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Research Article

Household Solid Waste Management (HSWM) Awareness and Applications: A Comparative Study on Urban and Rural Sustainable Practices

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Abstract: Solid Waste Management has been a problem for rural and urban communities. The study aims to provide a basis for urban and rural communities to improve their awareness, attitudes, and practices on solid waste management at a household level and collaborate with local government units toward effective Household Solid Waste Management (HSWM) implementation, ordinances, and mitigation. A 30-item close-ended assessment with 5-item follow-up questions was constructed to determine and compare the level of awareness, attitudes, and practices on HSWM between Barangay Bignay, Valenzuela (urban group), and Barangay Santa Elena, Hagonoy (rural group). The data was analyzed using One Way Analysis of Variance (ANOVA) to know the significant relationship between the bases (i.e., awareness, attitudes, and practices) in both barangays. Findings showed that the awareness of HSWM, practices, and attitude was high in the urban area, having a p-value of 0.003474, a lesser p-value than in rural with 0.007341. The comparisons analyzed using ANOVA reflecting a p-value of 0.96 concluded that there is a significant difference between the bases on the two groups since it is greater than the 0.50 level of significance. The bases were determined to have a positive relationship and thus directly affect the respondents' applications on HSWM and their communities. The LGUs implement an SWM program but still needs improvement as these contradict the measured practices. The study suggests a stricter implementation and orientation for both barangays on solid management programs.

Keywords: Community Perceptions; Environmental Sanitation; Environmental Problems; Reduce, Reuse, and Recycle (3R).

1. Introduction

One of the underlying environmental problems many disregards are waste management in communities, even at household unit levels [1]–[3]. Solid waste management is concerned with 3 (three) components: collection, transportation, and disposal [4]–[7]. Solid waste management is comprehensively subdivided into activities such as the practices of the 3Rs, namely, reduce, reuse, and recycle, as well as segregation and disposal [8]. Improper garbage disposal persists because of the rising global population and the high pace of industrialization. Most people lack environmental education, which often leads to inadequate, if not ineffective, environmental practice [9], [10]. Following this fact, priority should be given to policies aimed at improving environmental sanitation and community perceptions of waste management to reduce disease outbreaks and the negative economic effects associated with lost working hours, treatment costs, and

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clean-up activities at the national level. This research aims to address this urgency [11].

In alignment with this is the Republic Act 9003 or Ecological Solid Waste Management which mandates the implementation of municipal solid waste management programs through local government units (LGUs) in the Philippines. It is one of the programs that the government formed to help with solid waste management. It tells the local government units (LGUs) how to set up their own Solid Waste Management Boards, write a 10-year plan for waste management, build materials recovery facilities (MRFs), and final disposal facilities [12]. Regardless of having such laws, a study about the Philippines' Solid Waste Management states that as the population increases, living standards and industrialization in the urban areas or NCR rises, and thus waste disposal activities rapidly increase even within a day [13].

Besides, the estimation of the National Solid Waste Management Commission exposes that NCR, with 12 million people in an area, generates waste having 9, 212. Ninety-two tons per day, and Region 3 with 3,890.12 tons per day. Moreover, as of 2012, the World Bank predicted that by 2025, the waste would hike to 0.9 kilograms per day from the current record of 0.5 kilograms per day. They concluded that the Philippines has a low end of waste management in the mentioned regions. This study is dedicated to bridging the wide range of problems brought about by the inadequacy of practicing solid waste management. This study mainly assesses the awareness and application of household solid waste management in Barangay Bignay, Valenzuela City, and Barangay Santa Elena, Hagonoy, Bulacan.

It seeks to assess the knowledge of the residents in terms of their household solid waste management practices and procedures to help them have a successful program on solid waste management methods. The researchers are committed to comparing the two barangays that are geographically and socioeconomically different. One with which represents the urban area, and the other is rural. The study is anchored on the study Waste Management in Rural and Urban Ghana". They used a cross-sectional survey in urban and rural in Ghana's Ashanti and Greater Accra regions. The study confirms that the spatial location between the two areas significantly differs in solid waste management [14]–[16].

In addition, a study entitled "Knowledge, Awareness, Perceptions, and Practices on Solid Waste Management of Households in Selected Urban Barangays in Sorsogon City, Sorsogon, Philippines," undermines and supports the claims of this research journal. This study examines the factors influencing household SWM practices in Sorsogon City, Sorsogon, Philippines. They determined if the socio-demographic characteristics and their environmental knowledge, awareness, and perception relate to the household's SWM practices [17].

The study aims to encourage reflection that shall influence the respondents' sustainable lifestyle and fundamentally provide data to ascertain environmental problems through characterizing household-unit dilemmas and act as the basis for effective SWM implementation, mitigation, and ordinances updates within observed communities.

2. Material and Method

2.1. Research Approach

Quantitative and qualitative designs are appropriated and utilized. The researchers gather numerical data by constructing a five-point Likert scale survey form, which implies using quantitative data collection. Albeit having numerical values as such data provide direct answers, a questionnaire is also constructed for follow-up questions that would let the respondents indicate specifically the action plan of their communities, coinciding with the second statement of the problem - which led the researchers in utilizing a qualitative approach. The mixed-method approach is strategic for attaining the specific objectives of the study. It is considered to fill the gap of potentially insufficient data in a quantitative approach that the qualitative approach explains in a rather in-depth manner.

2.2. Instruments

The researcher designed a survey questionnaire to obtain the essential data for this study. A descriptive survey is issued and disseminated in two ways: an in-person survey and social media and email distribution using a Google form to assess the participants. The researcher's readings, references, professional literature, and published publications connected to and pertinent to the study were used to draft an appropriate questionnaire.

2.3. Procedures

To reach out to the 100 respondents, 50 in Barangay Bignay, Valenzuela, and 50 in Barangay Santa Elena, Hagonoy, the researchers have formally written a proposal letter to the Barangay chairpersons of both the urban and rural representatives. The researchers aim to collaborate the study with barangay offices to gain authorization to perform with the research instruments distributed through an in-person approach to follow health protocols.

2.3.1. Assessing the Awareness of Urban and Rural Representatives on HSWM

This portion encompasses assessing the level of awareness of the 100 respondents on household solid waste level of awareness with a five-point Likert Scale labeled "Fully Aware" as the highest and "Not Fully Aware" as the lowest. This scale should alleviate the researchers to determine how high the level of awareness of both groups is and to draw comparisons from the data collected.

2.3.2. Assessing the Attitude of the Urban and Rural Representatives on HSWM

This portion of the survey evaluates the respondents' attitude toward household waste management that intercepts with their environmental concerns on both household and community levels. To aid the respondents in determining their HSWM attitude, ten questions with the same five-point scale were labeled with "Strongly Agree" as the highest point and "Strongly Disagree" as the lowest point.

2.3.3. Assessing how the Urban and Rural Representatives practice HSWM

This portion of the survey suggests common practices that should help the respondents reflect on their solid waste management applications at the household level. Since the researcher aims to determine how such applications are acquired, the five-point scale survey was altered by having "Very Often" as the highest and "Never" as the lowest point. Such applications include composting, reusing, recycling, and engagement in municipal-level waste management.

2.3.4. Determining action plans applied that the respondents' local government provides

This portion of the survey aims to determine the action plans the respondents provided in legal policies or crafted legislation at the local or community level. This lists five-item interview questions that answer their community's most common waste management problems, their commitments to HSWM, the local environmental services, and their suggestion about their community's solid waste management applications.

2.4. Instruments

There is an ethical clearance obtained in the process of doing the research. One of the methods requires the residents to participate in a self-administered survey to determine their awareness and actual practices concerning household solid waste management. Abiding in the Republic Act No. 10173 (Data Privacy Act of 2012), the researchers ascertain that data collected through such procedures as conducting a survey shall initially present data privacy consent or contract and ensure that the subjects' participation is voluntary. The researchers upheld ethical participation and informed them about the study's objectives to also determine the suitability of the respondents for their participation.

2.5. Data Analysis

The researchers initially assessed and accumulated the background profiles of their respondents. This shall lead them to provide answers on their representative locations, i.e., Barangay Bignay and barangay Santa Elena, their ages, and the number of households. Upon accomplishing this socio-demographic information, the researchers categorically determine the number of respondents.

The survey respondents shall answer subdivided into three bases or parts. The researchers aim to assess the respondents' awareness, attitudes, and practices that would reflect on how evident household solid waste management applications are in rural and urban areas, thus comparing which sites need prioritizing with SWM education. To test the correlation between the bases set in both urban and rural barangays, analysis of variance (ANOVA) is used. Finally, the listing method shall be utilized to collectively present the personal insights and recommendations in enforcing SWM in their communities from the lenses of the respondents of the rural and urban representatives.

3. Result and Discussion

3.1. Socio-Demographic Profile

The sociodemographic profile of the respondents is imperative to test the proportions of the two groups being monitored. The following figures, therefore, give the percentage of the group according to categorical questions, such as gender, location or community, and total number in the household

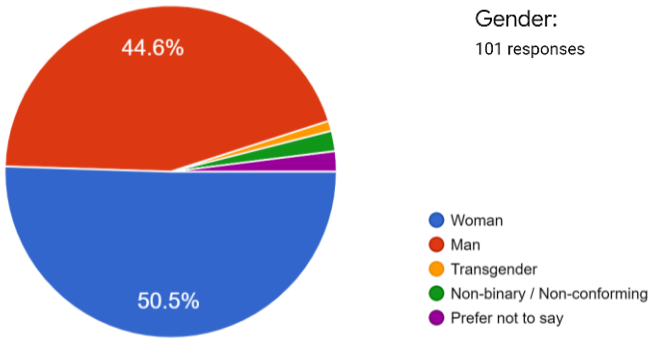

Figure 1. Gender Identity of Survey Respondents

The survey responses reveal that most of the respondents who engaged in the survey that discusses household solid waste management are women. Drawing this data, the researchers have assessed that the

dominance of women gender with 50.50% may imply that most of the respondents in both urban and rural groups are concerned with environmental practices are women. This is followed by 44.60% of men, and the remaining percentages were transgender and non-binary gender groups. The dominance of gender may directly affect the results analyzed, as described in Tables 1, 2, and 3.

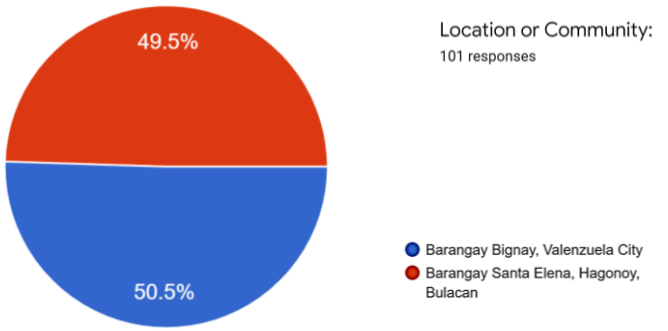

Figure 2. Respondents on Urban and Rural Community

This chart shows the proportion of respondents based on their designated location or communities. 49.50% of the sampled respondents reside in Barangay Santa Elena, Hagonoy, Bulacan. Meanwhile, a large percentage of 50.50 percent resides in barangay Bignay, Valenzuela City. This happens because 51 respondents belong to the urban group (Barangay Bignay), and 50 belong to the rural group (Barangay Santa Elena). To avoid encountering gaps in quantifying the scores, the researchers agreed to limit the groups to 100 respondents, with each community having 50 respondents.

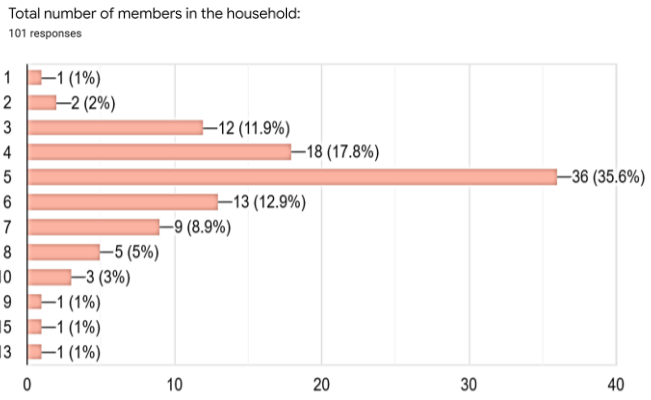

Figure 3. The total number of members in the household of respondents.

The survey shows that most respondents have had 5 (five) members in their households, garnering 35.60%. This is followed by having 4 (four) members, which is 17.80% out of the total responses in the survey. 12.9% of the survey have 6 (six) members in their households. Observing this data led the researchers to strategically reach out to more respondents through referral or snowball sampling.

3.2. Assessment and Relationships

Directly answering the problem statements in the research, comparisons between urban and rural awareness, attitude, and practices on Household Solid Waste Management (HSWM) were performed using One-Way Analysis of Variance (ANOVA).

Table 1. Comparing Urban and Rural Awareness in HSWM (ANOVA)

Groups	Count	Sum	Average	Variance
ATU	10	41.14	4.114	0.19316
ATR	10	38.96	3.896	0.21918

Source of Variation	SS	df	MS	F	P-value	F-crit
Between Groups	0.238	1	0.238	1.153	0.297	4.414
Within Groups	3.711	18	0.206			
Total	3.948	19				

The urban and rural attitudes were also compared by getting the aspect mean of the scores of the ten-item set for attitude questions. Treating the data with single-factor ANOVA yielded a p-value of 0.297. Because the p-value of 0.297 is greater than the 0.05 level of significance, this implies that there are significant differences between the two groups. Meanwhile, based on the mean and variance of the two groups, the urban group has a better attitude in HSWM.

Table 2. Comparing Urban and Rural Attitudes on HSWM (ANOVA)

Groups	Count	Sum	Average	Variance
AWU	10	37.54	3.754	0.14018
AWR	10	36.90	3.690	0.03691

Source of Variation	SS	df	MS	F	P-value	F-crit
Between Groups	0.020	1	0.020	0.231	0.636	4.414
Within Groups	1.594	18	0.088			
Total	1.614	19				

Urban and rural awareness were compared by getting the aspect mean of the scores of the ten-item awareness

questions. By treating the data with One-Way ANOVA, the p-value of 0.636 was obtained. Because the p-value of 0.636 is greater than the 0.05 level of significance, this would imply that there are significant differences between the two groups. On the other hand, comparing the two means and variances concludes that the urban group has a higher awareness of HSWM.

Table 3. Comparing Urban and Rural Practices in HSWM (ANOVA)

Groups	Count	Sum	Average	Variance
PRU	10	32.50	3.250	0.46989
PRR	10	32.64	3.264	0.26971

Source of Variation	SS	df	MS	F	P-value	F-crit
Between Groups	0.001	1	0.001	0.002	0.960	4.414
Within Groups	6.656	18	0.370			
Total	6.657	19				

The urban and rural practices were finally compared by getting the aspect mean of the scores of the ten-item practice questions. By once again treating the data with single-factor ANOVA, the p-value of 0.960 was obtained. The p-value of 0.960 is greater than the 0.05 level of significance, thus implying that there are significant differences between the two groups. Meanwhile, based on the mean and variance of the two groups, it is evident that the urban group has better HSWM practices.

From the data treatment presented, a problem statement was answered to determine which has a higher awareness, attitude, and practice of good household solid waste management. The urban group has better HSWM awareness, attitude, and practices than of rural group.

To elaborate, the quantifiable assessment was supported with follow-up questions that provide lists of the existing local action plans on communities being compared based on respondents' retention and answers (Table 4).

Table 4. List of Existing LGU Action Plans

Barangay Bignay, Valenzuela (Urban Group)	Barangay Santa Elena, Hagonoy (Rural Group)
Para sakin is yung TUPAD na ginagawa yung araw-araw na pagwawalis sa kalsada, although may bayad sya but atleast na-educate ang tao about environmental responsibilities.	*Gumawa ng pangkat na mag lilinis ng karsada kada araw*
1. Scheduled collection of waste/garbage. 2. Street sweepers 3. In schools, colored trashcans were for segregation.	I think the "*tapat ko, linis ko*". Wherein we should take responsibility for the waste in our place. Moreover, some campaigns on how to properly dispose of garbages.
The community started a clean-up drive program which also promotes/teaches proper waste segregation and disposal to the community members.	Safe Closure and Rehabilitation Plan
Pet bottles sa *mga kanto*	Can hardly recall it. However, the MRF still exists up to this time with veggie plants around it. Our barangay has push-cart collectors who make rounds from one house to another on a scheduled basis.
May Balik Sa Plastik program	TUPAD

The table filters the answers and features the highly relevant action plans for the study. This answers the problem statement, which aims to evaluate the existing action plans of their local government unit that the respondents personally apply. With these as bases, the researchers could point out and agree that the action plans provided lacked public awareness, implementation, community engagement, and penalties.

To satisfy the problem statement, which aims to substantiate the relationship between the variables, ANOVA was applied to both urban and rural awareness, attitude, and practices, as presented in Tables 5 and 6.

Table 5. Relationship of Awareness, Attitude, and Practices on Effective Household Solid Waste Management in Urban

Groups	Count	Sum	Average	Variance
AW	10	37.54	3.754	0.14018
AT	10	41.14	4.114	0.19316
PR	10	32.50	3.25	0.470

Source of Variation	SS	df	MS	F	P-value	F-crit
Between Groups	3.767	2	1.884	7.035	0.004	3.354

Source of Variation	SS	df	MS	F	P-value	F-crit
Within Groups	7.229	27	0.268			
Total	10.996	29				

From the data in the above tables, the researchers concluded that awareness, attitude, and practices in the urban and rural groups have a significant relationship. The Urban group has higher household solid waste management practices and applications among the two places being compared. This can be cited in determining their p-values, with Barangay Bignay having a p-value of 0.004, a lesser p-value than rural with 0.007.

The outcomes of this study were as follows: Residents in both urban and rural areas have a strong affiliation between their awareness, attitudes, and practices. There is a substantial difference in the solid waste management organizations in urban and rural areas. Urban areas receive better solid waste management services than rural ones. The study's solid waste composition analysis found that of the two localities being studied, Barangay Bignay, Valenzuela has higher household waste management techniques and practices than the other. In terms of sorting, decreasing, repurposing, and recycling solid waste, urban dwellers are more conscious and practiced than rural residents.

4. Conclusion

This research also reveals various essential discoveries that will impact solid waste management. Moreover, scheduled waste collection and volunteer sweepers, colored trash bins, *Tulong Panghanapbuhay sa Ating* Disadvantaged/ Displaced Workers (TUPAD), *May Balik sa Plastik* Program, and Safe Closure and Rehabilitation Plan are just a few of the services that are provided. Although the private sector is participating in the handling and disposing of the created solid waste, the existing condition leaves much to be desired. According to the report, this situation is a recipe for a major epidemic of diseases in urban and rural areas.

Compared to rural communities, this study demonstrates that the solid waste condition in urban areas is terrible. Although urbanized areas have superior services, solid waste management is still a problem. SWM could be increased urbanization and changes in urban consumption levels.

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