



**UNIVERSITI PUTRA MALAYSIA**

***WASTE RECYCLING PRACTICE AMONG THE COMMUNITY DURING  
COVID-19 IN BANDAR BARU BANGI, SELANGOR AND ITS  
ASSOCIATION WITH KNOWLEDGE AND ATTITUDE***

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**BY**

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**This thesis submitted in fulfilment of the requirement for the degree of Bachelor of  
Science in Environmental and Occupational Health with Honours from the  
Faculty of Medicine and Health Sciences, Universiti Putra Malaysia**

## ACKNOWLEDGEMENTS

First and foremost, praises and thanks to the God, the Almighty, for His showers of blessings throughout my research work to complete the research successfully.

I would like to express a sincere gratitude to my research supervisor, Dr. Sharifah Norkhadijah binti Syed Ismail for providing me invaluable guidance throughout this research. It was a great privilege to work and study under her guidance.

I am extremely grateful to my parents for their love and prayers. Their continuous support and understanding when undertaking my research and writing my project help me sustained this far.

I would also like to express my gratitude to everyone who help me throughout my Final Year Project. It would have been impossible to finish my studies without their unwavering support over the past few years.

## ABSTRACT

### WASTE RECYCLING PRACTICE AMONG THE COMMUNITY DURING COVID-19 IN BANDAR BARU BANGI, SELANGOR AND ITS ASSOCIATION WITH KNOWLEDGE AND ATTITUDE

‘ALIAH BINTI ABDUL RAHMAN LAW

**Introduction:** Malaysia loses an estimated of RM 476 million on recyclables materials every year as recycling has not yet become a common practice. **Objectives:** To assess waste recycling practice among community during COVID-19 and its association with community's knowledge and attitude. **Methodology:** Survey was conducted among 244 respondents from six residential areas in Bandar Baru Bangi Selangor. Information on the sociodemographic characteristics, recycle waste generation and management and the knowledge, attitude and practice (KAP) of the community were collected using a modified questionnaire. The volume of waste generated and its composition were sampled from 25 houses in the study area. **Results and Discussion:** The community generated a total of 124.89 kg of solid waste in a week. This is about 0.14 kg/person or 0.71 kg/household of solid waste per day. From this volume, 81% of the waste or 101.45 kg were recycled in a week. This is equivalent to 0.11 kg/person or 0.58 kg/household of waste per day being recycled. The major recyclable waste was paper (51%), followed by plastic and used items such as clothes (19%). The community have good level of knowledge (n=187, 76.6%) and attitude (n=221, 90.6%) but poor level on recycling practice (n=151, 61.9%). There was a significant association between knowledge with gender. The attitude was significantly associated with age, race, monthly household income and housing type, while practice was associated with residential location, gender and number of household members. There was no significant relationship between the KAP. **Conclusion:** The recycling rate of the community was high despite of the pandemic. This was consistent with good level of knowledge and attitude but not reflected by the practice score.

**Keywords:** Knowledge, Attitude, Practice, Recycling, COVID-19

## ABSTRAK

### AMALAN KITAR SEMULA DI KALANGAN MASYARAKAT SEMASA COVID-19 DI BANDAR BARU BANGI, SELANGOR DAN KAITANNYA DENGAN PENGETAHUAN DAN SIKAP

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**Pengenalan:** Malaysia kerugian dalam anggaran RM 476 juta bagi bahan kitar semula setiap tahun kerana kitar semula belum lagi menjadi amalan biasa. **Objektif:** Untuk menilai amalan kitar semula sisa dalam kalangan komuniti semasa COVID-19 dan kaitannya dengan pengetahuan dan sikap komuniti. **Metodologi:** Tinjauan telah dijalankan di kalangan 244 responden dari enam kawasan perumahan di Bandar Baru Bangi Selangor. Maklumat mengenai ciri sosiodemografi, penjanaan dan pengurusan sisa kitar semula serta pengetahuan, sikap dan amalan (KAP) komuniti dikumpulkan menggunakan soal selidik yang diubah suai. Isipadu sisa yang dijana dan komposisinya telah diambil sampel daripada 25 buah rumah di kawasan kajian. **Keputusan dan Perbincangan:** Masyarakat menjana sejumlah 124.89 kg sisa pepejal dalam masa seminggu. Ini adalah kira-kira 0.14 kg/orang atau 0.71 kg/isi rumah sisa pepejal sehari. Daripada jumlah ini, 81% daripada sisa atau 101.45 kg telah dikitar semula dalam seminggu. Ini bersamaan dengan 0.11 kg/orang atau 0.58 kg/isi rumah sisa sehari yang dikitar semula. Sisa kitar semula utama ialah kertas (51%), diikuti oleh plastik dan barangan terpakai seperti pakaian (19%). Komuniti mempunyai tahap pengetahuan yang baik (n=187, 76.6%) dan sikap (n=221, 90.6%) tetapi tahap amalan kitar semula yang lemah (n=151, 61.9%). Terdapat perkaitan yang signifikan antara pengetahuan dengan jantina. Sikap itu dikaitkan secara signifikan dengan umur, bangsa, pendapatan isi rumah bulanan dan jenis perumahan, manakala amalan dikaitkan dengan lokasi kediaman, jantina dan bilangan ahli isi rumah. Tiada hubungan yang signifikan antara KAP. **Kesimpulan:** Kadar kitar semula masyarakat adalah tinggi walaupun dilanda wabak. Ini adalah konsisten dengan tahap pengetahuan dan sikap yang baik tetapi tidak dicerminkan oleh skor amalan.

**Kata kunci:** Pengetahuan, Sikap, Amalan, Kitar semula, COVID-19

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## LIST OF ABBREVIATIONS

BBB	Bandar Baru Bangi
MSW	Municipal solid waste
SWCorp	Solid Waste Management and Public Cleansing Corporation
3R	Reuse, Reduce, Recycle
UPM	Universiti Putra Malaysia
KAP	Knowledge, attitude and practices
MRO	Movement Restriction Order
MPKJ	Kajang City Council
SWM	Solid waste management
OBRC	Oregon Beverage Recycling Cooperative
WTE	Waste-to-energy
UN ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
MBPJ	Petaling Jaya City Council

# CHAPTER 1

## INTRODUCTION

### 1.1 Research Background

A universal solid waste problem is growing, and the municipalities around the world are bearing the most severe impact. Global urbanization, industrial development, and economic growth result in rising amount of municipal solid waste (MSW) production annually (Moh & Abd Manaf, 2017). The COVID-19 outbreak also has changed worldwide waste production patterns, necessitating appropriate attention. This epidemic results in unforeseen fluctuation on waste amount and composition (Sharma et al., 2020). Plastic waste has been generated at a rate of 1.6 million tonnes per day since the COVID-19 epidemic. Every day, about 3.4 billion single-use face masks and shields are thrown away. Meanwhile, the COVID-19's PCR kits were capable of producing 15,000 tonnes of plastic waste where 97% of it were dispose through waste incineration (Yousefi et al., 2021). Furthermore, the usage of single-use plastic packaging with low recyclability in e-commerce skyrocketed during COVID-19. It was claimed that South Koreans' online purchases of food and other essentials increased by 92.5% and 44.5% respectively due to COVID-19 (Vanapalli et al, 2021).

Over the years, recycling as one of the 3R initiative has earned significant attention as a means of safeguarding the environment and providing a solution to address solid waste economically and ecologically. Under the 12th Malaysia Plan, the Solid Waste Management and Public Cleansing Corporation (SWCorp) has boosted the aim for recycling rate in the seven

states under its supervision to 40% by 2025. The 40% target on recycling cannot be achieved unless progressive steps are implemented, and the people give their commitment to recycling efforts (Bernama, 2022). However, due to COVID-19 outbreak, this might interfere or delay for its achievement. We are also not so sure on the recycling rate during COVID-19 and its achievements as we have no data on recent recycling rate.



## 1.2 Problem Statement

Recycling is defined as a waste collection plans and action to allow materials to be reused. Recycling allows for the recovery of secondary raw materials resulting in low greenhouse gas emissions (Geiger et al., 2019). However, recycling does take a lot of effort from an individual because the domestic waste needs to be separated, prepared, and stored (Ramayah et al., 2012). Solid Waste Corporation (SWCorp) has reported the recycling rate of Malaysia during COVID-19 pandemic in 2020 was 30.67%. Even though the rate exceeded the target of 30% set for 2020 but it is far behind other developed countries such as Singapore (59%), Korea (49%), and Taiwan (60%) (Malaysian Investment Development Authority, 2021).

Since the spread of SARS-CoV-2 across the globe, the demand for masks, hand sanitizers, gloves, and other essential goods has risen unexpectedly. This has significantly increased the number and volume of plastic trash for single use plastic (Singh et al., 2022). In addition, changes in lifestyle, particularly in the provision of daily essentials, such as the popular use of home delivery services, have increased the amount of paper and plastic trash generated from packing goods.

According to Das et al., (2021b), the lockdown and other community infection prevention methods have resulted in a significant rise in municipal solid waste (MSW) but COVID-19 has halted and restricted recycling activities among the community due to the concerns about the transmission of the virus. This has been reported in several studies where it has imposed significant worries regarding the use of traditional equipment such as garbage truck compactors due to fear of the virus spreading into the air (Yousefi et al., 2021). For instance, the Oregon Beverage Recycling Cooperative (OBRC) in Oregon, Oregon received

roughly 45% less recycling waste in April 2019 compared to in April 2018 due to the implementation of staying at home policy. Even if the redeeming centres were reopened, the number of recycle waste would eventually decrease (Singh et al., 2022). In addition, with the impeded of recycling of packaging materials during the pandemic, the demand of virgin packaging material has soared and causes the recycling companies around Europe are dealing with significant problem due to the outbreak of COVID-19. The virgin plastic is cheaper and cleaner to produce and use than recycled plastic, that cause recycling facilities to face losses.

Selangor is reported with the highest daily solid waste generation in Peninsular Malaysia (Jamil, 2018). Since the onset of Movement Restriction Order (MRO), the state has seen a rise in the amount of domestic waste due to single-use plastics from residential areas (Chen et al., 2021). Organic waste has been the major contributor of household trash in Selangor by 48.07% followed by recycle items such as paper (29.53%), glass (2.65%), metal (1.90%) and others (16.69%) (Samah et al., 2013). Unlike several states and federal territories in the country (Pahang, Kedah, Perlis, Melaka, Johor, Negeri Sembilan, Putrajaya, Kuala Lumpur), that made compulsory to do waste recycling through the enforcement of the Solid Waste and Public Cleansing Management Act 2007 (Act 672), Selangor do not segregate their waste at source. Bandar Baru Bangi (BBB) in Selangor is known as an industrial area dominated by electrical and electronics industries, manufacturing industries and plastic industries (Rahman & Rahman, 2010). A study by Basri et al., (2017) has reported 101.6 kg of recyclable items and 689.7 kg of food waste was collected in BBB.

Poor solid waste disposal and increasing number of solid wastes in landfills cause a slew of environmental issues as well as health risk to human (Nordin & Saliluddin, 2016). Regular solid waste mix with virus contaminated biomedical waste pose serious health and

safety threats to people especially the sanitation personnel (Singh et al., 2022). Moreover, the pollution from municipal solid waste can increase the chances of disease transmission causing infectious diseases outbreak (Yousefi et al., 2021). Hence, safe waste management and disposal are essential components of an efficient disaster response. Authorities have suggested that medical, residential, and toxic waste disposal be treated as a vital and urgent public service in order to reduce potential secondary health and environmental effects (Sharma et al., 2020).

According to Badrum and Mapa (2020), community's knowledge, attitude and practices (KAP) is a first step in developing comprehensive and participatory solid waste management strategies, programmes, and policies. A lack of public understanding and awareness will result in a lack of engagement and ineffective policy. Infrastructure alone will not ensure the success of recycling as one of the solid waste management programmes. More effort should be placed into understanding public knowledge, attitude and practice. The relationship between attitude and subjective norms might influence people's recycling habits. This is explained by the Theory of Planned Behaviour. Subjective norms are crucial in persuading people to recycle. It can enhance the likelihood of individuals recycling if they have a good attitude and encourage those who are aware of the benefits of recycling (Mohsin et al., 2018). For instance, a study by Nordin & Adman (2019) has reported low level of knowledge (25%) and practice (0%) on solid waste segregation among Selangor population despite of positive attitude (85%).

There were limited studies done to assess the impact of COVID-19 on recycling activities especially in developing country like Malaysia. Due to unsystematic analysis and ad-hoc record keeping among local authorities and related private organisations, our country is still lacking in accurate and well-established data on solid waste management and recycling.

Therefore, this study aimed to measure the volume of recycle waste produced during COVID-19 and the level of KAP on recycling in order to discover how community feel about recycling as a proper and sustainable waste management strategy, considering their present practises and sociodemographic characteristics (Badrum & Mapa, 2020). This study provides a baseline information on the recycling activities during the pandemic and could be used to solve the recycling challenges such as, low public participation and commitment, lack sense of responsibility in handling solid waste, public perception of solid waste as local municipalities problem, undermining solid waste management issues, and ineffective education. Indeed, with rising consumption and solid waste generation rates, source separation and recycling practises provide a reasonable approach, concise policy and plan strategies (Moh & Abd Manaf, 2017).

### 1.3 Study Justification

Bandar Baru Bangi is an urban area known as Knowledge City where various universities are located in Bandar Baru Bangi. Most people in Bandar Baru Bangi come from an educated background. In research from Mohsin et al. (2018), people with a high level of education are more likely to participate in recycling programmes because they are aware of the negative consequences of not recycling. Despite that, the average recycling rate of household waste was 6.5% in Bandar Baru Bangi while 23% of waste was potentially recyclable in 2011 (Watanabe et al., 2011). There is no latest data on recycling practice in Bandar Baru Bangi to analyze the recent recycling rate and assess changes in KAP of the community especially during COVID-19 situation.

From my observation, although there are numerous recycling centres, recycling campaigns and recycling drop off points in Bandar Baru Bangi, but it is only available at certain location such as Section 3 and Section 4 which make it hard for people who live in other Sections to practice recycling behaviour. Moreover, less involvement by the local government, Majlis Perbandaran Kajang (MPKJ) has resulted in less participation by locals in recycling (Mohsin et al., 2018). Furthermore, the aim of this study was to promote more environmental awareness and thoughtful decision-making, which could have an impact on current consumer culture and its associated throw-away attitudes. Hopefully this research can enhance the awareness and knowledge on poor solid waste management which can contribute to the development of various disease among the community.

As Malaysia strives to project itself as a developed nation, the issue of sustainable waste management has become a top priority for policymakers and other relevant stakeholders.

Despite the government's efforts such as the enactment of new regulations and the pursuit of privatisation, Malaysia continues to remain behind in sustainable waste management practises, especially in the context of recycling. Therefore, this research is crucial to provide future baseline information to develop an effective approach and future evaluation on recycling program effectiveness.

Furthermore, the findings of this study can provide a pragmatic assistance for the construction of a well-informed communication strategy by examining the roles and importance of recycling information in modifying recycling behaviour through people perceptible. In addition, the goal was to contribute to the existing understanding on the effects of information on recycling practices while also making recycling more convenient and accessible for community. The outcome of this research will assist the governments, policy makers, waste management strategists, local administrators, and researchers in developing sustainable policies, identify new ideas to rate and develop strong community recycling programs.

## **1.4 Research Question**

How is the waste recycling activity among the community during COVID-19 in Bandar Baru Bangi, Selangor and its association with knowledge and attitude?

## **1.5 Research Objective**

### **1.5.1 General Objective**

To determine the level of recycling practice among the community in Bandar Baru Bangi, Selangor during COVID-19 and its association with their knowledge and attitude.

### **1.5.2 Specific Objectives**

1. To determine the sociodemographic characteristics of the community in Bandar Baru Bangi, Selangor.
2. To determine the characteristics of waste generated of the community in Bandar Baru Bangi, Selangor during COVID-19.
3. To determine the level of knowledge, attitude, and practice on recycling among the community in Bandar Baru Bangi, Selangor during COVID-19.
4. To determine the association between the level of knowledge, attitude, and practice on recycling with sociodemographic characteristics among the community in Bandar Baru Bangi, Selangor during COVID-19.

5. To determine the relationship between the level of knowledge, attitude, and practice on recycling among the community in Bandar Baru Bangi, Selangor during COVID-19.

## **1.6 Research Hypothesis**

1. There is significant association between the level of knowledge, attitude, and practice of recycling and sociodemographic characteristics among the community in Bandar Baru Bangi, Selangor during COVID-19.
2. There is significant relationship between the level of knowledge, attitude, and practice on recycling among the community in Bandar Baru Bangi, Selangor during COVID-19.

## **1.7 Study Variables**

Independent variable:

1. The sociodemographic of community in Bandar Baru Bangi, Selangor
2. Knowledge on waste recycling during COVID-19
3. Attitude on waste recycling during COVID-19

Dependant variable: Practice on waste recycling during COVID-19

## 1.8 Definition of Terms

### 1. Knowledge, Attitude and Practice (KAP)

Conceptual: KAP surveys are commonly used to identify knowledge gaps and behavioural patterns among sociodemographic subgroups to implement effective public health interventions (Lee et al., 2021).

Operational: KAP data are collected using a structured and standardized self-administered questionnaire which were distributed physically and via online platform.

### 2. Knowledge

Conceptual: Knowledge is a set of understandings, knowledge and of “science.” It is also one’s capacity for imagining, one’s way of perceiving (Kaur et al., 2014).

Operational: Level of knowledge on recycling during COVID-19 is evaluated via self-administered and close-ended questionnaire.

### 3. Attitude

Conceptual: Manner, disposition, feeling, position with regard to a person or things, tendency or orientation which can be in the form of likes, dislikes, biases, views or feeling regarding a situation or issue (Sammut, 2013).

Operational: Level of attitude on recycling during COVID-19 is evaluated via self-administered and close-ended questionnaire.

#### 4. Practice

Conceptual: An individual's visible act in response to a stimulus. This is something that deals with the concrete and actions (Yaziz, 2015).

Operational: Level of practice on recycling is evaluated via self-administered and close-ended questionnaire.

#### 5. Recycling

Conceptual: Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products (United States Environmental Protection Agency, 2018).

Operational: A social survey will be conducted to measure respondents' knowledge, attitude and practice on recycling during COVID-19 using a structured and self-administered questionnaire.

#### 6. Sociodemographic

Conceptual: Sociodemographic reflects the demographic and social characteristics that define people in a specific population (Abdullahi, 2020).

Operational: Sociodemographic characteristics of the respondents are collected using a structured and self-administered questionnaire. It consists of information such as age, sex, education, ethnicity, race, number of household members and income.

#### 7. Community

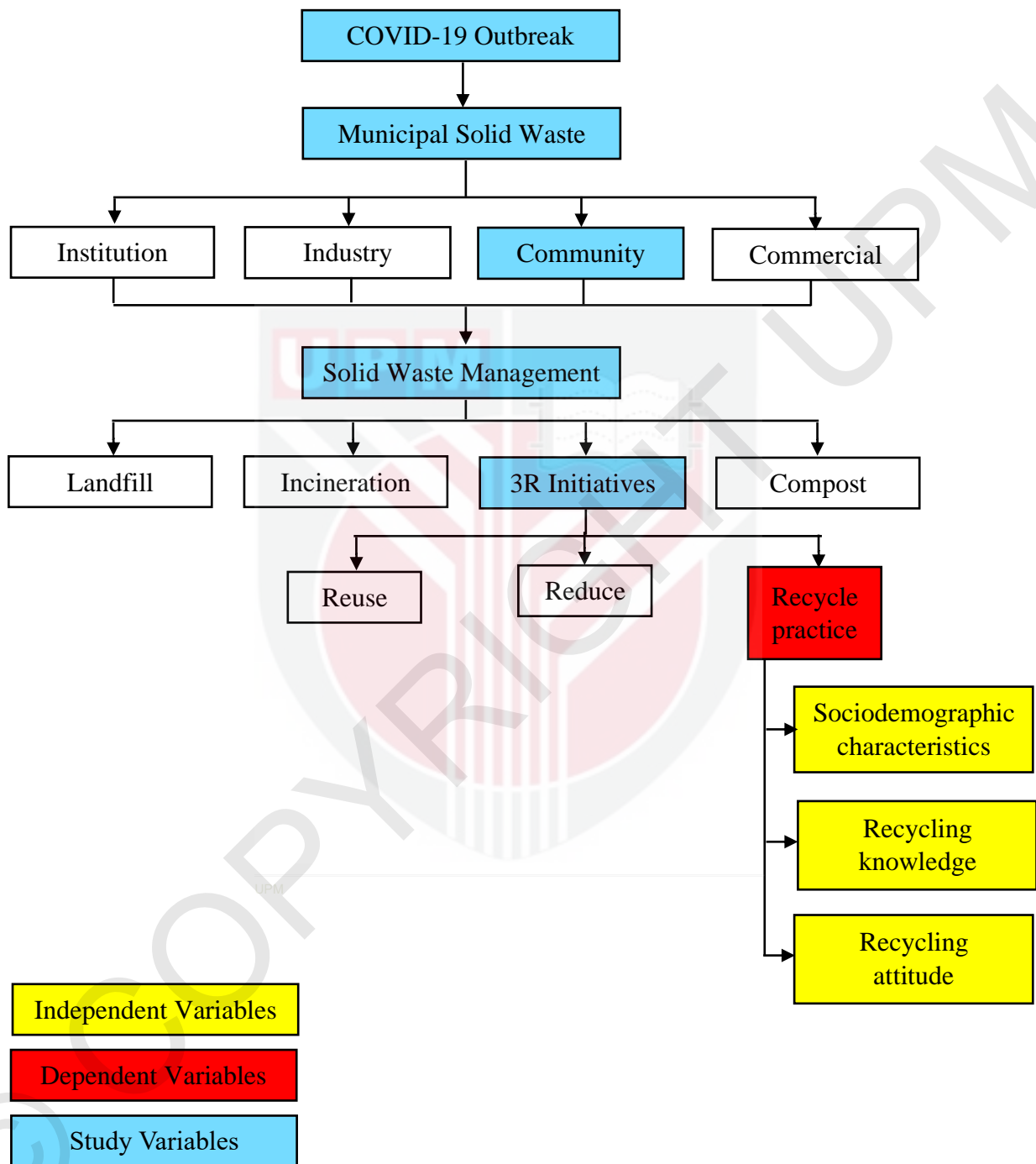
Conceptual: Community is a group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings (Allman, 2015).

Operational: Malaysian citizen aged between 18 to 60 years old and above living in Bandar Baru Bangi, Selangor are included in this study. Informed consent was obtained accordingly from all respondents.

### 1.9 Conceptual Framework

Figure 1.4 summarizes the conceptual framework of the research to provide broad overview of this study. The factors that are important to this study are represented by the coloured boxes. COVID-19 outbreak surely has a great impact on solid waste management. The solid waste management component that this study focused on is waste collection and transportation which is recycling.

This study seeks to determine whether sociodemographic characteristics of community in Bandar Baru Bangi, Selangor have an impact on recycling practice during COVID-19. Besides, this study wants to evaluate whether knowledge and attitude on recycling during COVID-19 outbreak influence recycling practice during COVID-19.



**Figure 1.1: Conceptual Framework**  
(Syed Ismail et al., 2021)

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Solid Waste Generation during COVID-19

Ever since SARS-CoV-2 has spread across the globe, demand for masks, hand sanitizers, gloves, and other essential goods has risen unexpectedly. As a result of the epidemic, there has been a significant shift in waste generation, such as an increase in the number and volume of plastic trash for single use in PPE such as respirators, masks, disposable gloves, and syringes (Singh et al., 2022). In addition, changes in lifestyle, particularly in the provision of daily essentials, such as the popular use of home delivery services, have increased the amount of paper and plastic trash generated by packing goods. These developments, together with an increase in the proportion of people eating ready-made meals instead of home-cooked have resulted in a rise in municipal solid trash in some communities (Yousefi et al., 2021). Figure 2.1 illustrates the effects of COVID-19 on plastic waste generation.



**Figure 2.1: COVID-19 Implications on Plastic Waste Generation**  
(George, 2021)

Based on Das et al. (2021a) perspective, the composition of MSW created from various sources remained unchanged even during COVID-19 outbreak. Nevertheless, the amount and composition of waste may differ. The composition of MSW has been seen to be dynamic as it is impacted by various aspects in a community such as income, lifestyle, season, type of household, wealth, and geography. Generally, production of organic waste is higher in developing countries and rural areas. On the other hand, high-income households produce more metals, plastics, and glass as they consume more processed foods and other commodities. Total food waste increased by 12% during COVID-19 outbreak.

## 2.2 Overview of Solid Waste Management

Solid waste management (SWM) is an important component of any environmental management system. Based on the reduce, reuse, and recycle (3R) principles, SWM approaches have been adapted into a more efficient and realistic choice for establishing sustainability (Das

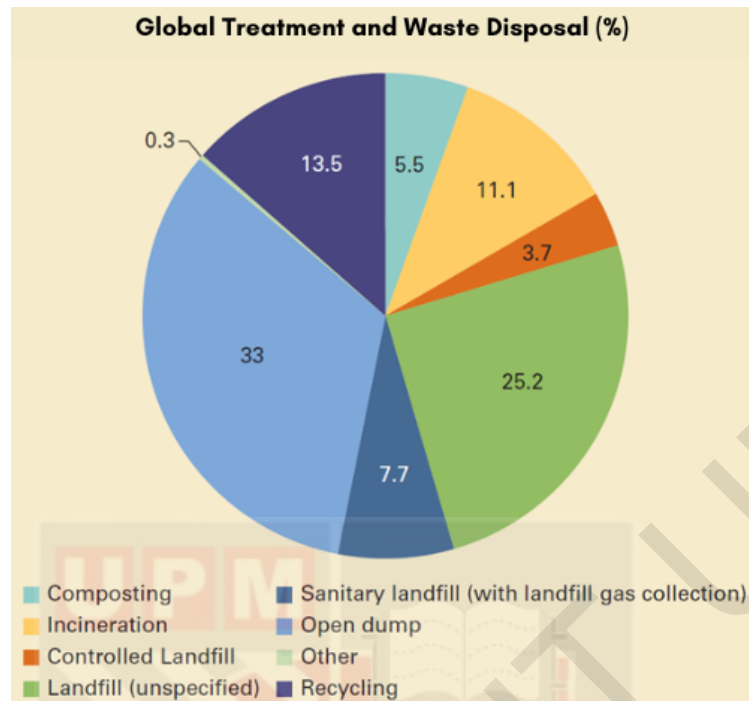
et al., 2019). SWM consists of 5 main components as shown in Figure 2.2. Recycling is in recovery component as the materials that may be discarded as waste are processed to create new products (United States Environmental Protection Agency, 2022).



**Figure 2.2: Components of Solid Waste Management**  
(Waste Tech Engineering, 2022)

### 2.2.1 Overview of Global Solid Waste Management

Most of the waste is currently deposited or disposed of in landfills around the world. Approximately 37% of garbage is disposed of in a landfill while 8% of the trash going to sanitary landfills that have landfill gas collection systems. About 31% of waste is dumped openly, while 19% is recycled or composted, and 11% is burnt for final disposal (The World Bank, 2016).



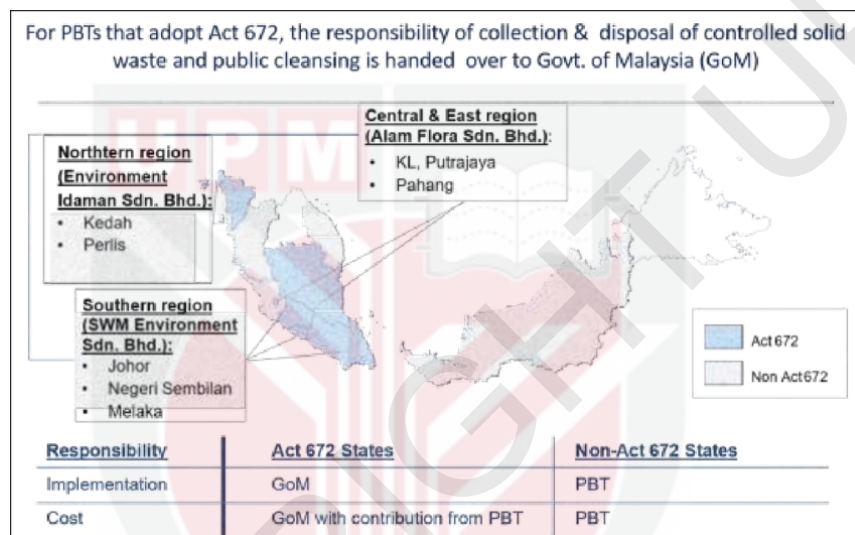
**Figure 2.3: Global Treatment and Waste Disposal**  
(The World Bank, 2016)

The worldwide organic content of MSW is 46%, but it climbs to 64% in developing nations. Landfill is the most cost-effective disposal strategy globally till now. 70% of MSW is disposed of as landfill while 19% is collected for recycling and composting. Recycling and other alternative purposes, such as energy and compost, are appropriate MSW management methods that have the potential to result in a greener economy that includes sustainable development (Das et al., 2021a).

### 2.2.2 Overview of Malaysia Solid Waste Management

Solid waste management is Malaysia's most pressing environmental concern, with landfilling serve as the primary disposal technique for the country's annual growth in solid waste production. The population of Malaysia is increasing so it is not a surprise that the area

of land available is becoming scarce. Therefore, constructing additional landfills is challenging, especially given the paucity of land. Another option for creating landfills would be to locate them near other residential areas (Moh & Abd Manaf, 2017). Moh and Abd Manaf (2014) stated that despite the high potential and opportunities for solid waste recycling, wastes are still simply being dumped in an open area of ground without any attempt for recovery and recycling.



**Figure 2.4: States of Malaysia Implementing Act 672**  
(Zainu, 2020)

Even though local governments spend more than half of their solid waste budget on collection, only 76% of rubbish generated is collected. Hence, solid waste management was privatised. Idaman Bersih Sdn Bhd for the northern regions, Alam Flora Sdn Bhd for the middle regions, and Southern Waste Management for the southern regions are the three solid waste concessionaires that currently have their respective operation zones.

## **2.3 Recycling in Solid Waste Management**

Recycling is defined as individuals' trash collection plans and action to allow materials to be reused. Recycling allows for the recovery of secondary raw materials resulting in low greenhouse gas emissions. Nowadays, promoting recycling is crucial to address today's garbage issues (Geiger et al., 2019). Even so, recycling does take a lot of effort on the part of the individual because domestic waste must be separated, prepared, and stored (Ramayah et al., 2012).

### **2.3.1 Overview of Malaysia Waste Recycling**

According to Nordin and Saliluddin (2016), the Malaysian government, through the Ministry of Housing and Local Government, began a national recycling campaign in 1993. Even so, people's reactions and feedback were unremarkable since waste output continues to rise due to small efforts to recycle while municipal solid waste landfills continue to expand. The Ministry of Housing and Local Government reintroduced recycling programmes in 2000, with the goal of reducing 22% total generated garbage by 2020. In 2019, Malaysia's recycling rate is 28.1% which has exceeded the set target. This is due to the Government's effort of solid waste separation at source (Department of Statistics Malaysia, 2020). According to the Solid Waste Corporation (SWCorp), the recycling rate achieved in 2020 was 30.67%, exceeding the benchmark of 30% set for 2020 but still falling short of other developed countries such as Singapore (59%), Korea (49%), and Taiwan (60%) (Malaysian Investment Development Authority, 2021).

Due to unsystematic analysis and ad-hoc recordkeeping among local authorities and related private organisations, Malaysia is still lacking in accurate and well-established information on solid waste management and recycling. Thus, a holistic approach is initiated by the government, local authorities, and private organizations to develop integrated solid waste management system, strategies on source separation and recycling and awareness campaigns. Despite the ongoing efforts, a lot of challenges remain unresolved, including low public participation and commitment, lack sense of civic responsibility in handling solid waste, public perception of solid waste as local municipalities problem, undermining solid waste management issues, and ineffective education. Indeed, with rising consumption and solid waste generation rates, source separation and recycling practises provide a reasonable option through the implementation of effective and concise policy and plan strategies (Moh & Abd Manaf, 2017).

### **2.3.2 Recycling and COVID-19**

Due to worries about the virus's transmission, COVID-19 has halted or restricted activities such as recycling. It has imposed significant worries regarding the use of traditional equipment such as garbage truck compactors due to fear of the virus spreading into the air (Yousefi et al., 2021). Das et al. (2021a) stated that lockdown and other community infection prevention methods have resulted in a significant rise in MSW for public service providers. However, as recycling of packaging materials was impeded during the pandemic, the demand of virgin packaging material has soared. Recycling companies around Europe are dealing with significant problem due to the outbreak of COVID-19. Since virgin plastic is cheaper and cleaner to produce and use than recycled plastic, recycling facilities are facing a socioeconomic issue. Incineration of recyclable garbage will unavoidably be encouraged, resulting in negative

environmental effects and a reduction in resource recovery (recyclable plastic). As every country is implementing staying-at-home policy similar like in Oregon, Oregon, the Oregon Beverage Recycling Cooperative (OBRC) received roughly 45 percent less recycling returns in April 2019 than in April 2018. Even if the redeeming centres were reopened, the number of returns would eventually decrease (Singh et al., 2022).

### **2.3.3 Types of Recyclable Waste**

Most of the household waste are recyclable items if the waste is segregated properly from the commingled waste. The most generated recyclable waste is plastic. Bottles, foodstuff packaging and container are made from plastic. It also includes parcel packaging and online food order package that has increased tremendously in number during COVID-19. Next is paper products and empty paper containers. For instance, magazines, newspaper, cardboard and paperboard (Abdullah et al., 2022).

Moreover, clothing and textile is also a type of recyclable waste. All recyclable textiles include discarded garments and fabrics as well. On the other hand, a specialized area of the waste and recycling sector called electrical and electronic equipment recycling works to keep electrical devices out of landfills. These include mobile phones, televisions or computers (Cudjoe et al., 2021). In addition, metal items can be recycled multiple times. The quality of both non-ferrous and ferrous metal of all grades do not degrade when recycled. Iron and steel are example of ferrous metal while aluminium, lead, stainless steel and copper are non-ferrous metals. Besides, glass also can be recycled repeatedly.

Recyclable glass products are as good as newly made from the raw materials because its purity remain 100%. Glass items are like jars, windows, glass bottles and drinking glasses (Das et al., 2021a). Furthermore, food leftover is another type of recyclable waste. Food scraps can be thrown in compost bin that is able to convert food waste into nutrient-rich compost. Food waste also can be converted into biogas by anaerobic digester to generate energy widely known as waste-to-energy systems (WTE) or even fuel source for vehicles (Nordin & Adman, 2019).

#### **2.4 Knowledge, Attitude and Practice on Recycling**

Individual knowledge is acknowledged as an essential and influential aspect in practices, and it plays a big role in helping the implementation of recycling programmes and ensuring their success. This idea is at the heart of policymaking, and it requires a thorough understanding of the concrete factors that influence behaviour (Bortoleto et al., 2012). Yukalang et al. (2018) described that a substantial contribution to solid waste recycling may be achieved by providing continuous and planned training through educational approaches, as well as the establishment of waste separation organisations. Even so, according to another study, the previous approach of influencing public attitude, behaviour, and perception could only reach a limited number of people through media campaigns, leaflet drops and newspaper advertisements (Malik et al., 2015).

### 2.4.1 Knowledge on Recycling

Majority of people in the community are aware of environmental issues and acknowledge that the issues must be addressed, but they are not motivated to put their knowledge into action. Some people may have the basic understanding of recycling, but they are unable to make intricate connections between the benefits of recycling and the environmental costs of not recycling. Despite the fact that a large number of printed and electronic materials on recycling were distributed, they failed to educate and raise awareness. Some citizens even dismiss these efforts, stating that recycling is less relevant than other issues (Moh and Abd Manaf, 2014). Amouei et al. (2016) found out that despite having a basic understanding of waste recycling, most people do not practice it effectively. This also explains that although there is 100% awareness of the necessity of recycling, recycling has not become a universal way of life in Malaysia based on a survey done by the Ministry of Housing and Local Government. However, the public participation can be increased by combining the usage of all media such as Internet, print media, broadcast media and outdoor media. When people obtain a lot of knowledge about the impacts of recycling, they will be more mindful of their recycling performance towards the environment (Malik et al., 2015). Guerrero et al. (2013) also mentioned that individual waste segregation behaviour can be influenced by awareness campaigns based on their environmental concerns and involvement in resolving associated issues. Table 2.1 summarizes past research conducted on knowledge towards recycling.

**Table 2.1: Past Research on Knowledge of Recycling**

<b>Journal</b>	<b>Study Location</b>	<b>Target Population</b>	<b>Level of Knowledge</b>
Malik et al., 2015	Putrajaya	Residents	<ul style="list-style-type: none"> <li>• 50.8% of the respondents have satisfactory knowledge on waste segregation gained from various types of information sources.</li> <li>• 49.2% individuals do not have knowledge on waste segregation.</li> </ul>
Babaei et al., 2015	Abadan city, Iran	Household	<ul style="list-style-type: none"> <li>• 94.5% of respondents have low level of knowledge on recycling.</li> </ul>
Nordin & Saliludin, 2016	Serdang	Undergraduate students	<ul style="list-style-type: none"> <li>• 85.2% of respondents have high level of knowledge on recycling.</li> </ul>
Islam et al., 2016	Bangladesh	Public	<ul style="list-style-type: none"> <li>• Only 9% of the participants were aware of E-waste and its detrimental effects on human health and the environment.</li> </ul>
Afroz et al., 2016	Kuala Lumpur, Malaysia	Household	<ul style="list-style-type: none"> <li>• Participants' knowledge was low (42%) on certain recycling issues which indicates that participants were not aware on recycling information.</li> </ul>
Mohsin et al., 2018	Bandar Baru Bangi and Semenyih	Residents	<ul style="list-style-type: none"> <li>• 81% of respondents were aware about the recycling program (Program Masjid Lestari) which indicated that the residents had obtained information on the recycling program.</li> </ul>
Almasi et al., 2019	Iran	Kermanshi women	<ul style="list-style-type: none"> <li>• 45% of respondents reported moderate knowledge level on 3R.</li> <li>• Internet have enhanced 83% of females' knowledge on 3R.</li> </ul>
Badrum & Mapa, 2020	Sabah	Villagers	<ul style="list-style-type: none"> <li>• Most of the respondents (96.2%) have excellent knowledge on solid waste management and the consequences of improper waste management.</li> </ul>

Zand et al., 2020	Iran	Tehranian women	<ul style="list-style-type: none"> <li>69.6% of the respondents had good level of knowledge towards 3R and MSW recovery.</li> </ul>
Sustainability Victoria, 2022	Victoria, Australia	Public	<ul style="list-style-type: none"> <li>68% of participants reported satisfactory level of knowledge as they only had some incorrect understanding on what can and cannot be recycled.</li> </ul>

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#### 2.4.2 Attitude on Recycling

A flawless relationship was observed between attitudes for recycling and waste reduction in American society, with a focus on both people and society's feelings about waste recycling and the environment. Individuals who think positively about the benefits of recycling are more likely to engage in recycling activities, according to the study. Therefore, it is critical to understand people's attitudes on recycling, whether at the individual or family level, because if societies feel that there is no advantage to whatever they do, they will not engage in it (Wright, 2011). Besides, based on research conducted in Alor Setar, Kedah, majority of households believe that environmental concerns are the responsibility of government rather than theirs. They also felt that recycling is just a volunteering activity and not a compulsory activity that everyone needs to be involve into (Husnina et al., 2018). On the other hand, the willingness to pay for fee services monthly and the availability of recycling bins have encouraged a high level of compliance from the community (Malik et al., 2015). Table 2.2 describes past research conducted on attitude towards recycling.

**Table 2.2: Past Research on Attitude of Recycling**

<b>Journal</b>	<b>Study Location</b>	<b>Target Population</b>	<b>Level of Attitude</b>
Malik et al., 2015	Putrajaya	Residents	<ul style="list-style-type: none"> <li>• 47.1% of residents had satisfactory recycling attitude</li> <li>• 52.9% mentioned that the process of segregating solid waste was a hassle to them.</li> </ul>
Babaei et al., 2015	Abadan city, Iran	Household	<ul style="list-style-type: none"> <li>• 94.3% of participants had good attitude on recycling.</li> </ul>
Nordin & Saliludin, 2016	Serdang	Undergraduate students	<ul style="list-style-type: none"> <li>• 42.9% of respondents had positive level of attitude towards recycling.</li> </ul>
Islam et al., 2016	Bangladesh	Public	<ul style="list-style-type: none"> <li>• Only 5-10% of the respondents willing to for sustainable E-waste management system.</li> <li>• 53.72% of respondents preferred to make money by selling their E-waste.</li> </ul>
Afroz et al., 2016	Kuala Lumpur, Malaysia	Household	<ul style="list-style-type: none"> <li>• The attitude of respondents was low (35%) considering their willingness to participate in recycling campaign.</li> </ul>
Mohsin et al., 2018	Bandar Baru Bangi and Semenyih	Residents	<ul style="list-style-type: none"> <li>• 89% of the community agreed that Program Masjid Lestari (recyclable waste collection program) was very effective to enhance recycling participation.</li> </ul>
Almasi et al., 2019	Iran	Kermanshi women	<ul style="list-style-type: none"> <li>• 52% of respondents reported moderate knowledge level on 3R.</li> <li>• 83% of females highlighted that Internet improved their attitude on 3R.</li> </ul>
Badrum & Mapa, 2020	Sabah	Villagers	<ul style="list-style-type: none"> <li>• Majority of respondents (76.6%) had excellent attitude towards solid waste management initiatives in their own house and in the neighbourhood.</li> </ul>
Zand et al., 2020	Iran	Tehranian women	<ul style="list-style-type: none"> <li>• 72.9% of respondents had satisfactory attitude level towards 3R and MSW recovery.</li> </ul>

Sustainability  
Victoria, 2022

Victoria,  
Australia

Public

- 83% of respondents have positive attitude towards recycling who believe that recycling is everyone's responsibility.

### 2.4.3 Practice on Recycling

Poor community participation in recycling and waste separation is linked to lack and inconsistency in enforcing current legislation such as Solid Waste Management and Public Cleansing Act (Act 672) (Razali et al., 2019). According to several research, Malaysians refuse to recycle since the recycling facilities available are insufficient and inconvenient for them (Akil et al., 2015). Having a collection centre in a residential area can encourage the community to opt the facilities more frequently and take an active part in recycling programme. In most situations, as the distance to the recycling bins decreases, the number of people who separate and recycle the waste increases. In contrast, the greater the distance of recycling facilities centre, the more time needed to reach and recycle the waste which result people to less likely recycle their waste (Guerrero et al., 2013). Table 2.3 sums up the past research conducted on practice towards recycling.

**Table 2.3: Past Research on Practice of Recycling**

<b>Journal</b>	<b>Study Location</b>	<b>Target Population</b>	<b>Level of Practice</b>
Babaei et al., 2015	Abadan city, Iran	Household	<ul style="list-style-type: none"><li>• 98.3% of participants showed weak practice on source separation and recycling.</li><li>• Women (1.3%) were more effective in recycling than men (0.4%).</li></ul>
Nordin & Saliludin, 2016	Serdang	Undergraduate students	<ul style="list-style-type: none"><li>• 49% of the respondents had good recycling practices.</li></ul>

Islam et al., 2016	Bangladesh	Public	<ul style="list-style-type: none"> <li>• 30% of the respondents sold their unwanted E-waste products to local scrap merchant to make money.</li> <li>• 20% of the households mentioned that their E-waste was discarded together with household waste.</li> </ul>
Noor, 2016	Johor Bahru	Residential areas	<ul style="list-style-type: none"> <li>• 51.4% of respondents do not recycle as there is no legal requirement on recycling.</li> </ul>
Moh & Manaf, 2017	Malaysia	Public	<ul style="list-style-type: none"> <li>• 36.46% of respondents had good level of recycling practice who committed to source separation and recycling.</li> </ul>
Mohsin et al., 2018	Bandar Baru Bangi and Semenyih	Residents	<ul style="list-style-type: none"> <li>• Only 150 people from BBB residence participated in the Program Masjid Lestari (recyclable waste collection program) which indicated that the recycling practice among the community was still very poor.</li> </ul>
Sarbassov et al., 2019	Nur-Sultan city, Kazakhstan	Household	<ul style="list-style-type: none"> <li>• 24% of the respondents segregate the household solid waste at source for recycling.</li> </ul>
Almasi et al., 2019	Iran	Kermanshi women	<ul style="list-style-type: none"> <li>• 77% of respondents had weak practice on 3R.</li> <li>• 10% of Kermanshah people never separated the MSW while 17.5% never recycle their waste.</li> </ul>
Badrum & Mapa, 2020	Sabah	Villagers	<ul style="list-style-type: none"> <li>• 43% of respondents had good practice level in solid waste management.</li> </ul>
Zand et al., 2020	Iran	Tehranian women	<ul style="list-style-type: none"> <li>• The practice on solid waste recycling and separation of solid waste from source among the women was low (33%).</li> </ul>

## **2.5 Impact of Improper Solid Waste Management**

### **2.5.1 Impact of Improper Solid Waste Management on Environment**

Alam and Ahmade (2013) mentioned that waste decomposition into constituent chemicals is a common source of pollution in the surrounding environment. This issue is particularly significant in developing countries. A serious environmental concern is gas release by decomposing waste. Methane is a byproduct of bacteria's anaerobic respiration, which thrives in moist landfills. At the maximum anaerobic decomposition rate, methane concentrations can exceed 50% of the composition of landfill gas. Another problem with methane gas is it contribute to the enhanced of greenhouse gas effect and climate change. The gases rise to the atmosphere and trap heat resulting global warming and formation of extreme weather such as storms and typhoons (Ziraba et al., 2016).

Other than that, Ziraba et al. (2016) discussed that tonnes of medical waste especially during COVID-19 frequently mixed with residential waste and electronic waste, while industrial effluents are frequently discharged into waterways. For instance, petroleum goods particularly lead-based paints are dumped in open areas or waterways. Some of the chemicals released may have short term effects on flora and fauna but others may be transported through the food chain and accumulate resulting long-term negative consequences.

Next, leachate generation is a concern to surface, ground water systems and soil. Landfill leachate is released when rainwater seep through decomposing garbage. Leachate is very toxic as it contains high concentration of dissolved and suspended organic compounds, inorganic matters and heavy metals (Stefanakis et al., 2014). The repercussion of landfill

leachate is eutrophication in aquatic bodies, harmful effects on fauna and hinder the effectiveness of conventional biological wastewater treatment (Ikehata & Li, 2018).

Furthermore, Ndukwe et al. (2019) mentioned that decomposed wet waste emits a foul stench. People living near the dumpsite are affected by the foul odour and unsettling sight of scavenging animals, rodent and vermin at dumping grounds (Ziraba et al., 2016). Moreover, open burning causes air pollution while scattered illegal open dumping frequently clogs drains and sewer where these obstructions cause flooding and unsanitary problems in the city (Ejaz et al., 2012).

### **2.5.2 Impact of Improper Solid Waste Management on Human Health**

Firstly, improper solid waste management consequence on public health is infection. Poor medical waste management increase the risk of disease transmission to public, waste handlers, healthcare personnel and patients. Jerie (2016) stated that biological sample, contaminated clinical waste and sharp clinical equipment can spread harmful germs. As example, Hepatitis B spreads through cut or puncture wound from contaminated surface or needle stick. Also, degradation of organic compound is a site of various microorganisms' growth which contribute to the transmission of disease through vectors and human contact especially when handling waste without wearing protective wear and using bare hands.

Next, poor drainage due to blocked drains filled with solid waste will increase the likelihood of urban floods which helps mosquito to breed thus spreading malaria and dengue disease. Flood in the city will not only damage property and drainage system but also take human and animal lives. Besides, people are expose to chemical hazard. Combustion of

chemicals at disposal sites or in incinerators can cause respiratory and allergy problems. Old batteries and insecticides items that are frequently discarded as trash also contain chemicals that are harmful to human life. Medical waste may potentially contain cytotoxic and carcinogenic chemicals. For example, a case happened in Goiania, Brazil where poorly discarded equipment can have significant impact to the population. This cause by a defunct radiotherapy unit that got stolen from an abandoned hospital emit caesium-137 radiation resulting for deaths (Ziraba et al., 2016).

### **2.5.3 Impact of Improper Solid Waste Management on Waste Handler Workers**

Medical waste handlers who do not wear personal protective equipment are more likely to contract nosocomial infections (Ziraba et al., 2016). Dumping sites become source of contamination for waste handlers because of the proliferation of flies, mosquitoes, and rats. These vectors are disease transmitters that have an impact on human health. Consequently, dermatological, respiratory, genetic, and a variety of other infectious disorders emerge. Waste workers also can get gastrointestinal infections through contaminated food or water due to improper fecal matter management where human faeces are disposed as general waste. As example, waste handlers are expose to pathogenic parasites such as cholera and typhoid fever infection. Based on several health surveys from the previous studies, waste workers also developed irritation of the skin, eyes and nose, psychological disorders, and allergies (Ndukwe et al., 2019).

In addition, waste handlers are expose to sharp object injury when they handle the unsorted waste that contain sharp medical waste such as surgical blades and needles while domestic waste contain broken glass. The potential of injury from sharp items is always present

to waste pickers when the mixed waste is disposed of in an open dump site (Jerie, 2016). During the COVID-19 pandemic, production of sharps healthcare waste should be treated with special caution and appropriately managed, as SARS-CoV-2 has been observed to live on a variety of surfaces for a period of time. Contaminated sharp objects with the pathogen might easily infect waste workers, thereby increasing community spread (Das et al., 2021b). Moreover, waste collectors that encounter with COVID-19 patients and handle virally contaminated pharmaceutical waste while collecting it from designated treatment units can quickly become infected with SARS-CoV-2 (Malsparo, 2020). Table 2.4 summarizes the impact of improper solid waste management.

**Table 2.4: Impact of Improper Waste Management**

Scope	Impact of Improper Solid Waste Management	Description	Sources
Environment	Methane release	<ul style="list-style-type: none"> <li>• Enhance greenhouse gases effect</li> <li>• Rapid climate change</li> </ul>	Ziraba et al., 2016
	Water pollution	<ul style="list-style-type: none"> <li>• Short terms effect on flora and fauna</li> <li>• Chemicals enter food chain and bioaccumulate</li> </ul>	Ziraba et al., 2016
	Leachate generation	<ul style="list-style-type: none"> <li>• Eutrophication</li> <li>• Harmful effects on fauna</li> <li>• Prevent conventional biological wastewater treatment</li> </ul>	Stefanakis et al., 2014 Ikehata & Li, 2018
	Nuisance	<ul style="list-style-type: none"> <li>• Wet waste odour</li> <li>• Present of scavenging animals, pests and rodent</li> </ul>	Ndukwe et al., 2019 Ziraba et al., 2016
	Air pollution	<ul style="list-style-type: none"> <li>• Open burning</li> </ul>	Ejaz et al., 2012

	Unhygienic condition	<ul style="list-style-type: none"> <li>• Illegal dumping clogs drain and sewer</li> <li>• Cause flooding</li> <li>• Insect breeding</li> </ul>	Ejaz et al., 2012
Human health	Infection	<ul style="list-style-type: none"> <li>• Spread harmful germs</li> <li>• Transmission of disease through vectors and human contacts</li> </ul>	Jerie, 2016
	Urban flood	<ul style="list-style-type: none"> <li>• Malaria</li> <li>• Dengue</li> <li>• Cost human lives</li> </ul>	Ziraba et al., 2016
	Combustion of chemicals	<ul style="list-style-type: none"> <li>• Respiratory problems</li> <li>• Allergy</li> </ul>	Ndukwe et al., 2019
	Cytotoxic and carcinogenic chemicals	<ul style="list-style-type: none"> <li>• Death</li> </ul>	Ziraba et al., 2016
Waste handler workers	Gastrointestinal infections	<ul style="list-style-type: none"> <li>• Contaminated food or water</li> <li>• Cholera</li> <li>• Typhoid</li> </ul>	Ndukwe et al., 2019
	Injury	<ul style="list-style-type: none"> <li>• Unsorted sharp objects</li> </ul>	Jerie, 2016
	COVID-19 infection	<ul style="list-style-type: none"> <li>• Contaminated biomedical waste</li> <li>• SARS-CoV-2 virus transmission</li> </ul>	Das et al., 2021b Malsparo, 2020

## 2.6 Benefits of Recycling

Recycling gives positive impact on the electrical energy and the environment. Cudjoe et al. (2021) described that manufacturing new products using recyclable materials consume less energy consumption. China saved an overall of 3743.3 Mtce of electricity from 2005 to 2017 by recycling solid waste. Solid waste recycling saved an average of 43.2% on electricity during that time. Next, greenhouse gas (GHG) emissions such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ozone (O<sub>3</sub>) are reduced in the atmosphere. For example, solid waste recycling has saved 4765.9 billion kg of CO<sub>2</sub>, 10,669.8 M kg of NO<sub>x</sub> emissions and 22.502 billion kilogrammes of methane. Besides, solid waste recycling has the ability to reduce air pollution such as volatile organic compounds (VOCs), particulate matter (PM), hydrogen chloride (HCl), sulphur dioxide (SO<sub>2</sub>), nitrogen oxide (NO<sub>x</sub>) and sulphur oxide (SO<sub>x</sub>).

Karaali and Khadjavi (2021) emphasizes that recycling also has an economic impact to a country. Producing items from recycled materials is often less expensive than using "new" ones. Recycling generates more jobs than waste, and these jobs employ varieties of low, middle, and high-skilled employees. Recycling can also benefit one's local community financially. Isabella County, Michigan, for example, does not have its own landfill. As a result, the county must pay to have its waste disposed of at a landfill in a neighbouring county. Alternatively, the county can sell all recyclable items collected by the recycling centre to buyers, generating revenue for the county. Therefore, the more local citizens recycle, the less garbage they produce, and the more money the county has to spend on services for its citizens. These economic advantages can be seen at all levels.

Thus, recycling materials that can be reused will be well worth the effort of saving the environment. Who knows what might have happened to the environment if recycling does not exist. We might be living with waste. People must take recycling seriously and consider the beneficial outcomes from recycling activities. It would be advantageous if the people are aware of what lies ahead for the environment. Reducing illegal dangerous landfills and developing cost-effective waste management systems will lead us to a harmonious society.



## CHAPTER 3

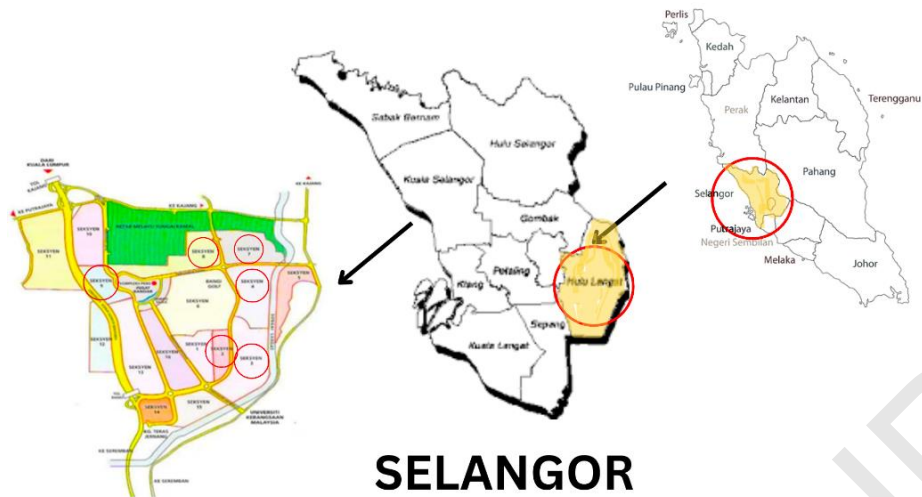
### METHODOLOGY

#### 3.1 Study Design

A cross-sectional study in community level was conducted from September 2022 to October 2022 to determine the recycling practice of the residents in Bandar Baru Bangi during COVID-19. They have recycling facilities near to the residential area.

#### 3.2 Study Location

The study was conducted in Bandar Baru Bangi, Selangor. Bandar Baru Bangi is a township situated in Hulu Langat District, in south-eastern Selangor, Malaysia. It is located between Kajang and Putrajaya and is about 25 km away from the capital city, Kuala Lumpur. There are 16 sections in Bandar Baru Bangi. Bandar Baru Bangi is a part of Kajang Municipality (MPKj), in the state of Selangor. Section 2, Section 3, Section 4, Section 7, Section 8 and Section 9 were selected as the sampling area. The study location was illustrated in Figure 3.2. These locations were chosen to assess the level of recycling practice and its association with knowledge and attitude on recycling in places that have recycling facilities. In these areas, there are waste collectors who collect recyclable items such as paper and metals. There are also donation points to donate clothes and electric appliances and recycling points to recycle plastics, metals and paper.



**Figure 3.1: Location of The Sampling Areas at Bandar Baru Bangi, Selangor**  
(Leong et al., 2019)

### 3.3 Sampling

#### 3.3.1 Study Population

The target population of this study was the community living in Bandar Baru Bangi, Selangor Section 2, Section 3, Section 4, Section 7, Section 8 and Section 9.

#### 3.3.2 Sampling Unit

Inclusion criteria:

The samples were Malaysian citizen aged between 18 to 60 years old and above that live in Bandar Baru Bangi, Selangor for more than a year. They are included in this study as they are adult who are familiar with recycling programs and recycling facilities in Bandar Baru Bangi. Besides, more age specific groups were better at representing the population of the community.

Exclusion criteria:

There are several criteria of excluded house's samples which were empty houses, guesthouse and other houses with infrequent garbage disposal, and houses that were occupied occasionally. These houses are excluded during the sampling period to prevent outliers and maintain accuracy of data analysis.

### **3.3.3 Sampling Method**

Stratified and purposive sampling according to housing type was used to select six sections out of 16 Sections in Bandar Baru Bangi. The six sections that will be selected are Section 2, Section 3, Section 4, Section 7, Section 8 and Section 9. These sections were selected to assess residents' recycling practice in places with recycling infrastructures and facilities provided. The housing types include bungalow, terrace, semi-detached, condominium and apartment. There were about 40 houses selected in each Sections. Then, considering community's 10% drop out rate, convenience sampling was used to select 244 respondents by door to door survey and by spreading the questionnaire on online platforms such as WhatsApp, Twitter, Telegram and Facebook. Convenience sampling is a non-probability sampling technique to select a sample from a convenience location where the samples are easy to access. It is also used due to time constraint and lack of response obtained from target population.

### 3.3.4 Sample Size Estimation

The sample size was calculated using correlation sample size calculation formula. The calculation using Eq. 3.1 was as follows:

$$N = \left[ \frac{Z_{\alpha} + Z_{\beta}}{C} \right]^2 + 3 \quad \text{Eq. 3.1}$$

Where,

N= Total sample size

$Z_{\alpha}$ = The standard normal deviate for  $\alpha$   
(95% confidential interval = 1.9600)

$Z_{\beta}$ = The standard normal deviate for  $\beta$   
(80% of power = 0.8416)

$$C = 0.5 \times \ln \left[ \frac{(1+r)}{(1-r)} \right]$$
$$= 0.1892$$

r= Correlation coefficient between knowledge and practice on solid waste management (0.187)  
based on study done by Laor et al. (2018) in Northern Thailand

$$N = \left[ \frac{Z_{\alpha} + Z_{\beta}}{0.5 \times \ln \left[ \frac{(1+r)}{(1-r)} \right]} \right]^2 + 3$$
$$= \left[ \frac{1.9600 + 0.8416}{0.5 \times \ln \left[ \frac{(1+0.187)}{(1-0.187)} \right]} \right]^2 + 3$$
$$= \left[ \frac{1.9600 + 0.8416}{0.1892} \right]^2 + 3$$
$$= 222$$

Considering 10% of drop out

$$= \left[ \left( \frac{10}{100} \right) \times 222 \right] + 222$$

$$= 244.2$$

$$= 244 \text{ respondents}$$

The total sample size is 244 respondents.

### **3.4 Instrumentation**

#### **3.4.1 Waste Characterization**

The waste characterization method was adopted and modified from Guidelines for Solid Waste Management Assessment (Baseline Survey) (United Nations Economic and Social Commission for Asia and the Pacific, 2010) to understand the waste composition and the volume of waste generated by the community in a week. Four or five houses were selected from all selected residential area (Section 2, Section 3, Section 4, Section 7, Section 8 and Section 9) respectively by several housing types such as bungalow, terrace, semi-detached, condominium and apartment to reflect various socioeconomic level. In total, 25 households were involved for waste characterization analysis. The households who were willing to contribute their waste were given two different coloured plastic bags specifically to separate the general waste (non-recyclable items) in one bag and the recyclable items in another plastic bags. This was done to avoid bias caused by survey-induced behavioural changes where householders are believed to recycle more frequently than normal throughout the survey period (Ali et al., 2017). The collected waste in all the plastic bags were segregated to the recyclable items according to its category by the researcher. Later, the waste was weighed using

DICKSON analogue weighing scale 3kg and the weight of the recyclable items was recorded according to its category. The waste generated was collected, weighed and waste composition was recorded everyday for 7 consecutive days at a specified time to consider variation throughout the week based on UN ESCAP data recording formats.

### 3.4.2 Questionnaire

The questionnaire was available in Malay and English language. The self-administered and close-ended questions were adopted and modified from questionnaire in Guidelines for Solid Waste Management Assessment (Baseline Survey) (United Nations Economic and Social Commission for Asia and the Pacific, 2010) and several previous research on solid waste management and recycling was referred to construct questions on KAP on recycling. These include research on recycling practices among Bandar Baru Bangi and Semenyih residents (Mohsin et al., 2018), awareness of solid waste segregation among household of Banting community (Nordin & Adman, 2019), KAP in recycling activity in Hulu Langat, Selangor (Sobri & Rahman, 2016) and analysis of Chinese households' recycling behaviour (Chu et al., 2016). Furthermore, questions focusing on KAP on COVID-19 waste management was adopted and modified from Basavaraj et al. (2021).

The questionnaire consisted of five parts and the description of each section were as follows:

#### Part A:

Sociodemographic information of the respondents such as age, gender, race, education level, housing type, monthly average household income, number of household members and residential location.

Part B:

Solid waste generation and management addressing community's daily or weekly household and COVID-19 waste generation estimation and examination of existing recyclable waste management and recycling system in Bandar Baru Bangi.

Part C:

Knowledge on waste recycling which assessed the knowledge on existing recycling facility at residential area, type of recyclable bins in Malaysia, COVID-19 waste, benefit of recycling system during COVID-19 and impact of improper waste management during COVID-19.

Part D:

Attitude towards waste recycling focusing on community's perspective on recycling system during COVID-19 and belief in recycling activity.

Part E:

Practice on waste recycling examined the public engagement in various recycling activities in the residential area.

Assessment of KAP section in the questionnaire was explained as below:

Knowledge:

There were 10 questions in this section. Each knowledge questions consisted of two options which were yes and no. 1 score was given for correct answer while 0 score was given for false answer. There were 6 true questions and 4 false questions. Bloom's cut-off point was adopted and modified for knowledge items with score of 1 to 10 (Abdullahi et al., 2016). The knowledge

level was classified as good (score 80% and above), moderate (60% to 79%) and poor (less than 60%).

**Attitude:**

This part consisted of 10 positive attitude statements. Attitude was measured by using 5-point Likert type scale. The rating scale of attitude was measured as 5 (strongly agree), 4 (agree), 3 (neutral), 2 (disagree) and 1 (strongly disagree). The mean scale value that classified attitude into three levels was adapted from KAP study on E-waste disposal among community in Malaysia (Mahat et al., 2019).

**Practice:**

10 positive practice items were designed to be answered using a likert-scale of 5 (always), 4 (often), 3 (sometimes), 2 (rarely) and 1 (never). The mean scale value that classified practice into three levels was adapted from KAP study on E-waste disposal among community in Malaysia (Mahat et al., 2019).

Table 3.1 shows the given cut-off point for knowledge, attitude and practice responses in this study.

**Table 3.1: The Cut-off Point for KAP Score**

Knowledge		Attitude		Practice	
Score	Level	Mean scale	Level	Mean scale	Level
8-10	Good	3.67-5.00	Good	3.67-5.00	Good
6-7	Moderate	2.34-3.66	Moderate	2.34-3.66	Moderate
0-5	Poor	1.00-2.33	Poor	1.00-2.33	Poor

### 3.5 Quality Control

The content of the questionnaire was validated and amended by an expert from USM before the actual data collection to get useful information for the study. The pre-test was conducted by selecting 30 respondents among the residents in study area. The reliability of questionnaire for pre-test was analysed using Cronbach's alpha test in IBM SPSS Statistics Version 28.0. Based on the result, the Cronbach's alpha value for attitude scale was 0.796 and 0.801 for practice scale where these indicate acceptable and good internal consistency respectively.

Besides, zero-point calibration was performed on the analogue weighing scale used for waste characterization. The empty bowl was placed on the weighing scale. Then, the scale needle was fixed at 0. Once the scale pointed to 0, the waste was placed on the bowl and the reading was taken. On the other hand, if the waste exceeded 3kg, the waste was segregated into several bags, weighed and the total weight was calculated.

### 3.6 Study Flowchart

This research involved primary data collection. The data collection process of this study was explained in Figure 3.2.

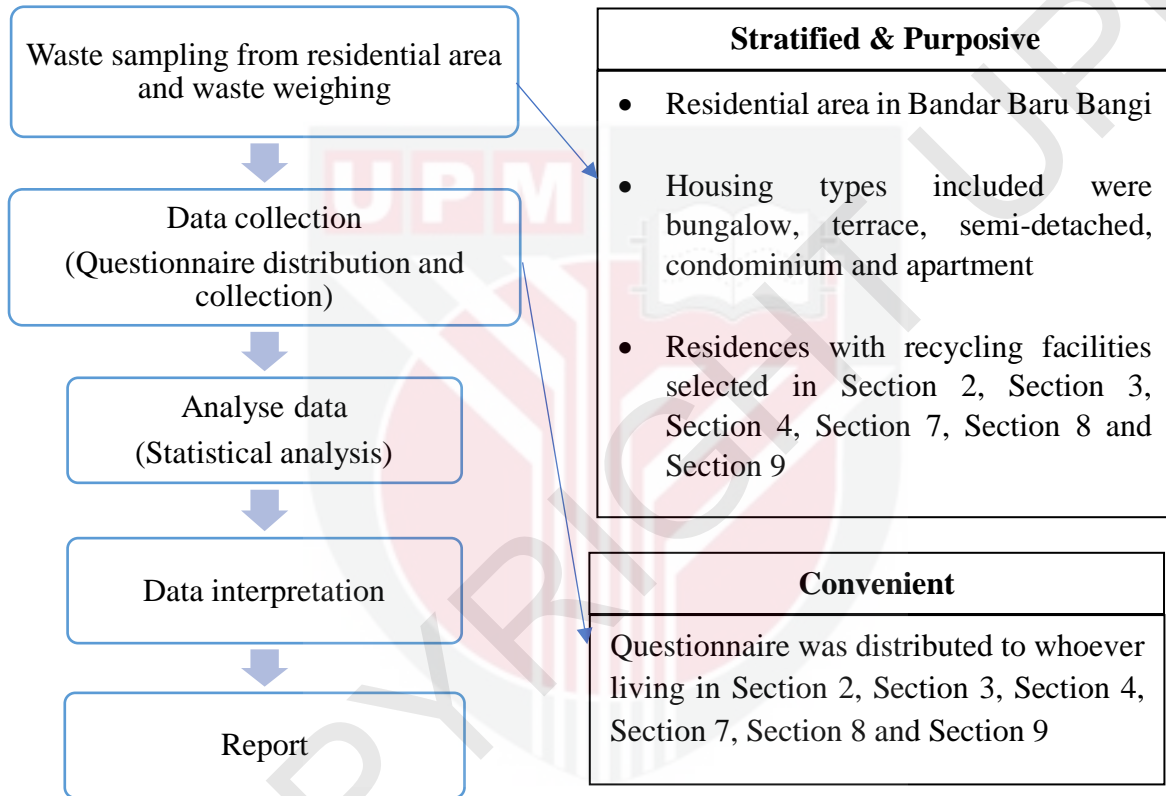


Figure 3.2: Study Flowchart

### 3.7 Statistical Analysis

The data obtained were analysed using IBM SPSS (Statistical Package for Social Sciences) Statistics Version 28.0 and Microsoft Excel 365. Table 3.2 shows the type of analysis conducted based on the specific objectives of the study.

**Table 3.2: List of The Data Analysis for The Study**

Specific Objectives	Data analysis
To determine sociodemographic characteristics of the community in Bandar Baru Bangi, Selangor.	Descriptive analysis
To determine the characteristics of waste produced by the community in Bandar Baru Bangi, Selangor during COVID-19.	Descriptive analysis
To determine the level of knowledge, attitude, and practice on recycling among the community in Bandar Baru Bangi, Selangor during COVID-19.	Descriptive analysis
To determine the relationship between the level of knowledge, attitude, and practice on recycling with sociodemographic characteristics among the community in Bandar Baru Bangi, Selangor during COVID-19.	Chi-Square test
To determine the relationship between the level of knowledge, attitude, and practice on recycling among the community in Bandar Baru Bangi, Selangor during COVID-19.	Spearman correlation

### **3.8 Ethical Consideration**

The ethical approval was obtained from Ethics Committee for Research Involving Human Subject of University Putra Malaysia (JKEUPM) with reference number of (JKEUPM-2022-397). The respondents' selection of this study was based on a voluntary basis. A brief explanation about the study was given to the respondents. If the respondents agreed on proceeding with the participation in the study, a written informed consent form were given to the respondents as an agreement. All the data is confidential and was strictly controlled as only the researchers could retrieve it.

## CHAPTER 4

### RESULTS

#### 4.1 Sociodemographic Characteristics of Community in Bandar Baru Bangi

In total 244 respondents involved in this study. Majority of respondents are from Section 3 Bangi (n=50, 20.5%) followed by Section 4 (n=47, 19.3%) and Section 7 (n = 44, 18.0%). Section 9 had the least respondents (n=31, 12.7%) (Table 4.1). Majority of the respondents are female (n=129, 52.9%) and 115 respondents are male (47.1%).

Most of the respondents are at the age of 18-24 (n=55, 22.5%). The education level of most of the respondents were Diploma and Degree (n=168, 68.9%), followed by secondary education (n=38, 15.6%) and Master/Phd (n=34, 13.9%). Respondents in this study consist of majority Malay (n=133, 54.5%), followed by Chinese (n=62, 25.4%) and Indian (n=49, 20.1%).

The average monthly household income of the majority community is between RM 2001-RM 3999 (n=59, 24.2%). Most respondents live in terrace house (n=77, 31.6%) with 4 to 6 household members (n=148, 60.7%).

**Table 4.1: Sociodemographic Characteristics of Community in Bandar Baru Bangi****(N=244)**

<b>Variable</b>	<b>Description</b>	<b>Frequency (N)</b>	<b>Percentage (%)</b>
Residential location	Section 2	35	14.3
	Section 3	50	20.5
	Section 4	47	19.3
	Section 7	44	18.0
	Section 8	37	15.2
	Section 9	31	12.7
Gender	Male	115	47.1
	Female	129	52.9
Age	18-24	55	22.5
	25-29	46	18.9
	30-34	37	15.2
	35-49	43	17.6
	50-65	39	16.0
	>65	24	9.8
Education level	No formal education	2	0.8
	Primary	2	0.8
	Secondary	38	15.6
	Diploma/Degree	168	68.9
	Master/Phd	34	13.9
Race	Malay	133	54.5
	Chinese	62	25.4
	Indian	49	20.1
Monthly household income	<RM 1000	5	2.0
	RM 1000-RM 2000	23	9.4
	RM 2001-RM 3999	59	24.2
	RM 4000-RM 5000	51	20.9
	RM 5001-RM 10000	56	23.0
	>RM 10000	50	20.5
Housing type	Bungalow	41	16.8
	Semi detached	47	19.3
	Terrace	77	31.6
	Condominium	34	13.9
	Apartment	45	18.4
Number of household members	1-3	63	25.8
	4-6	148	60.7
	>6	33	13.5

## 4.2 Solid Waste Generation and Management of Community in Bandar Baru Bangi during COVID-19

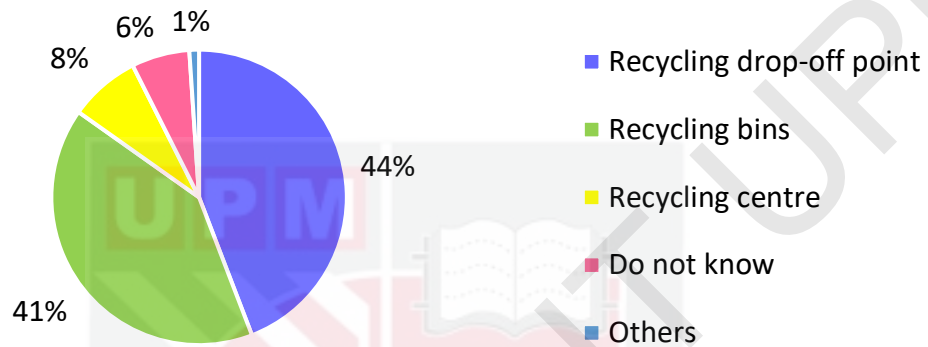
Table 4.2 displays the community's estimation on their solid waste generation. Majority of the respondents (n=114, 46.7%) generated between 0.5 kg to 1 kg/day food leftovers. Garden waste generation is mostly less than 1 kg/week (n=171, 70.1%). Majority of the respondents (49.4%) used less than or equal to 5 pieces of plastic bag/week and bought plastic bottle less than or equal to 5 bottles/week (75.4%). On the other hand, majority of the respondents estimated that they used less than 1 ream of paper waste per week, less than or equal to 5 glass bottles per week and less than 0.5 kg metal or tin per week.

In terms of waste related to COVID-19, majority of the respondents (n=231, 94.7%) generated less than or equal to 5 pieces of gloves and face mask (n=106, 43.4%) during the endemic period. Besides, the use of face masks has also been abolished by the authorities due to the reduction of COVID-19 cases and the overall percentage of vaccine acceptance when this study was conducted. Majority of the respondents (n=207, 84.8%) disposed less than or equal to 2 bottles of sanitizer per week.

**Table 4.2: Solid Waste Generation Estimation (N=244)**

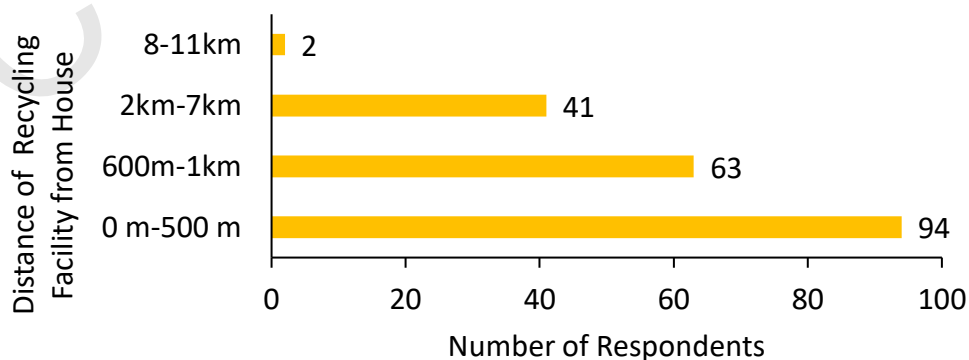
Type of Waste	Description	Frequency (N)	Percentage (%)
Food leftovers	Less than 0.5 kg/day	83	34.0
	Between 0.5 kg to 1 kg/day	114	46.7
	More than 1 kg/day	47	19.3
Garden waste	Less than 1 kg/week	171	70.1
	Between 1 kg to 2 kg/week	56	23.0
	More than 2 kg/week	17	7.0
Plastic bag	Less than or equal to 5 pieces/week	120	49.2
	Between 6 to 10 pieces/week	104	42.6
	More than 10 pieces/week	20	8.2
Plastic bottle	Less than or equal to 5 bottles/week	184	75.4
	Between 6 to 10 bottles/week	50	20.5
	More than 10 bottles/week	10	4.1
Paper	Less than 1 ream/week	221	90.6
	Around 1 ream/week	20	8.2
	2 ream or above/week	3	1.2
Glass	Less than or equal to 5 bottles/week	230	94.3
	Between 6 to 10 bottles/week	12	4.9
	More than 10 bottles/week	2	0.8
Metal or tin	Less than 0.5 kg/week	207	84.8
	Between 0.5 kg to 1 kg/week	30	12.3
	More than 1 kg/week	7	2.9
Glove	Less than or equal to 5 pieces/week	231	94.7
	Between 6 to 10 pieces/week	10	4.1
	More than 10 pieces/week	3	1.2
Face mask	Less than or equal to 5 pieces/week	106	43.4
	Between 6 to 10 pieces/week	87	35.7
	More than 10 pieces/week	51	20.9
Sanitizer bottle	Less than or equal to 2 bottles/week	227	93.0
	Between 3 to 4 bottles/week	15	6.1
	5 bottles or above/week	2	0.8

Figure 4.1 highlight type of recycling facility available in the residential area. Majority of the respondents (44%) indicate there is a recycling drop-off point in their housing area, followed by recycle bins (41%), and recycling centre (8%). Other kind of facility such as cooking oil collection centre. Few respondents have their own recycle bin (1%) and 6% respondents do not know the availability of recycling facility in their residential location.



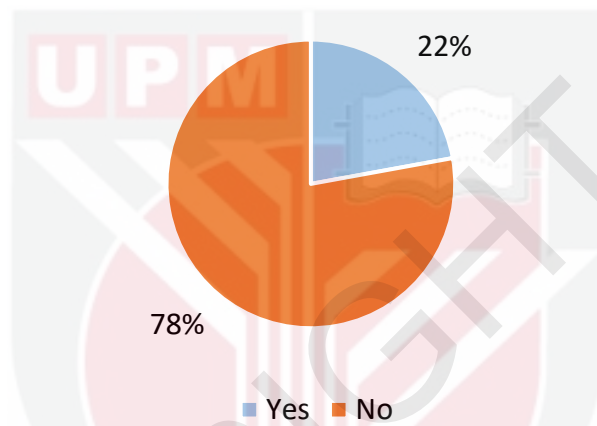
**Figure 4.1: Availability of Recycling Facility in The Residential Area (N=244)**

For most of the respondents, (n=94) the recycling facilities is located less than 500 m from the residential area. Some of them (n=63) have the recycling facilities between 600 metres to 1 kilometre from their house, followed by 41 respondents have recycling facilities between 2 kilometres to 7 kilometres and 2 respondents have the recycling facilities more than 8 kilometres from their housing area (Figure 4.2).



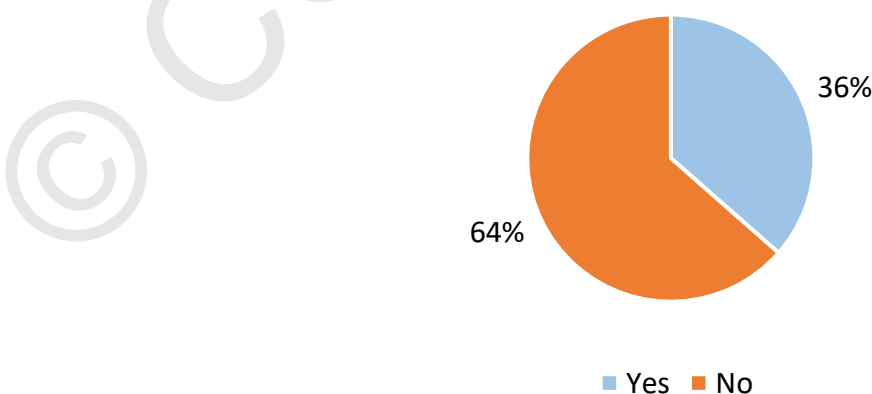
**Figure 4.2: The Distance of Recycling Facility from Residential Area (N=244)**

Figure 4.3, highlight 78% respondents indicate that there is no recycling program in their residential area while 22% respondents stated otherwise. Some of the programs mentioned by the community are recycling of used cooking oil, furniture, used clothes, general appliances, and green buying. These programs are conducted mostly at Masjid or Surau such as Surau Bangi Perdana, Surau Al-Kauthar and Surau Al-Ehsan or recycling centre such as at Recycling Centre UKM. The programs are also conducted by green club in housing area.



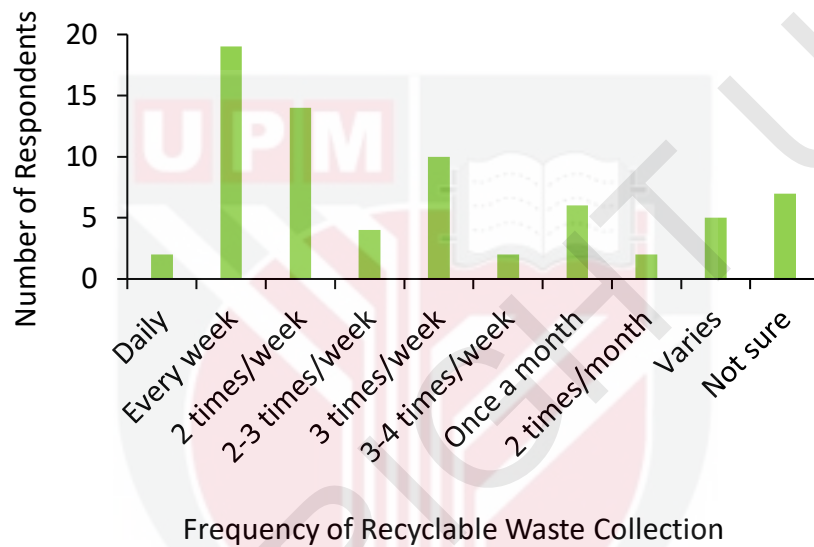
**Figure 4.3: Availability of Recycling Program (N=244)**

Majority of the respondents (64%) stated that there is no recyclable items collection in the residential area whereas 36% of respondents stated the opposite (Figure 4.4).



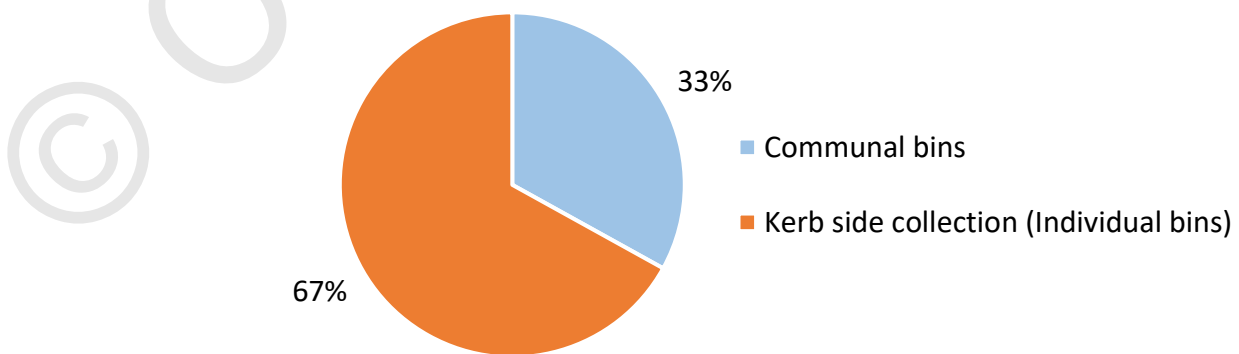
**Figure 4.4: Availability of Recyclable Items Collection in Residential Area (N=244)**

The frequency of recyclable items collection is highlighted in Figure 4.5. Most respondents (n=19) stated that the recyclable waste collection is every week followed by twice every week (n=14) and thrice every week (n=10). Only small number of respondents indicate that the waste collection is once a month (n=6) and twice a month (n=2) in their housing area. There also, uncertain recyclable waste collection in the housing area of 4 respondents while 7 respondents were not sure on the frequency of recyclable items collection.



**Figure 4.5: Frequency of Recyclable Items Collection (N=244)**

The type of general waste collection of 67% of the respondents are kerb side collections while 33% respondents use communal bins (Figure 4.6).



**Figure 4.6: Type of General Waste Collection in Residential Area (N=244)**

### 4.3 Solid Waste Generation Characteristics of Community in Bandar Baru Bangi during COVID-19

Table 4.3 presents the results of the total solid waste (recyclable and non-recyclable) generated at 25 selected houses for 7 consecutive days. During the sampling period, there were a total of 129 people from the 25 houses. A grand total amount of 251.44 kg of solid waste was generated over 7 days with an average of 17.84 kg per day. The result showed that the community's waste generation rate per person was 0.14 kg/person/day or 0.71 kg/house/day.

**Table 4.3: Total Solid Waste Generation (Recyclable and Non-Recyclable Items (kg) per Day for 25 Households (N=129)**

House No.	Housing Type	Family Size	Day 1 (Sun)	Day 2 (Mon)	Day 3 (Tue)	Day 4 (Wed)	Day 5 (Thu)	Day 6 (Fri)	Day 7 (Sat)	Total Weight, kg
1	Bungalow 1	6	0.78	0.51	0.91	1.17	1.50	1.17	1.51	7.53
2	Bungalow 2	5	2.35	0.55	0.48	0.14	0.45	0.17	0.78	4.91
3	Bungalow 3	5	0.50	0.20	0.35	0.34	0.91	0.18	0.87	3.35
4	Bungalow 4	6	0.41	0.55	0.29	0.25	0.38	3.90	7.30	13.07
5	Bungalow 5	5	1.63	0.30	0.52	0.52	0.38	0.52	0.43	4.29
6	Bungalow 6	4	0.34	0.21	0.17	0.14	0.20	0.20	0.15	1.40
7	Terrace 1	4	0.80	0.63	0.94	0.49	1.34	0.43	0.83	5.45
8	Terrace 2	6	0.59	0.16	0.74	0.46	0.29	1.95	3.45	7.62
9	Terrace 3	5	0.18	0.96	0.85	0.76	0.86	0.85	2.09	6.54
10	Terrace 4	7	0.13	0.76	0.13	0.25	0.08	0.11	0.36	1.79
11	Terrace 5	5	0.94	0.11	0.32	0.13	0.15	0.40	0.06	2.11
12	Terrace 6	7	0.32	0.85	0.50	0.36	0.14	0.41	0.31	2.87
13	Terrace 7	6	0.57	0.18	0.22	0.21	0.20	0.19	0.21	1.76
14	Semi-D 1	5	0.99	0.52	0.26	0.36	0.86	0.14	0.90	4.02

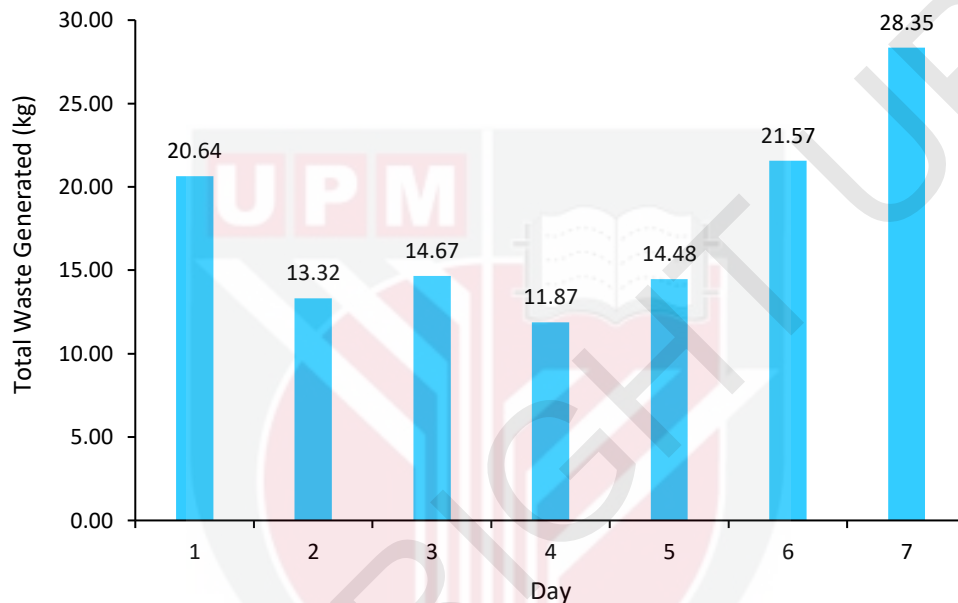
15	Semi-D 2	7	1.52	0.18	0.06	0.26	0.21	0.24	0.56	3.02
16	Semi-D 3	6	0.74	0.09	0.27	0.09	0.37	0.18	0.64	2.36
17	Semi-D 4	6	1.46	0.63	0.84	0.18	1.31	0.27	0.92	5.60
18	Semi-D 5	3	0.53	0.80	0.67	0.21	1.62	0.27	0.35	4.43
19	Semi-D 6	2	0.84	0.85	0.83	0.69	1.04	3.17	1.07	8.48
20	Flat 1	3	0.30	1.29	0.12	0.23	0.14	0.28	0.19	2.53
21	Flat 2	5	0.16	0.37	0.11	0.18	0.13	0.16	0.32	1.41
22	Flat 3	6	0.53	0.62	0.59	0.28	0.48	0.57	0.69	3.75
23	Flat 4	6	3.24	1.67	4.22	3.60	1.11	3.87	4.04	21.74
24	Flat 5	4	0.13	0.18	0.24	0.29	0.14	0.99	0.17	2.13
25	Flat 6	5	0.72	0.195	0.115	0.32	0.255	1.005	0.19	2.8
Total		129	20.64	13.32	14.67	11.87	14.48	21.57	28.35	124.89

Waste Generation Rate

0.14 kg/person/day

0.71 kg/house/day

Figure 4.7 highlight the solid waste generation trend for 7 days at 25 selected houses. The highest generation of solid waste was on Saturday at 28.35 kg, followed by Friday (21.57 kg) and Sunday (20.64 kg). Less waste was generated in the middle of the week which is on Wednesday (11.86 kg).



**Figure 4.7: Solid Waste Generation Trend (N=129)**

Table 4.4 presents the results of the recycle waste generated at 25 selected houses for 7 consecutive days. A total amount of 101.45 kg of recycle waste was generated over 7 days with an average of 14.49 kg per day. The recycle waste generation rate per person was 0.11 kg/person/day or 0.58 kg/house/day. From the total solid waste generated a week (124.89 kg), 81% of the waste (101.45 kg) were recycled.

**Table 4.4: Recycle Waste Generation (kg) per Day for 25 Households (N=129)**

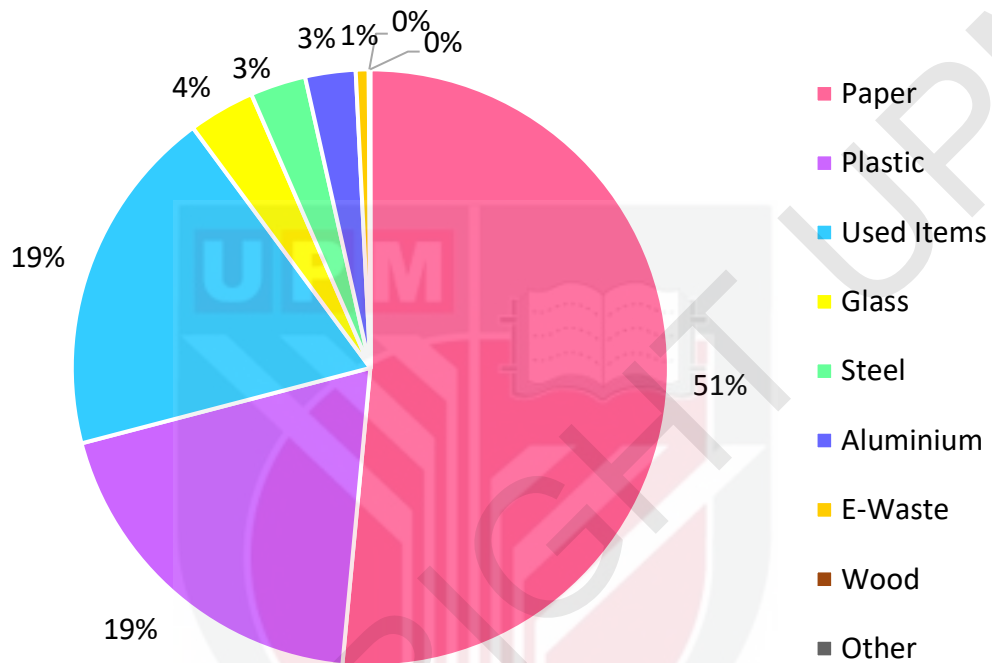
House No.	Housing Type	Family Size	Day 1 (Sun)	Day 2 (Mon)	Day 3 (Tue)	Day 4 (Wed)	Day 5 (Thu)	Day 6 (Fri)	Day 7 (Sat)	Total Weight, kg
1	Bungalow 1	6	0.58	0.38	0.47	1.13	1.17	0.88	1.29	5.89
2	Bungalow 2	5	2.01	0.33	0.23	0.07	0.20	0.11	0.68	3.61
3	Bungalow 3	5	0.44	0.13	0.22	0.11	0.80	0.08	0.73	2.49
4	Bungalow 4	6	0.22	0.45	0.22	0.16	0.27	3.80	7.20	12.31
5	Bungalow 5	5	0.91	0.05	0.30	0.34	0.25	0.32	0.24	2.40
6	Bungalow 6	4	0.17	0.09	0.12	0.06	0.16	0.14	0.11	0.83
7	Terrace 1	4	0.55	0.13	0.67	0.23	0.73	0.29	0.41	3.00
8	Terrace 2	6	0.49	0.11	0.64	0.43	0.17	1.93	3.05	6.81
9	Terrace 3	5	0.15	0.74	0.60	0.40	0.65	0.50	1.42	4.45
10	Terrace 4	7	0.056	0.60	0.03	0.20	0.02	0.04	0.29	1.22
11	Terrace 5	5	0.73	0.03	0.25	0.07	0.09	0.35	0.02	1.53
12	Terrace 6	7	0.15	0.66	0.17	0.22	0.06	0.28	0.23	1.76
13	Terrace 7	6	0.48	0.16	0.20	0.11	0.17	0.13	0.17	1.41
14	Semi-D 1	5	0.96	0.40	0.20	0.21	0.86	0.06	0.90	3.58
15	Semi-D 2	7	0.79	0.16	0.05	0.24	0.14	0.13	0.48	1.97
16	Semi-D 3	6	0.66	0.07	0.26	0.08	0.25	0.16	0.63	2.10
17	Semi-D 4	6	1.44	0.29	0.80	0.13	1.18	0.20	0.89	4.92
18	Semi-D 5	3	0.39	0.75	0.05	0.12	1.59	0.20	0.28	3.37
19	Semi-D 6	2	0.84	0.55	0.80	0.64	1.03	2.96	0.85	7.66
20	Flat 1	3	0.20	1.14	0.05	0.16	0.08	0.20	0.09	1.90
21	Flat 2	5	0.02	0.27	0.09	0.10	0.06	0.10	0.25	0.87
22	Flat 3	6	0.37	0.44	0.49	0.28	0.20	0.44	0.61	2.82
23	Flat 4	6	3.05	1.47	4.17	3.51	1.11	3.65	3.82	20.77
24	Flat 5	4	0.07	0.03	0.14	0.20	0.09	0.91	0.13	1.55
25	Flat 6	5	0.69	0.05	0.10	0.14	0.19	0.92	0.19	2.27
Total		129	16.35	9.43	11.28	9.30	11.46	18.73	24.91	101.45
Waste Generation Rate			0.11 kg/person/day 0.58 kg/house/day							

Table 4.5 shows the major recycle waste disposed was paper (55.34 kg), followed by plastic (20.89 kg), and used item (20.35 kg). Other recycle waste from this area include glass (3.87 kg), steel (3.24 kg), aluminium (2.93 kg), e-waste (0.75 kg), wood (0.07 kg) and other waste (0.03 kg).

**Table 4.5: The Volume of Recycle Waste Generated (kg) per Day by Composition (N=129)**

Day	Recyclable Waste Generated (kg)								
	Paper	Plastic	Glass	Aluminium	Used Items	Wood	E-Waste	Steel	Others
1	8.82	3.25	0.81	0.71	2.50	0.01	0.26	0	0
2	9.15	2.83	0.80	0.53	2.02	0	0.11	0	0
3	6.99	2.29	0.29	0.65	0.65	0	0.16	0.26	0
4	6.82	1.73	0.17	0.17	0.37	0	0.02	0	0.03
5	7.01	3.02	0.91	0.33	0.14	0.04	0.03	0	0
6	7.30	2.73	0.34	0.24	5.30	0.03	0	2.80	0
7	9.26	5.05	0.56	0.31	9.37	0	0.18	0.18	0
Total	55.34	20.89	3.87	2.93	20.35	0.07	0.75	3.24	0.03

Figure 4.8 illustrates the composition of recyclable waste from the 25 households. The biggest constituent was paper at 51% followed by plastic and used items (19%), glass (4%), steel and aluminium (3%), e-waste (1%), wood and other waste (0%).



**Figure 4.8: Recyclable Waste Generation in The Community (N=129)**

#### **4.4 Level of Knowledge, Attitude and Practice on Recycling among Community in Bandar Baru Bangi during COVID-19**

Table 4.6 shows majority of respondents have good knowledge on recycling during COVID-19 (n=187, 76.6%) with the mean score (SD) of 8.40 (1.25). Meanwhile, 21.7% or 53 respondents have moderate level of knowledge about recycling. Only 1.6% (n=4) respondents have poor understanding on recycling during COVID-19.

As for community's attitude on recycling during COVID-19, majority of the respondents (n = 221, 90.6%) have good attitude with the mean score (SD) of 4.32 (0.91). Only small number of respondents have poor attitude (n=15, 6.1%) and moderate attitude (n=8, 3.3%).

Nevertheless, the community's practice of recycling during COVID-19 is low (n=151, 61.9%) with the mean (SD) score of 2.23 (0.87). Only small number of respondents (n=19, 7.8%) have good practice. Meanwhile, 74 (30.3%) respondents have moderate practice.

**Table 4.6: The level of KAP on Recycling among Community in Bandar Baru Bangi during COVID-19**

<b>Level of KAP</b>	<b>Frequency (N)</b>	<b>Percentage (%)</b>	<b>Overall Mean <math>\pm</math> SD</b>
<b>Level of knowledge</b>			
Good (8-10)	187	76.6	8.40 $\pm$ 1.25
Moderate (6-7)	53	21.7	
Poor (0-5)	4	1.6	
<b>Level of attitude</b>			
Good (3.67-5.00)	221	90.6	4.32 $\pm$ 0.91
Moderate (2.34-3.66)	8	3.3	
Poor (1.00-2.33)	15	6.1	
<b>Level of practice</b>			
Good (3.67-5.00)	19	7.8	2.23 $\pm$ 0.87
Moderate (2.34-3.66)	74	30.3	
Poor (1.00-2.33)	151	61.9	

Table 4.7 denotes that the items where all respondents answered correctly was Question 7 with mean score of 1.00 which indicates that public are aware that improper COVID-19 waste management will lead to disease transmission especially SARS-CoV-2 virus. Besides, 96.31% (n=235) respondents also acknowledged that recycling helps preserve the environment because recycling can reduce the amount of waste dump into the landfill (mean score=0.96) and reduce pollution (n=230, 94.26%) (mean score=0.94). Furthermore, respondents are aware of the existence of recycling facilities in their neighbourhood (n=226, 92.62%) (mean score=0.93). 204 (83.61%) respondents also admitted that recycling of waste produced by COVID-19 patients are not allowed (mean score=0.84).

Item with the highest incorrect answer was Question 4 (n=104, 42.62%) which suggested that the respondents were still not well informed that commingled recyclable waste with COVID-19 waste will result the waste to be non-recyclable as it is no longer safe for recycle due to contamination with virus. Moreover, 54 (22.13%) respondents were not familiar that food scraps produce good organic fertilizer for plants and soil for Question 8 (mean score=0.78).

**Table 4.7: Mean Score for Knowledge on Waste Recycling Questions**

Question	Frequency N (%)		Mean $\pm$ SD
	Correct answer	Wrong answer	
1. Is there any recycling facility around your housing area?	226 (92.62)	18 (7.38)	0.93 $\pm$ 0.26
2. Are used disposable masks and gloves recyclable?	183 (75.00)	61 (25%)	0.75 $\pm$ 0.43
3. Are there generally three types of recyclable bins and an organic waste bin in Malaysia?	196 (80.33)	48 (19.67)	0.80 $\pm$ 0.40
4. Is the segregation of COVID-19 waste from recyclable household waste is effective safe recycling practice?	140 (57.38)	104 (42.62)	0.57 $\pm$ 0.50
5. Is the colour coding of containers not important in a safe waste control?	201 (82.38)	43 (17.62)	0.82 $\pm$ 0.40
6. Is the recycling of waste produced by COVID-19 patients allowed?	204 (83.61)	40 (16.39)	0.84 $\pm$ 0.40
7. Does improper disposal of COVID-19 waste contribute to the spread of the epidemic?	244 (100.00)	0 (0.00)	1.00 $\pm$ 0.00
8. Does food scraps produce bad organic fertilizer for plants and soil?	190 (77.87)	54 (22.13)	0.78 $\pm$ 0.42
9. Does good recycling practice helps reduce pollution?	230 (94.26)	14 (5.74)	0.94 $\pm$ 0.23
10. Can recycling reduces the amount of waste in landfills?	235 (96.31)	9 (3.69)	0.96 $\pm$ 0.19

Table 4.8 revealed that the respondents have the highest mean score for Question 10 ( $4.45 \pm 0.97$ ), followed by Question 9 ( $4.43 \pm 1.02$ ) and Question 8 ( $4.42 \pm 0.99$ ). Majority of the respondents strongly agreed ( $n=169$ , 69.26%) that recycling activity should be essential in their life (Question 10). Majority of them (70.49%,  $n=172$ ) also strongly agreed that recycling is everyone's responsibility (Question 9), and 67.62% ( $n=165$ ) strongly agreed that recycling saves the environment (Question 8). Besides, the respondents strongly agreed that labelling and color-coding of waste containers are crucial ( $n=166$ , 68.03%). 65.98% ( $n=161$ ) also strongly agreed that separating wastes (hazardous wastes from non-hazardous wastes) facilitates safe recycling practice.

Nevertheless, Question 7 has the lowest mean score of  $3.95 \pm 1.11$  which indicates that majority of the respondents strongly agreed that they would not engage in the recycling activity if the pick-up services for recyclables were not available ( $n=108$ , 44.26%). Moreover, only half of the respondents strongly wish to recycle their parcel packaging ( $n=122$ , 50%). Furthermore, for COVID-19 waste items, 57.38% ( $n=140$ ) strongly agreed that special containers need to be placed in the community for the storage and collection of COVID-19 waste. In addition, 63.93% ( $n=156$ ) and 61.89 % ( $n=151$ ) of the community strongly agreed that color-coding of bins to separate COVID-19 waste from recyclable waste is essential and enhancing knowledge on recycling is important since the household waste commingled with COVID-19 waste (mean score=4.35).

**Table 4.8: Mean Score for Attitude on Waste Recycling Questions**

Question	Frequency N (%)					Mean $\pm$ SD
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1. Labelling and color-coding of waste containers are important.	0 (0.00)	1 (0.41)	7 (2.87)	70 (28.69)	166 (68.03)	4.41 $\pm$ 1.02
2. It is essential to use color-coding to separate COVID-19 waste from recyclable waste.	0 (0.00)	2 (0.82)	6 (2.46)	80 (32.79)	156 (63.93)	4.35 $\pm$ 1.03
3. Separating wastes (hazardous wastes from non-hazardous wastes) facilitates safe recycling practice.	0 (0.00)	0 (0.00)	5 (2.05)	78 (31.97)	161 (65.98)	4.39 $\pm$ 1.02
4. Special containers need to be placed in the community solely for the storage and collection of COVID-19 waste.	0 (0.00)	4 (1.64)	14 (5.74)	86 (35.25)	140 (57.38)	4.23 $\pm$ 1.08
5. It is important to increase knowledge on recycling since the household waste mixed with COVID-19 waste.	0 (0.00)	1 (0.41)	8 (3.28)	84 (34.43)	151 (61.89)	4.35 $\pm$ 1.01
6. I would like to recycle my parcel packaging.	0 (0.00)	1 (0.41)	30 (12.30)	91 (37.30)	122 (50.00)	4.19 $\pm$ 0.98
7. I would recycle even if the pick-up services for recyclables were not available.	1 (0.41)	8 (3.28)	52 (21.31)	75 (30.74)	108 (44.26)	3.95 $\pm$ 1.11
8. I believe recycling helps protect the environment from being polluted.	0 (0.00)	0 (0.00)	8 (3.28)	71 (29.10)	165 (67.62)	4.42 $\pm$ 0.99
9. Recycling is the responsibility of every individual.	0 (0.00)	2 (0.82)	10 (4.10)	60 (24.59)	172 (70.49)	4.43 $\pm$ 1.02
10. Recycling should be an essential part of our way of life.	1 (0.41)	2 (0.82)	9 (3.69)	63 (25.82)	169 (69.26)	4.45 $\pm$ 0.97

Table 4.9 present that most of the respondents (n=62, 25.41%) isolate food waste from recyclable waste daily as they have special container for food waste in their house. Besides, 18.03% (n=44) of the respondents have more than one bin to segregate their waste for recycling daily while 15.98% (n=39) of the respondents dispose garbage according to the category of recycle bins. Furthermore, 52.46% (n=128) of the respondents sent the used clothes to recycling facilities yearly.

Despite that, majority of the respondents never participate in the recycling program or campaign in their residential area (n=125, 51.23%) and never bought recycled products (n=101, 41.39%). Moreover, 42.21% (n=103) of the respondents send the recyclable items to the recycling centre yearly. In addition, 127 out of 244 respondents (52.05%) never compost their food waste or garden waste and isolate the used mask from the recyclable waste. The community also never recycle during COVID-19 endemic (n=108, 44.26%).

**Table 4.9: Mean Score for Practice on Waste Recycling Questions**

Question	Frequency N (%)					Mean $\pm$ SD
	Never	Rarely	Sometimes	Often	Always	
1. I recycle during COVID-19.	108 (44.26)	59 (24.18)	41 (16.80)	21 (8.61)	15 (6.15)	2.08 $\pm$ 1.23
2. I isolate food waste from recyclable waste.	76 (31.15)	39 (15.98)	30 (12.30)	37 (15.16)	62 (25.41)	2.88 $\pm$ 1.60
3. I dispose garbage according to the category of recycle bins.	68 (27.87)	47 (19.26)	47 (19.26)	43 (17.62)	39 (15.98)	2.75 $\pm$ 1.44
4. I compost food waste or garden waste.	127 (52.05)	42 (17.21)	19 (7.79)	40 (16.39)	16 (6.56)	2.08 $\pm$ 1.36
5. I isolate the used mask from the recyclable waste.	127 (52.05)	40 (16.39)	14 (5.74)	21 (8.61)	42 (17.21)	2.23 $\pm$ 1.56
6. I have more than one bin to segregate waste for recycling in my house.	106 (43.44)	48 (19.67)	17 (6.97)	29 (11.89)	44 (18.03)	2.41 $\pm$ 1.56
7. I participate in the recycling program or campaign.	125 (51.23)	73 (29.92)	30 (12.30)	9 (3.69)	7 (2.87)	1.77 $\pm$ 1.00
8. I send the used clothes to recycling facilities.	55 (22.54)	128 (52.46)	43 (17.62)	10 (4.10)	8 (3.28)	2.14 $\pm$ 0.92
9. I send the recyclable items to the recycling centre.	81 (33.20)	103 (42.21)	45 (18.44)	9 (3.69)	6 (2.46)	2.01 $\pm$ 0.95
10. I buy recycled products.	101 (41.39)	86 (35.25)	37 (15.16)	12 (4.92)	8 (3.28)	1.94 $\pm$ 1.03

#### **4.5 Association between Level of Knowledge, Attitude and Practice on Recycling with Sociodemographic Characteristics among Community in Bandar Baru Bangi during COVID-19**

Table 4.10 shows the association between level of knowledge and the sociodemographic characteristics. Based on the mean score, residents in Section 8 have the highest knowledge scores compared to other residential area in this study. Female (n=107, 82.9%) respondents have good knowledge compared to male (n=80, 69.6%) respondents. Respondents at the age of 18 to 24 years old were having the highest level of knowledge compared to other age categories. Respondents with no formal education seems having the highest knowledge level with the mean score of  $8.50 \pm 0.71$ ). Chinese ( $8.47 \pm 1.21$ ) and those with income of <MYR 1000 ( $8.80 \pm 0.84$ ) have high level of knowledge scores. Respondents who lives at the condominium was reported with the highest knowledge score of  $8.56 \pm 1.16$ . There is no difference of knowledge score by number of household where the score for small household members (1 to 3 people) was  $8.40 \pm 1.23$  and big household members (4 to 6 people) was  $8.45 \pm 1.22$ .

Table 4.10 shows a significant association between knowledge on recycling during COVID-19 with gender ( $p < 0.005$ ). On the contrary, result shows no significant association between knowledge on recycling during COVID-19 and residential location ( $p = 0.131$ ), age ( $p = 0.574$ ), education level ( $p = 0.820$ ), race ( $p = 0.429$ ), monthly household income ( $p = 0.855$ ), housing type ( $p = 0.340$ ) and number of household members ( $p = 0.334$ ).

**Table 4.10: Association between Level of Knowledge and Sociodemographic Characteristics**

Sociodemographic Characteristics	Mean ± SD	Knowledge <i>n</i> (%)			x <sup>2</sup>	p-value
		Good	Moderate	Poor		
<i>Residential location</i>						
Section 2	8.09 ± 1.52	23 (65.7)	11 (31.4)	1 (2.9)	15.035	0.131
Section 3	8.12 ± 1.34	34 (68.0)	15 (30.0)	1 (2.0)		
Section 4	8.51 ± 1.20	38 (80.9)	9 (19.1)	0 (0.0)		
Section 7	8.66 ± 0.91	38 (86.4)	6 (13.6)	0 (0.0)		
Section 8	8.92 ± 1.01	32 (86.5)	5 (13.5)	0 (0.0)		
Section 9	8.03 ± 1.30	22 (71.0)	7 (22.6)	2 (6.5)		
<i>Gender</i>						
Male	8.12 ± 1.29	80 (69.6)	33 (28.7)	2 (1.7)	6.330	0.042*
Female	8.64 ± 1.17	107 (82.9)	20 (15.5)	2 (1.6)		
<i>Age</i>						
18-24	8.64 ± 1.18	45 (81.8)	9 (16.4)	1 (1.8)	8.561	0.574
25-29	8.37 ± 1.34	35 (76.1)	9 (19.6)	2 (4.3)		
30-34	8.35 ± 1.09	29 (78.4)	8 (21.6)	0 (0.0)		
35-49	8.49 ± 1.20	34 (79.1)	8 (18.6)	1 (2.3)		
50-65	8.26 ± 1.31	28 (71.8)	11 (28.2)	0 (0.0)		
>65	8.04 ± 1.46	16 (66.7)	8 (33.3)	0 (0.0)		
<i>Education level</i>						
No formal education	8.50 ± 0.71	2 (100.0)	0 (0.0)	0 (0.0)	4.390	0.820
Primary	7.00 ± 1.41	1 (50.0)	1 (50.0)	0 (0.0)		
Secondary	8.39 ± 1.22	31 (81.6)	6 (15.8)	1 (2.6)		
Diploma/Degree	8.43 ± 1.25	128 (76.2)	37 (22.0)	3 (1.8)		
Master/Phd	8.29 ± 1.34	25 (73.5)	9 (26.5)	0 (0.0)		

<i>Race</i>						
Malay	8.38 ± 1.31	100 (75.2)	31 (23.3)	2 (1.5)	3.832	0.429
Chinese	8.47 ± 1.21	50 (80.6)	10 (16.1)	2 (3.2)		
Indian	8.37 ± 1.15	37 (75.5)	12 (24.5)	0 (0.0)		
<i>Monthly household income</i>						
<RM 1000	8.80 ± 0.84	5 (100.0)	0 (0.0)	0 (0.0)	5.510	0.855
RM 1000-RM 2000	8.61 ± 0.99	20 (87.0)	3 (13.0)	0 (0.0)		
RM 2001-RM 3999	8.31 ± 1.34	44 (74.6)	14 (23.7)	1 (1.7)		
RM 4000-RM 5000	8.45 ± 1.19	40 (78.4)	10 (19.6)	1 (2.0)		
RM 5001-RM 10000	8.27 ± 1.31	41 (73.2)	14 (25.0)	1 (1.8)		
>RM 10000	8.46 ± 1.30	37 (74.0)	12 (24.0)	1 (2.0)		
<i>Housing type</i>						
Bungalow	8.10 ± 1.38	27 (65.9)	14 (34.1)	0 (0.0)	9.032	0.340
Semi detached	8.34 ± 1.27	59 (76.6)	17 (22.1)	1 (1.3)		
Terrace	8.47 ± 1.29	27 (79.4)	6 (17.6)	1 (2.9)		
Condominium	8.56 ± 1.16	37 (82.2)	8 (17.8)	0 (0.0)		
Apartment	8.49 ± 1.10	37 (78.7)	8 (17.0)	2 (4.3)		
<i>Household members</i>						
1-3	8.40 ± 1.23	50 (79.4)	12 (19.0)	1 (1.6)	4.573	0.334
4-6	8.45 ± 1.22	115 (77.7)	32 (21.6)	1 (0.7)		
>6	8.15 ± 1.44	22 (66.7)	9 (27.3)	2 (6.1)		

\*Significance level  $\alpha < 0.05$

The mean attitude scores was higher among residence in Section 7 ( $4.52 \pm 0.39$ ) compared to other area. Male has a better mean attitude scores ( $4.35 \pm 0.82$ ) compared to women ( $4.29 \pm 0.98$ ) in this study. Respondents at the age 30 to 34 have a better attitude score ( $4.61 \pm 0.40$ ) compared to the respondents at the age of 18 to 24 ( $4.06 \pm 1.20$ ). Respondents with no formal education have the highest attitude scores ( $4.65 \pm 0.07$ ). As for races, Indian was recorded with the highest attitude scores ( $4.63 \pm 0.36$ ). Respondents with household income of MYR 4000 to MYR 5000 ( $4.48 \pm 0.58$ ) and living in the apartment ( $4.63 \pm 0.39$ ) have higher attitude scores compared to the rest of the group. There is no difference of the attitude score by number of household where the score for small household members (1 to 3 people) was  $4.38 \pm 0.80$  and big household members (4 to 6 people) was  $4.37 \pm 0.82$  (Table 4.11).

Table 4.11 shows that age, race, monthly household income and housing type have significant association on level of attitude towards recycling during COVID-19 ( $p < 0.005$ ). There were no significant association between attitude towards recycling during COVID-19 and residential location ( $p = 0.085$ ), gender ( $p = 0.532$ ), education level ( $p = 0.399$ ) and number of household members ( $p = 0.095$ ).

**Table 4.11: Association between Level of Attitude and Sociodemographic Characteristics**

Sociodemographic characteristics	Mean $\pm$ SD	Attitude <i>n</i> (%)			$\chi^2$	p-value
		Good	Moderate	Poor		
<i>Residential location</i>						
Section 2	4.35 $\pm$ 0.72	32 (91.4)	2 (5.7)	1 (2.9)	16.548	0.085
Section 3	4.04 $\pm$ 1.16	42 (84.0)	2 (4.0)	6 (12.0)		
Section 4	4.42 $\pm$ 0.80	42 (89.4)	3 (6.4)	2 (4.3)		
Section 7	4.52 $\pm$ 0.39	43 (97.7)	1 (2.3)	0 (0.0)		
Section 8	4.19 $\pm$ 1.11	33 (89.2)	0 (0.0)	4 (10.8)		
Section 9	4.43 $\pm$ 0.98	29 (93.5)	0 (0.0)	2 (6.5)		
<i>Gender</i>						
Male	4.35 $\pm$ 0.82	106 (92.2)	4 (3.5)	5 (4.3)	1.262	0.532
Female	4.29 $\pm$ 0.98	115 (89.1)	4 (3.1)	10 (7.8)		
<i>Age</i>						
18-24	4.06 $\pm$ 1.20	47 (85.5)	1 (1.8)	7 (12.7)	24.070	0.007*
25-29	4.36 $\pm$ 0.82	41 (89.1)	3 (6.5)	2 (4.3)		
30-34	4.61 $\pm$ 0.40	36 (97.3)	1 (2.7)	0 (0.0)		
35-49	4.15 $\pm$ 1.21	37 (86.0)	0 (0.0)	6 (14.0)		
50-65	4.53 $\pm$ 0.50	37 (94.9)	2 (5.1)	0 (0.0)		
>65	4.31 $\pm$ 0.45	23 (95.8)	1 (4.2)	0 (0.0)		
<i>Education level</i>						
No formal education	4.65 $\pm$ 0.07	2 (100.0)	0 (0.0)	0 (0.0)	8.360	0.399
Primary	4.55 $\pm$ 0.64	2 (100.0)	0 (0.0)	0 (0.0)		
Secondary	4.33 $\pm$ 0.54	35 (92.1)	3 (7.9)	0 (0.0)		
Diploma/Degree	4.31 $\pm$ 0.98	151 (89.9)	4 (2.4)	13 (7.7)		
Master/Phd	4.29 $\pm$ 0.92	31 (91.2)	1 (2.9)	2 (5.9)		

<i>Race</i>						
Malay	4.14 ± 1.13	113 (85.0)	6 (4.5)	14 (10.5)	17.226	0.002*
Chinese	4.44 ± 0.51	59 (95.2)	2 (3.2)	1 (1.6)		
Indian	4.63 ± 0.36	49 (100.0)	0 (0.0)	0 (0.0)		
<i>Monthly household income</i>						
<RM 1000	3.80 ± 1.63	4 (80.0)	0 (0.0)	1 (20.0)	22.144	0.014*
RM 1000-RM 2000	4.38 ± 0.63	22 (95.7)	0 (0.0)	1 (4.3)		
RM 2001-RM 3999	4.46 ± 0.53	57 (96.6)	2 (3.4)	0 (0.0)		
RM 4000-RM 5000	4.48 ± 0.58	47 (92.2)	3 (5.9)	1 (2.0)		
RM 5001-RM 10000	4.22 ± 1.09	50 (89.3)	0 (0.0)	6 (10.7)		
>RM 10000	4.12 ± 1.24	41 (82.0)	3 (6.0)	6 (12.0)		
<i>Housing type</i>						
Bungalow	4.25 ± 0.80	38 (92.7)	1 (2.4)	2 (4.9)	20.070	0.010*
Semi detached	4.49 ± 0.68	62 (80.5)	4 (5.2)	11 (14.3)		
Terrace	4.03 ± 1.25	31 (91.2)	2 (5.9)	1 (2.9)		
Condominium	4.38 ± 0.66	45 (100.0)	0 (0.0)	0 (0.0)		
Apartment	4.63 ± 0.39	45 (95.7)	1 (2.1)	1 (6.1)		
<i>Household members</i>						
1-3	4.38 ± 0.80	58 (92.1)	2 (3.2)	3 (4.8)	7.900	0.095
4-6	4.37 ± 0.82	138 (93.2)	3 (2.0)	7 (4.7)		
>6	3.96 ± 1.32	25 (75.8)	3 (9.1)	5 (15.2)		

\*Significance level  $\alpha < 0.05$

In general, the mean scores for the practice of respondents in this study was low. However, residence in Section 4 have better practice score ( $2.53 \pm 0.95$ ) compared to the rest of the group. Female tend to recycle more ( $2.39 \pm 0.93$ ) compared to male ( $2.05 \pm 0.75$ ). Slightly difference trend from attitude and knowledge, the practice among respondents at the age of 50 to 65 ( $2.40 \pm 0.97$ ) and those with educational background of Master / Phd ( $2.50 \pm 0.88$ ) were better compared to the rest of the group. Malays ( $2.31 \pm 0.93$ ) and household income of > MYR 10,000 ( $2.52 \pm 1.03$ ) shows a better practice score. Those residence at the terrace house ( $2.51 \pm 1.01$ ) and house members of 4 to 6 ( $2.33 \pm 0.84$ ) are likely to engage in recycling practice more compared to the rest of the group (Table 4.12).

There is no significant association between level of practice and age ( $p=0.055$ ), educational level ( $p=0.098$ ), race ( $p=0.260$ ), monthly household income ( $p=0.593$ ) and housing type ( $p=0.052$ ).

**Table 4.12: Association between Level of Practice and Sociodemographic Characteristics**

Sociodemographic characteristics	Mean ± SD	Practice <i>n</i> (%)			$\chi^2$	p-value
		Good	Moderate	Poor		
<i>Residential location</i>						
Section 2	1.93 ± 0.65	1 (2.9)	7 (20.0)	27 (77.1)	19.535	0.034*
Section 3	2.23 ± 0.82	2 (4.0)	21 (42.0)	27 (54.0)		
Section 4	2.53 ± 0.95	7 (14.9)	18 (38.3)	22 (46.8)		
Section 7	2.14 ± 0.92	4 (9.1)	9 (20.5)	31 (70.5)		
Section 8	2.30 ± 0.85	2 (5.4)	14 (37.8)	21 (56.8)		
Section 9	2.15 ± 0.87	3 (9.7)	5 (16.1)	23 (74.2)		
<i>Gender</i>						
Male	2.05 ± 0.75	1 (0.9)	37 (32.2)	77 (67.0)	14.515	<0.001*
Female	2.39 ± 0.93	18 (14.0)	37 (28.7)	74 (57.4)		
<i>Age</i>						
18-24	2.28 ± 0.87	4 (21.1)	15 (27.3)	36 (65.5)	17.985	0.055
25-29	2.28 ± 0.87	4 (21.1)	16 (34.8)	26 (56.5)		
30-34	1.90 ± 0.77	2 (10.5)	3 (8.1)	32 (86.5)		
35-49	2.26 ± 0.86	3 (15.8)	15 (34.9)	25 (58.1)		
50-65	2.40 ± 0.97	5 (26.3)	15 (38.5)	19 (48.7)		
>65	2.19 ± 0.78	1 (5.3)	10 (41.7)	13 (54.2)		
<i>Education level</i>						
No formal education	1.95 ± 0.07	0 (0.0)	0 (0.0)	2 (100.0)	13.434	0.098
Primary	2.25 ± 0.07	0 (0.0)	0 (0.0)	2 (100.0)		
Secondary	2.07 ± 0.83	2 (5.3)	9 (23.7)	27 (71.1)		
Diploma/Degree	2.21 ± 0.87	12 (7.1)	49 (29.2)	107 (63.7)		
Master/Phd	2.50 ± 0.88	5 (14.7)	16 (47.1)	13 (38.2)		

<i>Race</i>						
Malay	2.31 ± 0.93	13 (9.8)	42 (31.6)	78 (58.6)	5.275	0.260
Chinese	2.19 ± 0.77	3 (4.8)	22 (35.5)	37 (59.7)		
Indian	2.07 ± 0.80	3 (6.1)	10 (20.4)	36 (73.5)		
<i>Monthly household income</i>						
<RM 1000	2.24 ± 0.95	0 (0.0)	2 (40.0)	3 (60.0)	8.370	0.593
RM 1000-RM 2000	2.10 ± 0.67	1 (4.3)	7 (30.4)	15 (65.2)		
RM 2001-RM 3999	2.09 ± 0.82	3 (5.1)	16 (27.1)	40 (67.8)		
RM 4000-RM 5000	2.32 ± 0.87	4 (7.8)	18 (35.3)	29 (56.9)		
RM 5001-RM 10000	2.10 ± 0.77	3 (5.4)	15 (26.8)	38 (67.9)		
>RM 10000	2.52 ± 1.03	8 (16.0)	16 (32.0)	26 (52.0)		
<i>Housing type</i>						
Bungalow	2.00 ± 0.74	2 (4.9)	10 (24.4)	29 (70.7)	15.405	0.052
Semi detached	2.13 ± 0.83	12 (15.6)	23 (29.9)	42 (54.5)		
Terrace	2.51 ± 1.01	1 (2.9)	14 (41.2)	19 (55.9)		
Condominium	2.22 ± 0.68	2 (4.4)	9 (20.0)	34 (75.6)		
Apartment	2.06 ± 0.77	2 (4.3)	18 (38.3)	27 (57.4)		
<i>Household members</i>						
1-3	2.06 ± 0.89	5 (7.9)	13 (20.6)	45 (71.4)	11.036	0.026*
4-6	2.33 ± 0.84	11 (7.4)	56 (37.8)	81 (54.7)		
>6	2.10 ± 0.88	3 (9.1)	5 (15.2)	25 (75.8)		

\*Significance level  $\alpha < 0.05$

#### 4.6 Relationship between Level of Knowledge, Attitude and Practice on Recycling among Community in Bandar Baru Bangi during COVID-19

The Spearman's correlation coefficient was carried out to determine the relationship between KAP. Table 4.13 shows no significant correlation between knowledge, attitude ( $p=0.056$ ) and practice ( $p=0.094$ ). There is also no significant relationship between attitude and practice ( $p=0.330$ ).

**Table 4.13: Relationship between KAP on Recycling among Community in Bandar Baru Bangi during COVID-19**

Variables	p-value	Spearman's correlation ( $\rho$ )
Knowledge and attitude	0.056	0.123
Knowledge and practice	0.094	0.107
Attitude and practice	0.330	-0.063

\*\*Significance level  $p < 0.01$  (two-tailed)

## CHAPTER 5

### DISCUSSION

#### 5.1 Sociodemographic Characteristics of Community in Bandar Baru Bangi

Majority of the respondents were from Section 3 and Section 4. These areas have more recycling drop-off points compared to other Sections (Section 2, Section 7, Section 8 and Section 9). In this study, most respondents were female. Smith (2008) stated that most research suggest that female are more likely to participate and answer a survey than men. The respondents were mainly young adults as this age group were willing to participate in a survey than other age groups.

In Bandar Baru Bangi, there was more Malay people compared to other races. As of July 2022, Malay was the largest ethnic group with 69.9% of Malaysians were Malay (Statista Research Department, 2022). Department of Statistics (2010) mentioned that Malaysia consists of 67.4% Malay, 24.6% Chinese, 7.3% Indian and 0.7% others. On average, the monthly household income of the community indicates that they were in B40 (lower class) and M40 (middle class) category. Most of the respondents live in terrace house as the recycling drop-off points were located near terrace housing area.

## **5.2 Solid Waste Generation and Management of Community in Bandar Baru Bangi during COVID-19**

The major solid waste produced in the study area was food waste. This is consistent with a study done by Teck et al. (2016) where 67.3% food waste from 11.4 MT food waste daily were reported in Bandar Baru Bangi coming from household sector. The garden waste generation in a week was low as it was observed that respondents mostly have no or small garden area in the study area. Plastic bag and plastic bottle usage remain consistent as they are still one of the most discarded waste in Malaysia. According to National Solid Waste Management, a quarter of 19000 tones solid waste generation per year by Malaysians was plastic (Chen et al., 2021). Most of the respondents in this study were recorded low disposal of A4 paper since most people of these days embraces technology where they go paperless and store their files online or in cloud (Xiong, 2021). Glass, metal or tin waste generation was also not high as people do not discard these materials often.

In term of COVID-19 waste generation, glove, face mask and sanitizer bottle usage were low. This is because glove is mostly use in healthcare settings instead of non-healthcare settings since there is inadequate data to encourage the public to use gloves regularly as COVID-19 preventive measure (European Centre for Disease Prevention and Control, 2020). Face mask waste generation was low during the study period due to the abolition of wearing masks in the country. However, half of the respondents still generate lots of face mask waste weekly due to transition of mandatory face masks in indoor settings or enclosed spaces in March 2022 to optional face masks usage indoors starting September 2022. On the other hand, sanitizer bottle can be used multiple times as it lasts for months. This has shown less being disposed.

Based on survey done among community in Bandar Baru Bangi, majority of community are aware of the existing recycling facilities in their residential area. Besides, many commented that the recycling facilities especially the recycling drop-off points were near to them. However, lack of recycling programs was organized to the community. This is the most significant barrier to increase the recycling rate as 42% of respondents globally mentioned lack of programs or services prevent them from recycling (Wood, 2021). Only recycling community at mosque were seen active conducting program in Bandar Baru Bangi. Moreover, there is no recyclable items collection in Bandar Baru Bangi. From researcher's observation, there were only recyclable waste lorry collector that rings out load "surat khabar lama, paper lama" and foreigner waste collector who rode on motorcycle. The frequency of collection also varies depends on the recyclable waste collector. As for now, there is no systematic recyclable waste collection system done by MPKj. The recyclable and non-recyclable waste are thrown together for waste collection. There is no waste separation and recycling program such as kerbside recycling collection initiated by Petaling Jaya City Council (MBPJ).

### **5.3 Solid Waste Generation Characteristics of Community in Bandar Baru Bangi during COVID-19**

Community in Bandar Baru Bangi during COVID-19 produced 0.14 kg/person/day or 0.71 kg/house/day. According to Lagerkvist and Dahlen (2012), the composition and household waste generation rate are influenced by lifestyle and behavioural factors. Waste generation was influenced by economic development such as goods' production and consumption. On the other hand, waste composition was determined by consumer product selection and packaging design.

Solid waste was mostly generated on Friday and during the weekends. On these three days, people usually go out after a busy weekdays schedule. People spend time with their friends. Family also tends to do grocery shopping and spend time together as weekend is regarded as family time. When they go back home, they bring a lot of things with packaging that may possibly go into the dustbin. On the contrary, people produced the least waste on Wednesday. Since it is in the middle of the week, people would prefer to stay home and do not spend much.

Most of the waste generated by the community was recyclable waste with the generation rate of 0.11 kg/person/day or 0.58 kg/house/day. Despite of the limitation due to the pandemic, the recycling rate for the community in this study was high which is 81%. This possibly shows that people generate more recyclable waste than non-recyclable waste during the pandemic. Malaysia has the potential to increase the recycling rate and made recycling as the main waste treatment and disposal. In 2021, Germany was a country with the highest recycling rate (66.1%). This was due to strict recycling policy (Botham, 2022). Unfortunately,

82.5% of waste in Malaysia was disposed in the landfill (Malaysian Investment Development Authority, 2021).

On the other hand, the recycling rate of this study was high probably due to survey induced behavioural changes where volunteers tend to recycle more frequently than normal throughout the survey period (Akil et al., 2017). Volunteers were given large size plastic bag to put in their waste. However, volunteers were inclined to fill in the plastic much as much as they can. Besides, they took the chance of clearing the recyclable items from their house by giving a massive amount of recyclable items during a week of the survey period. This result in abnormal recyclable waste collection data during the study. It was possibly due to the intention to recycle but having time constraints and must travel to the recycling centre at the same time. In summary, although cofounder has been eliminated such as public holiday or festive season and giving only a plastic bag to place the recyclable items which may increase the recyclable items collection, the recycling rate happen to be high.

From this study, paper waste was the biggest contributor for recyclable waste. People disposed cardboard, paperboard, paper packaging, newspaper, magazine and books. The second highest waste contributor was plastic such as plastic packaging, plastic bottle and plastic container. This was followed by used items that consist of shoes, blanket, bag, purse and clothes. Recyclable waste with less generation was glass (food and skincare packaging), steel, aluminium such as metal and tin waste from household that bought canned food for their pets and people who drank can drink every day followed by E-waste (batteries and cables) and lastly other waste.

There are several past research on waste generation and composition in Malaysia. Most of the study indicates either paper or plastic is the biggest contributor of recycable waste. For instance, TVET KL Campus waste composition is dominated by plastic (6.45%) followed by metal (4.27%), paper (3.61%), others (1.44%) and glass (1.36%) at cafeteria while the dining hall was also dominated by plastic (3.71%), paper (2.47%), metal (0.80%), glass (0.34%) and other waste (0.16%) (Rodzi et al., 2019). Furthermore, residential areas in Balakong, Selangor generated 29.53% paper, 16.69% plastic, 2.65% others, 1.90% glass and 1.16% metal (Samah et al., 2013). Another study on household waste generation and composition was conducted at low cost apartment located in Petaling Jaya, Selangor showed that the leading waste composition are plastic (25.2%) and paper (22.7%).

#### **5.4 Level of Knowledge, Attitude and Practice on Recycling among Community in Bandar Baru Bangi during COVID-19**

As shown in Table 4.6, the respondents showed good general knowledge on recycling during COVID-19. This is consistent with the findings of the study by Noor (2016) and Othman and Yuhaniz (2018) which indicates that majority of the citizen in Johor Bahru and Shah Alam had a basic understanding on recycling's main objective. In this study, the community are aware that COVID-19 waste is not recyclable and need to be separated out before recycling other materials. They also believe that COVID-19 patients' waste should not be recycled, and improper disposal of COVID-19 waste contribute to the spread of the epidemic.

In addition, community have good level of attitude towards recycling during COVID-19. The respondents strongly agree that COVID-19 related waste should be segregated at household level, and this is aligned with United Nations Environment Programme (UNEP) request. Moreover, the respondents admit that it is essential to allocate a labelled colour coded bin for COVID-19 waste at residential area to segregate hazardous and non-hazardous domestic waste to avoid potential health risks. Ly and Ly (2022) explained that people with idealistic attitude on waste segregation and recycling are more inclined to act in the future.

Furthermore, the domestic hazardous waste remains an issue as face masks are frequently dumped together with recyclables and non-recyclables items which portrays that the community has little regard for the environment. Besides, the health concern of commingled COVID-19 waste with other household recyclable waste is also practically low as community neglect to segregate recyclable waste from COVID-19 waste where it can cause secondary

transmission to humans especially to the recyclable waste collector. Unfortunately, due to lack practice on waste segregation and recycling during COVID-19, the recyclables waste was also treated as non-recyclable waste to avoid potential infection from waste (Hantoko et al., 2021).

### **5.5 Association between Level of Knowledge, Attitude and Practice on Recycling during COVID-19 with Sociodemographic Characteristics among Community in Bandar Baru Bangi**

A significant association was found between knowledge on recycling during COVID-19 with gender. This conforms with the study conducted by Zand et al. (2022) who reported that gender play a significant role in community's recycling knowledge. Galasso et al. (2020) found that women are more likely than men to perceive COVID-19 as a serious public health issue. Research also confirms that women are more knowledgeable about climate change scientific aspects and more likely to show concern about its implications (Somerville, 2018).

As for attitude on recycling during COVID-19, there were significant association towards age, race, monthly household income and housing type. This evidence is supported by Ugulu (2015) who mentioned that younger people display a more favourable attitude toward recycling than older people. Another study also found out that Malays tend to have good recycling practice than other races (Mutang & Haron, 2012). Different ethnic groups have different barriers or reasons for recycling attitude (Lakhan, 2019). They also have different ethics and different lifestyles (Tiew et al., 2019).

Khalil et al. (2019) explained that the moderating result of the causal relationship between attitude and intention tends to weaken as a household's income level rises. Similar to this, the moderating result demonstrates significant and positive causal link between attitude to recycling and perceived lack of facilitating conditions in low income households; whereas the relationship is significant and negative in high income residents. Akil et al. (2015) reported that majority of low income group recycle regularly compared to only 25% of high income group who recycle regularly. This is similar to Banga (2013) who found that respondents with high income were less likely to recycle.

Toit and Wagner (2020) found out that housing type is the second strongest factor on recycling where people living in houses (stand-alone residence) have more positive attitude in contrast to people living in townhouse (multi-level house) or apartments as they felt less able to recycle due to small space and lack of assistance from the house managing agencies. People who live in bungalow and semi-detached have better waste segregation attitude than individuals living in other type of houses (Fadhullah, 2022).

In terms of practice towards recycling during COVID-19, a significant association was found with residential location, gender and number of household members. From observation, community whose residential location with close proximity to the recycling drops-off points has good recycling practice. In addition, good recycling practice was observed when the recycling community in the residential location is active especially at mosque where they always conduct recycling program such as used cooking oil collection and used cloth collection. According to Akil et al. (2015), 15% of respondents mentioned that situational location barrier or service prevent them from participation in recycling.

Majority of research indicated that female is more likely to engage in eco-friendly behaviour particularly when it comes to personal and domestic activities such as recycling (Maulana & Dwipayanti, 2022). Brough et al. (2016) expressed that both women and men perceive eco-friendly behaviour as being more feminine and view their eco-friendly behaviour as being more feminine too. As a result, males unintentionally decided to engage in fewer green actions to maintain their masculinity.

Results of our study also indicate, 2.3% of respondents stated that not many people at home were the reason not to engage in recycling. This is consistent with a study by Singhirunnusorn et al. (2012) who reported an association of family size with the recycling practice. Chukwuone et al. (2022) also mentioned that the involvement in waste separation practice depends on household size as more household duties can be assigned with larger household members. Family size had significantly positive influence on waste separation practice (Handayani et al., 2018).

## **5.6 Relationship between Level of Knowledge, Attitude and Practice on Recycling among Community in Bandar Baru Bangi during COVID-19**

There was no significant relationship between knowledge and attitude in this study. This result is consistent with Laor et al. (2018) and Fiorillo (2013). However, the result is in contrast with Gusti (2016) who found that knowledge and attitude on sustainable waste management was positively correlated with each other. This is also consistent with finding from Ramayah et al. (2012) study that used Theory of Planned Behaviour to investigate the behaviour of recycled environmental conscious individuals and it is consistent with the theory in line with the theoretical assumptions.

Our findings also indicated no significant relationship between knowledge and practice. This highlights that recycling practice does not depend on the people knowledge about recycling but rather depends on their willingness to recycle. This is supported by Zhang and Wen (2014) and Azmin et al. (2022) who found that by only having good knowledge and attitude does not result in good practice. In the meantime, the result of this study contradicts with Sobri and Rahman (2016) where there is significant association of knowledge to the practice level.

Attitude and practice of respondents in this study also were not associated. This is similar with Azmin et al., (2022) that stated respondents had weak recycling practice despite having high knowledge and attitude. This is in contrasts with Wright (2011) who found that people with a positive attitude and knowledge were more likely to recycle. refers t Attitude o individual's willingness to cultivate a good practice. A moderate association was found

between attitude and practice due to individuals unreadiness to engage in environmental practice in Halim et al., (2021).



## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

#### 6.1 Conclusion

This study was designed to answer a research question of how is the waste recycling activity among the community during COVID-19 in Bandar Baru Bangi, Selangor and its association with their knowledge and attitude?

As a conclusion, in terms of the waste recycling activity, the volume of waste being recycled was 101.45 kg from the overall solid waste of 124.89 kg which was equivalent to 81%. This result was based on the observation done for a week in the study area. The recycling rate among the community in Bandar Baru Bangi was high despite of the limitation due to the COVID-19 pandemic with the major recyclable items was paper, plastic and others such as clothes. This possibly shows that people generate more recyclable waste than non-recyclable waste during the pandemic. In addition, the availability of the recycling facilities are near to their surroundings and even maybe influenced by the good level of knowledge and attitude of the community. However, this was not reflected by the practice score in this study as majority of the respondents in the community are having low practice score.

In terms of how this was associated with the knowledge and attitude, this study found that there is significant association of KAP towards recycling during COVID-19 and sociodemographic characteristics. Knowledge was significantly associated with gender.

Attitude was significant with age, race, monthly household income and housing type while a significant association was found between practice and residential location, gender and number of household members. However, there was no significant relationship between the level of knowledge, attitude, and practice on recycling among the community.

In COVID-19 era, it is crucial to consider COVID-19 waste management especially at community level as household waste commingled with COVID-19 waste. When COVID-19 waste was not segregated from recyclable waste at source, this may cause transmission of COVID-19 SARS-CoV-2 virus when the community send their recyclable items to recycling centre especially among workers at recyclable items collection centre.

## 6.2 Study Strength and Limitation

The strength of this study was the sampling method which consider various housing types that represent different income status of the community. The study sample were able to constitute a representative sample to reflect the population accurately.

Secondly, participants who participate in waste collection sampling are able to enhance their environmental awareness on recycling and instil thoughtful decision making to segregate recyclable and non-recyclable household waste. The researcher gave a poster as guidance on waste separation to the participants. The poster seems to help the participants as less inquiries were given to researcher after the poster distribution.

Thirdly, this research provides recent recyclable household waste generation data during COVID-19 pandemic period. This data can be a reference to represent the community's recyclable waste generation during COVID-19 situation. This study also explores KAP on recycling during COVID-19 at places with existing recycling facilities. This can be a future baseline data to determine the problem that prevent public recycling practice and develop a better approach on recycling programs.

The limitation of this study was information bias. The community tend to give positive answers in the questionnaires due to survey-induced behavioural change. It is well known that being observed can change people behaviour. Moreover, this study cannot be generalized to all population as this study was sampled only in Bandar Baru Bangi. The result was applied to a very specific population. Hence, the sample is not truly representative.

## **6.3 Recommendation**

### **6.3.1 Government**

Government should enforce strict and urgent SWM guidelines focusing on all sectors such as industry, community, institution and commercial during COVID-19 outbreak. A lot of developing countries with good SWM management system and high recycling rate came from enforceable policy. A long term SWM plan should be created taking socioeconomic factors into account and based on various potential pandemic scenarios for the following years. This is important to cope with current scarcity of the landfills area. Also, partial tax exemption can encourage residents to take part in SWM programs. Public are always interested with socioeconomic incentives, so it is good to apply in SWM initiatives.

### **6.3.2 Municipal Council**

Municipal council should organize free programs or training session on recycling to the community so that they are aware of their role and responsibilities to support solid waste management programs. This is to ensure that the municipal council's effort do not go to waste when organizing any programs on SWM. Community participation is crucial to indicate the successfulness of a program. Besides, adequate amount of money is needed to support programs that encourage source separation and recycling also improve recycling facilities. This helps to attract the community to make recycling as a habit. Next, municipal council should make an initiative for establishment of hazardous waste collection centre to the community. This will ease the effort of separation at source at household level.

### 6.3. Future Studies

It is suggested that future KAP surveys and waste collection sampling used in other waste management studies that focus on recycling practice to have a larger sample size. Larger sample size is more representative of the population as inferential statistics main objective is to generalize sample to a population. Larger sample size also provides a more accurate mean, easy to detect outliers and minimized margin of error. It is also recommended to increase residences for waste sampling. This will help to produce a more accurate waste generation data to represent Bandar Baru Bangi community.

Next, collaboration from other organizations or parties on solid waste management especially towards recycling research project is also beneficial. This helps to compare the significant results and efficiency of this project as collaboration expose researcher to develop new insight and take part in simulating discussions with other experts.

In addition, another study model approach can be applied to improve the quality of this study such as Theory of Planned Behaviour to have better understanding on community knowledge, attitude and practice on recycling. Theory of Planned Behaviour allows researcher to learn how people behave in various settings, situations and scenarios. Researchers will be able to identify obstacles in changing behaviour by obtaining information on attitudes towards norms, perceived control and behaviours.

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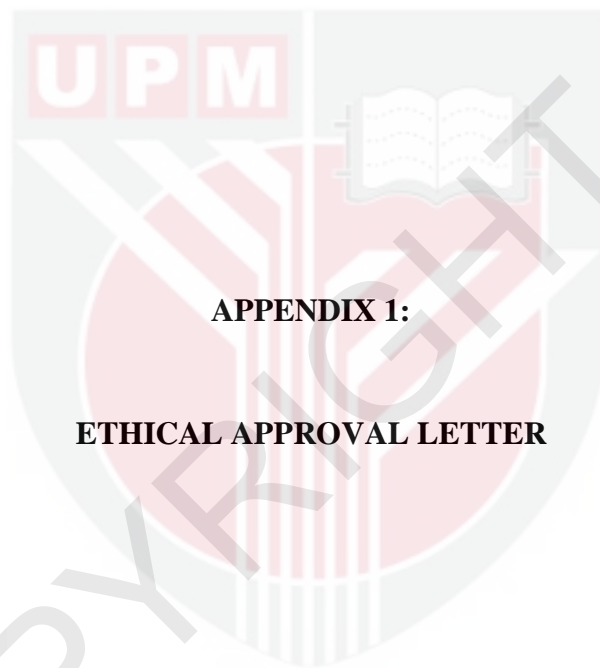
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**APPENDICES**



**APPENDIX 1:**

**ETHICAL APPROVAL LETTER**

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**PEJABAT TIMBALAN NAIB CANSOLOR (PENYELIDIKAN DAN INOVASI)**

OFFICE OF THE DEPUTY VICE CHANCELLOR (RESEARCH AND INNOVATION)

Rujukan kami : UPM/TNCPI/RMC/1.4.18.2 (JKEUPM)

Tarikh : 25 August 2022

Dr. Sharifah Norkhadijah Binti Syed Ismail  
Department of Environmental and Occupational Health  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
Serdang, Selangor

Dear Madam/Sir,

**RESEARCH PROJECT: WASTE RECYCLING PRACTICE AMONG COMMUNITY DURING COVID-19 IN BANDAR BARU BANGI, SELANGOR AND ITS ASSOCIATION WITH KNOWLEDGE AND ATTITUDE.**

**REFERENCE NO: JKEUPM-2022-397**

**PRINCIPAL INVESTIGATOR: DR. SHARIFAH NORKHADIJAH BINTI SYED ISMAIL**

**CO-INVESTIGATOR: 'ALIAH BINTI ABDUL RAHMAN LAW (STUDENT)**

The Ethics Committee for Research involving Human Subjects of University Putra Malaysia (JKEUPM) has studied the proposal for the above project and found that there were no objectionable ethical issues involved in the proposed study.

Please find the list of documents received and reviewed with reference to the study and committee members who reviewed the documents (as attached).

Notwithstanding above, we will not be responsible for any misconduct on the part of researcher in the course of carrying out the research.

**Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.**

Thank you.

**"WITH KNOWLEDGE WE SERVE"**

Sincerely yours,

**PROF. DR. ZAMBERI SEKAWI**  
Chair  
Ethics Committee for Research involving Human Subjects  
Universiti Putra Malaysia

**ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS  
(JKEUPM)  
UNIVERSITI PUTRA MALAYSIA**

<b>Research title</b>	: <b>Waste Recycling Practice Among Community During Covid-19 in Bandar Baru Bangi, Selangor and Its Association with Knowledge and Attitude.</b>
<b>Study Site</b>	: <b>Selangor.</b>
<b>JKEUPM Ref No.</b>	: <b>JKEUPM-2022-397</b>
<b>Principal Investigator</b>	: <b>Dr.Sharifah Norkhadijah Binti Syed Ismail</b>
<b>Co-investigator</b>	: <b>'Aliah Binti Abdul Rahman Law (Student)</b>

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 01/06/2022
2. Respondent's Information Sheet / Consent (English), Version 2 dated 09/08/2022
3. Proposal (English), Version 2 dated 24/08/2022
4. Questionnaire / Interviews (English), Version 1 dated 31/05/2022
5. Curriculum Vitae of:
  - a. Dr.Sharifah Norkhadijah Binti Syed Ismail

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

- Approved
- Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**
- Disapproved

Please note that the approval is **VALID UNTIL 25 AUGUST 2023**

Researchers should comply with the following:

- I. Complete a Study Final Report upon study completion (Form 3.2).
- II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.
- III. Applicable for Clinical Trial Studies and Clinical interventional Studies only: Progress Report has to be submitted to JKEUPM at every 6 months from the date of approval (Form 3.1). Report occurrences of all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs) and Protocol Deviation/ Violation at all JKEUPM approved sites to JKEUPM. All serious adverse events (SAEs) detected or being notified should be reported immediately to the sponsor except for those SAEs that the protocol or other document (e.g.,

Investigator's Brochure) identifies as not needing immediate reporting. The immediate reports should be followed promptly by detailed, written reports.  
The required forms can be obtained from the Ethics Committee for Research Involving Human Subjects (JKEUPM) website (<http://www.tncpi.upm.edu.my/faildokumen>).

Date of Approval: 25 August 2022

Members of the JKEUPM who reviewed the documents:

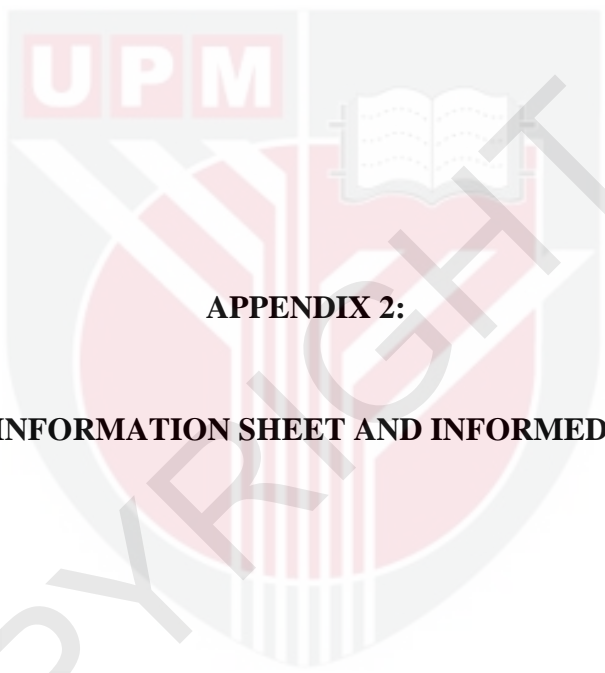
- i. Primary Reviewer: Dr. Norliza Binti Ahmad
- ii. Informed Consent Reviewer: Assoc. Prof. Dr. Abdullah Bin Mat Rashid @ Mat Idris



.....

**PROF. DR. ZAMBERI SEKAWI**  
Chair  
Ethics Committee for Research involving Human Subjects  
Universiti Putra Malaysia

JKEUPM is recognised by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER) in collaboration with the Forum for Ethical Review Committees in Asia and the Western Pacific Region (FERCAP) for its compliance with the Declaration of Helsinki, International Conference on Harmonization (ICH) Guidelines, Good Clinical Practice (GCP) Standards, Council for International Organizations of Medical Sciences (CIOMS) Guidelines, World Health Organization (WHO) Standards and Operational Guidance for Ethics Review of Health-Related Research and Surveying and Evaluating Ethical Review Practices, EC/IRB Standard Operating Procedures (SOPs), and Local Regulations and Standards in Ethical Review.



**APPENDIX 2:**

**PARTICIPANT'S INFORMATION SHEET AND INFORMED CONSENT FORM**



#### **BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN**

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

##### **1. TAJUK KAJIAN:**

Amalan Kitar Semula di Kalangan Masyarakat Semasa COVID-19 di Bandar Baru Bangi, Selangor dan Kaitannya dengan Pengetahuan dan Sikap

##### **2. PENGENALAN:**

Wabak COVID-19 telah mengubah corak pengeluaran sisa di seluruh dunia dan memerlukan perhatian yang sewajarnya. Wabak ini mengakibatkan turun naik yang tidak dijangka pada jumlah dan komposisi sisa. Oleh itu, kajian ini bertujuan untuk mendapatkan maklumat mengenai tahap pengetahuan, sikap dan amalan kitar semula semasa COVID-19 di kalangan komuniti Bandar Baru Bangi, Selangor.

##### **3. APAKAH YANG PERLU ANDA LAKUKAN?**

Terdapat dua jenis kaedah pengumpulan data iaitu:

- 1) Pensampelan penjanaan sisa dan pengukuran berat sisa
- 2) Borang soal selidik secara bersemuka atau *online*

Penyertaan adalah secara sukarela. Peserta diberi borang penerangan berkenaan penyelidikan dan borang persetujuan untuk menjadi responden. Peserta boleh menarik diri pada bila-bila masa tanpa sebarang denda dikenakan.

##### **4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?**

- 1) Rumah kosong
- 2) Pemilik rumah yang jarang membuang sampah
- 3) Pemilik rumah yang tidak tinggal tetap di rumahnya

##### **5. APAKAH FAEDAH MENYERTAI KAJIAN INI?**

###### **a) KEPADA ANDA SEBAGAI PESERTA?**

Peserta tidak memperoleh faedah secara langsung setelah pensampelan sisa dan penimbangan berat sisa di kawasan perumahan untuk kajian ini kerana kajian ini memerlukan masa yang lama untuk menghasilkan keputusan. Namun, penyertaan anda akan meningkatkan kefahaman penyelidik mengenai tahap pengetahuan, sikap dan amalan kitar semula semasa COVID-19 di kawasan tempat tinggal anda. Maklumat diperolehi dalam kajian ini dapat membantu dalam perancangan strategi kitar semula yang lebih baik kepada komuniti dan mengurangkan risiko kesihatan berikatan pengurusan sisa pepejal yang tidak

sempurna pada masa akan datang.

**b) KEPADA PENYELIDIK?**

Penyelidik dapat menghasilkan pemahaman baru tentang tahap pengetahuan, sikap dan amalan kitar semula semasa COVID-19 di komuniti bandar baru bangi bagi memperoleh idea bagi cadangan penambahbaikan program kitar semula di bandar baru bangi serta negara ini.

**6. ADAKAH IA BERISIKO?**

Tidak ada risiko yang dijangkakan dari penyelidikan ini. Responden diminta untuk menjawab dengan jujur. Tidak ada jawapan yang salah atau betul.

**7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?**

Ya, maklumat dan identiti peserta akan kekal rahsia dan hanya digunakan untuk kajian sahaja.

**8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?**

Untuk maklumat lanjut atau sebarang masalah berkaitan kajian, sila hubungi penyelidik di bawah:

<p><b>PENYELIA:</b></p> <p>Dr. Sharifah Norkhadijah binti Syed Ismail</p> <p>Jabatan Kesihatan Persekitaran dan Pekerjaan, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia</p>	<p>E-MEL: <a href="mailto:norkhadijah@upm.edu.my">norkhadijah@upm.edu.my</a></p> <p>NO. TEL: 012-2646712</p>
<p><b>PENYELIDIK:</b></p> <p>'Aliah binti Abdul Rahman Law</p> <p>Jabatan Kesihatan Persekitaran dan Pekerjaan, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia</p>	<p>E-MEL: <a href="mailto:201014@student.upm.edu.my">201014@student.upm.edu.my</a></p> <p>NO. TEL: 010-2821033</p>

## PERSETUJUAN MENYERTAI SOAL SELIDIK

Saya ..... No Kad Pengenalan. ....  
beralamat .....  
..... dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas \*(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan. Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya\* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

Saya setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

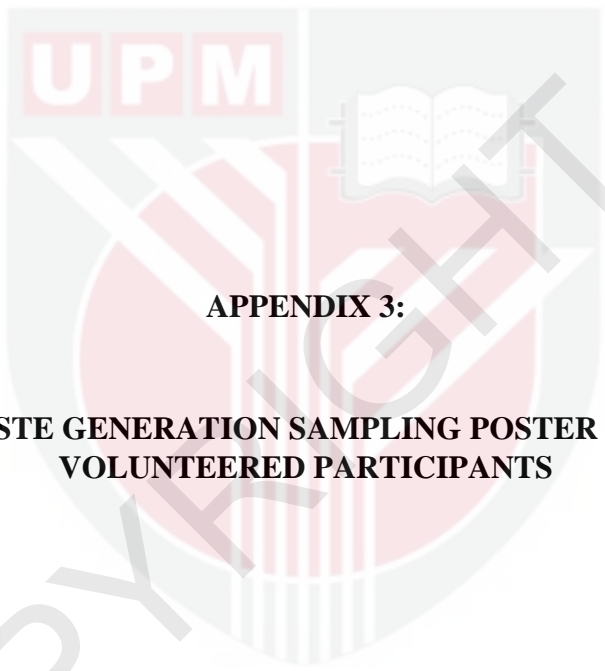
\*potong yang tidak berkenaan

Tandatangan ..... Tandatangan .....  
(Responden) (Saksi)

Tarikh : ..... Nama : .....  
No. K/P: .....

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh ..... Tandatangan .....  
(Penyelidik)



**APPENDIX 3:**

**WASTE GENERATION SAMPLING POSTER FOR  
VOLUNTEERED PARTICIPANTS**

# PERSAMPELAN SISA PEPEJAL

## 1 JANGKA MASA PROSES PERSAMPELAN

Hari 1: Pemberian plastik sampah Hari 1  
 Hari 2: Pengambilan plastik sampah Hari 1  
 Pemberian plastik sampah Hari 2  
 Hari 3: Pengambilan plastik sampah Hari 2  
 Pemberian plastik sampah Hari 3  
 Hari 4: Pengambilan plastik sampah Hari 3  
 Pemberian plastik sampah Hari 4  
 Hari 5: Pengambilan plastik sampah Hari 4  
 Pemberian plastik sampah Hari 5  
 Hari 6: Pengambilan plastik sampah Hari 5  
 Pemberian plastik sampah Hari 6  
 Hari 7: Pengambilan plastik sampah Hari 6  
 Pemberian plastik sampah Hari 7  
 Hari 8: Pengambilan plastik sampah Hari 7

## 2 BAGAIMANA PROSESNYA?

2 plastik sampah diberikan untuk  
mengasingkan sisa setiap hari

SISA YANG BOLEH  
DIKITAR SEMULA



- Tin/ Tin makanan
- Kertas/ Kad/ Sampul surat/ Buku/ Surat khabar
- Kadbod
- Botol plastik
- Bekas plastik yang dibersihkan
- Aluminium foil
- Balang/ botol kaca
- Bateri alkali
- Pakaian/ Beg/ Kasut/ Selimut

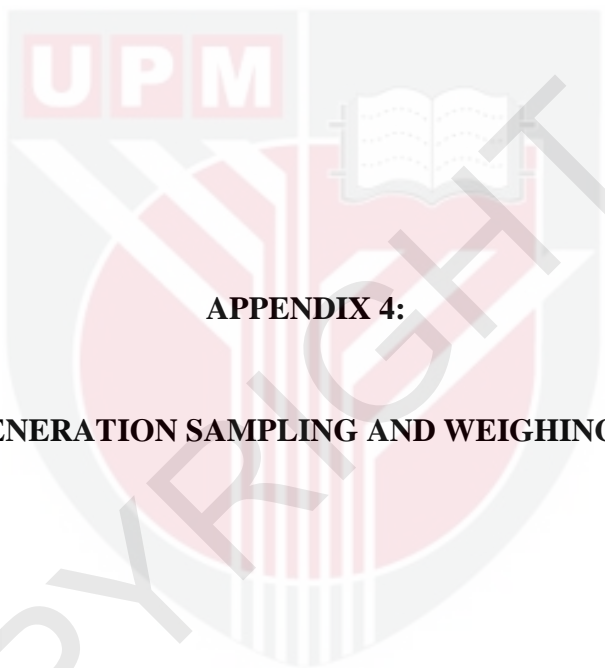
SISA YANG TIDAK BOLEH  
DIKITAR SEMULA



- Kotak makanan seperti kotak pizza
- Styrofoam/ Polystrene
- Bekas plastik kotor
- Cawan minuman terpakai
- Bekas yogurt
- Beg plastik
- Bekas makanan dan minuman takeaway
- Bekas makanan (Pembalut gula-gula, plastik jajan, kotak air minuman/ Bekas kaca yang telah pecah)
- Kertas yang tidak boleh dikitar semula (Tisu/ Napkin/ Paper towel)
- Wayar/ Kabel
- Pelitup muka
- Sarung tangan

\*Sampah basah tidak diterima  
(sisa makanan/ sisa sayuran/ sisa kebun)





**APPENDIX 4:**

**WASTE GENERATION SAMPLING AND WEIGHING PROCESS**



Picture shows two different coloured plastic bags given to volunteered respondents for waste sampling.



Picture shows the waste was collected by the researcher at the volunteered participant's house.



Picture shows the weighing process.

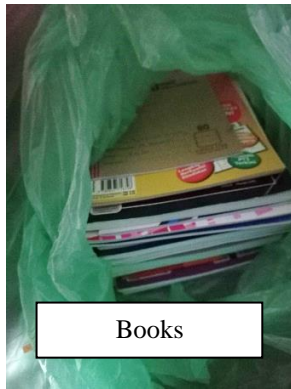
The weight of recycled items was recorded according to its category.



Glass bottles



Clothes



Books

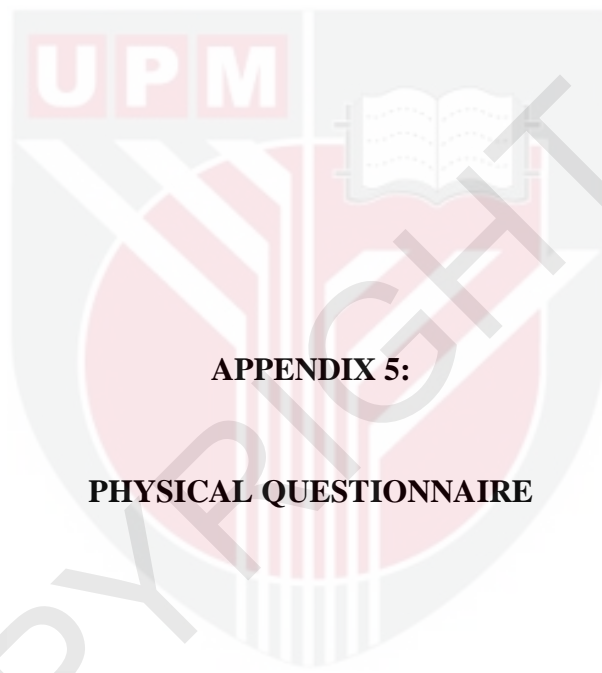


Paperboard

Picture shows the collected recycled waste were segregated based on its category.



Picture shows the volunteered participants received honorarium from the researcher on the last day of waste collection.



**APPENDIX 5:**

**PHYSICAL QUESTIONNAIRE**



**JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN**  
**FAKULTI PERUBATAN DAN SAINS KESIHATAN**  
**UNIVERSITI PUTRA MALAYSIA**

**AMALAN KITAR SEMULA DI KALANGAN MASYARAKAT**  
**SEMASA COVID-19 DI BANDAR BARU BANGI, SELANGOR**  
**DAN KAITANNYA DENGAN PENGETAHUAN DAN SIKAP**

**SOALAN UTAMA**

Soal selidik ini terdiri daripada lima (5) bahagian:

Bahagian A: Maklumat sosiodemografik

Bahagian B: Pengurusan sisa pepejal

Bahagian C: Tahap pengetahuan terhadap aktiviti kitar semula

Bahagian D: Sikap terhadap aktiviti kitar semula

Bahagian E: Amalan terhadap aktiviti kitar semula

**PART A: SOCIODEMOGRAPHIC INFORMATION/  
BAHAGIAN A: MAKLUMAT SOSIODEMOGRAFI**

Choose answer based on options provided.  
*Pilih jawapan berdasarkan pilihan yang disediakan.*

1. Age/ *Umur*

- 18-24 years old  
 25-29 years old  
 30-34 years old  
 35-49 years old  
 50-65 years old  
 >65 years old

2. Gender/ *Jantina*

- Male/ *Lelaki*  
 Female/ *Perempuan*

3. Race/ *Bangsa*

- Malay/ *Melayu*  
 Chinese/ *Cina*  
 Indian/ *India*  
 Others/ *Lain-lain:* \_\_\_\_\_

4. Education level/ *Tahap pendidikan*

- No formal education/ *Tiada pendidikan formal*  
 Primary school/ *Sekolah rendah*  
 Secondary school/ *Sekolah menengah* \_\_\_\_\_  
 Tertiary education (Diploma/ Degree)/ *Pengajian tinggi (Diploma/ Ijazah)*  
 Professional (Master/ Phd)/ *Profesional (Ijazah Sarjana/ Doktor Falsafah)*

5. Housing type/ *Jenis perumahan*

<input type="checkbox"/>	Bungalow/ <i>Banglo</i>
<input type="checkbox"/>	Terrace/ <i>Teres</i>
<input type="checkbox"/>	Condominium/ <i>Kondominium</i>
<input type="checkbox"/>	Apartment/ <i>Pangsapuri</i>
<input type="checkbox"/>	Others/ <i>Lain-lain</i> : _____

6. Monthly household income/ *Pendapatan bulanan isi rumah*

<input type="checkbox"/>	<RM 1000
<input type="checkbox"/>	RM 1000 - RM 2000
<input type="checkbox"/>	RM 2001 - RM 3999
<input type="checkbox"/>	RM 4000 - RM 5000
<input type="checkbox"/>	RM 5001 - RM 10000
<input type="checkbox"/>	>RM 10000

7. Number of household members/ *Bilangan isi rumah*

<input type="checkbox"/>	1-3
<input type="checkbox"/>	4-6
<input type="checkbox"/>	>6

8. Residential location/ *Lokasi kediaman*

<input type="checkbox"/>	Section 1/ <i>Seksyen 1</i>
<input type="checkbox"/>	Section 2/ <i>Seksyen 2</i>
<input type="checkbox"/>	Section 3/ <i>Seksyen 3</i>
<input type="checkbox"/>	Section 4/ <i>Seksyen 4</i>
<input type="checkbox"/>	Section 7/ <i>Seksyen 7</i>
<input type="checkbox"/>	Section 8/ <i>Seksyen 8</i>
<input type="checkbox"/>	Section 9/ <i>Seksyen 9</i>

**PART B: SOLID WASTE GENERATION AND MANAGEMENT/  
BAHAGIAN B: PENGHASILAN DAN PENGURUSAN SISA PEPEJAL**

Estimate the amount of household waste generated from your house./  
Anggarkan jumlah sisa isi rumah yang dihasilkan daripada rumah anda.

1. Food leftovers / Sisa makanan



1 kg=Half of 1 S size plastic bag/ 1kg=Separuh daripada 1 beg plastik bersaiz S

- Less than 0.5 kg/day (*Kurang daripada 0.5 kg/hari*)
- Between 0.5 kg to 1 kg/day (*Antara 0.5 kg sehingga 1 kg/hari*)
- More than 1 kg/day (*Lebih daripada 1 kg/hari*)

2. Garden waste/ Sisa kebun



1 kg=Half of 1 S size plastic bag/ 1kg=Separuh daripada 1 beg plastik bersaiz S

- Less than 1 kg/week (*Kurang daripada 1 kg/minggu*)
- Between 1 kg to 2 kg/week (*Antara 1 kg sehingga 2 kg/minggu*)
- More than 2 kg/week (*Lebih daripada 2 kg/minggu*)

3. Plastic bag/ Beg plastik

- Less than or equal to 5 pieces/week (*Kurang daripada atau sama dengan 5 keping/minggu*)
- Between 6 to 10 pieces/week (*Antara 6 hingga 10 keping/minggu*)
- More than 10 pieces/week (*Lebih daripada 10 keping/minggu*)

4. Plastic bottle/ Botol plastik

- Less than or equal to 5 bottles/week (*Kurang daripada atau sama dengan 5 botol/minggu*)
- Between 6 to 10 bottles/week (*Antara 6 hingga 10 botol/minggu*)
- More than 10 bottles/week (*Lebih daripada 10 botol/minggu*)

5. Paper/ Kertas



1 ream=500 sheets of paper/ 1 rim=500 helai kertas

- Less than 1 ream/week (*Kurang daripada 1 rim/minggu*)
- Around 1 ream/week (*Dalam lingkungan 1 rim/minggu*)
- 2 ream or above/week (*2 rim atau lebih/minggu*)

6. Glass/ Gelas

- Less than or equal to 5 bottles/week (*Kurang daripada atau sama dengan 5 botol/minggu*)
- Between 6 to 10 bottles/week (*Antara 6 hingga 10 botol/minggu*)
- More than 10 bottles/week (*Lebih daripada 10 botol/minggu*)

7. Metal or tin/ Logam atau tin



1 kg=1 S size plastic bag/ 1kg=1 beg plastik bersaiz S

- Less than 0.5 kg/week (*Kurang daripada 0.5 kg/minggu*)
- Between 0.5 kg to 1 kg/week (*Antara 0.5 kg sehingga 1 kg/minggu*)
- More than 1 kg/week (*Lebih daripada 1 kg/minggu*)

8. Glove/ Sarung tangan

- Less than or equal to 5 pieces/week (*Kurang daripada atau sama dengan 5 keping/minggu*)
- Between 6 to 10 pieces/week (*Antara 6 hingga 10 keping/minggu*)
- More than 10 pieces/week (*Lebih daripada 10 keping/minggu*)

9. Face mask/ Pelitup muka

- Less than or equal to 5 pieces/week (*Kurang daripada atau sama dengan 5 keping/minggu*)
- Between 6 to 10 pieces/week (*Antara 6 hingga 10 keping/minggu*)
- More than 10 pieces/week (*Lebih daripada 10 keping/minggu*)

10. Sanitizer bottle/ *Botol sanitasi*

- Less than or equal to 2 bottles/week (*Kurang daripada atau sama dengan 2 botol/minggu*)
- Between 3 to 4 bottles/week (*Antara 3 hingga 4 botol/minggu*)
- 5 bottles or above/week (*5 botol atau lebih/minggu*)

11. What recycling facility is available in your area?/ *Apakah fasiliti kitar semula yang terdapat di kawasan kediaman anda?*



**Recycling bins**



**Recycling center**



**Recycling drop-off point**

- Recycling bins/ *Tong kitar semula*
- Recycling center/ *Pusat kitar semula*
- Recycling drop-off point/ *Drop-off barangan kitar semula*
- Other/ *Lain-lain*: \_\_\_\_\_

12. How far is the recycling facility mentioned above from your residential area?/ *Berapa jauh fasiliti kitar semula yang disebut di atas dari kawasan kediaman anda?*

\_\_\_\_\_

13. How many recycling facility mentioned above in your residential area?/ *Berapa banyak fasiliti kitar semula yang disebut di atas di kawasan kediaman anda?*

\_\_\_\_\_

14. Is there any recycling program in your residential area?/ *Adakah terdapat program kitar semula yang dijalankan di kawasan kediaman anda?*

- Yes/ *Ya*
- No/ *Tidak*

If yes/ *Jika ya*,  
State the program/ *Nyatakan program tersebut*

---

15. Is there any recyclable items collection in your residential area?/ *Adakah terdapat sistem kutipan sisa bahan kitar semula di kawasan kediaman anda?*

- Yes/ *Ya*  
 No/ *Tidak*

If yes/ *Jika ya*,  
How often is recyclable items collected in your residential area?/ *Berapa kerap kutipan sisa bahan kitar semula di kawasan kediaman anda?*

---

16. What is the type of waste collection bin in your residential area?/ *Apakah jenis tong pengumpulan sampah di kawasan kediaman anda?*



**Communal  
collection**



**Kerb side  
collection  
(Individual bins)**

- Communal bins/ *Tong sampah komunal*  
 Kerb side collection (Individual bins)/  
*Koleksi tepi jalan (Tong sampah individu)*  
 Other/ *Lain-lain*: \_\_\_\_\_

**PART C: KNOWLEDGE ON WASTE RECYCLING/  
BAHAGIAN C: PENGETAHUAN TERHADAP KITAR SEMULA SISA**

Tick (✓) either "Yes" or "No" to answer the following questions./  
Tanda (✓) sama ada "Ya" atau "Tidak" untuk menjawab soalan berikut.

\*COVID-19 waste (self-test kit, disposable masks, gloves, apron)/ Sisa COVID-19 (kit ujian sendiri, pelitup muka pakai buang, sarung tangan, apron)

	Yes	No
1. Is there any recycling facility around your housing area?/ Adakah terdapat fasiliti kitar semula di sekitar kawasan kediaman anda?		
2. Are used disposable masks and gloves recyclable?/ Adakah topeng pakai buang dan sarung tangan terpakai boleh dikitar semula?		
3. Are there generally 3 types of recyclable bins and an organic waste bin in Malaysia?/ Adakah terdapat 3 jenis tong kitar semula dan satu tong sampah organik secara umumnya di Malaysia?		
4. Is the segregation of COVID-19 waste from recyclable household waste is effective in a safe recycling practice?/ Adakah pengasingan sisa COVID-19 daripada sisa isi rumah yang boleh dikitar semula berkesan dalam amalan kitar semula yang selamat?		
5. Is the colour coding of containers not important in a safe waste control?/ Adakah pengekodan warna tong tidak penting dalam kawalan sisa yang selamat?		
6. Is the recycling of waste produced by COVID-19 patients allowed?/ Adakah kitar semula sisa yang dihasilkan oleh pesakit COVID-19 dibenarkan?		
7. Does improper disposal of COVID-19 waste contribute to the spread of the epidemic?/ Adakah pelupusan sisa kit ujian sendiri Covid-19 yang tidak sempurna mengundang risiko penularan wabak?		
8. Does food scraps produce bad organic fertilizer for plants and soil?/ Adakah sisa makanan menghasilkan baja organik yang tidak baik untuk tumbuhan dan tanah?		
9. Does good recycling practice helps reduce pollution?/ Adakah amalan kitar semula yang baik membantu mengurangkan pencemaran?		
10. Can recycling reduces the amount of waste in landfills?/ Adakah kitar semula dapat mengurangkan jumlah sampah di tapak pelupusan sampah?		

**PART D: ATTITUDE ON RECYCLING ACTIVITIES/  
BAHAGIAN D: SIKAP TERHADAP KITAR SEMULA SISA**

Tick (✓) your answer using the following scale./

Tanda (✓).jawapan anda dengan menggunakan skala berikut.

\*COVID-19 waste (self-test kit, disposable masks, gloves, apron)/ Sisa COVID-19 (kit ujian sendiri, pelitup muka pakai buang, sarung tangan, apron)

	Strongly disagree/ Sangat tidak setuju	Disagree/ Tidak setuju	Neutral	Agree/ Setuju	Strongly agree/ Sangat setuju
1. Labeling and color-coding of waste containers is important./ <i>Pelabelan dan pengekodan warna tong sisa adalah penting.</i>					
2. It is essential to use color-coding to separate COVID-19 waste from recyclable waste./ <i>Penggunaan kod warna penting untuk mengasingkan sisa COVID-19 dan sisa yang boleh dikitar semula.</i>					
3. Separating wastes (hazardous wastes from non-hazardous wastes) facilitates safe recycling practice./ <i>Pengasingan sisa (sisa berbahaya daripada sisa tidak berbahaya) memudahkan pengurusan kitar semula yang selamat.</i>					
4. Special containers need to be placed in the community solely for the storage and collection of COVID-19 waste./ <i>Tong khas perlu diletakkan dalam komuniti untuk penyimpanan dan pengumpulan sisa COVID-19.</i>					

5. It is important to increase knowledge on recycling since the household waste mixed with COVID-19 waste./ <i>Meningkatkan pengetahuan tentang kitar semula penting memandangkan sisa isi rumah bercampur dengan sisa COVID-19.</i>					
6. I would like to recycle my parcel packaging./ <i>Saya ingin mengitar semula bungkusan parcel saya.</i>					
7. I would recycle even if the pick-up services for recyclables were not available./ <i>Saya akan mengitar semula walaupun perkhidmatan pengambilan barang kitar semula tidak tersedia.</i>					
8. I believe recycling helps protect the environment from being polluted./ <i>Saya percaya kitar semula dapat membantu melindungi alam sekitar daripada tercemar.</i>					
9. Recycling is the responsibility of every individual./ <i>Kitar semula merupakan tanggungjawab setiap individu.</i>					
10. Recycling should be an essential part of our way of life./ <i>Kitar semula perlu menjadi sebahagian penting dalam cara hidup kita.</i>					

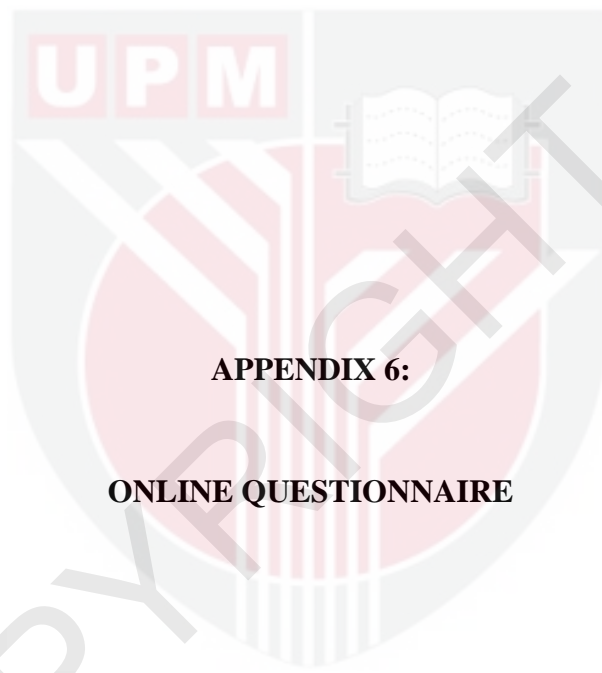
**PART E: PRACTICES ON RECYCLING ACTIVITIES**  
**BAHAGIAN E: AMALAN TERHADAP KITAR SEMULA SISA**

Tick (✓) your answer using the following scale./

Tanda (✓) jawapan anda dengan menggunakan skala berikut.

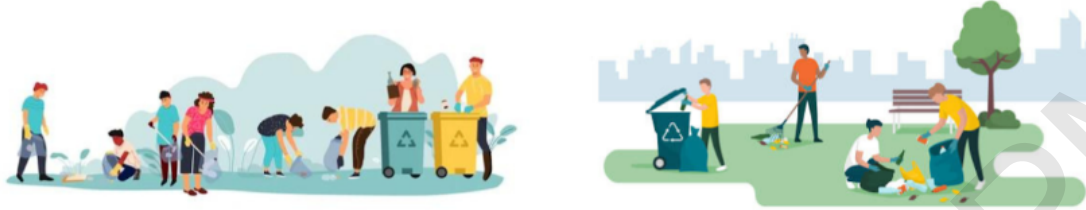
	Never/ Tidak pernah	Rarely/ Jarang	Sometimes/ Kadang- kadang	Often/ Selalu	Always/ Sentiasa
1. I recycle during COVID-19./ <i>Saya mengitar semula semasa COVID-19.</i>					
2. I isolate food waste from recyclable waste./ <i>Saya mengasingkan sisa makanan daripada sisa yang boleh dikitar semula.</i>					
3. I dispose garbage according to the category of garbage bins./ <i>Saya membuang sampah mengikut kategori tong kitar semula.</i>					
4. I compost food waste or garden waste./ <i>Saya membuat kompos jika terdapat sisa makanan atau sisa kebun.</i>					
5. I isolate the used mask from the recyclable waste./ <i>Saya mengasingkan pelitup muka yang telah digunakan daripada sisa yang boleh dikitar semula.</i>					
6. I have more than one bin to segregate waste for recycling in my house./ <i>Saya mempunyai lebih daripada satu tong sampah untuk mengasingkan sisa bagi kitar semula di rumah saya.</i>					

7. I participate in the recycling program or campaign./ <i>Saya menyertai program atau kempen kitar semula.</i>					
8. I send the used clothes to recycling facilities./ <i>Saya menghantar pakaian terpakai ke fasiliti kitar semula.</i>					
9. I send the recyclable items to the recycling centre./ <i>Saya menghantar barang yang boleh dikitar semula ke pusat kitar semula.</i>					
10. I buy recycled products./ <i>Saya membeli produk kitar semula.</i>					



**APPENDIX 6:**

**ONLINE QUESTIONNAIRE**



## WASTE RECYCLING PRACTICE AMONG COMMUNITY DURING COVID-19 IN BANDAR BARU BANGI, SELANGOR AND ITS ASSOCIATION WITH KNOWLEDGE AND ATTITUDE

Dear respondents,

My name is 'Aliah binti Abdul Rahman Law, a final year undergraduate student from Bachelor of Science (Environmental and Occupational Health) with Honours in Universiti Putra Malaysia. This study aims to determine the level of waste recycling practice among community during COVID-19 in Bandar Baru Bangi, Selangor and its association with knowledge and attitude. I will greatly appreciate if you could spend 5 minutes to answer this survey in order for me to get better understanding on this research. Thank you so much for your time./

*Responden yang dihormati,*

*Saya, 'Aliah binti Abdul Rahman Law, pelajar tahun akhir sarjana muda dari Bacelor Sains (Kesihatan Persekitaran dan Pekerjaan) dengan Kepujian di Universiti Putra Malaysia. Kajian ini bertujuan untuk mengetahui tahap amalan kitar semula sisa dalam kalangan masyarakat semasa COVID-19 di Bandar Baru Bangi, Selangor dan kaitannya dengan pengetahuan dan sikap. Saya amat menghargai jika anda boleh meluangkan masa 5 minit untuk menjawab tinjauan ini agar saya mendapat pemahaman yang lebih baik tentang penyelidikan ini. Terima kasih kerana meluangkan masa anda.*