Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
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http://ansinet.com

Journal of Applied Sciences 7 (22): 3356-3367, 2007
ISSN 1812-5654

Knowledge, Attitude and Behavior of the Urban Poor Concerning Solid Waste Management: A Case Study

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Abstract: This study has developed three Logistic Regression Models to determine and analyze the factors that could affect knowledge, attitude and behavior of the urban poor concerning solid waste management. To pursue the objective, the study has collected primary data from the level of living conditions of the poor residing in the squatters and low-cost flats of Kuala Lumpur city, Malaysia. The empirical results of the study are exciting as they provide evidence to the effect that knowledge, attitude and behavior of the urban poor communities concerning solid waste management are adequate and satisfactory. Hence, the low socio-economic profile of the urban poor has not been proven as causal to environmental degradation. The study suggests that it is inherent to improve the quality of lifestyles of the poor to enable them to come out of poverty threshold, even though an adequate and satisfactory solid waste management system exists amongst the communities.

Key words: Attitude, behavior, knowledge, Kuala Lumpur city, logistic regression models, solid waste management, urban poor

INTRODUCTION

Solid waste management has been a challenging task for the developing countries. Lack of appropriate policies, budgetary constraints and inefficient management and operation have been the main obstacles to maintain an improved and sustained solid waste management in the developing countries. Studies reveal that the low income and poor communities usually choose to degrade the environment (Brown *et al*., 1998; Anonymous, 1981, 1987, 1991, 1992, 1995; Jalal, 1993; Leach and Mearns, 1995; Mueller, 1993; Omuta, 1988; Ramphal, 1992; Tsen, 1991; WHO, 1992). Malaysia, a country that has a national vision to attain the developed status by the year 2020, has also been experiencing the environmental problems relating to solid waste management. In Malaysia, however, the problems of solid waste management have been resolved to a considerable extent by the appropriate actions and policies taken by the government in part by engaging the private sector. Nevertheless, the environmental problems particularly related to solid waste management amongst the squatters and low-cost flat dwellers in Kuala Lumpur are still prevalent. In light of this, the respective authorities may be pondering appropriate actions and further policies to resolve the issue of environmental degradation in these areas.

In some urban areas in Malaysia, the current estimated rate of municipal solid waste generation of 0.93 kg per capita per day is nearly as great as that on average in the European Community (Arango and Bertuzzi, 1994; Hasan *et al*., 1995). The World Bank Country Report (1992) revealed that municipal solid waste management as one of Malaysia's three most important urban environmental problems. The problem of solid waste management in Malaysia is thought to be intense in the squatters and low-income areas, where the low income and poor communities reside. The amount of waste generated from the squatters or informal settlements of Kuala Lumpur is estimated to be about 200 tones per day (Komoo, 1996). As squatter areas are generally underserved, only half of this amount is collected each day from central collection points (Razak, 1996). Since the squatters and low-income areas lag behind the basic amenities, it is generally perceived that the solid waste management in these areas is improper and unsustainable. It is also generally perceived that the poor are choosing to degrade the environment by practicing improper methods of waste handling because of their low-income levels and low

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socioeconomic profile. The study was designed to explore whether or not such widely perceived beliefs bear potential merits. The empirical results of the study are exciting, as poor people have showed their adequate and satisfactory knowledge, attitude and behavior, which counter the traditional misconception about them. The authors believe that the findings would add value to the public sector reform strategies in future.

MATERIALS AND METHODS

Sources of data and sample design: The analysis of this study is based on primary data collected from three areas of squatters and low-cost flats in Kuala Lumpur city. The data for this study were taken to assess the knowledge, attitude and behavior concerning current solid waste management of the urban poor particularly squatters and low-cost flat dwellers. Therefore the squatters and low-cost flat areas were chosen for the field survey. Trained interviewers paid their visits for several times in each study area. The interviewers had conducted the interviews with the persons who were the heads of the households, the wives or persons responsible for the economic decision for their families and older than 18 years.

The overall sampling design for the study can be described as stratified quota random sampling with the key stratification variable characteristics of household. In the first stage, the households to be surveyed had been selected purposively through a preliminary windshield survey in which the general characteristics of squatters or low-cost flats were found to exist. For doing this, enumerators were assigned to particular household types in each area, with minimum interview-quotas for each household-type. Then, to interject randomness into the sampling plan, enumerators had been advised to seek interviews with every second or third home on a particular street. A total of 300 household heads were interviewed from three parliamentary areas of Kuala Lumpur within which 100 households were selected from each area following the ratio of 60 and 40% for the squatters and low-cost flats, respectively.

Selection of the study area: The study was undertaken in three parliamentary areas of the Federal Territory of Kuala Lumpur. The parliamentary areas are Kepong, Segambut and Titiwangsa and the respective squatter areas that have been surveyed are Jinjang Utara Tambahan, Sentul Pasar and Datuk Keramat. It has been observed that most of the low-cost flats are situated at the places other than squatters and most of these are also scattered. Although a substantial number of low-cost flats are located at Jinjang Utara Tambahan that fulfilled the requirement of the sample size ratio of the study but their distribution was scattered in both Datuk Keramat and Sentul Pasar. However, there have been two low-cost flats selected from the area of Sentul Pasar, namely Flat Sri Terengganu and Flat Sri Kelantan. Sentul Pasar is an area that was considered within the broader boundary of Sentul Utara. To collect data in accordance with sample size ratio, three low-cost flats have also been selected from Datuk Keramat area. The selected low-cost flats are Flat Pangsa Murni, Flat Seri Perlis 2 and Flat Keramat Jaya and these three flats are located at the center place of Datuk Keramat area (Fig. 1).

Two initial criteria prompted the researchers to select these three areas. First, the poverty groups residing within the federal territory of Kuala Lumpur were predominantly concentrated in the squatter areas. In addition, a considerable number of the urban poor had also been living in the low-cost flats. Therefore, in order to gather actual information on the urban poor and their solid waste management, squatters and low-cost flats were chosen. Second, the study focuses on 'multi-cultural diversity' that is comprised of the several ethnic groups, such as Malay, Chinese and Indian.

Moreover, to interject all the ethnic groups into the study three different squatter and low-cost flat areas were selected with the view that an individual ethnic group must be dominant in each area. From this point of view, three areas of squatters and low-cost flats were selected within which an individual ethnic group was found to be dominant. The study covered such areas from Kuala Lumpur city in which Chinese were found to be the most dominant group in Jinjang Utara Tambahan while Indians and Malays were found to be the most dominant group, respectively in Sentul Pasar and Datuk Keramat.

Empirical models design: Prior to designing suitable models to identify the factors that could affect knowledge, attitude and behavior of the urban poor concerning solid waste management, numerous literatures have been surveyed. However, previous and relevant studies reveal that both poverty and environmental degradation have been increasing in many developing countries. There is also a rising trend in the poverty-environment literature, which disputes the conventional theory and argues that a more complex set of variables comes into play and that simple generalizations of this multidimensional problems are often erroneous and miss many important points (Leach and Mearns, 1995). Most of the previous studies point out socio-economic, demographic, cultural and institutional factors as important variables in the poverty-environmental degradation nexus. In fact, at the micro or household level, the factors that could influence the

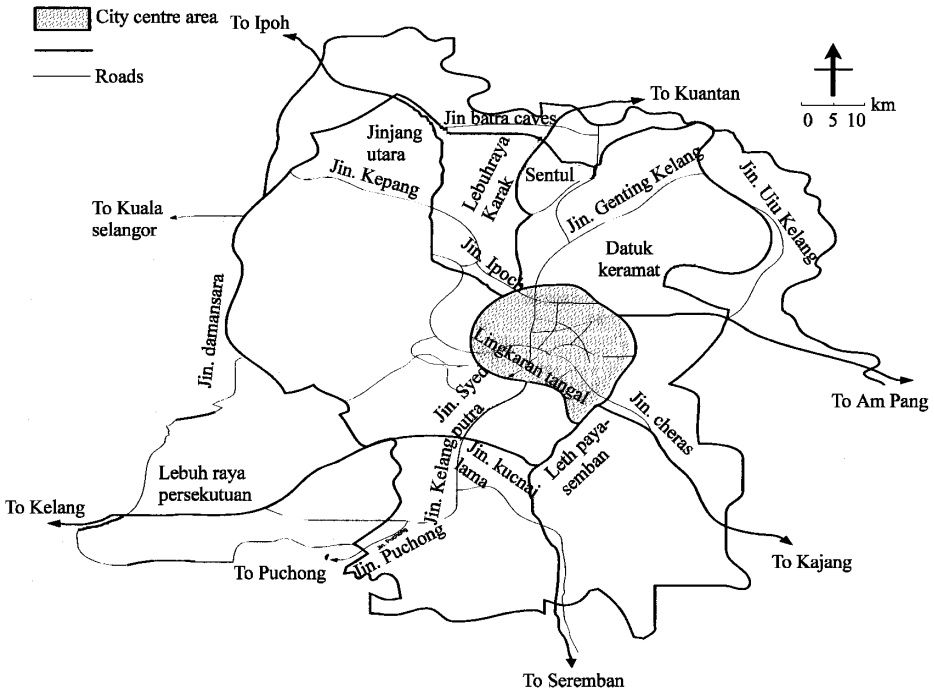

Fig. 1: Map showing the location of the three study areas ih Kuala Lampur city in which the study was undertaken

poverty-environment nexus are somewhat different since the households are forced in each and every environmental decision-making by their knowledge, attitude and behavior (Murad, 2002). Environmental economists have also developed models to explore the linkages between poverty and household waste management systems. Those economists have used household level data to estimate the factors that contribute to the system of household waste management in which particular considerations were given to recycling, reuse and source reduction of waste. Many solid waste studies at the household level have also shown patterned relationships between levels of income and knowledge, attitudes and behavior of householders concerning solid waste management (Oskamp *et al*., 1991; Allen *et al*., 1993; Hong *et al*., 1993; Jenkins, 1993; Boyce, 1994; Reschovsky and Stone, 1994; Fullerton and Kinnaman, 1996; Jakus *et al*., 1997; Ikiara *et al*., 1998; Taylor *et al*., 1998; Ebreo and Vinning, 1999; Grodzinska-Jurczak and Kostuj, 2001). Therefore, selection and design of models for this study were based on the determination of the factors that could affect poor householders' knowledge, attitude and behavior concerning solid waste management.

This study has developed three Logistic Regression Models to determine and analyze the factors that could affect knowledge, attitude and behavior of the urban poor concerning solid waste management. In general, the terms of knowledge, attitude and behavior are qualitative in nature and the assessment of these terms certainly depends on many other factors. Therefore, three individual dependent dummy variables of householders' knowledge, attitude and behavior have been regressed against the relevant socioeconomic and environmental factors relating to urban poor householders' solid waste management. The dependent variables have been designed as dichotomous dummy and they each consists of two hypothetical assumptions: adequate and not adequate or satisfactory and not satisfactory. The independent variables are both qualitative (dummy) and quantitative in nature. However, examining the effects of a number of independent variables on the above dependent variables led to the consideration of using Logistic Regression Model.

Technique of analysis: Three models have been drawn by using logistic regression results. The t-statistic has been used as a guide to indicate the importance of a variable in the logistic regression models. The Maximum Likelihood (ML) method was used to estimate the parameters in logistic regression models. The significant relationships between dependent and independent variables have been examined from the value of the correlation coefficient (R) in two variable cases and for t-values, adjusted R^2 values and F-values in the multivariate cases. In addition, the conventional goodness of fit indicators such as R^2 and adjusted R^2 has also been used. In the classical regression

model R^2 can range in value between 0 and 1, with a value of close to 1 indicating a good fit. But the logistic regression model or binary dependent variable model is not likely to yield an R^2 close to 1. Among the preferable alternatives to R^2 as a measure of goodness of fit the likelihood ratio index and/or Cox and Snell R^2 and Nagelkerke R^2 have also been used to predict logistic regression model in an extensive manner.

RESULTS AND DISCUSSION

Factors affecting householders' knowledge regarding solid waste management: The first logistic regression model was constructed to determine the factors that could affect householders' knowledge regarding solid waste management. The results of the model were found to be very satisfactory. The Cox and Snell R^2 was found to be 0.696 and most of the predictions were correct. As a modification of the Cox and Snell R^2 the Nagelkerke R^2 was also estimated, which is found to be very high and is about 0.928. The prediction success table was very nicely symmetrical, indicating that the model performs well at predicting both the yes and no responses. Based on the model performance as judged by the success table (Classification Table), the model proves to exhibit a high coefficient of predicting power, which was found at about 96.3%. The Hosmer and Lemeshow statistic was also estimated, which provides useful information about the calibration of the model. In Hosmer and Lemeshow Test, the observed significance level for chi-square value was found to be 0.406, which does not reject the null hypothesis of the model in the sense that there is no difference between the observed and predicted values. Thus, the model appears to fit the data reasonably well. In addition, the Chi-square also tests the null hypothesis that the coefficients for all the terms in the present model, except the constant, are 0, which is comparable to the overall F-test for regression. In the present model, the Chi-square value of 356.986 at $p<0.01$ significance level indicates that logistic regression is meaningful in the sense that the dependent variable is related to each specified independent variable. The correlation matrix of the variables was also studied to identify the occurrence of multicollinearity. The model confirms of involving no multicollinearity, that is, no two variables had a correlation in excess of 0.80.

Since the observations are of individual householders and not grouped, the logistic regression model was estimated using the maximum-likelihood estimation procedure. The final logistic regression model takes the following form:

$$\text{Ln}\frac{P_i}{1-P_i} = \underset{}{-3.140} \underset{(-1.6405)}{-1.446X_1} \underset{(-1.4232)}{-0.661X_2} \underset{(-4.3487)}{+0.003X_3} \underset{(-3.0000)}{+}$$

$$\underset{(5.3787)}{12.328X_4} \underset{(0.4635)}{+0.54X_5} \underset{(1.5504)}{+1.662X_6} \underset{(1.9852)}{+3.349X_7} \underset{(0.4287)}{+0.655X_8}$$

Table 1 shows that 4 independent variables are statistically significant while other 4 variables are insignificant. The estimated equation shows that the socio-economic factors, namely monthly income of the head of households (variable X_3) and households' economic status (variable X_6) and the demographic factors of respondents, namely Area 1 (variable X_7) and Area 2 (variable X_8) have a positive effect on householders' knowledge regarding solid waste management. The factors such as householders' perception on the health implications of waste (variable X_4) and householders' knowledge about source-reduction of waste (variable X_5) have the same positive effect on their knowledge regarding solid waste management. On the other hand, the socio-economic factor, namely years of schooling of householders (variable X_2) and the demographic factor, namely gender status of householders (variable X_1) have a negative effect on their knowledge regarding solid waste management. These findings indicate that householders' knowledge regarding solid waste management will tend to be adequate with the increase in their income, perception on the health implications of waste and knowledge about the source-reduction of waste.

The variable of gender (variable X_1) was considered in the model to examine whether or not householders' knowledge regarding solid waste management significantly differs between male and female. Although the coefficient has proven to be insignificant, but it's negative sign was expected. Hence, female heads of households have demonstrated a higher level of awareness and knowledge regarding solid waste management. This is evidenced by the negative coefficient for gender as an independent variable. Such a result is readily interpretable within the context of household heads' differential in regard to conceptualization of their household mode and orientation of management. Male heads of households by their very nature derived from their socialization would emphasize out-door activities and issues and to a lesser extent household issues which have their origin and decision making in relation to their handling within outside the household domain. This finding is in line with many notions in the literature that proclaim women, in

Table 1: Factors affecting householders' knowledge regarding solid waste management

Variable	Estimated coefficient (β)	SE	Wald statistic
Constant (α)	-3.140 (-1.6405)^{NS}	1.914	2.690
Dummy variable considering gender of householders (X_1) (1 for male, 0 for otherwise)	-1.446 (-1.4232)^{NS}	1.016	2.025
Years of schooling of householders (X_2)	-0.661 (-4.3487)***	0.152	18.829
Monthly income of householders (In MYR) (X_3)	0.003 (3.0000)***	0.001	7.070
Dummy variable considering householders' perception on the health Implications of waste (X_4) (1 if harmful, 0 for otherwise)	12.328 (5.3787)***	2.292	28.933
Dummy variable considering whether householders ever heard about "source-reduction" of waste (X_5) (1 if "yes", 0 for otherwise)	0.546 (0.4635)^{NS}	1.178	0.215
Dummy variable considering economic status of households (X_6) (1 if "poor", 0 for otherwise)	1.662 (1.5504)^{NS}	1.072	2.401
Dummy variable considering area of respondents reside in (area 1) (X_7) (1 for Jinjang Utara, 0 for otherwise)	3.349(1.9852)**	1.687	3.942
Dummy variable considering area of respondents reside in (area 2) (X_8) (1 for Sentul, 0 for otherwise)	0.655(0.4287)^{NS}	1.528	0.184
Chi-square Statistic = 356.986			
df = 8			
-2 Log Likelihood = 58.569			
Cox and Snell R^2 = 0.696			
Nagelkerke R^2 = 0.928			
Hosmer and Lemeshow Chi-square = 8.284 at 0.406 level of significance.			

Values in parentheses are t-values of the logistic regression coefficients; ***: Significant at 0.01 level; **: Significant at 0.05 level; NS: Not significant at 0.05 level; (P_i = 1 if householders' knowledge is adequate and P_i = 0 for Otherwise)

general, as being sensitive guardian of the environment being it built or natural (Satterthwaite, 1997).

The dummy variable of households' economic status (X_6) was proven to be insignificant, but positively related to householders' knowledge regarding solid waste management. The interpretation is quite direct. The logistic regression analysis has provided evidence that the poor household heads have exhibited a higher knowledge profile concerning solid waste management in comparison to their relatively well-off counterparts. This finding is indeed crucial as it runs counter to the widely voiced assertion in the literature that the poor contribute for much more to degrading the environment in relation to the better off. Such a finding, which set itself apart from the general theme in the literature, is indeed significant to sound environmental policy making, which does not unnecessarily militate against the poor. Furthermore, the higher knowledge status as ascribing to poor households is explainable upon reference to the tendency of the poor to explore and exploit income generation or saving activities and ventures. It seems plausible to make the assertion that solid waste management is quite of a potential arena for capturing income generation and saving activities as a means of augmenting relatively poorer households' income.

The variables of area dummies such as Area 1 (variable X_7) and Area 2 (variable X_8) have been proven to be positively related to respondents' knowledge regarding solid waste management. The Area 1 variable (X_7) was also proven to be statistically significant ($p<0.05$). These findings imply that the respondents at both Jinjang Utara and Sentul have elicited higher level of knowledge regarding solid waste management. Furthermore, obtaining a significant coefficient value of Area 1 variable is more interesting, which implies that respondents from Jinjang Utara would be expected to show a higher level of knowledge in regard to solid waste management relative to other sub-sets of the sample.

However, a positive and highly significant level ($p<0.01$) of coefficient value of the variable of householders' income (variable X_3) indicates that there is a direct and strong relationship between income and level of knowledge of householders regarding solid waste management. This finding is likely as a higher level of income may enable a person to be more educated, which in turn may enable the same person to be more knowledgeable in regard to environmental management systems. In fact, people in higher income brackets are on average more aware of any environmental degradation than their lower income counterparts. Since environmental awareness arises from knowledge and education, which may be the results of higher levels of income, the level of adequacy of knowledge of householders in regard to solid waste management has thus been positively and significantly related to their income level.

On the basis of the assumption that having education is a normal good, it is expected, holding all other factors constant, that householders' knowledge and their years of schooling would be positively correlated. In the estimated logistic regression model, the coefficient

value of the variable of years of schooling of respondents (variable X_2) was found to be highly significant ($p<0.01$), but negatively related to their knowledge regarding solid waste management. This runs counter to logical reasoning, which envisage education is a means of enlightenment and as such it should help boost the level of adequacy in householders' knowledge regarding solid waste management. The justification for this is the very little variation in the magnitude of the variable as amongst householders making up the sample. For example, out of 300 respondents only 3 were found to have a university degree qualification and the mean of years of schooling of all respondents is 7.9600 with a standard deviation of 3.5242. Thus the negative coefficient value of the variable of years of schooling of respondents in the present study does not necessarily mean that persons with a university degree qualification are not aware of and knowledgeable about solid waste management.

Factors affecting householders' attitude towards solid waste management: The second logistic regression model was constructed to determine the factors that could affect householders' attitude towards solid waste management. The results of the model were found to be very satisfactory. The estimated Cox and Snell R^2 was found to be 0.434 and most of the predictions were correct. As a modification of the Cox and Snell R^2 the Nagelkerke R^2 was also estimated, which is found to be acceptable and is about 0.594. The prediction success table is also nicely symmetrical, indicating that the model performs well at predicting both the yes and no responses. Based on the model performance as judged by the success table (Classification Table), the model proves to exhibit a high coefficient of predicting power, which was found to be about 85.0%. The Hosmer and Lemeshow statistic was also estimated, which provides useful information about the calibration of the model. In Hosmer and Lemeshow Test, the observed significance level for chi-square value was found to be 0.085, which does not reject the null hypothesis of the model in the sense that there was no difference between the observed and predicted values. Thus, the model appears to fit the data reasonably well. In addition, the Chi-square also tests the null hypothesis that the coefficients for all the terms in the present model, except the constant, are 0, which is comparable to the overall F-test for regression. In the present model, the Chi-square value of 170.890 at $p<0.01$ significance level indicates that logistic regression is meaningful in the sense that the dependent variable is related to each specified independent variable. The correlation matrix of the variables was also studied to identify the occurrence of multicollinearity. The model confirms of involving no multicollinearity, that is, no two variables had a correlation in excess of 0.80.

The results of fitting the logistic regression model for assessing householders' attitude for the whole sample are given in Table 2. Since the observations are of individual householders and not grouped, the logistic regression model was estimated using the maximum-likelihood estimation procedure. The final logistic regression model takes the following form:

$$\underset{}{\text{Ln}\frac{P_i}{1-P_i}} = \underset{}{-0.198} + \underset{(2.2733)}{1.032}X_1 - \underset{(-0.6129)}{0.038}X_2 + \underset{(1.0000)}{0.001}X_3 +$$

$$\underset{(4.3591)}{4.737}X_4 - \underset{(-0.1087)}{0.060}X_5 - \underset{(-2.9672)}{3.706}X_6 - \underset{(-2.8692)}{2.083}X_7 - \underset{(-2.3896)}{3.938}X_8 +$$

$$\underset{(3.5984)}{1.792}X_9 - \underset{(-1.5058)}{0.780}X_{10} - \underset{(-3.2443)}{1.872}X_{11} + \underset{(3.3539)}{1.962}X_{12}$$

Table 2 shows that all the independent variables are statistically significant, except for the years of schooling of head of households (variable X_2), monthly income of head of households (variable X_3), householders' attitude towards the waste collectors in collecting all the waste (variable X_5) and economic status of households (variable X_{10}). The estimated equation shows that the demographic factors, namely gender (variable X_1) and Area 2 (variable X_{12}) and socio-economic factor, namely monthly income of the head of household (variable X_3) have a positive effect on householders' attitude towards solid waste management. Similarly, the attitudinal factors such as householders' attitude towards the people that dispose of waste everywhere (variable X_4) and householders' attitude towards the other area cleaning services (sweeping and cleaning streets, cleaning drains, cleaning playground areas, cutting grass, collecting yard waste and cutting and trimming branches) (variable X_9) have also a positive effect on their attitude towards solid waste management. These findings imply that householders' attitude towards solid waste management will tend to be satisfactory with an improvement in their income, attitude towards the people that dispose of waste everywhere and attitude towards the other area cleaning services.

On the other hand, householders' attitudinal factors such as attitude towards the waste collectors in collecting all the waste (variable X_5), satisfaction with the time of waste collection in their area (variable X_6), attitude towards the distance of public dust-bins from their house (variable X_7) and attitude towards the problems of mosquitoes and flies as they are attracted to waste (variable X_8) have a negative effect on their attitude towards solid waste management. These findings imply that householders' attitude towards solid waste

Table 2: Factors affecting householders' attitude towards solid waste management

Variables	Estimated coefficient (β)	SE	Wald statistic
Constant (α)	-0.198 (-0.2562)^{NS}	0.773	0.065
Dummy variable considering gender of householders (X_1) (1 for male, 0 for otherwise)	1.023 (2.2733)**	0.450	5.166
Years of schooling of householders (X_2)	-0.038 (-0.6129)^{NS}	0.062	0.365
Monthly income of head of households (X_3)	0.001 (1.0000)^{NS}	0.001	1.402
Dummy variable considering householders' attitude towards people those dispose of waste everywhere (X_4) (1 if satisfactory, 0 for otherwise)	4.737 (4.3591)***	1.086	19.028
Dummy variable considering householders' attitude towards the waste collectors in collecting all the wastes (X_5) (1 if satisfactory, 0 for otherwise)	-0.060(-0.1087)^{NS}	0.522	0.013
Dummy variable considering householders' satisfaction with the time of waste collection in their residential area (X_6) (1 if satisfactory, 0 for otherwise)	-3.706 (-2.9672)***	1.249	8.811
Dummy variable considering householders' attitude towards the distance of public dust-bins from house (X_7) (1 if satisfactory, 0 for otherwise)	-2.083 (-2.8692)***	0.726	8.225
Dummy variable considering householders' attitude towards the problems of mosquitoes and flies as they are attracted to waste (X_8) (1 if satisfactory, 0 for otherwise)	-3.938 (-2.3896)**	1.648	5.710
Dummy variable considering householders' attitude towards other area cleaning services such as sweeping and cleaning streets, cleaning drains, cleaning playground areas, cutting grass, collecting yard waste and cutting and trimming branches (X_9) (1 if satisfactory, 0 for otherwise)	1.792 (3.5984)***	0.498	12.935
Dummy variable considering economic status of households (X_{10}) (1 if "poor", 0 for otherwise)	-0.780 (-1.5058)^{NS}	0.518	2.271
Dummy variable considering area of respondents reside in (Area 1) (X_{11}) (1 for Jinjang Utara, 0 for otherwise)	-1.872 (-3.2443)***	0.577	10.510
Dummy variable considering area of respondents reside in (Area 2) (X_{12}) (1 for Sentul, 0 for otherwise)	1.962 (3.3539)***	0.585	11.267
Chi-square Statistic = 170.890			
df = 12			
-2 Log Likelihood = 223.405			
Cox and Snell R^2 = 0.434			
Nagelkerke R^2 = 0.594			
Hosmer and Lemeshow Chi-square = 13.878 at 0.085 level of significance.			

Values in parentheses are t-values of the logistic regression coefficients; ***: Significant at 0.01 level; **: Significant at 0.05 level; NS: Not significant at 0.05 level; (P_i = 1 if householders' attitude is satisfactory and P_i = 0 for Otherwise)

management will tend to be satisfactory with the necessary efforts taken for resolving the problems of not collecting all the waste, infrequent waste collection, distance of public dust-bins from house and mosquitoes and flies as they are attracted to waste.

The demographic variable of gender (variable X_1) was considered in the model to examine whether or not householders' attitude towards solid waste management significantly differs between male and female. The coefficient has proven to be statistically significant ($p<0.05$) and positively related to householders' attitude towards solid waste management. This result is quite compatible with the one on knowledge regarding solid waste management. Analysis of knowledge regarding solid waste management has given evidence to the effect that women household heads are more knowledgeable in regard to solid waste management. It is quite natural that if women's knowledge and expectation in relation to solid waste management is higher relative to their men counterparts, then their attitude towards solid waste management practices and attributes would tend to be less favorable. A negative proportionality between knowledge and hence attitude and reality expressed in terms of the performance of solid waste management system is logical and as such expected.

The dummy variable of households' economic status (variable X_{10}) was proven to be insignificant and negatively related to householders' attitude towards solid waste management. The basis of interpretation here follows the theme of the interpretation given to gender. The poor have shown less satisfaction and hence a negative attitude towards solid waste management. Such a negative stand for the poor would stem from their higher knowledge standing relative to the better off. It is natural for higher levels of knowledge to generate less favorable attitude towards performance. The relationship here is between aspiration and reality. High levels of aspirations would ultimately result in lower satisfaction.

The variables of area dummies of respondents such as Area 1 (variable X_{11}) and Area 2 (variable X_{12}) have proven to be statistically significant ($p<0.01$). The Area 1 variable (variable X_{11}) has proven to be negatively related to respondents' attitude towards solid waste management. This finding implies that the respondents at Jinjang Utara have shown less satisfaction and hence a negative

attitude towards solid waste management. It has already been explained that Jinjang Utara respondents have shown a higher knowledge with regard to solid waste management in relation to other parts of the sample spatial domain. Being it the case, Jinjang Utara respondents would then hold some high hopes concerning the aspects and attributes of solid waste management. Such a mental frame of mind would inevitably result in less satisfaction with the performance and attributes of the solid waste management system. On the other hand, a highly significant and positive coefficient value of the Area 2 variable (variable X_{12}) is obtained. This finding implies that the respondents at Sentul have enjoyed better solid waste collection and disposal services in their residential areas and hence, a positive attitude towards solid waste management relative to other sub-sets of the sample.

The highly significant level of the model coefficients indicates that there is a strong relationship between dependent and independent variables. In this regard, the coefficient value of the variable of monthly income of head of household (variable X_3) was proven to be statistically insignificant with a positive relationship of the variable with householders' attitude towards solid waste management. This finding just implies that people with higher income level are more satisfied with the current waste collection and disposal services than their low-income counterparts. In fact, people with higher level of income may live in a place where waste collection and disposal services are adequate and satisfactory. Moreover, people in higher income brackets can spend money for enjoying better waste collection and disposal services and hence they have exhibited a positive attitude towards solid waste management.

The coefficient value of socio-economic factor, namely years of schooling of householders (variable X_2), is not statistically significant here, but negatively correlated with householders' attitude towards solid waste management. This result is likely as the people with more years of schooling are generally more aware of the quality of environmental services than their less educated counterparts. Since the respondents of the present study are living in the squatters and low-cost flats where waste collection and disposal services are generally inadequate and unsatisfactory, hence the respondents with more years of schooling have exhibited a negative attitude towards current waste collection and disposal provisions in their residential area.

Factors affecting householders' behavior concerning solid waste management: The third logistic regression model was constructed to determine the factors that could affect urban poor householders' behavior concerning solid waste management. The overall results of the model were found to be satisfactory. The Cox and Snell R^2 was found to be 0.376 and most of the predictions were correct. As a modification of the Cox and Snell R^2 the Nagelkerke R^2 was also estimated, which was also found to be highly acceptable and about 0.521. The prediction success table is also nicely symmetrical, indicating that the model performs well at predicting both the yes and no responses. Based on the model performance as judged by the success table (Classification Table), the model proves to exhibit a high coefficient of predicting power, which was found at about 82.7%. The Hosmer and Lemeshow statistic was also estimated, which provides useful information about the calibration of the model. In Hosmer and Lemeshow Test, the observed significance level for chi-square value was found to be 0.067, which does not reject the null hypothesis of the model in the sense that there is no difference between the observed and predicted values. Thus, the model appears to fit the data reasonably well. In addition, the Chi-square also tests the null hypothesis that the coefficients for all the terms in the present model, except the constant, are 0, which is comparable to the overall F-test for regression. In the present model, the Chi-square value of 141.428 at $p<0.01$ significance level indicates that logistic regression is meaningful in the sense that the dependent variable is related to each specified independent variable. The correlation matrix of the variables was also studied to identify the occurrence of multicollinearity. The model confirms of involving no multicollinearity, that is, no two variables had a correlation in excess of 0.80.

The results of fitting the logistic regression model for assessing householders' behavior concerning solid waste management for the whole sample are given in Table 3. Since the observations are of individual householders and not grouped, the logistic regression model was estimated using the maximum-likelihood estimation procedure. The final logistic regression model takes the following form:

$$\ln\frac{P_i}{1-P_i} = \underset{}{-1.757} \underset{(-1.7641)}{-0.969X_1} \underset{(-2.2588)}{-0.071X_2} \underset{(-1.2909)}{+0.001X_3} \underset{(1.0000)}{+}$$

$$\underset{(1.9783)}{1.096X_4} + \underset{(1.0221)}{0.556X_5} + \underset{(2.5921)}{1.449X_6} + \underset{(2.0000)}{0.878X_7} + \underset{(1.3097)}{0.960X_8} -$$

$$\underset{(-3.1598)}{1.147X_9} + \underset{(2.2616)}{1.167X_{10}} + \underset{(0.3357)}{0.236X_{11}} + \underset{(0.6133)}{9.592X_{12}}$$

Table 3 shows that all the independent variables are statistically significant, except for the years of schooling of householders (variable X_2); behavior of householders

Table 3: Factors affecting householders' behavior concerning solid waste management

Variable	Estimated coefficient (β)	Standard error	Wald statistic
Constant (α)	-1.757 (-1.7641)^{NS}	0.996	3.112
Dummy variable considering gender of householders (X_1) (1 for male, 0 for otherwise)	-0.969 (-2.2588)**	0.429	5.105
Years of schooling of householders (X_2)	-0.071 (-1.2909)^{NS}	0.055	1.662
Monthly income of head of households (In MYR) (X_3)	0.001 (1.0000)***	0.001	6.745
Dummy variable considering whether householders or their family members dispose of waste in their own dust-bin (X_4) (1 if yes, 0 for otherwise)	1.096 (1.9783)**	0.554	3.914
Dummy variable considering whether householders or their family members dispose of waste by selling to an itinerant buyer (X_5) (1 if yes, 0 for otherwise)	0.556 (1.0221)^{NS}	0.544	1.045
Dummy variable considering whether householders or their family members dispose of waste in a public dust-bin received from local town authority or contractor (X_6) (1 if yes, 0 for otherwise)	1.449 (2.5921)***	0.559	6.725
Dummy variable considering whether householders or their family members dispose of waste by burning (X_7) (1 if yes, 0 for otherwise)	0.878 (2.0000)**	0.439	3.989
Dummy variable considering whether householders or their family members give consideration about the products' package that can be reused, while buying something (X_8) (1 if yes, 0 for otherwise)	0.960 (1.3097)^{NS}	0.733	1.715
Dummy variable considering type of house of householders (X_9) (1 for squatter, 0 for low-cost flat)	-1.147 (-3.1598)***	0.363	10.016
Dummy variable considering economic status of households (X_{10}) (1 if poor, 0 for otherwise)	1.167 (2.2616)**	0.516	5.122
Dummy variable considering area of respondents reside in (Area 1) (X_{11}) (1 for Jinjang Utara, 0 for otherwise)	0.236 (0.3357)^{NS}	0.703	0.113
Dummy variable considering area of respondents reside in (Area 2) (X_{12}) (1 for Sentul, 0 for otherwise)	9.592 (0.6133)^{NS}	15.639	0.376
Chi-square Statistic = 141.428			
df = 12			
-2 Log Likelihood = 241.852			
Cox and Snell R^2 = 0.376			
Nagelkerke R^2 = 0.521			
Hosmer and Lemeshow Chi-square = 14.624 at 0.067 level of significance.			

Values in parentheses are t-values of the logistic regression coefficients; ***: Significant at 0.01 level; **: Significant at 0.05 level; NS: Not significant at 0.05 level; (P_i = 1 if householders' behavior is satisfactory and P_i = 0 for otherwise)

or their family members concerning disposition of waste by selling to an "itinerant" buyer (variable X_5); consideration given by householders or their family members about the products' package that can be reused, while buying something (variable X_8) and the areas of respondents reside in (variable X_{11} and variable X_{12}). The estimated equation shows that the demographic factors of respondents, namely Area 1 (variable X_{11}) and Area 2 (variable X_{12}) and the socio-economic factors of respondents such as monthly income of the head of household (variable X_3) and economic status of household (variable X_{10}) have positive effect on their behavior concerning solid waste management. Similarly, the behavioral factors of householders or their family members such as disposition of waste in their own dust-bin (variable X_4); disposition of waste by selling to an "itinerant" buyer (variable X_5); disposition of waste in a public dust-bin received from local town authority or contractor (variable X_6); disposition of waste by burning (variable X_7) and consideration about the products' package that can be reused, while buying something (variable X_8) have also positive effect on their behavior concerning solid waste management. These findings imply that behavior of householders or their family members concerning solid waste management will be satisfactory if they can enjoy higher income; dispose of waste in their own dust-bins; dispose of waste by selling to the itinerant buyers; dispose of waste in the public dust-bins provided by local town authority or contractor; dispose of waste by burning; and can consider, while buying something, about the products' package that can be reused.

The variable of gender of householders (variable X_1) was considered in the model to examine whether their behavior concerning solid waste management significantly differs between male and female. The coefficient of the variable has proven to be significant ($p<0.05$) and negatively related to householders' behavior concerning solid waste management. The result implies that female householders have demonstrated a higher satisfactory behavior concerning solid waste management. This result is also quite compatible with the one on knowledge regarding solid waste management. Analysis of knowledge has given evidence to the effect that female householders are more knowledgeable regarding solid waste management. It is quite natural that

if women's knowledge regarding solid waste management is higher relative to their men counterparts then their behavior concerning solid waste management would be more favorable. A positive proportionality between knowledge and hence behavior expressed in terms of solid waste management system is logical and as such expected.

A dummy variable, namely type of house (variable X_9) was considered in this model to examine whether respondents' behavior concerning solid waste management significantly differs between squatters and low-cost flat dwellers. The variable was proven to be highly significant ($p<0.01$) and negatively related to respondents' behavior concerning solid waste management. The interpretation is direct and also consequential. Squatters suffer from congested space, poor amenities and a pronounced lack of necessary elements, which would not provide for a healthy environment. As such, squatter households would be expected to behave in a negative way towards solid waste management. Such a negative way is expected from them as originating from their poor environment rather than being based on a behavioral norm.

The variable of economic status of households (variable X_{10}) was proven to be statistically significant and positively related to householders' behavior concerning solid waste management. The interpretation is quite direct as the logistic regression analysis has provided evidence that the poor householders have exhibited a higher satisfactory behavior concerning solid waste management in comparison to their relatively well-off counterparts. This finding is indeed crucial as it runs against the widely voiced assertion in the literature that the poor contribute for much more to degrade the environment in comparison to the better off. Such a finding, which set itself apart from the general theme in the literature, is indeed significant to sound environmental policy making, which does not unnecessarily militate against the poor. Moreover, the satisfactory behavioral pattern as ascribing to poor householders is explainable upon reference to the tendency of the poor to explore income generation or saving activities and ventures. It seems plausible to make the assertion that solid waste management is quite a potential arena for capturing income generation and saving activities as the means of augmenting relatively poorer households' income.

The variables of area dummies such as Area 1 (variable X_{11}) and Area 2 (variable X_{12}) have proven to be insignificant, but positively related to respondents' behavior concerning solid waste management. Generally, these findings imply that the respondents residing at both Jinjang Utara and Sentul have demonstrated more satisfactory behavior concerning solid waste management in comparison to the respondents residing in Datuk Keramat. However, obtaining insignificant coefficient values of both area dummies is not so interesting as it implies that respondents residing in Jinjang Utara and Sentul would not be expected to show a significant level of differences in their behavior concerning solid waste management in comparison to the other sub-set of the sample.

A highly significant level of logistic regression coefficient indicates that there is a strong relationship between dependent and independent variables. In this regard, the coefficient value of the variable of monthly income of head of household (variable X_3) has proven to be highly significant ($p<0.01$) and positively related to householders' behavior concerning solid waste management. This finding implies that householders in higher income brackets have demonstrated satisfactory behavior concerning solid waste management. In fact, people with higher income can systematically manage their household waste by hiring and engaging waste pickers and hence their satisfactory behavior is evidenced in this study.

The coefficient value of the independent variable of years of schooling of householders (variable X_2) is not statistically significant here, but negatively related to their behavior concerning solid waste management. Based on the assumption that having education is a normal good and thus it is expected, holding all other factors as constant, that years of schooling of householders and their behavior concerning solid waste management would be positively correlated. Hence, obtaining a negative coefficient runs against the logical reasoning, which envisages education is a means of perception and as such it should help boost the level of satisfaction in householders' behavior concerning solid waste management. The justification for this is the very little variation in the magnitude of the variable as amongst householders making up the sample. For instance, out of 300 survey respondents in the present study only 3 were found to have a university degree qualification and the mean of years of schooling of all respondents is 7.9600 with a standard deviation of 3.5242.

CONCLUSIONS

The findings of this study are really exciting, as the urban poor have shown satisfactory knowledge, attitude and behavior concerning solid waste management in comparison to their relatively better-off counterparts. The urban poor are also proven to behave in ways conducive to and friendly with environmentally sound solid waste

management, as they are the recyclers, re-users and source reducers of their household wastes. The overall result of this study is indeed crucial as it runs against the widely voiced assertion in the literatures that the poor choose to degrade the environment. Such finding, which set itself apart from the general theme in the literature, is indeed significant to sound environmental policy making, which does not unnecessarily militate against the poor. The results of the study have also given evidence to the effect that the urban poor and low-income groups are victims rather than agents of environmental degradation.

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