

ORIGINAL ARTICLE

Municipal Solid Waste Recycling Behavior and Its Association With Socio-demographics at Low-cost Apartments in Klang, Selangor, Malaysia

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ABSTRACT

Introduction: The knowledge, attitudes, and practice of householders regarding municipal waste disposal are essential to achieving effective waste management. Thus, this study was conducted to determine residents' recycling awareness and behaviour at a low-cost apartment in Klang. **Methods:** A cross-sectional study was conducted among residents of a low-cost apartment in Klang. The sample size was calculated by using the Krejcie and Morgan table. A total of 234 respondents were randomly selected to participate in this study. Data were gathered using a structured questionnaire and analysed with SPSS. **Results:** The results found that education level had a significant relationship with knowledge ($p = 0.019$) at a significance level of 0.05. Additionally, three socio-demographic variables had a significant relationship with practicing recycling with regards to gender ($p = 0.003$) and education level ($p = 0.041$). However, there was no significant relationship between attitude and socio-demographics with a p-value of more than 0.05. Therefore, respondents with better socio-demographics such as high education levels and high incomes had good recycling practices. The results of Pearson correlation showed a significant association between knowledge and attitude ($p = 0.000$), and a positive significant correlation coefficient with Pearson's correlation results ($r = 0.301$). **Conclusion:** According to the findings, education, raising individual awareness, providing sufficient facilities, and implementing coordinated cohesive recycling programs by the authorities play critical roles in solid waste management. Therefore, it is possible to improve citizens' practises by improving their knowledge while taking practical steps to promote this environmental activity.

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INTRODUCTION

Solid waste has been a problem for as long as humans have lived in settled communities, and modern cultures generate significantly more solid waste than early humans ever did. In developed countries, daily life can generate several pounds of waste per person, not just directly at home, but also indirectly by industries that manufacture consumer products. Household waste accounts for the vast majority of municipal solid waste (MSW) sources, and it is to this source that the majority of

municipal waste management costs are directed. Similar to other developing countries, Malaysia is currently dealing with an increase in waste output alongside the issues and costs associated with waste management (1). The primary method to dispose waste in Malaysia is landfilling (2). As large amounts of recyclable waste are disposed to landfills, the lifespans of landfills cannot be maximised. Apart from that, Malaysia lags behind other developing countries with better recycling rates, such as Taiwan and Singapore (3). Fauziah and Agamuthu (3) asserted that public adoption of the Global 3Rs strategy remains deficient. Several researchers have identified the same recycling concerns among the public (4).

Recycling helps local governments save money by prolonging the life of landfills, lowering transportation

and equipment costs, as well as reducing vehicle operating and maintenance costs. This activity is an alternative way of reducing the amount of waste that needs to be managed to ensure that MSW is not totally disposed in landfills (5, 6). Recycling can be defined as a process of minimizing, reducing, collecting and transforming solid waste to produce products (7). The Malaysian government has conducted several campaigns to encourage Malaysians to segregate and recycle their waste, but the campaigns did not receive much feedback from the community. Furthermore, there is a lack of information and knowledge about the methods and importance of waste segregation and recycling as well as insufficient education to change the mindsets of city dwellers. Other factors that may prevent people from accessing the behaviour of recycling are lack of space, no facilities, relatively few and unattractive recycle bins, as well as insufficient collection recycling centres in residential areas (8). These issues must be addressed immediately to save the environment as residential areas in the city are generating increasingly higher amounts of waste every year (9).

Despite numerous approaches and efforts to promote various rules, initiatives, and education about recycling awareness since the 1990s, the proportion of recycled solid waste has remained below 5% of total waste disposal (4). Malaysia has set a goal of increasing its recycling rate to 22% by 2020 but the current recycling rate is largely low (10). Discovering new ways to minimise, reuse, and recycle the materials and used items is a major challenge for this century. Research, education, and public engagement can achieve long-term solutions as well as improvements in public attitudes and practices concerning waste management. However, the lack of recycling information is a major concern, as recycling information does not reach every individual in the community (11).

To ensure the effectiveness of MSW management, local governments must provide adequate infrastructure and recognize public concerns, knowledge, and behaviour (11). According to Babaei et al. (12), knowledge can be defined as an awareness or understanding of a community; while attitude is a way of thinking or feeling about something and it also refers to the beliefs of the community that may have influenced that attitude; practice refers to the action that is based on knowledge and attitudes of the community. Furthermore, public participation in the recycling process has a significant impact on the performance of household recycling programmes. In order to obtain a better knowledge of the elements that influence resident commitment in waste management programmes, it is critical to study and perform theory-based comprehensive surveys. On the other hand, it is essential to understand the behavioural and psychological factors that influence household recycling activities in order to achieve the goal of better and more effective recycling programmes

in the community. Thus, this research aimed to study the relationship between social demographics and the knowledge, attitude and practice (KAP) of recycling activities specifically at low-cost apartments.

MATERIALS AND METHODS

Study Population and Location

The research was carried out in the Sri Bayu Apartment in the Klang district. It is about 15 kilometres northwest of Klang, with coordinates of 3°01'00.6"N 101°25'36.4"E. Malays make up the majority of the population, followed by Chinese, Indians, and foreigners. There are 680 homes across four blocks of apartments and five floors, with a total population of nearly 2000 people.

Questionnaire Development

This is a cross-sectional study. A structured study was used to identify the association between socio-demographics and KAP among residents of a low-cost apartment in Klang. A set of questionnaires was adopted based on previous studies done by Ferronato et al. (13), Zhang et al. (14) and Akil et al. (7). The questionnaire was in both Malay and English. It consisted of four parts: part A for socio-demographics, part B for knowledge regarding recycling, part C for attitude, and part D for practices in recycling. Seven questions were included in the first section of the questionnaire, which evaluated the respondents' socio-demographic characteristics. Gender, age, race, number of households, education level, household income, and occupation were some of the socio-demographics included in this section. The second part assessed the respondents' knowledge on waste. The questionnaire was constructed on a 5-point Likert scale containing eight questions which were rated 1 for strongly disagree, 2 for disagree, 3 for not sure, 4 for agree and 5 for strongly agree. Each respondent's cumulative knowledge score may vary from 1 to 40, with higher scores indicating a more positive knowledge about recycling. The third section looked into the respondents' attitudes on recycling. It consisted of 13 questions and the questionnaire was evaluated on a 5-point Likert scale with a maximum possible score of 65. The final step was to assess the respondents' recycling practises over the course of their lives. These were closed-ended and structured questions. In this survey, only Malaysian citizens were chosen as respondents. The survey was conducted from January to March 2021.

Sample size

The sample size for the study was comprised of the target respondents who were picked from among the targeted population. The sample size was determined by applying the Krejcie and Morgan (15) sample size calculation method. After calculating the total population (680), 234 respondents (s) were required in this study.

Data analysis

In this study, IBM Statistical Program for Social Sciences (SPSS) version 26 was used to analyse the answers of the respondents. Descriptive statistics were used to analyse the basic information. Actual counts, relative frequencies, means, and standard deviation were used in the descriptive analysis to illustrate the sample's characteristics. Next, the descriptive data were used to discover variables related to socio-demographics and KAP. The descriptive statistics, Pearson correlation, and χ^2 model were applied to determine variables linked with socio-demographics and KAP. All inferential statistics were derived at a 95% confidence level. At a significance level of less than 0.05, the Chi-square and Pearson tests were applied to investigate the relationship between demographic variables and knowledge, attitude, and practise. Tables were used in this project.

Ethical considerations

A written ethics approval by the UiTM Research Ethics Committee for the study titled 'Municipal Solid Waste Recycling Behaviour at Low-cost Apartment in Klang, Selangor' was obtained with the approval code References No: REC/05/2021(UG/MR/475). Furthermore, the information obtained from this study is kept confidential by the investigators. All respondents were notified that they were providing informed consent for their data to be used for research purposes by taking the survey.

RESULTS

Socio-demographic characteristics

Data were analysed from a total of 234 samples. The gender of the respondents was almost equal; with females making up a slightly larger percentage at 52 percent of the total respondents. The age of respondents was mostly from 31 to 43 years old (39.7 percent), followed by 18 to 30 years old (34.2 percent), 44 to 56 years old (20.9 percent), and 57 years old (5.1 percent). Malay respondents represented more than half of the respondents at 71.8 percent, followed by Chinese (15.8 percent), with the fewest being Indians at 12.4 percent. In terms of family size, 50.4 percent had family sizes of two to four people in the house, followed by 42.7 percent with five to seven family members. The majority of those who engaged in these activities reported completing high school (44.4 percent), with approximately 24.4 percent of respondents had completed STPM/diploma. Meanwhile, higher education accounted for at least 15.8 percent of the total respondents, while the lowest education (12 percent). Out of the 234 respondents, 42.7 percent had family incomes ranging from RM 2,001 to RM 4,000, followed by those in the RM 4,001 to RM 8,000 range (26.9 percent) with the remaining 21.4 percent reported household income that falls below RM 2,000. More than half of the respondents (51.3%) worked in the private sector. Apart from that, self-

employed respondents made up 23.9 percent, students and unemployed respondents accounted for almost 3 percent, while 15 percent of respondents worked in the government sector. The results of socio-demographic characteristics are shown in Table I.

Table I: Socio-demographic characteristics of respondents

| Characteristics | Frequency (n) | Percent (%) |
|------------------------|---------------|-------------|
| <i>Sex</i> | | |
| Male | 122 | 52.1 |
| Female | 112 | 47.9 |
| <i>Age</i> | | |
| 18 – 30 | 80 | 34.2 |
| 31 – 43 | 93 | 39.7 |
| 44 – 56 | 49 | 20.9 |
| > 57 | 12 | 5.1 |
| Mean = 1.97 | SD = 0.871 | |
| <i>Race</i> | | |
| Bumiputra | 168 | 71.8 |
| Chinese | 37 | 15.8 |
| Indian | 29 | 12.4 |
| Others | 0 | 0 |
| <i>People in Home</i> | | |
| 1 | 2 | 0.9 |
| 2 – 4 | 118 | 50.4 |
| 5 – 7 | 100 | 42.7 |
| ≥8 | 14 | 6.0 |
| Mean = 2.54 | SD = 0.622 | |
| <i>Education Level</i> | | |
| Lowest school | 28 | 12.0 |
| High School | 104 | 44.4 |
| STPM/Diploma | 57 | 24.4 |
| Degree/master | 37 | 15.8 |
| Others | 8 | 3.4 |
| <i>Monthly Income</i> | | |
| 0 – RM 2,000 | 50 | 21.4 |
| RM 2,001 – RM 4,000 | 100 | 42.7 |
| RM 4,001 – RM 8,000 | 63 | 26.9 |
| > RM 8,001 | 21 | 9.0 |
| Mean = 2.24 | SD = 0.889 | |
| <i>Occupation</i> | | |
| Government Staff | 35 | 15.0 |
| Private Staff | 120 | 51.3 |
| Self-employed | 56 | 23.9 |
| Student | 8 | 3.4 |
| Unemployed | 7 | 3.0 |
| Other | 8 | 3.4 |

Knowledge, Attitude and Practices (KAP) on recycling

The level of knowledge was analysed according to the scores obtained. The maximum score for knowledge regarding recycling was 40, and the minimum score was 8. In total, eight questions on knowledge were asked, with a high score ranges from 31 to 40, moderate score from 20 to 30, and a low score from 8 to 19. The result showed the respondents mainly scored high in the knowledge section (70 percent), with 29.1 percent scored moderate while a mere 0.9 percent scored low. Following that, the respondents' attitudes towards recycling were examined through 13 questions that yields three levels of attitude based on total scores with calculations and range provided by Laor et al. (2018) [11]. The score ranges from 48 to 65, which refer to a positive attitude, from 31 to 47 which signifies a neutral attitude, and from 13 to 46, which represents negative attitude. The results of the cumulative attitude questions indicated that over half of the respondents had a positive attitude (52.6 percent), followed by neutral (45.7 percent) and negative (1.7 percent). In regard to practice, close-ended questions were used to examine the recycling practises. The respondents were asked about their recycling habits at home with answer options provided as either "yes" or "no". This research found that only 39.7 percent of respondents answered "yes" and 60.7 percent of respondents did not recycle. Tables II and III show the respondents' results for each statement discussed in this section.

Table II: Level of knowledge and attitude among respondents

| Level of knowledge and attitude | Respondent Score Group | Frequency n (%) |
|---------------------------------|----------------------------|-----------------|
| <i>Level of knowledge</i> | | |
| Good | 31-40 (Mean:34.52 SD:2.32) | 164 (70.0) |
| Moderate | 20-30 (Mean:28.72 SD:1.74) | 68 (29.1) |
| Low | 8-19 (Mean:2.49 SD:0.00) | 2 (0.9) |
| Mean:32.72 SD:3.57 | | |
| <i>Level of attitude</i> | | |
| Positive | 48-65(Mean:52.13 SD:4.50) | 123 (52.6) |
| Neutral | 31-47(Mean:43.85 SD:2.87) | 107 (45.7) |
| Negative | 13-30(Mean:28.00 SD:0.82) | 4 (1.7) |
| Mean:47.93 SD:6.17 | | |

Table III: Level of practice among respondents

| Level of practice | Frequency (n) | Percent (%) |
|-------------------|---------------|-------------|
| Yes | 93 | 39.7 |
| No | 141 | 60.3 |

Relationship between KAP and socio-demographics of respondents

To assess the relationship between socio-demographic data and the KAP, the Pearson χ^2 model was used with the significance level set at 0.05. The associated socio-demographic factors and KAP are summarized in Tables IV, V and VI. The results show that all socio-demographic variables, with the exception of education level, had no statically significant relationship with knowledge. The non-significant variables refer to gender ($p = 0.345$), age ($p = 0.083$), race ($p = 0.152$), number of people in home ($p = 0.718$), monthly income ($p = 0.110$) and occupation ($p = 0.072$), while education level reported a p-value of 0.019. The findings also show that there was no statistically significant association between the socio-demographic variables and the respondents' attitudes, for which gender ($p = 0.375$), age ($p = 0.435$), race ($p = 0.252$), number people in home ($p = 0.796$), monthly income ($p = 0.062$), occupation ($p = 0.361$) and education level ($p = 0.502$) were also tested.

Table IV: Statistical relationship between socio-demographic variables and recycling knowledge

| Socio-demographic characteristic | Knowledge n (%) | | | p-value |
|----------------------------------|-----------------|-----------|---------|---------|
| | Good | Moderate | Low | |
| <i>Sex</i> | | | | |
| Male | 83 (68) | 37 (30.3) | 2 (1.6) | 0.345 |
| Female | 81 (72.3) | 31 (27.7) | 0 (0) | |
| <i>Age</i> | | | | |
| 18 – 30 | 65 (81.3) | 15 (18.8) | 0 (0) | 0.083 |
| 31 – 43 | 56 (60.2) | 35 (37.6) | 2 (2.2) | |
| 44 – 56 | 34 (69.4) | 15 (30.6) | 0 (0) | |
| > 57 | 9 (75) | 3 (25) | 0 (0) | |
| <i>Race</i> | | | | |
| Bumiputra | 121 (72) | 45 (26.8) | 2 (1.2) | 0.152 |
| Chinese | 28 (75.7) | 9 (24.3) | 0 (0) | |
| Indian | 15 (51.7) | 14 (48.3) | 0(0) | |
| <i>People in Home</i> | | | | |
| 1 | 2 (100) | 0 (0) | 0 (0) | 0.718 |
| 2 – 4 | 79 (66.9) | 37 (31.4) | 2 (1.7) | |
| 5 – 7 | 72 (72) | 28 (28) | 0 (0) | |
| ≥8 | 11 (78.6) | 3 (21.4) | 0 (0) | |
| <i>Education Level</i> | | | | |
| Lowest school | 13 (46.4) | 15 (53.6) | 0 (0) | 0.019* |
| High School | 72 (69.2) | 32 (30.8) | 0 (0) | |
| STPM/Diploma | 42 (73.7) | 13 (22.8) | 2 (3.5) | |
| Degree/master | 30 (81.1) | 7 (18.9) | 0 (0) | |
| Others | 7 (87.5) | 1 (12.5) | 0 (0) | |

CONTINUE

Table IV: Statistical relationship between socio-demographic variables and recycling knowledge(cont.)

| Socio-demographic characteristic | Knowledge n (%) | | | p-value |
|----------------------------------|-----------------|-----------|---------|---------|
| | Good | Moderate | Low | |
| <i>Monthly Income</i> | | | | |
| 0 – RM 2,000 | 32 (64) | 18 (36) | 0 (0) | 0.110 |
| RM 2,001 – RM 4,000 | 64 (64) | 35 (35) | 1 (1) | |
| RM 4,001 – RM 8,000 | 53 (84.1) | 9 (14.3) | 1 (1.6) | |
| > RM 8,001 | 15 (71.4) | 6 (28.6) | 0 (0) | |
| <i>Occupation</i> | | | | |
| Government Staff | 27 (77.1) | 7 (20) | 1 (2.9) | 0.072 |
| Private Staff | 73 (60.8) | 47 (39.2) | 0 (0) | |
| Self-employed | 8 (100) | 0 (0) | 0 (0) | |
| Student | 44 (78.6) | 11 (19.6) | 1 (1.8) | |
| Unemployed | 5 (71.4) | 2 (28.6) | 0 (0) | |
| Other | 7 (87.5) | 1 (12.5) | 0 (0) | |

Note: *Significance level $\alpha = 0.05$

Table V: Statistical relationship between socio-demographic variables and recycling attitude

| Socio-demographic characteristic | Attitude n (%) | | | p-value |
|----------------------------------|----------------|-----------|----------|---------|
| | Positive | Neutral | Negative | |
| <i>Sex</i> | | | | |
| Male | 68 (55.7) | 53(43.4) | 1(0.8) | 0.375 |
| Female | 55 (49.1) | 54 (48.2) | 3 (2.7) | |
| <i>Age</i> | | | | |
| 18 – 30 | 45 (56.3) | 33 (41.3) | 2 (2.5) | 0.435 |
| 31 – 43 | 45 (48.4) | 47 (50.5) | 1 (1.1) | |
| 44 – 56 | 27 (55.1) | 22 (44.9) | 0 (0) | |
| > 57 | 6 (50) | 5 (41.7) | 1 (8.3) | |
| <i>Race</i> | | | | |
| Bumiputra | 88 (52.4) | 77 (45.8) | 3(1.8) | 0.252 |
| Chinese | 24 (64.9) | 13 (35.1) | 0(0) | |
| Indian | 11 (37.9) | 17 (58.6) | 1 (3.4) | |
| <i>People in Home</i> | | | | |
| 1 | 2 (100) | 0 (0) | 0 (0) | 0.796 |
| 2 – 4 | 59 (50) | 57 (48.3) | 2 (1.7) | |
| 5 – 7 | 53 (53) | 45 (45) | 2 (2) | |
| ≥8 | 9 (64.3) | 5 (35.7) | 0 (0) | |
| <i>Education Level</i> | | | | |
| Lowest school | 14 (50) | 13 (46.4) | 1 (3.6) | 0.502 |
| High School | 52 (50) | 50 (48.1) | 2 (1.9) | |
| STPM/Diploma | 30 (52.6) | 26 (45.6) | 1 (1.8) | |
| Degree/master | 25 (67.6) | 12 (32.4) | 0 (0) | |
| Others | 2 (25) | 6 (75) | 0 (0) | |

CONTINUE

Table V: Statistical relationship between socio-demographic variables and recycling attitude (cont.)

| Socio-demographic characteristic | Attitude n (%) | | | p-value |
|----------------------------------|----------------|-----------|----------|---------|
| | Positive | Neutral | Negative | |
| <i>Monthly Income</i> | | | | |
| 0 – RM 2,000 | 16 (32) | 32 (64) | 2 (4) | 0.062 |
| RM 2,001 – RM 4,000 | 59 (59) | 40 (40) | 1 (1) | |
| RM 4,001 – RM 8,000 | 36 (57.1) | 25 (41.3) | 1 (1.6) | |
| > RM 8,001 | 12 (57.1) | 9 (42.9) | 0 (0) | |
| <i>Occupation</i> | | | | |
| Government Staff | 14 (40) | 20 (57.1) | 1 (2.9) | 0.361 |
| Private Staff | 60 (50) | 58 (48.3) | 2 (1.7) | |
| Self-employed | 4 (50) | 4 (50) | 0 (0) | |
| Student | 39 (69.6) | 16 (28.6) | 1 (1.8) | |
| Unemployed | 3 (37.5) | 4 (57.1) | 0 (0) | |
| Other | 3 (37.5) | 5 (62.5) | 0 (0) | |

Note: *Significance level $\alpha = 0.0$

Table VI: Statistical relationship between socio-demographic variables and recycling practices

| Socio-demographic characteristic | Practices n (%) | | p-value |
|----------------------------------|-----------------|------------|---------|
| | Yes | No | |
| <i>Sex</i> | | | |
| Male | 39 (32) | 83 (68) | 0.011* |
| Female | 54 (48.2) | 58 (51.8) | |
| <i>Age</i> | | | |
| 18 – 30 | 20 (25) | 60 (75) | 0.003* |
| 31 – 43 | 46 (49.5) | 47 (50.5) | |
| 44 – 56 | 24 (49) | 25 (51) | |
| > 57 | 3 (25) | 9 (75) | |
| <i>Race</i> | | | |
| Bumiputra | 63 (37.5) | 105 (62.5) | 0.146 |
| Chinese | 20 (54.1) | 17 (45.9) | |
| Indian | 10 (34.5) | 19 (65.5) | |
| <i>People in Home</i> | | | |
| 1 | 1 (50) | 1 (50) | 0.969 |
| 2 – 4 | 48 (40.7) | 70 (59.3) | |
| 5 – 7 | 39 (39) | 61 (61) | |
| ≥8 | 5 (35.7) | 9 (64.3) | |
| <i>Education Level</i> | | | |
| Lowest school | 7 (25) | 21 (75) | 0.041* |
| High School | 44 (42.3) | 60 (57.7) | |
| STPM/Diploma | 17 (29.8) | 40 (70.2) | |
| Degree/master | 21 (56.8) | 16 (43.2) | |
| Others | 4 (50) | 4 (50) | |

CONTINUE

Table VI: Statistical relationship between socio-demographic variables and recycling practices (cont.)

| Socio-demographic characteristic | Practices n (%) | | p-value |
|----------------------------------|-----------------|-----------|---------|
| | Yes | No | |
| <i>Monthly Income</i> | | | |
| 0 – RM 2,000 | 16 (32) | 34 (68) | 0.162 |
| RM 2,001 – RM 4,000 | 36 (36) | 64 (64) | |
| RM 4,001 – RM 8,000 | 32 (50.8) | 31 (49.2) | |
| > RM 8,001 | 9 (42.9) | 12 (57.1) | |
| <i>Occupation</i> | | | |
| Government staff | 20 (57.1) | 15 (42.9) | 0.139 |
| Private staff | 40 (33.3) | 80 (66.7) | |
| Self-employed | 3 (37.5) | 5 (62.5) | |
| Student | 24 (42.9) | 32 (57.1) | |
| Unemployed | 4 (57.1) | 3 (42.9) | |
| Other | 2 (25) | 6 (75) | |

Note: *Significance level $\alpha = 0.05$

Meanwhile, Table VI presents the results for the analysis between socio-demographic variables and respondents' practice of recycling. Based on a 0.05 significant level, gender ($p = 0.011$), age ($p = 0.003$), and education level ($p = 0.041$) were found to be statistically significant. However, three variables, which includes race ($p = 0.252$), number people in home ($p = 0.969$), monthly income ($p = 0.162$) and occupation ($p = 0.139$) were found to have no significant relationship to recycling practices. Following that, a Pearson correlation (r) was conducted with a significant level set at 0.01. The results identified a significant association between knowledge and attitude ($p = 0.000$), with a positive correlation coefficient ($r = 0.301$). However, there was no significant association found between knowledge and practice ($p = 0.012$) with a negative Pearson correlation of $r = -0.163$. Additionally, no significant association was also reported between attitude and knowledge (p value of 0.200) and analysis indicted a negative correlation coefficient ($r = -0.084$). The results of the Pearson correlation are shown in Table VII.

Table VII: Correlation relation between KAP of respondents

| Variables | p-value | Pearson's correlation (r) |
|------------------------|---------|---------------------------|
| Knowledge and attitude | 0.000 | 0.301** |
| Knowledge and practice | 0.012 | -0.163* |
| Attitude and practice | 0.200 | -0.084 |

** Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

The results of the present study indicated that the respondents had a high level of knowledge on recycling. Findings on the attitudes of respondents also showed positive results. More than half of the respondents demonstrated low levels of recycling practices. The results also showed a mix of significant and non-significant relationship between socio-demographic

variables and KAP, with education, for instance, having a significant relationship with the level of knowledge. Interestingly, this finding is similar to the study conducted at ten cities across China by Wang et al. (16) who reported that 'white collar' workers were more familiar about recycling than 'manual workers,' which might be due to the fact that 'white collar' workers are often better educated. However, other socio-demographic characteristics did not affect the level of knowledge, and this includes gender, age, race, number of people at home, monthly household income, and occupation. The results of this study is not consistent with those of the study by Laor et al. (11) that was conducted in Thailand, which reported a significant relationship between the level of knowledge and age ($p = 0.000$), as well as education level ($p = 0.012$). Similarly, the result of this study also contradicts Babaei et al. (12), who reported that occupational characteristics had a significant relationship with knowledge at p-value of 0.001 ($p < 0.05$) indicating that government employed respondents were more knowledgeable than self-employed or unemployed ones. This is consistent with Laor et al. (11) whose analysis of demographic factors also reported a relationship between occupation and knowledge ($p = 0.039$). Apart from that, Wang et al. (16) reported that low income respondents were more knowledgeable compared to higher income respondents. This statement contradicts with the author's study findings.

With regards to the attitudes of the respondents on recycling, no socio-demographic characteristics affect the level of attitudes of the respondents. This contrasts with the investigation by Yaziz and Rahman (17) who reported that 16.2% of respondents ages 17 years old were more likely to have good attitude than others ($p = 0.018$). These findings are also in line with those of Almasi et al. (18), who concluded that socio-demographic as well as attitude variables had a significant correlation ($p < 0.05$).

In terms of recycling practises, three demographic variables influenced the intensity of recycling practises, namely, gender, age, and level of education. These findings are in agreement with Akil et al. (7); who found a positive relationship between education level and the practice of recycling. The findings are also supported by Yaziz and Rahman (17), who reported an association between age and recycling practice. In their article, more than 49% of respondents at age 17 had good recycling practices compared to others, with a p-value of less than 0.05 ($p = 0.000$). These findings are comparable to the previous studies by Martin et al. (19) and Bruvold et al. (20), where it was found that older persons recycle simply because they have more free time; after all, recycling is a time-consuming task. However, it was contrary to a study done by Du toit and Wagner (21), who found that age was the strongest predictor; the older the respondent, the more likely the household recycled.

The results are not in agreement with the study by Otitoju and Seng (22); as it was reported that there was no significant relationship between women and men in recycling of waste. However, the author found that three socio-demographic characteristics, race, number of people in home, monthly household income, and occupation, also had no association relation to recycling practices. These results are supported by Otitoju and Seng (22), who found that ethnicity did not show a significant association with recycling practices at p value of 0.242. In addition, these results are contrary to the study by Akil et al. (7). They reported that the number of people who recycled 'most of the time' are from the low income group (RM 500 to RM 999), all of whom reportedly recycled 'most of the time', compared to the high income group (RM 10,000 to RM 14,999) where only 25 percent of them recycled most of the time. This statement supports the results of the study by Banga (23), who reported that higher monthly income respondents were unlikely to engage in recycling.

Next, the present study attempted to identify the reasons why respondents participated or did not participate in recycling. For that, the results found that 35.9 percent of respondents answered because they realised that recycling can preserve our resources and protect the world. This result was not similar to the reasons found in the research done by Wilcox (24), who reported that the largest reason for recycling was to make money (56 percent). Furthermore, when asked why respondents do not recycle at home, most respondents said they have insufficient storage space at home (48.7 percent). This is inconsistent with the results of Babaei et al. (12) who mentioned that the majority of respondents (99.3 percent) did not have easy access to recycling bins.

Finally, Pearson's correlation revealed a statistically significant relationship between knowledge and attitude, with a significant positive correlation. This result is contradictory to the study by Fiorillo (25), but similar with Sobri and Rahman (6). Additionally, there is a weak negative significant correlation coefficient between knowledge and practice, with a reported r value of -0.163. Results also indicates that there is no significant relationship between attitudes and practices, which shows that despite high levels of knowledge and attitude, respondents had weak recycling practices. This is not similar to the report by Wright (26), who stated that those with good levels of knowledge and attitude were more likely to recycle.

CONCLUSION

In this study, it was found that younger aged respondents had better levels of knowledge and attitude about recycling waste, which could be because younger people have easier access to information through social media, Twitter and websites. Unfortunately, the levels

of practising recycling were very low. The reasons were not limited to the lack of information and campaigns. Instead, the facilities needed to be expanded and must be developed parallel with education as well as promotion for public participation in recycling. The findings of this study are expected to be used as fundamental data for local council. For future studies, more research can be done to determine the association between sociodemographic factors and different types of housing in recycling activities. Furthermore, these results can signal the local government to enhance their strategies and deliver input regarding recycling and prioritizing the needs of certain groups. Finally, non-governmental organizations (NGOs) and resident associations must collaborate and promote recycling efforts in the community.

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REFERENCES

1. Jayaraman K, Vejayon S, Raman S, Mostafiz I. The proposed e-waste management model from the conviction of individual laptop disposal practices- An empirical study in Malaysia. *Journal of Cleaner Production*. 2019 Jan 20;208:688-96.
2. Rodzi RM. Analysis of solid waste generation and composition in Malaysia TVET campus. *International Journal of Integrated Engineering*. 2019 May 6;11(2).
3. Pariatamby A, Fauziah SH. Sustainable 3R practice in the Asia and Pacific Regions: the challenges and issues. In *Municipal solid waste management in Asia and the Pacific Islands 2014* (pp. 15-40). Springer, Singapore.
4. Fauziah SH, Agamuthu P. Trends in sustainable landfilling in Malaysia, a developing country. *Waste Management & Research*. 2012 Jul;30(7):656-63.
5. Alam M, Siwar C. Waste recycling in Malaysia: Transition from developing to developed country. *Jereme, IA, Alam, MM, and Siwar, C*. 2015:1-4.
6. Miafodzzyeva S, Brandt N. Recycling behaviour among householders: Synthesizing determinants via a meta-analysis. *Waste and Biomass Valorization*. 2013 Jun;4(2):221-35
7. Oztekin C, Teksüz G, Pamuk S, Sahin E, Kilic DS. Gender perspective on the factors predicting recycling behavior: Implications from the theory of planned behavior. *Waste Management*. 2017 Apr 1;62:290-302.
8. Zainu ZA, Songip AR. Policies, challenges and

- strategies for municipal waste management in Malaysia. *Journal of Science, Technology and Innovation Policy*. 2017;3(1):10-4.
9. Sobri NA, Rahman HA. Knowledge, Attitude and Practices on Recycling Activity Among Primary School Students in Hulu Langat, Selangor, Malaysia. *Indian J. Environment. Prot.*. 2016;36(10):792-800.
 10. Akil AM, Foziah J, Ho CS. The effects of socio-economic influences on households recycling behaviour in Iskandar Malaysia. *Procedia-Social and Behavioral Sciences*. 2015 Aug 22;202:124-34.
 11. Moh YC, Abd Manaf L. Overview of household solid waste recycling policy status and challenges in Malaysia. *Resources, Conservation and Recycling*. 2014 Jan 1;82:50-61.
 12. Abdel-Shafy HI, Mansour MS. Solid waste issue: Sources, composition, disposal, recycling, and valorization. *Egyptian journal of petroleum*. 2018 Dec 1;27(4):1275-90.
 13. Norkhadijah SS, Mariah HH, Irniza R, Emilia ZA. Commitment, attitude and behavioural changes of the community towards a waste segregation program: a case study of Malaysia. *Waste Manag. Environ. VII*. 2014 May 12;180:137-48.
 14. Laor P, Suma Y, Keawdounlek V, Hongtong A, Apidechkul T, Pasukphun N. Knowledge, attitude and practice of municipal solid waste management among highland residents in Northern Thailand. *Journal of Health Research*. 2018 Mar 12.
 15. Babaei AA, Alavi N, Goudarzi G, Teymouri P, Ahmadi K, Rafiee M. Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*. 2015 Sep 1;102:94-100.
 16. Ferronato N, D'Avino C, Ragazzi M, Torretta V, De Feo G. Social surveys about solid waste management within higher education institutes: A comparison. *Sustainability*. 2017 Mar;9(3):391.
 17. Zhang H, Liu J, Wen ZG, Chen YX. College students' municipal solid waste source separation behavior and its influential factors: A case study in Beijing, China. *Journal of cleaner production*. 2017 Oct 15;164:444-54.
 18. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educational and psychological measurement*. 1970 Sep;30(3):607-10.
 19. Wang H, Liu X, Wang N, Zhang K, Wang F, Zhang S, Wang R, Zheng P, Matsushita M. Key factors influencing public awareness of household solid waste recycling in urban areas of China: A case study. *Resources, Conservation and Recycling*. 2020 Jul 1;158:104813.
 20. Yaziz AN, Rahman AH. Knowledge, attitude and practice towards recycling activity among secondary school students at Hulu Langat, Selangor, Malaysia. In *Proceedings of the 1st International Conference on Interdisciplinary Development Research*, Chiangmai, Thailand 2015 Sep (pp. 17-18).
 21. Martin M, Williams ID, Clark M. Social, cultural and structural influences on household waste recycling: A case study. *Resources, conservation and recycling*. 2006 Oct 1;48(4):357-95.
 22. Bruvoll A, Halvorsen B, Nyborg K. Households' recycling efforts. *Resources, Conservation and Recycling*. 2002 Nov 1;36(4):337-54.
 23. Almasi A, Mohammadi M, Azizi A, Berizi Z, Shamsi K, Shahbazi A, Mosavi SA. Assessing the knowledge, attitude and practice of the kermanshahi women towards reducing, recycling and reusing of municipal solid waste. *Resources, Conservation and Recycling*. 2019 Feb 1;141:329-38.
 24. Du Toit J, Wagner C. The effect of housing type on householders' self-reported participation in recycling. *Smart and Sustainable Built Environment*. 2020 Apr 7.
 25. Otitoju TA, Seng L. Municipal solid waste management: household waste segregation in Kuching South City, Sarawak, Malaysia. *American Journal of Engineering Research (AJER)*. 2014;3(6):82-91.
 26. Banga M. Household knowledge, attitudes and practices in solid waste segregation and recycling: the case of urban Kampala. *Zambia Social Science Journal*. 2011;2(1):4.
 27. Wilcox MA. A study of college student attitudes and behaviors related to recycling.
 28. Fiorillo D. Household waste recycling: national survey evidence from Italy. *Journal of Environmental Planning and Management*. 2013 Oct 1;56(8):1125-51.
 29. Wright Y. Relating recycling: Demographics, attitudes, knowledge and recycling behavior among UC Berkeley students. *UC Berkeley Student Recycling*. 2011 Mar 9