infantile diarrhoea and health expenditure in Salvador. The study employed cross-sectional data collected on children less than two years in Canabrava and logit model used for the analysis. Variables used for the analysis include; availability of toilet, garbage storage facility inside the house, mother's education, employment of the head of the family and number of people living per room. Result of the study indicated that, children's exposure to these garbage disposals accounted for 95% of infantile diarrhoea in Salvador. This led to the increase in household health expenditure. The government finds it difficult to establish waste recycling plant due to lack of funds. The study failed to identify the appropriate approaches to be employed by the government to achieve that.

These empirical studies together with other studies (Harvey et al., 2015; McCubbin & Delucchi, 1999; Mujtaba & Ashfaq, 2021; McCubbin & Delucchi, 1999; Rafiq et al., 2015; Silva et al. 2013; Yahaya et al., 2016; Wang et al., 2019 and others) have not examined the subject matter with respect to Ghana. Especially, when it comes to examining the effect of waste disposal on household health expenditure. This study fills this yawning gap in existing empirical studies by employing repeated cross-sectional data from Ghana Living Standard Survey (GLSS 5, 6 & 7) to construct pseudo panel for the analysis. In addition, the study contributes to existing empirical studies by highlighting on the roles that needs to be played by institutions towards dealing with the problem.

### 3. METHODOLOGY

This section discusses the construction of the pseudo panel, the model specification and variables used for the estimation.

#### 3.1 Construction of the Pseudo Panel

Pseudo panel can be constructed when there is a repeated cross-sectional data. The fifth, sixth and seventh round of the Ghana Living Standard Survey (GLSS 5, 6 & 7) were used to construct the pseudo panel using their observations as cohorts. A cohort is a group of individuals that have the same characteristics that do not change over time. Cohorts are mostly constructed based on the date of birth of the observations in the survey data (Deaton, 1985). In order to reduce measurement errors, there is the need to have large number of cohorts, preferable more than 72 (Deaton, 1985). For every cohort, it is ideal to have 100 or more observations for the calculation of the means of the cohort. Pseudo panel can either be a static panel or dynamic panel model.

Converting the repeated cross-sectional data into pseudo panel is relevant based on the following reasons; 1) It allows the researcher to use panel estimators; fixed effect, random effect, Generalized Moments of Method (GMM) and System Generalized Moments of Method (System-GMM) to account for the unobserved heterogeneity effect of the observations. 2) It helps to group the observations into cohort (example grouping people based on their date of birth, region of first workplace and others). This helps to evaluate how variables (for example companies' changes in the price of their products or government policies) affects these cohorts differently. 3) Pseudo panel has an advantage over genuine panel because it addresses the issue of attrition (Deaton, 1985; Moffit, 1993). In pseudo panel, the cohorts are constructed based on time invariant variables for example the year of birth of the individual.

Let's assume you want to define a cohort based on those who were born from 1970-1975 in the Eastern region of Ghana. This means that, when the researcher goes for survey to collect data on the second visit and the same individuals cannot be found. The researcher can collect data on those who were born from 1970-1975 in the Eastern region to replace these people in order to carry out the research. In so doing, it addresses the issue of attrition which genuine panel cannot address. Two approaches have been used for constructing pseudo panel in literature; Deaton

approach and Moffit approach. Deaton (1985) first used pseudo panel for his analysis. Deaton's approach for constructing pseudo panel used the observations of the cohort (for example 100 observations) to construct cohort means. These cohort means were used to represent each cohort for the analysis. Due to the construction of the cohort means, continuous variables are more preferred for the analysis. The other approach used by Moffit (1993) employed cohort dummies as an instrument for the analysis. This study employs Deaton's approach for constructing the cohorts and their means for the analysis. This approach is selected due to the nature of the data used for the study.

These cohorts are constructed based on the year of birth of the individuals in the survey data; 1940-1944, 1945-1949, 1950-1954, 1955-1959, 1960-1964, 1965-1969, 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999. Each year of birth group is subdivided into gender (male or female) and region of birth (northern belt, middle belt and coastal belt). Thus, there are cohorts such as 1950-1954 male northern belt, 1950-1954 male middle belt, 1950-1954 male coastal belt, 1950-1954 female northern belt, 1950-1954 female middle belt and 1950-1954 female coastal belt. A total number of 216 cohorts are used for the analysis in order to address the issue of measurement error in the pseudo panel.

### 3.2 Variables, measurement and expected outcomes

This section presents the variables used for the study, their proxies and expected results. All the variables are collected from Ghana Living Standard Survey (GLSS 5, 6 & 7).

#### *Dependent variable*

Health expenditure is proxied by total amount spent on health treatment. The variable is measured in local currency (cedis).

#### *Independent variables*

Solid waste disposal is proxied by the amount paid for refuse disposal while liquid waste disposal is proxied by the amount paid for toilet facility. The two variables are measured in cedis. It is expected that as the citizenry spend on proper waste disposal, it will reduce their health expenditure. Hence, it is expected to have negative effect, as also stated in the study of Addo and Opoku-Acheampong (2015).

Institution is proxied by the type of Faith Based Organization (FBO) the person belongs to. The variable is a categorical variable; 1 (Christian), 2 (Moslems), 3 (traditionalist), 4 (others). Faith Based Organizations' ability to give their members training on proper waste disposal will lead to the reduction in their health expenditure. Hence, it is expected to have negative effect on their health expenditure as also stated in the study of Fernández-Solís and Rybkowski (2012).

#### *Control variables*

Education is proxied by expenses on education. The variable is measured in local currency (cedis). Rendering of better educational services will improve the citizenry's knowledge on better health practises. This will reduce their health expenditure, hence it is expected to have negative effect, as also stated in the study of Isaac and Emmanuel (2015). Access to water is proxied by distance to the source of drinking water. The variable is measured in meters. The citizenry getting access to water will improve their health to reduce their health expenditure. Hence, it is expected to have negative effect, as also stated in the study of Akmal and Jamil (2021).

Employment is proxied by the number of years the individual has been working. The variable is measured in years. As the individual spends more time working, there is the need to enhance their health stock to make them productive. This increases their health expenditure, hence the variable is expected to have positive effect. As also stated in the study of Loboka et al. (2013).

Health facility is proxied by the total amount spend on health facility whether private facility or public facility. The variable is measured in local currency (cedis). Individuals' ability to receive better health facility services will improve their health. Leading to the reduction in their health expenditure, hence it is expected to have negative effect. As also stated in the study of Farida et al. (2019). With respect to age the variable itself is used for the analysis. As the individual ages, their health deteriorates leading to the increase in their health expenditure. Hence, it is expected to have positive effect, as also stated in the study of Mariana et al. (2016).

### 3.3 Model for the study

There is a higher tendency that, household health expenditure incurred in the previous year will have an effect on their current year's health expenditure. For example, if an individual spent on quality healthy drugs, food supplements, better health facility services and moved to a healthy environment in 2010. It is expected that, it will help the individual to maintain a good health condition to reduce their health expenditure in the current year, that is 2011. Hence, the study employs dynamic panel model for the analysis. Panel unit root test is taken to check for the existence of unit root in the panel data. The result shows that, there is unit root in the data as shown in table 5. Hence, System Generalized Method of Moments (System GMM) is used for the analysis.

The general model for System GMM as specified by Hansen (1982) can be written as;

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{it} + \mu_i + \mu_t + \varepsilon_{it} \dots\dots\dots(1)$$

$Y_{it}$  = dependent variable,  $Y_{it-1}$  = lag of dependent variable  $X_{it}$  = independent variables  
 $U_i, U_t$  and  $\varepsilon_{it}$  represent country fixed effect, time fixed effect and idiosyncratic error term respectively.  
 Hence, the study specifies its model as;

$$Hldheaexp_{it} = \beta_0 + \beta_1 Hldheaexp_{i,t-1} + \beta_2 waste_{it} + \beta_3 waste_{it} * Institution_{it} + \beta' X_{it} + \mu_i + \mu_t + \varepsilon_{it} \dots \dots \dots (2)$$

Where  $Hldheaexp_{it}$  is household health expenditure,  $waste_{it}$  comprises of solid and liquid waste disposal. The liquid waste disposal is used for the robustness check. Institutions represents Faith Based Organizations (FBO).  $X_{it}$  represents a vector of control variables that affect household health expenditure. These include; employment (employ), health facility (Hlthfac), education (Educ), age (Age) and access to water (Water). In the equation, waste disposal is interacted with institution to find out how institutions (Faith Based Organizations, FBO, like churches) through educating their members help to reduce improper waste disposal towards reducing household health expenditure.

#### 4. RESULTS AND DISCUSSION

This section focuses on the summary statistics, correlation test, panel unit root test, Sargan test, Arellano-bond test and results from the System GMM.

##### 4.1 Summary statistics

This section presents the summary statistics of the variables (see Table 1 for more details). Due to the higher values of health expenditure, it was logged to improve its summary statistics. Results for the summary statistics as displayed in table 1 indicates that, health expenditure shows a mean value of (4.98), minimum value (0.69) and maximum value (9.97). Liquid waste disposal shows a mean value of (12358.83), minimum value (1340) and maximum value (56894). Solid waste disposal indicates a mean value of (1082.34), minimum value (3) and maximum value (10419.38).

**Table 1 Summary statistics**

| Variable                     | Observation | Mean     | Std. Dev. | Min   | Max      |
|------------------------------|-------------|----------|-----------|-------|----------|
| Health expenditure (Hlthexp) | 216         | 4.980    | 1.936     | 0.693 | 9.972    |
| Employment (employ)          | 216         | 29.185   | 14.843    | 2.791 | 78.88    |
| Education (educ)             | 216         | 71.430   | 126.131   | 3.654 | 1284     |
| Liquid waste                 | 216         | 12358.83 | 10039.34  | 1340  | 56894    |
| Solid waste                  | 216         | 1082.338 | 1775.825  | 3     | 10419.38 |
| Access to water(water)       | 216         | 8.669    | 6.703     | 1.22  | 34.55    |
| Health facility (hlthfac)    | 216         | 8.463    | 4.978     | 1     | 19       |
| Age                          | 216         | 42.509   | 13.237    | 18    | 72       |
| Institution                  | 216         | 5.16     | 1.24      | 2.9   | 8.9      |

**Source:** Data Output from Stata

Results from both liquid waste disposal and solid waste disposal, indicate wide difference in waste disposal among these cohorts in the northern belt, middle belt and coastal belt. The huge population of the country are found in the middle and coastal belts leading to huge level of waste generation in these areas than the northern belt where the population is less dense. This explains the wide difference in the liquid and solid waste disposal among these belts of the country. Results from institutions (faith based organizations) indicate a mean value of (5.16), minimum value (2.9) and maximum value (8.9). This means that, services rendered by these Faith Based Organizations (FBO) towards educating their members on proper waste disposal is almost the same across the northern belt, middle belt and coastal belt.

##### 4.2 Correlation test and panel unit root test

Correlation test is carried out for the independent variables to check for multicollinearity using the Variance Inflator Factor (VIF). The result of the test as displayed in table 4, indicates no existence of multicollinearity among the independent variables. According to the rule of thumb, when the VIF is higher than 5, it represents the existence of multicollinearity among the independent variables. From the estimates obtained shows that, liquid waste disposal has the highest value of 1.23 and institution with a value of 1.22 which means multicollinearity is not a problem for the analysis.

**Table 4:** Variance Inflation Factor (VIF) test for correlation.

| Variables             | VIF  | 1/VIF |
|-----------------------|------|-------|
| Health facility       | 1.03 | 0.972 |
| Institution           | 1.22 | 0.819 |
| Liquid waste disposal | 1.23 | 0.815 |
| Solid waste disposal  | 1.16 | 0.858 |
| Educational level     | 1.03 | 0.975 |
| Age                   | 1.05 | 0.956 |
| Access to water       | 1.12 | 0.896 |
| Employment            | 1.06 | 0.945 |
| Mean VIF              | 1.11 |       |

**Source:** Data Output from Stata

In deciding whether to use Generalized Method of Moments (GMM) or System Generalized Method of Moments (system GMM), the panel unit root test is carried out. The estimate from Fisher-type test shows a p-value of 0.680 in table 5, this means that there is the existence of unit root in the panel data.

**Table 5:** Panel unit root (Fisher-type test)

| Estimation                | Statistic value | Statistic value | P-values |
|---------------------------|-----------------|-----------------|----------|
| Inverse chi-squared (10)  | P               | 93.1097         | 0.6800   |
| Inverse normal            | Z               | -5.8038         | 0.4590   |
| Inverse logit t (29)      | L*              | -10.7689        | 0.3670   |
| Modified inv. chi-squared | Pm              | 18.5839         | 0.2890   |

**Source:** Data Output from Stata

Given this situation, System GMM is more preferred because it uses the lag of the first difference of the variable as instrument to correct for panel unit root. In addition, it also uses the lag level of the variable as instrument to deal with the issue of endogeneity. This increases the number of instruments used for the estimation than GMM.

#### 4.3 Sargan test and Arellano-bond test

The Sargan test for identification of instruments indicates a probability value of 0.62 implying that, all instruments for the analysis are valid as shown in table 6.

**Table 6:** Test for identification of instruments (Sargan test)

| Test        | Chi2   | Prob>Chi2 |
|-------------|--------|-----------|
| Sargan test | 391.66 | 0.62      |

**Source:** Data Output from Stata

Arellano-Bond test is carried out to find out whether there exists serial correlation. The result as shown in table 7 indicates that there is no first order serial correlation in the model.

**Table 7 Test for serial correlation (Arellano-Bond test)**

| Test          | z    | Prob>z |
|---------------|------|--------|
| Arellano-Bond | 1.17 | 0.24   |

**Source:** Data Output from Stata

#### 4.4 Analysis of results from System GMM

This section analyzes the results from the system GMM. The result indicates that, previous household health expenditure has a negative effect on current household health expenditure with a value of 0.29 as shown in table 2. Put differently, the result means that individuals' previous household health expenditure helps to reduce their current household health expenditure. This result is consistent with our expectation and results of these empirical studies (Akmal & Jamil, 2021; Anjali & Sanjay, 2019; Farida et al., 2019). Intuitively, when the individuals are able to spend on quality medical drugs, better health facility services, healthy meals and live in a better healthy environment. It enhances their health to reduce their health expenditure in their subsequent years in their lives.

**Table 2:** Effect of solid waste disposal on household health expenditure

| Household Health Expenditure           | GMM                       | System GMM                  |
|--|---------------------------|-----------------------------|
| Previous Household Health Expend (Lag) | 0.206**<br>(0.0681)       | -0.296***<br>(0.0481)       |
| Solid waste disposal                   | -0.0000696<br>(0.0000740) | 0.000841**<br>(0.000273)    |
| Education level                        | 0.0336<br>(0.0949)        | 0.0913<br>(0.0670)          |
| Health facility                        | -0.175<br>(0.152)         | -0.138<br>(0.113)           |
| Employment                             | -0.0119*<br>(0.199)       | 0.246**<br>(0.132)          |
| Age                                    | 0.00567<br>(0.00994)      | 0.0192**<br>(0.00646)       |
| Institution                            | 0.0389<br>(0.111)         | 0.364***<br>(0.0801)        |
| Access to water                        | -0.00350<br>(0.0208)      | -0.00195<br>(0.0151)        |
| Solidwaste*Institution                 |                           | -0.000166***<br>(0.0000473) |
| <i>N</i>                               | 206                       | 211                         |

Standard errors in parentheses  
 \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Source:** Data Output from Stata

Estimate from solid waste disposal indicates a positive effect on household health expenditure with a value of 0.00085. When you control for these variables; health facility, employment rate, education level, access to water, institutions and ages of the individuals. Put differently, this result means that improper waste disposal leads to the spread of diseases like malaria, cholera, diarrhoea, bilharzia, dengue and others. This eventually leads to the increase in the household health expenditure. This result is consistent with the results of these empirical studies (Isaac & Emmanuel, 2015; Preker et al., 2016; Rafiq et al., 2015).

**Table 3:** Effect of liquid waste disposal on household health expenditure (Robustness check)

| Household Health Expenditure          | GMM                         | System GMM                 |
|---------------------------------------|-----------------------------|----------------------------|
| Previous household Health Expenditure | 0.211**<br>(0.0657)         | 0.299***<br>(0.0465)       |
| Liquid waste disposal                 | 0.0000561***<br>(0.0000151) | 0.000117*<br>(0.0000466)   |
| Education level                       | 0.0770<br>(0.0914)          | 0.118*<br>(0.0658)         |
| Health facility                       | -0.193<br>(0.147)           | -0.103<br>(0.107)          |
| Employment                            | -0.0511<br>(0.190)          | 0.0581<br>(0.135)          |
| Age                                   | 0.00657<br>(0.00958)        | 0.0134*<br>(0.00640)       |
| Institution                           | 0.132<br>(0.109)            | 0.375***<br>(0.0998)       |
| Access to water                       | -0.00256<br>(0.0200)        | -0.0142<br>(0.0149)        |
| Liquid waste*institution              |                             | -0.0000128<br>(0.00000971) |
| <i>N</i>                              | 206                         | 211                        |

Standard errors in parentheses  
 \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Source:** Data Output from Stata

In the study of Rafiq et al. (2005) found strong positive effect on household health expenditure due to the use of genuine panel data from countries in Eastern Europe. In table 3 where liquid waste disposal is used as robustness check, it produces similar positive result with a value of 0.00012. However, when solid waste disposal is interacted with institution (Faith Based Organizations) as shown in table 2. The result indicates a negative effect on household health expenditure with a value of 0.00017. Put differently, the result implies that activities carried out by institutions like Faith Based Organizations (FBO) helps to reduce improper waste disposal, leading to the reduction in household health expenditure.

Faith Based Organizations' (FBO) ability to carry out educational activities for its members on proper waste disposal helps to reduce household health expenditure. The reason is because these activities enhance the knowledge of their members on the negative effect of improper waste disposal. In addition, they sometimes provide them with sanitation facilities to improve their waste disposal. These members' ability to put these training knowledge into practise reduces their exposure to diseases and reduces their health expenditure. In the study of Maggie and Elimelech (2007) rather found a strong negative effect on household health expenditure. Due to frequent educational activities organized by these Faith Based Organizations (FBO) for their members on proper waste disposal.

The estimate for employment indicates that, employment has positive effect on household health expenditure with a value of 0.25. Put differently, the result means that as individuals are able to secure jobs it increases their household health expenditure. This result is consistent with our expectation but not the results of these empirical studies (Foday et al., 2013; Kwasi and Kuitunen, 2005; McCubbin and Delucchi, 1999). In Ghana, a lot of workers work under poor working conditions (excessive working hours with low wages and salaries), this adversely affects their health leading to the increase in their health expenditure. In the study of McCubbin and Delucchi (1999) rather found a strong negative effect on household health expenditure. Their study postulated that, as the individuals' secure jobs they are able to afford good meals, drugs and live in a healthy environment. This helps to improve their health thereby leading to the reduction in their health expenditure.

Result from the ages of individuals indicates a positive effect on household health expenditure with a value of 0.019. Put differently, as the individual's age advances their health deteriorates leading to the increase in their



health expenditure. This outcome is consistent with our expectation and empirical studies carried out by Silva et al. (2013), Yahaya et al. (2016) and Loboka et al. (2013). It is a palpable fact that, as the individual's age advances their health deteriorates as postulated by Grossman (1972) in his model. This leads to the increase in their health expenditure.

## 5. CONCLUSION

Ensuring proper waste disposal has been a challenge to a lot of countries in Africa especially Ghana. In recent times, numerous private waste management companies have sprung up complementing the efforts of government towards achieving proper waste disposal and reducing health expenditure. This study contributes to existing empirical studies by examining the effect of waste disposal on household health expenditure in Ghana. The study achieved its objective with the use of repeated cross-sectional data from Ghana Living Standard Surveys (5, 6 & 7) to construct the pseudo panel for the analysis. The Deaton's approach is adopted for the construction of the pseudo panel with the use of their cohorts and their means for the analysis.

Results from the study indicates that, improper solid waste disposal leads to the spread of diseases like malaria, cholera, diarrhoea, dengue and others. This leads to the increase in the health expenditure of these households. The result from the interaction of solid waste disposal and institutions (Faith Based Organisation) indicates reduction in health expenditure. This means that, activities carried out by these organizations for its members on proper waste disposal prevents the spread of diseases leading to the reduction in their health expenditure. In the study, liquid waste disposal is used for the robustness check, its interaction with institutions result is not significant.

Hence, the study recommends that, local government institutions like Municipal, Metropolitan and District Assemblies (MMDAs) and Ministry of Local Government (MLG) should complement the efforts of these Faith Based Organizations (FBOs) to help achieve higher positive outcome. The study wanted to include the activities of these local government institutions in the analysis but the data was not available. Hence, future studies that can get access to such data should include them in their analysis for more robust results.

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## Data availability statement

The data that support the findings of this study are openly available in [figshare] at [<https://www.statsghana.gov.gh/>]  
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