Household Awareness and Compliance to Waste Segregation in Tuguegarao City

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Abstract

The increasing volume of household waste remains to be a growing challenge for many urban communities. In Tuguegarao City, daily waste production experiences a steady rise, with households contributing to the bulk of the total waste output. Henceforth, this study aimed to assess the level of awareness and compliance of households to waste segregation using a mixed-method design anchored in the Theory of Planned Behavior. Survey results from 382 households revealed high levels of awareness (M = 20.5) and compliance (M = 3.28), with significant differences observed on age, education, income, and household size. A positive correlation (r = 0.288, p < .001) indicated that higher awareness led to better compliance. Qualitative findings unveiled that proper information dissemination and social influence acted as key enablers, while weak policy enforcement, insufficient resources, and competing household priorities served as key inhibitors.

Keywords: *household waste, waste segregation, awareness, compliance*

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Introduction

The world continues to generate a plethora of waste that varies in classifications and sources on an unprecedented scale. A significant contributor to the global waste crisis is municipal solid waste (MSW), which encompasses all types of waste that originate from residential and commercial sources. In fact, the United Nations Environmental Programme (2024) reported that over 2 billion tons of MSW across the globe are generated annually, with projections indicating a rise to nearly 3.8 billion tons by 2050. To put this into perspective, if all MSW were to be compressed into standard shipping containers and lined up from one end to another, they would be able to encircle the Earth's equator up to 25 times (UNEP, 2024). Such staggering quantities underscore the urgent need for efficient and sustainable solid waste management practices. Nonetheless, there have been efforts to address this burgeoning issue such as the formulation of the Sustainable Development Goals (SDGs), notably SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, and SDG 14: Life Below Water. However, despite such attempts to mitigate this crisis, the global community is still experiencing a continuous upward trend in waste production.

Significantly, households in urbanized areas assume a substantive role in the daily production of waste as they are able to generate considerable amounts. This necessitates the importance of implementing regular waste collection schedules and ensuring proper segregation practices to facilitate safe disposal. By adhering to these measures, environmental cleanliness is preserved, and public health is upheld. Ultimately, effective waste management practices are essential to address the increasing waste generated in urban areas, which pose a significant challenge to sustainable development.

In the Philippines, the Environmental Management Bureau (2019) unveiled that residential waste emerges as the predominant contributor of the nation's total municipal solid waste output, accounting for 56.7%. It was also revealed in 2010 that the country grapples with a daily average waste generation per capita of 0.40 kilograms. However, if all cities, excluding Manila, and provincial capitals, are to be scrutinized or taken into account, this figure escalates to 0.50 kilograms, indicative of the heightened waste production dynamics inherent in urbanized settings. Notably, within the bustling metropolis of Metro Manila alone, the daily per capita waste generation further surges to 0.60 kilograms.

In Tuguegarao City, waste management is regulated by the Comprehensive Environmental Management Code (City Ordinance No. 58-2017), which aims to promote environmental conservation and proper waste disposal. In addition, Article 2 of the ordinance states the individual responsibilities of residents on the proper manner of disposing waste. However, data from the Updated Ten Year Ecological Solid Waste Management Plan (2016-2025) indicates that residential areas contribute significantly to waste generation, with 54,745 kilograms produced daily. Additionally, Jaucian & Sugarol

(2022) reported that in 2007, the city produced a weekly total of 1,012 cubic meters of municipal solid waste, which is equivalent to each resident producing 0.5 kilograms of waste per day in urban barangays and 0.42 kilograms per day in rural barangays.

Moreover, projections also suggest a continual increase in the city's total waste generation, with figures reaching 105,390.657 kilograms per day in 2022, 107,424.839 kilograms per day in 2023, and an expected rise to 111,611.517 kilograms per day by 2025. The main issue in the aforementioned solid waste management plan is that few households properly segregate their waste, especially in the urban barangays. Without proper and immediate action, this trend could result to the deterioration of both the environment and public health in the years ahead.

Therefore, there is a clear need to focus on the level of awareness and compliance of Tuguegarao City's residents regarding waste segregation. A study in this regard would be imperative for the following reasons. First, gaining understanding into the awareness and compliance levels among Tuguegarao City's residents may provide valuable insight for the development of effective policies and programs aimed at addressing the city's waste management issue. Second, while there exists an abundance of research on waste segregation awareness and compliance, very few studies focus specifically on Tuguegarao City. Thus, this study fills a critical gap in the literature, contributing significantly to the understanding of household waste segregation practices in the city.

Research Objectives

The study examined household awareness and compliance with waste segregation, taking into account respondent profiles such as age, sex, marital status, income, education, and household size. It assessed levels of awareness and compliance, identified significant differences based on household profile, and analyzed the relationship between awareness and compliance.

Methodology

Research Design

The study utilized a mixed-method research design consisting of two phases: quantitative and qualitative. The quantitative phase was used to measure the level of awareness and compliance of the respondents to waste segregation, along with their potential correlations. With the aid of the results from the initial phase, the qualitative phase then identified the enablers and inhibitors of households in practicing waste segregation.

Locale of the Study

The study was conducted in Tuguegarao City, the capital of the Province of Cagayan, which is situated in the northeastern region of the Philippines. The city has been selected due to its current waste management issues. In total, there are 49 barangays with differing

populations and socioeconomic status. Specifically, households spread across the barangays are the primary target.

Sampling Procedure

The researchers employed a multi-stage sampling design consisting of two stages. In the first stage, a simple random sampling technique was used to select the barangays to be included. Within these selected barangays, cluster sampling was utilized to divide each barangay into zones. These zones underwent a random selection to ensure a representative sample from each barangay. In the second stage, respondents were identified from the sampled zones using simple random sampling once again.

Research Respondents/Participants

In the quantitative phase, the respondents consisted of 382 household heads, defined as individuals responsible for making decisions within their homes and as the primary contributors to the household income. For the qualitative phase, participants were selected from the extremes of the true-or-false test results, specifically the five highest-scoring and five lowest-scoring respondents comprising of a total of ten participants.

Research Instrument

The study employed a questionnaire and interview guide crafted by the researchers, which undertook content validation and Filipino translation by experts. The questionnaire includes three sections: the profile of the respondents, a true-or-false test assessing the level of awareness to waste segregation, and a Likert scale measuring the level of compliance to waste segregation. The items in the latter two sections are drawn from the provisions outlined in Ordinance No. 58-2017, also referred to as the Comprehensive Environmental Management Code of Tuguegarao City.

Research Procedure

The researchers first sought the permission of the mayor to conduct the study within the city, followed by the approval of the barangay captains in their respective barangays. Each respondent was provided with a personal questionnaire accompanied by a free and prior informed consent form, ensuring he/she has the autonomy to participate willingly. Interviews were personally administered after data from the questionnaires were generated. The identities of all respondents were kept anonymous, and the results were handled with the utmost confidentiality.

Ethical Considerations

This study adhered to the highest ethical standards while ensuring the integrity of the data collected. The researchers acknowledged the profound responsibility to protect the rights, privacy, and welfare of all individuals involved. This commitment to ethical conduct included obtaining informed consent from the respondents and ensuring confidentiality throughout the research process. Thus, obtaining necessary permissions from relevant

authorities, such as barangay captains, and the respondents and participants were ensured before undertaking the study.

Data Analysis

Frequency and percentage were used to analyze the profile of the respondents, while their level of awareness and compliance to waste segregation were assessed by calculating their means. Awareness was interpreted using the following scores from the true-or-false test: Not at all Aware (1–6), Slightly Aware (7–12), Moderately Aware (13–18), and Fully Aware (19–25). On the other hand, tests of differences were examined using t-test and Analysis of Variance (ANOVA), while Pearson Correlation Coefficient (r) was used to investigate the relationship between the level of awareness and compliance of the respondents to waste segregation. Additionally, the qualitative findings underwent transcription, coding, and thematic analysis.

Results/Findings

Profile of Respondents

The respondents in the study varied across age groups, most of which falling between the age range of 25 to 34 years, comprising 23.30% of the sample (89 individuals). Majority of the respondents were female, accounting for 62.97% (238 individuals). As for marital status, the largest proportion of respondents, comprised of 60.73% (232 individuals), were married individuals. Regarding monthly income, nearly half of the respondents, 48.43% (185 individuals), fell under the low-income bracket, earning between ₱9,520 and ₱21,194. Educational attainment was relatively high, with 43.19% (165 individuals) being college graduates. Household size also showed notable trends, with 41.62% (159 households) having five or more members. Most households had two adults (65.18% or 249 households) and one child (40.63% or 141 households).

Table 1. Profile of Respondents

Variable	Frequency	Percentage
Age		
18-24	56	14.66
25-34	89	23.30
35-44	72	18.85
45-54	62	16.23
55-64	61	15.97
65 or above	42	10.99
Sex		
Male	238	62.97
Female	144	37.03
Marital Status		
Married	232	60.73
Single	98	25.65
Living in cohabitation	23	6.02
Separated	5	1.31
Widowed	24	6.28

Income Class		
Poor (below ₱9,520)	6	1.57
Low Income (but not poor, ₱9,520 To ₱21,194)	28	7.33
Lower Middle Class (₱21,194 to ₱43,828)	48	12.57
Middle Class (₱43,828 to ₱76,669)	185	48.43
Upper Middle Income (₱76,669 to ₱131,484)	115	30.1
Highest Educational Attainment of the Household Head		
No Grade Completed	11	2.88
Primary Education Graduate	11	2.88
Elementary Graduate	42	10.99
Junior High School Graduate or High School Graduate (RBEC)	84	21.99
Senior High School Graduate	30	7.85
College Graduate	165	43.19
Post-Baccalaureate Graduate	39	10.21
Total Number of Members in the Household		
1	10	2.62
2	25	6.54
3	65	17.02
4	123	32.20
5 or above	159	41.62
Total Number of Adults in the Household		
1	60	15.71
2	249	65.18
3	36	9.42
4	27	7.07
5 or above	10	2.62
Total Number of Children in the Household		
0	46	13.26
1	141	40.63
2	89	25.65
3	45	12.97
4 or above	26	7.49

Level of Awareness of The Respondents to Waste Segregation

The level of awareness of respondents toward waste segregation was remarkably high, with 74.35% (284 respondents) being fully aware. Another 24.61% (94 respondents) were found to be moderately aware, while only 1.05% (4 respondents) were slightly aware.

The mean score of 20.5 corresponds to a category of "fully aware," highlighting a generally strong awareness of waste segregation practices among the respondents.

Table 2. Level of Awareness of the Respondents to Waste Segregation

Level of Awareness	Frequency	Percentage
Fully Aware	284	74.35
Moderately Aware	94	24.61
Slightly Aware	4	1.05
Mean Score	**20.5**	**Fully Aware**

Level of Compliance of The Respondents to Waste Segregation

The level of compliance with waste segregation practices was similarly high, with 63.09% (241 respondents) identified as fully compliant. Following this, a smaller group of 25.92% (99 respondents) were labelled as moderately compliant, while 10.99% (42 respondents) were categorized as sometimes compliant. The mean compliance score of 3.28 also indicates that respondents, on average, are classified under the "fully compliant" category.

Table 3. Level of Compliance of the Respondents to Waste Segregation

Level of Compliance	Frequency	Percentage
Fully Compliant	42	63.09
Moderately Compliant	99	25.92
Sometimes Compliant	241	10.99
Mean	**3.28**	**Fully Compliant**

Correlation Between the Level of Awareness and Compliance of The Respondents to Waste Segregation

A significant positive correlation was found between the level of awareness and compliance with waste segregation ($r = 0.288$, $p < .001$). This suggests that higher awareness is associated with better compliance, emphasizing the importance of educational initiatives to promote waste segregation practices.

Table 4. Correlation Matrix

		Level of Compliance	Level of Awareness Score
Level of Compliance	Pearson's r	—	
	df	—	
	p-value	—	
Level of Awareness Score	Pearson's r	0.288 ***	—
	df	380	—
	p-value	< .001	—

Note. H_a is positive correlation

Table 4. Correlation Matrix

	Level of Compliance	Level of Awareness Score

Note. * p < .05, ** p < .01, *** p < .001, one-tailed

Enablers and Inhibitors Influencing Household Awareness and Compliance to Waste Segregation

Key enablers to household waste segregation include proper information dissemination with signages, posters, and barangay meetings serving as efficient reminders. Social media, particularly Facebook, have also been instrumental in raising awareness as local authorities often post announcements online. Additionally, various communal activities such as seminars, workshops, and clean-up drives have not only raised awareness to waste segregation but also encouraged further engagement. Following this, clear instructions have also been cited as a key factor in enabling compliance. Another significant factor is the often-overlooked role of social influence. Many claim that they engage in segregating waste because they observe others practicing it, in addition to recognizing the perceived benefits that it brings to the society and the environment. Some also added that giving incentives to households who handle waste properly would further encourage others to participate.

In terms of inhibitors, a primary constraining factor is the weak enforcement of City Ordinance No. 58-2017. Without proper implementation, people tend to go about their own doing, leading to apathy or lack of motivation. Participants also pointed out the insufficiency of necessary resources like bins and collection areas, which makes proper segregation difficult. Many also shared that they are often too busy or physically tired to monitor waste at home, especially after work, making compliance even harder.

Table 5. Themes, Codes, and Significant Responses of Study Participants

Themes	Codes	Significant Responses of Study Participants
	Enablers	
Proper Information Dissemination	• Availability of Reminders	The signages in our barangay have really been a big help because that's where we get instructions on how to separate our trash at home. **P3**
	• Awareness through Social Media	We mostly find out about reminders from the LGU through Facebook and other barangays...so we just follow what they're doing. **P3**
	• Community Education	I believe the awareness campaigns in schools and the community have really helped me get into the habit of separating our waste. **P4**

	• Significance of Meetings	During barangay meetings, they always bring up the importance of it [waste segregation], which is a nice reminder. **P1**
	• Clarity of Rules	I think what really helps waste segregation work here is having clear rules. **P4**
Social Influence	• Social Encouragement	I see our neighbors and relatives actively separating their trash, which encourages me to do the same. **P2**
	• Perceived Social Benefit	Honestly, it's knowing that waste segregation helps keep our barangay clean and protects the environment. **P1**
	• Rewards and Incentives	Maybe offering rewards or incentives for households doing a good job in segregating waste would encourage others to get on board too. **P4**
Inhibitors		
Weak Policy Enforcement	• Lax Enforcement of Policy	It seems like our officials are a bit relaxed when it comes to imposing fines. I've seen some cases where the segregation wasn't done properly, but they weren't called out for it. **P3**
Insufficient Resources	• Lack of Proper Bins	The barangay doesn't provide free bins, so we end up buying trash bags all the time to use at home. Sometimes, we even have to use old sacks when we run out of bags.) **P2**
	• Insufficient collection spots	Additionally, not having easy access to collection spots makes it even harder to stick to proper waste segregation. **P4**
Conflicting Tasks	• Competing Household Priorities	Balancing everything at home, like chores and other responsibilities, makes it hard to prioritize waste segregation. More often than not, we end up forgetting to separate our trash, and the bins get mixed up because we're focused on other things. **P5**
	• Practical barriers	Sometimes when I'm too tired from work I can't double check the waste if it's properly segregated before disposing it at the designated place for garbage collection. **P3**

Discussions

The study unveiled invaluable insights regarding the level of awareness and compliance of households to waste segregation in Tuguegarao City. Findings indicate that respondents exhibited a generally high level of awareness in terms of the city's prescribed waste segregation practices, as stipulated in City Ordinance No. 58-2017, with a mean score of 20.5 which translates to "fully aware." Similarly, results also show that a mean of 3.28 have

been obtained by the respondents which is equivalent to "fully compliant" on the compliance scale.

These results align with the Theory of Planned Behavior (Ajzen, 1991), which explains that awareness reflects attitude, a key predictor of behavior. In this case, a stronger awareness of waste segregation leads to more positive attitudes, which in turn support better compliance. When people understand the value of a behavior, and believe they are capable of doing it, they are more likely to act accordingly.

Among profile variables, age, highest educational attainment of the household head, and total number of children in the household were found to significantly influence both the respondents' level of awareness and compliance to waste segregation. However, variables such as household income and total number of adults were also found to affect the latter.

The study revealed that respondents of the younger age group, specifically 18-24 and 25-34 years, scored significantly higher than those in the older age brackets in both aspects of awareness and compliance. This result negates the claim of Vassanadumrongdee and Kittipongvises (2018), who suggested that elderly individuals are more knowledgeable and compliant when it comes to waste management. This can be attributed to the fact that younger generations have more access to social media which also serves as a vast repository for environmental advocacies such as proper waste segregation.

Additionally, younger individuals are often more exposed to environmental education, be it through school programs or various subjects concerning the environment such as science or civics, which highlights the importance of another significant variable: educational attainment. Respondents who are post-baccalaureate graduates scored significantly higher in waste awareness. Surprisingly, senior high school graduates were the most compliant among the group. This supports several studies which suggest that higher educational qualifications lead to increased engagement to waste segregation practices. This, in turn, also emphasizes the importance of education in promoting proper waste management (Dai et al., 2017; Alhassan et al., 2018).

The total number of children in the household was also identified as a key factor in influencing compliance levels to waste segregation, although it does not significantly affect awareness. Households with only two children were found to be more aware and compliant as opposed to those with more children in their homes, particularly five or more. This confirms the findings of Addo et al. (2017) that a larger household size is linked to weaker waste segregation practices. This is because households with more children generally consume more goods on average, leading to higher waste generation, thus increasing the difficulty of managing waste.

Affluent families belonging to upper income groups, particularly those in the rich and high-income range, demonstrated the highest levels of compliance to waste segregation. This can be attributed to their financial capability to purchase essential materials for proper waste management such as garbage bags or plastic bins. Furthermore, their access to higher education aligns with a key finding of this study, which indicates that higher educational attainment significantly enhances compliance with waste segregation. However, this contradicts several studies suggesting that low-income households have higher compliance levels when waste segregation is concerned compared to high-income families (Xu et al., 2017; Alhassan et al., 2020).

An unexpected finding was that the number of adults in a household significantly influenced compliance, with single-adult households being the most compliant. This is in congruence with a study by Okonta & Mohlalifi (2020) which reported that smaller family sizes were more likely to comply with waste segregation practices. Another explanation is that the sole adult in the household bears full responsibility on waste segregation duties which, in turn, offers greater consistency, while smaller households will often consume less resources, thereby reducing waste.

Interestingly, the study also unveiled a significant positive correlation between the level of awareness and compliance to waste segregation ($r = 0.288$, $p < .001$), indicating that higher awareness is related to better compliance, which also highlights the importance of educational initiatives in promoting waste segregation. This is in alignment to the findings of several studies stating that individuals with higher levels of awareness have an increased likeliness in engaging with waste segregation practices (Babaei et al., 2015; Dai et al., 2017; Alhassan et al., 2018; Flores, 2021; Pallegedara et al., 2024).

Similarly, social media, particularly Facebook, was also regarded as a valuable source of information, providing quick and accessible updates on waste segregation practices. Participants stated that they often rely on it for announcements and examples from other communities. This reflects the findings of Elmosaad et al. (2023), who noted that platforms like social media and television help increase household waste segregation. Notably, having clear rules was also stressed as an important factor as it reduces confusion and enables participants to follow rules with less difficulty. This is attested by Rangone (2018), in which he emphasized that the clarity and understandability of rules are key to effective policy compliance. Moreover, community-based education such as awareness campaigns in schools and barangay meetings was likewise seen as helpful in forming consistent waste segregation habits. Sewak (2021) observed comparable outcomes in areas with active seminars and outreach programs, while Prisco and Cubillas (2022) recognized the key role of schools in fostering long-term environmental responsibility.

Social influence was also seen as a strong motivator in encouraging waste segregation. Participants shared that observing neighbors or relatives separate their waste

encouraged them to do the same. Others have also emphasized that it is the benefit that they perceive, such as a cleaner environment, is what keeps them committed to the practice. Rousta et al. (2020) found that social pressure and attitude are key factors influencing household waste segregation, particularly in developing countries. However, some also mentioned that financial incentives could also substantially further increase community participation, as monetary rewards bring immediate and tangible benefits. Studies also suggest that such economic benefits serve as better motivators than social encouragement (Zhao & Van de Walle, 2024; Xu et al., 2018).

When taking inhibitors into account, a prominent contributor is the lack of active policy enforcement. It has been cited by some of the participants that their communities are often lax when it comes to reinforcing the city's ordinance to waste segregation. This lack of interest towards regular monitoring demotivates citizens as it creates a notion that there are no significant consequences for failing to comply, which discourages accountability and responsibility. In essence, weak enforcement and coordination of policy within regulatory institutions, such as the local government, effectively prevent waste compliance (Makondo et al., 2015).

Access to sufficient resources and facilities such as bins and collection spots are invaluable in ensuring effective waste disposal and segregation. However, the lack of such greatly inhibits many to properly dispose of their waste. Many raised the concern that their respective communities have an inadequate amount of waste bins and collection spots. The absence of these vital resources drives people to sort their waste in inappropriate areas. This highlights the fact that insufficient bins and collection sites, regardless of positive attitude, significantly decreases compliance to properly segregate waste (Odonkor et al., 2020).

As the participants are household heads, this means that they are often tasked with various responsibilities in their homes. These competing priorities were cited to prevent them from consistently practicing waste segregation which leads to occasional or sometimes habitual indifference in sorting waste. Additionally, some reported that fatigue from work prevent them from engaging in waste segregation as they are either too tired or too preoccupied. This aligns with Geffen et al. (2020) and Kushwah et al. (2022), who found that time, physical strain, and household demands reduce the likelihood of proper waste management.

In the statistical test of relationship, the quantitative findings affirm a positive correlation between awareness and compliance levels, indicating that higher awareness leads to greater compliance (Babaei et al., 2015; Dai et al., 2017; Alhassan et al., 2018; Flores, 2022; Pallegedara et al., 2024). Qualitative findings reinforce this, with participants expressing that being aware is what makes them comply to segregate waste, while its absence hinders them to do so. The identified enablers, such as information dissemination and social influence, help explain how awareness is formed and sustained, thereby

reinforcing compliance. Conversely, inhibitors like weak enforcement, lack of resources, and practical barriers, despite the high level of awareness, shed light on the factors that limit citizens to practice waste segregation properly.
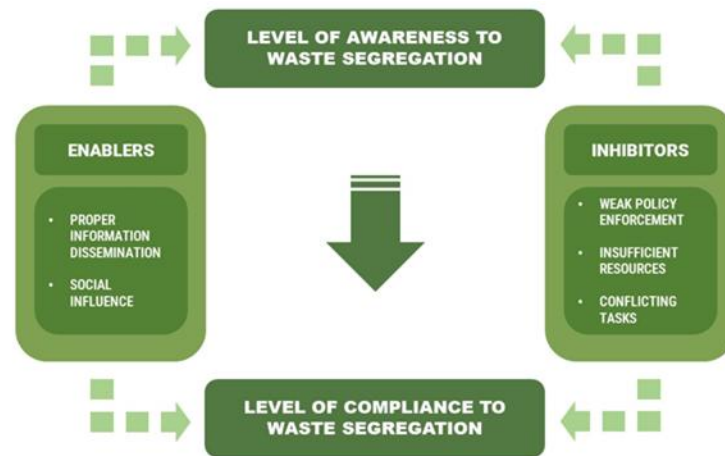

Figure 1. Interplay of Enablers and Inhibitors in the Relationship between the Level of Awareness and Compliance to Waste Segregation

Conclusions

The citizens of Tuguegarao City exhibited high awareness and compliance to waste segregation which are influenced by factors such as education, age, income, and household size. The positive link between awareness and compliance highlights the role of community education and consistent policy implementation. While information dissemination and social influence promote better practices, challenges persist due to weak enforcement, limited resources, and household constraints. These findings highlight the need to enhance policy measures and sustain education initiatives to strengthen community-wide adherence to waste segregation practices.

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Conflicts of Interests

The authors declare no conflict of interest.

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