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INFORMAL COLLECTION OF HOUSEHOLD SOLID WASTE IN THREE TOWNS OF ANAMBRA STATE, NIGERIA

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Key words: street collection containers, cart pushers, long distance

Abstract. Management of urban solid waste implies the collection, transfer, treatment recycle, reuse and disposal of such waste. Collection of urban household solid waste traditionally rests with government agencies designated with such responsibility. Solid waste collection begins from storage at the household level to the final treatment or disposal point and represents the most important aspect of urban solid waste management. Little has however been written on urban household solid waste collection in Nigeria. Using empirical data from three urban areas of Anambra State, Nigeria, the paper examines the place of informal private solid waste collectors in household solid waste collection. The ANOVA technique is used to test the null hypothesis that the sample means of the distance to designated community/street solid waste collection containers in the residential neighbourhoods of the three towns are equal. We conclude on household patronage of informal private solid waste collectors as against government provided community/street collection containers in the areas studied.

Introduction

A common and disturbing sight in the urban residential neighbourhoods in Nigeria are the heaps of uncollected household solid waste at strategic locations. Where the municipal or local authorities have community waste collection receptacles in these neighbourhoods, these are often filled up with household solid waste and spill over to the ground and into the nearby gutters. These receptacles and containers full of household solid waste are left uncollected for days and

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sometimes weeks and subsequently become feeding grounds for dogs as well as breeding grounds for rodents and other disease vectors. They also serve as areas for waste scavengers and picker looking for items from the waste dump which could be reused or sold for money.

According to (Walling et al., 2004), in Nigeria, there are insufficient public bins as the amount of trash that accumulates in a matter of hours appear to be more than waste collectors could collect in a day. In addition, a large percentage of the solid waste fails to get to the urban public dump site. When refuse accumulates, households and businesses pile it in the median of major roads and burn it (Walling et al., 2004).

While waste exists in any of the following three forms, solid, liquid, gaseous or any of the intermingled form, (Cointreau, 1982; & Sha'ato et al., 2007) have noted that solid waste (garbage) specifically exists in either solid or semi-solid state. Therefore, solid waste refers to leaves, food remnants, builders' rubble, biomedical debris, household hardware, plastic materials, paper/cartons, textiles, bones, ash/dust/stones, dead animals, human and animal excreta, bottles/glass, leather and such materials as are thrown away as useless.

The management of urban solid waste is one of the most challenges environmental problems confronting Nigeria and other developing countries, where services are often poor especially in low income areas. Municipal solid waste management thus refers to the collection, transfer, treatment, recycling, resource recovery and disposal of solid waste in urban areas (Coffey and Coad, 2010). Collection of solid waste implies initial storage of waste in the household, business premises or shop, loading and unloading and transfer of the waste as well as all stages of the transportation of the waste to its final disposal or treatment point. While the common buzz words in the media and discussions about the management of urban solid waste are 'recycling' and 'reuse' it should however be noted that the collection and transportation of solid waste represent the most important aspects of municipal solid waste management, for they make the biggest demands on municipal finances and have one of the biggest impact on urban living in terms of public health and the appearance of cities and towns.

In terms of responsibility for collection, this has traditionally been given to the municipal authority, local government or specialised government agency tasked with the function of collection of household solid waste. A common and frequent deficiency however, is the failure of governments to provide sufficient financial resources to necessary to achieve an acceptable level of services for the urban areas of Nigeria and most developing countries. A further unfortunate situation in these countries is that the meagre financial resources are used to acquire inadequate and often inappropriate solid waste collection equipment or to maintain an insufficient and obsolete fleet (Coffey and Coad, 2010; Coad, 2011). The failure to provide

minimum levels of service by the authority tasked with the responsibility for collecting urban household solid waste in Nigeria may explain the rise in the growth in number and patronage of informal private waste collectors by households in the cities and towns across the country. Much has been written on urban solid waste management in Nigeria (see Babayemi and Dauda, 2009; Babalola et al., 2010; Ezigbo, 2012 and Ayuba et. al., 2013). These authors emphasise the need for an effective municipal solid waste management in the urban areas of Nigeria generally and highlight the different aspect of municipal solid waste management. However little has been written on household solid waste collection and even less so on the role of informal waste collectors.

Adebola (2006) observed that the inability of government owned agencies to effectively handle the upsurge in the quantity of municipal solid waste generated must have created a 'vacuum' in the collection, transportation, recovery, recycling and disposal of solid waste in Lagos, a vacuum, which was filled by both the formal and informal private waste collectors.

Olaruntade et. al., (2013) in their work, listed the quantity of municipal solid waste generated in Akure over an eleven year period, between 2000 and 2010, inclusive, noting that the increase over these years was attributed to the increased efforts by government to sanitise the city. Anierobi and Efobi (2013) in their study of Awka and Onitsha in Anambra State, note the role of the informal sector operators in sorting, re-useable and recycling materials from heaps of garbage in dumpsites and converting these wastes to something more useful at a high risk to their health. While these research efforts provide major insights into the study of urban solid waste collection in Nigeria, they however concentrate on the municipal wide level. They fail for example to look at the specific level of residential solid waste. Treatment at this level is very important since the biggest generators of municipal solid waste are the households. In addition, the above studies fail to provide information on the quantity of total household solid waste collected by government waste collection agencies and that which informal collectors cart away or other ways household choose to remove generated solid waste. It is equally necessary to determine specific failings of the public solid waste collection agencies, which households observe and which thus encourage the patronage of informal waste collectors. Such information has implication for route planning, types of vehicle and transportation of collected waste.

This paper therefore is divided into four parts. The first part is the introduction. The second part is on the different methods of collection of household solid waste. The third part of the paper presents the main findings of the study in the case study locations including the test of hypothesis. The fourth part of the paper is the conclusion.

1. Methods of Collection of Household Solid Waste

On municipal wide level, household solid waste account for about 75% of all generated solid waste (Hoornweg and Bhada-tata, 2012). In the developing countries including Nigeria, it is estimated that about 60% of household solid waste consists of organic materials. The remaining 40% consists of inorganic solid waste of paper, cardboard, plastic, glass, rubber and metals (Coffey and Coad, 2010). The point of collection of household solid waste therefore, is the location where the waste passes from the generator, to the collection authority. This is the point of interface between the service beneficiary and the service provider. The generator of the solid waste is thus responsible for taking the waste to the point of collection, and so, is concerned about the time and effort required and must therefore be willing and able to perform this task. On the other hand, the collection agency is concerned about the cost of collection, operation, access, loading as well as problems that arise when the generator fails to perform his task. Four basic location points are possible where the household generated solid waste could be transferred to the collection agency namely;

1.1 Kerbside Collection: This is in street collection at the property boundary of the generator of the solid waste. Under this arrangement, the collection vehicle with its crew collects household solid waste in containers which have been left at the roadside. Residents need to be informed well in advance under this arrangement about the days on which the collection of the household waste will take place so that they can bring out generated waste in time for collection. This method of household solid waste collection requires effectiveness, regular and well organised service to take the households along, because delays in collection will lead to household's waste being left outside for longer periods of time than necessary, with increased incidence of scattering of the waste by animals and waste pickers. This method appears to be commonly adopted method in the developed world having replaced the back-door approach as labour costs of the latter method have increased.

1.2 Back-Door Collection: Under this method of household solid waste collection, residents are only expected to store their waste in their premises outside the backdoor. The waste collection crew goes into each property, takes out the solid waste container, empties same into the collection vehicle and returns the container to its place. With little or no involvement by the household in the collection process, this method of household waste collection results in increased labour cost. In some areas, the privacy and security issues tend to discourage the consideration of this approach. This approach is used mostly in the industrialised countries but is now being replaced by the kerbside collection method because of the high labour cost involved.

1.3 Community/Street Container: This is in the street collection but at a short distance from the property of the solid waste generator. Under this method of household solid waste collection, the residents are expected to bring their generated waste to the point of the community/street container where the solid waste collection vehicle visits at intervals to remove accumulated waste. The main selling point of this method of collection is that it has the potential to significantly reduce the number of points from which household solid waste has to be collected. The potential cost saving advantage of this approach could however be defeated if the community/street containers are too widely spaced out (longer distance for residents), and poor public acceptance and cooperation. This could result in household solid waste being thrown on the ground to avoid having to be brought to the community/street containers.

1.4 Block Collection Method: This is another form of the in-street method where a solid waste collection vehicle travels a pre-determined route at stipulated intervals, known by the residents. The collection vehicle stops, rings a bell or plays music. On hearing this signal, households bring their solid waste container to the collection vehicle and hands it over to a member of the crew who empties the waste into the vehicle and passes the container back to the householder. The timing of this approach must be such that there is a member of the household at home to bring out their solid waste.

Of the four methods discussed, the Community/Street; and Block Collection methods are often seen as providing the lowest level of service. They also represent the commonest methods of household solid waste collect approaches adopted in most developing countries including Nigeria.

2. Littering and Illegal Dumping of Household Solid Waste

Littering and illegal dumping of household solid waste in the residential neighbourhood of urban areas of Nigeria and other countries in the developing world have become major sources of pollution and pose serious health risks to residents and significantly affect the appearance of the neighbourhoods. A number of reasons may be responsible for the littering and illegal dumping of household solid waste in the urban areas of the developing world. These include:

2.1 Inconvenience with Community/Street Solid Waste Collection Containers: Where community/street solid waste collection containers are inconvenient to use, people may drop their household waste besides them rather than into them. Users of these containers who come later would not wish to walk over the dumped waste to reach the containers so they also deposit their solid waste outside the containers. Unsatisfactory features of the containers could include a height that is inconvenient for children using them, lids or covers of containers

which are difficult for children to open or considered to be unclean so users may not want to touch them;

2.2 *Wrongly Located Community/Street Solid Waste Collection Containers:* Community/Street solid waste collection containers need to be located within easy walking distances of the residential properties they are intended to serve. In addition these containers must of necessity be located in places that are accessible to the solid waste collection vehicles. Residents often may be unwilling to cross busy roads to reach a community/street solid waste collection container;

2.3 *Dumping Waste in Drains:* Some residents seem to think wrongly though, that drains are a convenient place for household solid waste. It is assumed that the flowing water will carry the waste away and it will no longer be a nuisance. However, drains are the worst possible place for waste because waste materials block them and provide stagnant stretches of water for mosquitoes to breed and cause flooding (Hoornweg and Bhada-Tata, 2012).

3. Informal Waste Collectors

The rather unsatisfactory system of household solid waste collection in the cities of Nigeria and many countries in the developing world has prompted residents to consider alternative approaches to evacuate household solid waste, including the patronage of informal private waste collectors. Certainly the presence of a vacuum that needs to be filled in the system of household solid waste collection may be responsible for the growth of informal solid waste collection in the towns and cities of the developing world. Informal solid waste collector refers to the person involved in the collection of any substance from the street, or a person who searches for discarded items and collects them (Sentime, 2011).

Informal waste collectors are equally described as people involved in recovering materials to sell for re-use and or/ recycling. The specific place and circumstance pertaining to waste collection seem to determine the different ways of describing informal waste collectors.

In Mexico for example, informal waste collectors are called 'Pepenadores' (Medina, 1997), which implies poor people making a living from waste recovery. In Cairo, Egypt, informal waste collectors are known as 'Zabbaleen' (Neamatulla, 1998), which is Arabic for garbage collector and those involved are mainly migrants into the city.

In Anambra state, and other states in Nigeria, the cart-pushers are the informal waste collectors involved in the house-to-house evacuation of solid waste and transport same to government approved collection point (Community/Street Container) for a fee.

4. Case Study Area

Anambra state is located in the South Eastern part of Nigeria (coordinates 6.3333° N, 7.0000° E) with a 2012 estimated population of about 4.7 million and more than 60% of the population living in urban areas (UN-Habitat, 2009). The three major urban areas in the state are Awka, the state capital, Onitsha, the commercial centre and Nnewi the industrial hub of the state.

The agency tasked with the responsibility of collecting household solid waste in Anambra state, Nigeria, is the Anambra State Waste Management Authority (ASWAMA) which was established to perform the following functions:

- Clean the streets, remove, collect and dispose of domestic, commercial and industrial waste;
- Remove, and dispose of carcass of dead animals from public places;
- Prepare and update from time to time the master plans for waste collection and disposal in the cities, towns and villages in the state and control resultant waste systems within the state;
- Approve and monitor all waste disposal systems in the state;
- Make provision for waste management services to state agencies' local governments, industries, business entities and private persons within the state by receiving waste at the authority's facilities pursuant to contract agreement between the authority and such other party;
- Issue, renew and revoke licence of private waste collectors; and
- Do all such acts as are necessary or incidental to the proper discharge of its duties under the law (Anambra State of Nigeria, 2011).

To perform its function under the above law in terms of collection of domestic solid waste from residential areas, the ASWAMA has provided community/street collection containers at strategic locations along the streets in the residential neighbourhoods where residents are expected to convey generated household solid waste and put same into the containers. The agency hauls such waste in its vehicles to the town's final solid waste dump site.

5. Research Methodology

The research methodology adopted in this study is largely a quantitative design, specifically a sample survey approach to quantitatively determine the percentage of generated household solid waste removed by different means including that collected by informal private waste collectors and the distance to approved community/street solid waste collection containers which households have to cover in the residential neighbourhoods of Awka, Onitsha and Nnewi. Another justification for the choice of a quantitative research approach may be explained by the fact that evidence from the literature supports the use of

quantitative methodology for such a study (Epp & Mauger, 1988; Yusof *et al.*, 2002; OECD, 2008; Kayode & Omole, 2011; Abbasi *et al.*, 2013). The key target population are the household heads to obtain data on household solid waste collection and distance to community/street collection containers. In the absence of a frame of all household heads in the urban areas studied, the research adopted a simple random sampling system for selection of household heads to be enumerated in the residential neighbourhoods of Awka, Onitsha and Nnewi. The simple random approach was also adopted to overcome selection problems arising from the reluctance of some households at being enumerated. A total of 2 field assistants were employed and trained for the enumeration of the household heads.

The study used fully structured questionnaires as the instrument for data collection. This was piloted to validate and sharpen the questionnaires before the final administration on the sampled population was carried out. The questionnaire included questions on the different system adopted by households at collection and disposal of generated household solid waste and the distance in metres to community/street solid waste collection containers.

The direct face-to-face approach of data collection was adopted to collect data on solid waste from the sample respondents. However before the main interviews were conducted, the data collection instrument (structured questionnaires) was piloted (pre-test) to validate the instrument and make sure that the respondents would understand the questions and procedures for data collection. It also served as one of the means for training the 2 field assistants in the data collection procedure. After the pilot of the data collection instrument, the main interview of the respondents was then conducted.

The data collected from the above exercise was coded, collated and imputed into the Statistical Package for the Social Sciences (SPSS) 15 software for analyses and the production of figures (to present and describe results) as well as ANOVA tables to compare mean distances to the community/street solid waste collection containers in the case study towns of Awka, Onitsha and Nnewi, Anambra state, Nigeria..

6. Results and Discussion

Figure 1 provides a breakdown of how sampled households in Awka remove their generated household solid waste. The figure shows that 34% of sampled households indicated that they take their generated household solid waste to the neighbourhood community/street collection containers for the public agency responsible for final collection to collect and convey such waste to the town's final disposal point. Figure 1 equally shows that about 16% of sampled households employ the services of informal private solid waste collectors to pick up their

generated household waste from their homes and convey such to the community/street collection containers.

Figure 1 equally shows that 40% of sampled households either dump generated household solid waste in the bush, burn it or dump it in public drains.

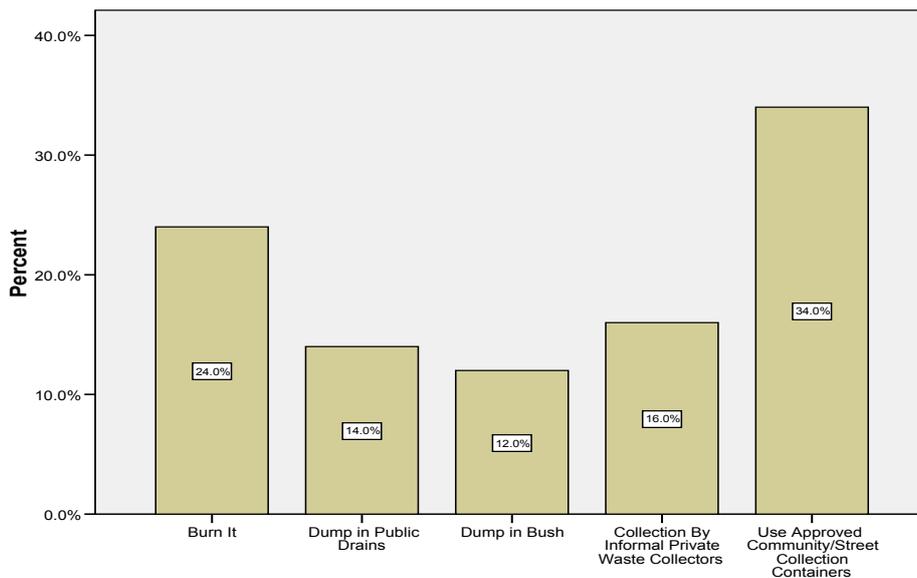


Figure 1 Household disposal of generated solid waste in Awka

Figure 2 provides a breakdown of how sampled household in Onitsha remove generated solid waste. From the table 50% of sampled households employ the services of informal private solid waste collectors to convey such waste to the community/street collection containers. From Figure 2, only about 14% of households prefer to carry generated household solid waste to the government provided community/street collection containers. From figure 2, 36% of sampled households dispose of generated household solid waste either by dumping it in public drains, burning it or dumping it in the bush.

The implication of the information is that the majority of households in the town do not find the use of publicly provided community/street solid waste collection containers as a convenient means to remove generated household solid waste. It does appear that they find the use of informal private waste collectors and other means of disposal more convenient removal and disposal approaches in the town. A general impression from the foregoing is that households in Onitsha, the major economic centre of Anambra state appear not to be well served by the

government provided community/street solid waste collection containers or outright rejection of such collection method.

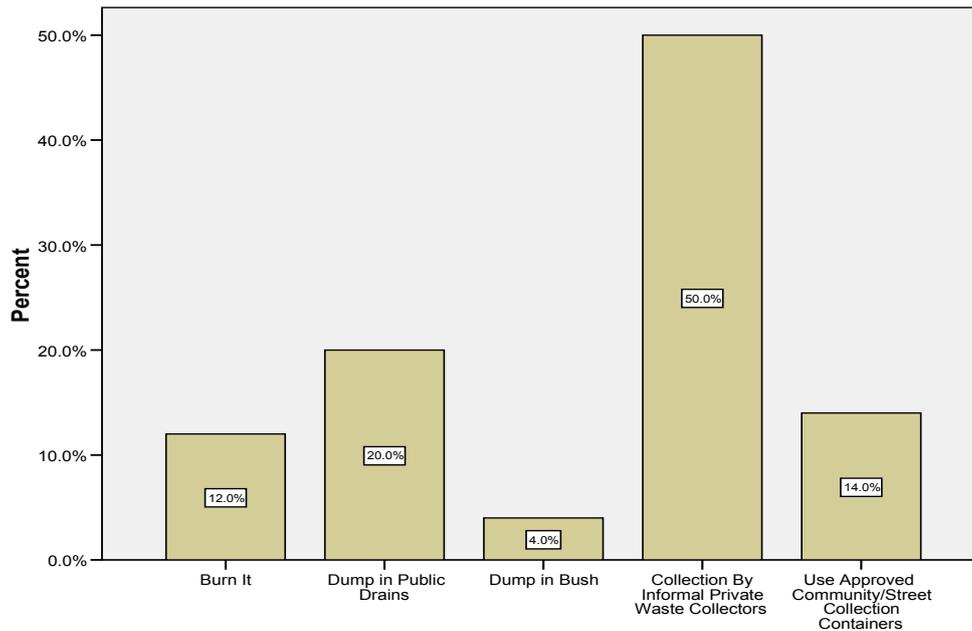


Figure 2 Household disposal of generated solid waste in Onitsha

Figure 3 provides a breakdown of how sampled households in Nnewi, the third town in our area of study, Anambra state, Nigeria remove generated solid waste from their homes.

From Figure 3, 44% of sampled households in Nnewi, Anambra state, the main industrial centre of the state, employ the services of informal private solid waste collectors to remove generated household waste, while 16% of sampled households take generated household solid waste to government approved community/street collection containers. The remaining 40% of households either burn, dump in public drains or dump in the bush, generated household solid waste in Nnewi. A significant point to note here is that in the three towns, sampled residents appear to employ the services of informal private solid waste collectors to remove generated household solid waste. Equally, sampled households appear to 'indiscriminately' dispose of their generated solid waste either in the bush, burn it or dump it in public drains. Another important observation from the sampled households in the three towns is that only in Awka, the state capital do we observe that more than 30% of sampled households use the government provided

community/street collection contains as points of collection for generated household solid waste.

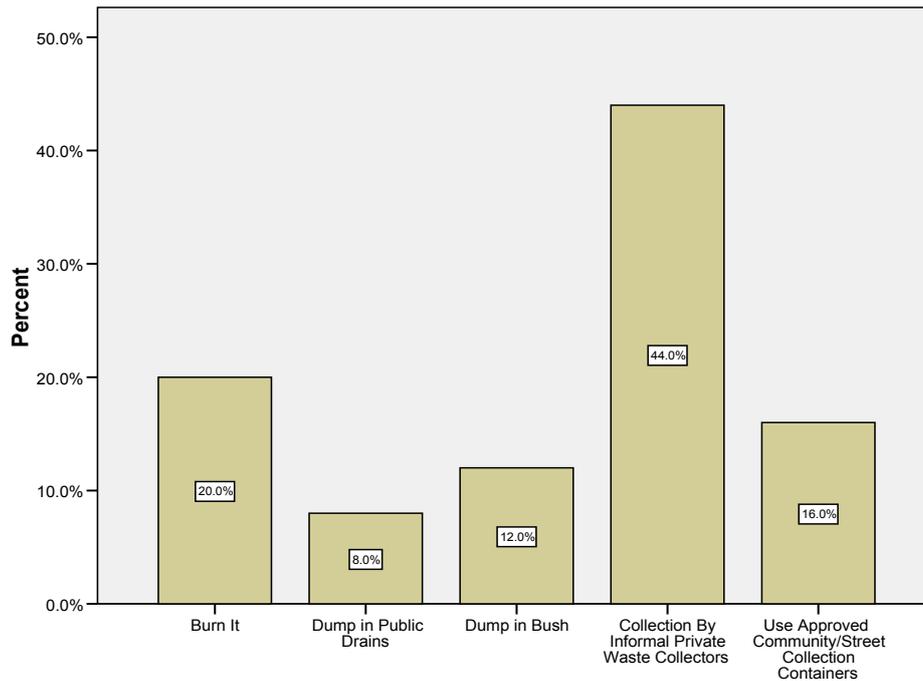


Figure 3 Household disposal of generated solid waste in Nnewi

It is important at this point to see if we could identify an explanation for the disparity in the use of government provided community/street solid waste collection contains by sampled households in the three major towns in Anambra state. Table 1 is a one way ANOVA F -test table. The null hypothesis is that the samples of the distance from households in the study areas come from populations with the same mean. From table 1 we see that the p -score is so low that we reject the null hypothesis of no difference. By rejecting the null hypothesis, we have decided that at least one of these populations has a mean that is not equal to the others.

Table 1 One way ANOVA Analysis of distance to community/street collection containers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	77117177	2	38558588.667	538.736	.000
Within Groups	10521130	147	71572.313		
Total	87638307	149			

The *F*-test itself fails to tell us which of the populations, and how many, differ. The *F*-test also fails to tell us which of the possible pairwise (sub-groups) differences between samples are significant. To determine which samples are significant, we turn to a set of techniques called post-hoc comparisons to find out which of the populations differ(s) from others. Table 2 provides a comparison of means for each town against other towns in the study area.

Table 2 Post Hoc multiple comparisons of mean distance of the three towns
Dependent Variable: Distance to Community/Street Collection Containers Scheffe

(I) Towns	(J) Towns	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Awka	Onitsha	-54.200	53.506	.600	-186.52	78.12
	Nnewi	-1547.400*	53.506	.000	-1679.72	-1415.08
Onitsha	Awka	54.200	53.506	.600	-78.12	186.52
	Nnewi	-1493.200*	53.506	.000	-1625.52	-1360.88
Nnewi	Awka	1547.400*	53.506	.000	1415.08	1679.72
	Onitsha	1493.200*	53.506	.000	1360.88	1625.52

* The mean difference is significant at the .05 level.

The first row in table 2 compares Awka with Onitsha and Nnewi. The second row compares Onitsha with Awka and Nnewi while the third row compares Nnewi with Awka and Onitsha. The important aspect to table 2 is the Sig. column which provides the exact significance for the difference between any two means.

Where this is less than 0.05, SPSS places an * (asterisks), next to the value in the mean difference column, indicating a significant difference between the means of the two samples being compared, at the SPSS default significance level of 0.05. Collecting these * (asterisks) together we can see that a significant difference exists between the means for each of the following pairwise (sub-groups) comparisons:

- Awka by Nnewi

- Onitsha by Nnewi

In other words, for each of these pairwise (sub-group) combinations, we can reject the hypothesis that the mean distance from the residences of households to the community/street collection containers are the same.

The difference in the mean distances to community/street solid waste collection containers in the three urban areas of Awka, Onitsha and Nnewi in Anambra state, Nigeria helps provide explanation for the patronage by households of informal private solid waste collectors in the areas studied. Thus the urban areas with higher patronage of informal private solid waste collectors; Onitsha and Nnewi appear to have higher mean distances to community/street solid waste collection containers than Awka, which has highest patronage of government provided community/street solid waste collection containers. Therefore, it does appear that the lower the mean distance to community/street solid waste collection containers, the higher the use of government provided community/street solid waste collection containers in the towns studied. Conversely, the higher the mean distance to community/street solid waste collection containers, the higher the patronage by households of informal private solid waste collectors.

We equally observe that the higher the mean distance to government provided community/street solid waste containers, the higher the incidence of 'indiscriminate' disposal of household generated solid waste into the bush, public drains or the incidence of burning such waste.

The study has further demonstrated that outside the Anambra state capital of Awka, in the other urban areas such as Onitsha and Nnewi the distance households need to go to a community/street solid waste collection container appears to be much longer. Distance to community/street containers is a very important variable for assessing the effectiveness or otherwise of public waste collection and management agencies in the urban areas of the developing world. The evidence presented by the above study in Anambra state, Nigeria using the urban areas of Awka, Onitsha and Nnewi, does point to an ineffective system of collecting generated household solid waste by the government agency tasked with that responsibility reflected in the 'indiscriminate' disposal of household solid waste and high incidence of patronage of informal private solid waste collectors.

Improvement in the system of solid waste management by the Anambra State Waste Management Authority (ASWAMA) must begin with the reduction of the distances households need to walk to reach a community/street solid waste collection container within residential neighborhoods. The mean distance the agency should endeavour to achieve must be much lower than the current distance as observed in Awka, the Anambra state capita which appears to be the lowest of the three towns.

This the agency can achieve by providing more of such community/street solid waste collection containers closer to residential areas in the urban centres of Anambra state than the evidence currently suggests. With this in place, households are then more likely to take to the community/street solid waste collection containers their generated solid waste for collection by the Anambra State Waste Management Authority and a better and more effective performance by the agency would be the overall outcome.

Conclusions

The study has demonstrated that informal private solid waste collectors play a major role in the cities of Anambra state, Nigeria. Evidence from the three urban areas of Awka, Onitsha and Nnewi, shows, that the informal private solid waste collectors remove generated household solid waste from a large percentage of households, in these areas. The study further shows that the patronage which these collectors enjoy differs across the three urban areas with Onitsha and Nnewi demonstrating higher levels of patronage of the informal private collectors than Awka the state capital. There is also evidence to show that the higher the mean distance the households have to walk to a government provided community/street solid waste collection container, the more likelihood that residents would patronize the informal private waste collectors to evacuate generated household solid waste. The policy implication for a more effective solid waste collection of household solid waste in the urban areas of Anambra state therefore, is on the considerable reduction of the mean distance to community/street solid waste collection containers, than the current distance suggests. This can be achieved through the provision of more of the community/street collection containers much closer to the households they are intended to serve.

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