

## Household Waste Management among Riverside Communities and other Determinants

### *Pengelolaan Sampah Rumah Tangga pada Masyarakat Tepi Sungai dan Faktor yang Mempengaruhinya*

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#### ABSTRACT

Littering was recognized as an important cause of environmental pollution and was related to health problems. Banjarmasin city has been achieved the predicate of Adipura in 2015, but in reality there were still many drainage that clogged because of the pile of garbage, especially in the river. Management and disposal of household waste was an important issue in the city of Banjarmasin. The purpose of this study was to identify socioeconomic and demographic factors related to family members' knowledge, practice, and behavior related to household waste management and produce corrective action plans. This study uses cross-sectional design. The study population is people in the city of Banjarmasin who live on the edge of the river and meet the sample inclusion and exclusion criteria. Sampling was done using multistage random sampling method. Binary logistic regression was used for data analysis. We found that education level, household income, and sex were independently linked to littering. We also found that communities have unsafe knowledge, practices, and behaviors in relation to waste management. This study concludes that promotion of environmental information and public education on proper waste disposal needs to be done to improve the health and safety of the community environment.

**Keywords:** Knowledge, practice, behavior, household waste, management

#### ABSTRAK

Membuang sampah sembarangan diketahui sebagai penyebab penting pencemaran lingkungan dan terkait dengan masalah kesehatan. Kota Banjarmasin telah mendapat predikat Adipura pada tahun 2015, tetapi kenyataannya masih banyak drainase yang tersumbat karena tumpukan sampah, terutama di sungai. Pengelolaan dan pembuangan limbah rumah tangga merupakan masalah penting di Kota Banjarmasin. Tujuan dari penelitian ini adalah mengidentifikasi faktor sosial ekonomi dan demografi yang terkait dengan pengetahuan, praktik, dan perilaku anggota keluarga terkait dengan pengelolaan limbah rumah tangga dan membuat tindakan perbaikan. Penelitian ini menggunakan desain cross-sectional. Populasi penelitian adalah masyarakat di Kota Banjarmasin yang tinggal di tepi sungai dan memenuhi kriteria inklusi dan eksklusi sampel. Pengambilan sampel dilakukan menggunakan metode multistage random sampling. Regresi logistik digunakan untuk analisis data. Kami menemukan bahwa tingkat pendidikan, pendapatan rumah tangga dan jenis kelamin secara independen terkait dengan membuang sampah sembarangan. Kami juga menemukan bahwa masyarakat memiliki pengetahuan, praktik, dan perilaku yang tidak aman dalam kaitannya dengan pengelolaan limbah. Penelitian ini menyimpulkan bahwa promosi informasi lingkungan dan pendidikan publik tentang pembuangan limbah yang tepat perlu dilakukan untuk meningkatkan kesehatan dan keselamatan lingkungan masyarakat.

**Kata kunci:** Pengetahuan, praktik, perilaku, sampah rumah tangga, pengelolaan

## INTRODUCTION

Times were constantly evolving and producing cutting-edge products to meet the most basic needs of life. However, the production and consumption of the resulting resources end with an important issue related to waste management in different parts of the world. Often the rest of the production or the rest of the resources that are not used only become garbage that pollute the environment.<sup>1,2</sup> Environmental pollution associated with littering has a serious negative impact on the health and safety of the people.<sup>3,4</sup> To prevent environmental pollution due to improper waste handling required appropriate steps. Garbage must be sorted by type, organic or non-organic, applying sanitary landfill techniques or incineration techniques for waste that can not be decomposed easily.<sup>5</sup> Inadequate waste management can be attributed to many factors, but it is important to emphasize the role, attitude, the practice of community waste management, and their interaction with other factors in the waste management system. Society is the ultimate end user.<sup>6,7</sup>

Safe management and disposal of household waste was a problem faced by Banjarmasin City, Indonesia. Banjarmasin city has a main landfill with an area of about 39.46 hectares. In addition Banjarmasin city government has provided temporary dump or trashbin for the community, but there are still many people who throw garbage into the river or open land.<sup>8</sup> Barriers to waste management in the city of Banjarmasin may be quite unique in terms of environmental impacts, socioeconomic factors, and cultural heritage, so different areas will find effective different strategies for proper waste management. Some studies have found that good safety awareness at home or knowledge about waste related to adverse health effects associated with household waste disposal strategies.<sup>9,10</sup> For example, safety behavior was required to prevent direct contamination and exposure of infectious and harmful substances to health from household waste. On the other hand, increasing knowledge can encourage positive attitudes and build safe practices in society. In Banjarmasin, there is a shortage of measures aimed at informing the public about the causal relationship between environmental pollution and health, and no long-term evaluation provisions. Therefore, research

and development of waste management should continue to develop data, models and concepts related to long-term waste disposal. The main objectives of the study were (1) to identify factors related to inappropriate household waste disposal and (2) to assess household knowledge about health and safety risks posed by inappropriate household waste disposal.

## MATERIAL AND METHOD

Banjarmasin City is the largest city in South Kalimantan Province. The city was estimated to contain more than one-third of the population in South Kalimantan Province. Banjarmasin dubbed the City of Thousand River has an area of 98.46 km<sup>2</sup> whose territory is an archipelago consisting of about 25 small islands. Based on BPS data of Banjarmasin City in 2016, Banjarmasin has a population of 675,440 people with a density of 9,381 people per km<sup>2</sup>. South Kalimantan Province has a population of about 1.9 million people. The study population is residents in the city of Banjarmasin who live on the edge of the river and meet the sample inclusion and exclusion criteria.<sup>11,12</sup>

This is cross-sectional study. Sampling was done using multistage random sampling method. The main sampling unit was households located on the outskirts of the Martapura River in Central Banjarmasin Sub-District, Banjarmasin City. This sub-district was chosen because the Martapura River is located almost along this Sub-District so that there are many houses on the river bank in this Sub-District. The secondary sampling unit consists of random sub-sampling in the reporting unit to obtain a household sample according to the household list established by the study team leader and the community representative. The tertiary sampling unit was a single member per household, preferably head of household. Based on the response rate by prospective participants obtained a sample of 784 participants.

The study was conducted between March and June 2017. As part of the inclusion criteria, the participants must be eligible (1) to be at least 18 years of age, (2) agree to participate in the study, (3) be able to speak Banjar language or at least Bahasa, and (4) not suffering from mental disorders or central nervous system disorders (including behavioral disorders).

To improve community responses, community leaders were asked to help recruit data collectors from the community. Data collectors were a combination of university students and senior high school students. Interviewers were trained intensively with regard to study procedures and questionnaires. Data collectors were also specially trained to ensure that prospective participants were fully informed of their rights before getting approval. The questionnaire contains detailed information about the participants regarding waste disposal practices. This study also asks about knowledge and safety behavior related to household waste management. The study questionnaire was made by researchers after a literature search on related topics.<sup>13</sup> Prior to the study, the validity

and reliability of the questionnaire were conducted.

In this study, three variables were used to represent the outcome measure: waste disposal practices, knowledge about the negative impacts of littering household waste, and safety behavior associated with waste management. The community waste disposal practice comes from the question: “How do you usually get rid of trash?” This question consists of four values: a temporary dump/landfill, dumped into a river, open land, or burned. These four values were further dichotomized into good waste disposal practices when people dump trash directly into a temporary dump/landfill, or inappropriate waste disposal practices, when waste was discharged into rivers, open land,

**Table 1. Socioeconomic and Demographic Characteristics and Methods of Waste Disposal of Participants (n=784)**

Variable	n (%)	Methods of Waste Disposal			
		A Temporary Dump/Landfill n (%)	Into a River n (%)	Open Land n (%)	Burned n (%)
<b>Overall</b>	784 (100)	139 (17.7)	371 (47.3)	132 (15.3)	142 (18.1)
<b>Age (year)</b>					
18-35	289 (36.8)	28 (9.7)	184 (63.7)	35 (12.1)	42 (13.8)
36-40	273 (34.8)	32 (11.7)	150 (54.9)	50 (18.3)	41 (15.0)
41-60	184 (23.5)	59 (32.0)	30 (16.3)	45 (24.5)	50 (27.2)
≥60	38 (4.8)	20 (52.6)	7 (18.4)	2 (5.3)	9 (23.7)
<b>Sex</b>					
Male	328 (41.8)	85 (25.9)	128 (39.0)	40 (12.2)	75 (22.9)
Female	456 (58.2)	54 (11.8)	243 (53.3)	92 (20.2)	67 (14.7)
<b>Marital status</b>					
Single	153 (19.5)	27 (17.6)	53 (34.6)	36 (23.5)	37 (24.2)
Married	452 (57.6)	63 (13.9)	272 (60.2)	51 (11.3)	66 (14.6)
Divorce	66 (8.4)	17 (25.8)	16 (24.2)	20 (30.3)	13 (19.7)
Widow/widower	113 (14.4)	32 (28.3)	30 (26.5)	25 (22.1)	26 (23.0)
<b>Education level</b>					
Elementary School	225 (28.7)	8 (3.6)	160 (71.1)	33 (14.7)	24 (10.6)
Middle School	280 (35.7)	10 (3.6)	150 (53.6)	63 (22.5)	57 (20.4)
Senior High School	208 (26.5)	74 (35.6)	46 (22.1)	30 (14.4)	58 (27.9)
College	71 (9.1)	47 (66.2)	15 (21.1)	6 (8.5)	3 (4.2)
<b>Household income (IDR)</b>					
< 2.285.000	504 (64.3)	22 (4.4)	283 (56.2)	94 (18.7)	105 (20.8)
≥2.285.000	280 (35.7)	117 (41.0)	88 (31.4)	24 (8.6)	51 (18.2)
<b>Distance to a temporary dump/landfill</b>					
< 50 meters	80 (10.2)	38 (47.5)	11 (13.8)	17 (21.3)	14 (17.5)
50-100 meters	153 (19.5)	63 (41.2)	24 (15.7)	30 (19.6)	36 (23.5)
101-200 meters	356 (45.4)	23 (6.5)	184 (51.7)	65 (18.3)	84 (23.6)
> 200 meters	195 (24.9)	15 (7.7)	152 (77.9)	20 (10.3)	8 (4.1)

**Table 2. Knowledge of Health Impact and Participants Behavior Related to Waste Management (n=784)**

Questions about Correct Response	n (%) Correct Response
<b>Knowledge</b>	
Do the inappropriate waste disposal dangerous? (Yes)	726(92.6%)
Can surface water/groundwater/tap water be contaminated at any time? (Yes)	299 (38.1%)
Do the child's shit is as dangerous as an adult? (Yes)	321 (40.9%)
Do the following illness related to inappropriate waste disposal?	
Cholera (Yes)	463 (59.1%)
Typhoid (Yes)	498 (63.5%)
Dysentery (Yes)	69 (8.8%)
Malaria (Yes)	441 (56.3%)
Diarrhea (Yes)	161 (20.5%)
Injury (Yes)	26 (3.3%)
Respiratory infection (Yes)	34 (4.3%)
<b>Behavior</b>	
Do your kids play near the garbage? (No)	166 (21.2%)
Do you buy food from the shops near the trash? (No)	477 (60.9%)
Do you wash your hands properly after taking out the trash? (Yes)	410 (52.3%)
Do you drink boiled water? (Yes)	585 (74.6%)
Do you waste every day? (Yes)	432 (55.1%)
Do you usually keep garbage near the outside door? (No)	456 (58.2%)
Do you leave unprotected garbage near the outside door? (No)	192 (24.5%)
Do you leave the waste container overflowing? (No)	326 (41.6%)
Do you wash the trash containers with soap and water or cleaners with dry soil or sand? (Yes)	111 (14.2%)
Do child feces removed with other household garbage? (No)	277 (35.3%)
Do you usually treat water from the unprotected and suspicious surface, soil, and pipelines before use? (Yes)	115 (14.7%)
Do you sleep in a mosquito net? (Yes)	471 (60.1%)

or burned. The level of knowledge was considered "less" with a score  $<50\%$  and rated "good" with a score of  $\geq 50\%$ . The level of safety behavior was considered "safe" for those who score  $>$  mean and considered "unsafe" for the  $\leq$  mean.

Descriptive analysis was conducted to investigate the characteristics of waste disposal practices in the study population. Multivariate analysis of binary logistic regression was conducted to examine the influence of socioeconomic and demographic factors on the practice of community waste disposal, the level of public knowledge about the causes of diseases related to inappropriate waste management, and safety behavior related to waste management. To prevent the possibility that participants will apply good waste disposal practices during the study, the other six variables will be explained: age, sex, marital status, education level, household income, and distance to a

temporary dump/landfill. To predict participants' knowledge of the causes of disease from waste management, five predictors in this model: age, sex, marital status, education level, and household income.<sup>6,14</sup> For the questionnaire component, items and reliability were applied. Statistical significance is set at  $\leq 0.05$ .

## RESULT

Table 1 illustrates the frequency distribution of socioeconomic and demographic characteristics. There were a total of 784 participants. The mean age ( $\pm$  standard deviation) was  $41.6 \pm 16.2$  years, corresponding to the age range 18 to 66 years. The average household income of participants was IDR 2,645,000 ( $SD \pm 1,925,000$ ). Table 1 also identifies 4 methods of waste disposal. Most of the waste was discharged into the river (47.3%), disposed of burnt (18.1%), dumped into a tempo-

rary dump/landfill (20.2%), and disposed to open land (15.3%).

When analyzing waste disposal methods on socioeconomic and demographic aspects, we can quickly identify that participants in the 18-35 years age group often dump garbage in rivers (63.7%) or by burning (13.8%). Participants aged 36-40 years often throw their garbage into the river (54.9%) or dispose of waste by burning (15.0%). The most common method of disposal of participants in the 41-60 years age group was discharged to a temporary dump/landfill (32.0%) or by burn-

ing (27.2%), whereas age over  $\geq 60$  years was mostly disposed of waste to a temporary dump/landfill (52.6%) and with combustion (23.7%). Most of the women (53.3%) dumped more waste in rivers than men (39.0%). Participants with elementary school education (71.1%) and those with middle school education (53.6%) often dump garbage into rivers, while participants with senior school high school (35.6%) and education to college background (66.2%) often throw garbage into a temporary dump/landfill. Participants who earn <IDR 2,285,000 (56.2%) often throw gar-

**Table 3. Binary Model Logistic Regression Association between Waste Disposal Methods, Socioeconomic Characteristics, and Participant Demographics (n=784)**

Variable	Good Garbage Disposal (a Temporary Dump/Landfill) n (%)	Unadjusted		Adjusted	
		POR 95% CI	p	POR 95% CI	p
<b>Age (year)</b>					
18-35	28 (9.7)	2.43 (1.04-4.94)	0.05	1.80 (1.13-1.99)	0.01
36-40	32 (11.7)	1.42 (0.50-3.20)	0.10	1.23 (1.03-3.65)	0.01
41-60	59 (32.0)	5.65 (2.20-7.23)	0.00	1.57 (1.21-2.84)	0.00
$\geq 60$	20 (52.6)	Reference		Reference	
<b>Sex</b>					
Male	85 (25.9)	Reference		Reference	
Female	54 (11.8)	1.90 (0.73-3.64)	0.02	2.60 (1.56-3.88)	0.00
<b>Marital status</b>					
Single	27 (17.6)	2.45 (1.13-4.56)	0.04	1.52 (1.14-2.49)	0.00
Married	63 (13.9)	2.10 (1.42-4.54)	0.25	1.84 (1.48-2.24)	0.00
Divorce	17 (25.8)	2.79 (1.23-6.37)	0.30	1.45 (1.22-2.94)	0.03
Widow/widower	32 (28.3)	Reference		Reference	
<b>Education level</b>					
Elementary School	8 (3.6)	2.90 (1.04-4.24)	0.00	3.42 (1.26-4.16)	0.01
Middle School	10 (3.6)	3.34 (1.14-4.53)	0.00	2.12 (1.02-4.24)	0.00
Senior High School	74 (35.6)	2.14 (1.02-3.59)	0.10	1.81 (1.18-3.95)	0.00
College	47 (66.2)	Reference		Reference	
<b>Household income (IDR)</b>					
< 2.285.000	22 (4.4)	3.42 (1.33-4.56)	0.00	0.46 (0.02-0.85)	0.02
$\geq 2.285.000$	117 (41.8)	Reference		Reference	
<b>Distance to a temporary dump/landfill</b>					
< 50 meters	38 (47.5)	Reference	0.01	Reference	
50-100 meters	63 (41.2)	0.58 (0.24-1.20)	0.20	0.23 (0.03-0.84)	0.03
101-200 meters	23 (6.5)	1.53 (0.03-2.30)	0.00	0.10 (0.32-0.55)	0.01
> 200 meters	15 (7.7)	2.32 (1.03-3.40)		0.25 (0.11-0.94)	0.01

p < 0.05 significant

Note: IDR: Indonesian Rupiah; POR: Prevalence Odds Ratio; CI: Confidence Interval

bage into rivers, whereas participants with income  $\geq$  IDR 2,285,000 (41.8%) often dump garbage into a temporary dump/landfill. Participants who live less than 50 meters (47.5%) or between 50 to 100 meters (41.2%) often dump trash into a temporary dump/landfill, but participants living between 101 to 200 meters and over 200 meters of a temporary dump/landfill, respectively, dumping their waste into rivers (51.7% versus 77.9%).

Table 2 illustrates the knowledge of participants on the causes of diseases related to waste.

Satisfactorily, 92.6% of participants were aware of the fact that improper handling of waste was harmful to human health. Unfortunately, 61.9% of participants were unaware of the possible contamination of hosts from surface, soil, and piped water at any time due to inappropriate waste management. Likewise, 59.1% of participants considered that improper disposal of improper children did not have adverse health effects. Regarding participants' evaluation of their knowledge of diseases caused by inappropriate waste manage-

**Table 4. Binary Model Logistic Regression Associations between the Participants' Level Of Knowledge about the Causes of Diseases Related to Waste and the Socioeconomic and Demographic Characteristics of the Participants (n=784)**

Variable	Good Knowledge n (%)	Unadjusted		Adjusted	
		POR 95% CI	p	POR 95% CI	p
<b>Age (year)</b>	89 (32.9%)	2.13 (1.17-3.43)	0.03	1.44 (0.29-2.48)	0.50
18-35	72 (26.7%)	1.38 (0.52-3.93)	0.02	1.73 (0.83-3.94)	0.08
36-40	91 (33.7%)	1.13 (0.74-2.84)	0.01	0.85 (0.19-2.46)	0.10
41-60	18 (6.7%)	Reference		Reference	
$\geq 60$					
<b>Sex</b>	167 (61.9%)	Reference		Reference	
Male	103 (38.1%)	0.88 (0.32-2.58)	0.01	0.56 (0.39-0.89)	0.01
Female					
<b>Marital status</b>	70 (25.9%)	1.24 (0.23-2.54)	0.00	2.04 (1.13-4.79)	0.01
Single	92 (34.1%)	1.02 (0.12-2.45)	0.00	1.25 (1.04-4.57)	0.20
Married	36 (13.3%)	1.94 (0.89-3.49)	0.20	2.03 (1.40-4.69)	0.10
Divorce	72 (26.7%)	Reference		Reference	
Widow/widower					
<b>Education level</b>	19 (7.0%)	1.26 (0.65-2.64)	0.01	1.42 (1.32-1.82)	0.04
Elementary School	50 (18.5%)	2.08 (1.02-4.25)	0.10	1.32 (1.01-1.72)	0.01
Middle School	136 (50.4%)	4.10 (2.33-7.88)	0.10	1.60 (1.13-2.12)	0.00
Senior High School	65 (24.1%)	Reference		Reference	
College					
<b>Household income (IDR)</b>	82 (30.4%)	0.84 (0.52-1.42)	0.02	1.53 (0.77-3.41)	0.00
< 2.285.000	188 (69.6%)	Reference		Reference	
$\geq 2.285.000$					
<b>Distance to a temporary dump/landfill</b>	77 (28.5%)	Reference)		Reference	
< 50 meters	104 (38.5%)	1.22 (0.72-2.56)	0.00	2.80 (1.32-3.45)	0.00
50-100 meters	50 (18.5%)	1.48 (0.83-1.74)	0.40	1.20 (0.28-2.48)	0.06
50-100 meters	39 (14.4%)	0.64 (0.31-1.34)	0.50	1.12 (0.24-2.95)	0.25
101-200 meters					
> 200 meters					

p < 0.05 significant

Note: IDR: Indonesian Rupiah; POR: Prevalence Odds Ratio; CI: Confidence Interval

**Table 5. The Influence of Socioeconomic and Demographic Factors on the Safety Behavior of Participants Related to Waste Management (n=784)**

Variable	Good Behavior n (%)	Unadjusted		Adjusted	
		POR 95% CI	p	POR 95% CI	p
<b>Age (year)</b>					
18-35	83 (22.1%)	2.70 (1.63-4.84)	0.00	4.42 (1.96-7.70)	0.02
36-40	102 (27.2%)	1.75 (0.88-3.16)	0.05	1.50 (1.26-2.74)	0.00
41-60	168 (44.8%)	1.18 (0.72-1.78)	0.51	0.17 (0.11-0.67)	0.01
≥60	22 (5.9%)	Reference		Reference	
<b>Sex</b>					
Male	201 (53.6%)	Reference		Reference	
Female	174 (46.4%)	0.23 (0.11-0.60)	0.00	1.14 (1.11-1.93)	0.02
<b>Marital status</b>					
Single	64 (17.1%)	3.33 (1.28-5.67)	0.02	2.17 (1.78-4.68)	0.20
Married	156 (41.6%)	1.08 (0.48-2.45)	0.04	1.56 (1.24-4.11)	0.35
Divorce	38 (10.1%)	0.84 (0.44-1.57)	0.30	1.33 (1.14-3.13)	0.80
Widow/widower	117 (31.2%)	Reference		Reference	
<b>Education level</b>					
Elementary School	27 (7.2%)	0.55 (0.17-1.08)	0.00	1.31 (1.14-1.75)	0.00
Middle School	86 (22.9%)	1.22 (0.81-2.58)	0.04	1.74 (1.65-2.65)	0.04
Senior High School	196 (52.3%)	0.83 (0.47-1.48)	0.70	2.15 (1.45-4.84)	0.02
College	66 (17.6%)	Reference		Reference	
<b>Household income (IDR)</b>					
< 2.285.000	122 (32.5%)	0.74 (0.34-1.56)	0.03	1.45 (1.08-2.34)	0.01
≥2.285.000	253 (67.5%)	Reference		Reference	
<b>Distance to a temporary dump/landfill</b>					
< 50 meters	72 (19.2%)	Reference		Reference	
50-100 meters	203 (54.1%)	0.69 (0.48-1.99)	0.01	1.46 (1.15-1.86)	0.06
101-200 meters	54 (14.4%)	1.63 (0.87-2.86)	0.45	0.83 (0.43-1.24)	0.10
> 200 meters	46 (12.3%)	0.81 (0.42-1.68)	0.12	0.66 (0.22-1.54)	0.26

p< 0.05 significant

Note: IDR: Indonesian Rupiah; POR: Prevalence Odds Ratio; CI: Confidence Interval

ment, 59.1%, 63.5%, and 56.3% of participants were aware that, respectively, cholera, typhoid, and malaria could be attributable to treatment improper waste. However, few participants believed that diarrhea (20.5%), dysentery (8.8%), respiratory infections (4.3%), and injuries (3.3%) may be due to improper handling of waste.

Table 2 illustrates the safety behavior of participants in relation to waste management. Interestingly, 52.3% of participants adopted an important aspect of personal hygiene; That is, they wash their hands properly after garbage disposal.

Importantly, 55.1%, 58.2%, and 60.1% of participants throw garbage every day, usually put rubbish near the outside door, and sleep using a mosquito net. Another aspect of safety behavior remains a concern; participants did not prevent their children from playing near the garbage (78.8%), they left unprotected garbage near the outside door (75.5%), they did not often wash the trash can with soap or water or soakers with soil or sand dry (85.8%).

In Table 3, logistic regression model shows that variables such as sex, education level, marital status, household income, and distance of partici-

pants from permitted dumps make an independent statistical contribution to the model. The strongest predictors and incorrect practices of garbage disposal were education level, and sex with POR of 3.42 and 2.60, respectively. POR for income indicate a slight change in the possibility of inappropriate waste disposal. People living 50 meters from a temporary dump/landfill tend to dump there with POR of 0.65.

In Table 4, logistic regression model shows that only sex, education level, and household income contributed significantly to predictions. The likelihood of a female who knows the health effects associated with improper waste management is 0.56 times lower than the likelihood of men. In the same way, participants who are educated elementary school and middle school respectively, tend not to know the implications of waste in the cause of the disease. The POR shows that the participant's income IDR  $\geq 2,285,000$  is 3.80 times more likely to know the role of waste in the cause of the disease.

The results of logistic regression analysis to assess the effect of a set of factors on the likelihood of participants applying safety behaviors related to waste management are presented in Table 5. Given the model, age, gender, education level, and overall household income, statistically significant contributions to this model. The strongest predictor of safe behavior is between the ages of 18 and 35 who have an POR of 4.42. Participants with female sex, elementary school and middle school, and IDR  $< 2,285,000$  earnings did not tend to apply safe behaviors.

## DISCUSSION

This study develops a standardized and sustainable approach that identifies the broad spectrum of safety and knowledge-based variables and predicts and then directly examines the impact of socioeconomic and demographic factors related to waste and waste related knowledge. The results of this study provide concrete support for the hypothesis that households have important roles and responsibilities in littering. Predictors of inappropriate waste disposal practices were the level of education, sex, household income, and residence at a distance of more than 50 meters from a temporary dump/landfill. Similar findings have been

reported in previous studies.<sup>14,15</sup>

The authorities should be encouraged to promote environmental information and counseling to the community, because the extent to which people participate effectively, especially women, can only be improved through education and counseling. If garbage is collected by garbage collectors, the costs should be designed to be accessible to low-income communities.<sup>16</sup>

Another important goal of the study was to assess public knowledge about health risks from inappropriate waste management. In general, they have little knowledge of the implications of waste on environmental pollution.<sup>17</sup> It should also be noted that most participants were aware that improper waste management causes cholera, typhoid, and malaria. However, there is still a lack of understanding about some important diseases such as dysentery, diarrhea, respiratory infections, and injuries. The level of knowledge of participants less affected by household income, education level, and gender. This suggests that more effort is needed to awaken the public about disease prevention and health promotion with a particular focus on women.<sup>18</sup> For economically disadvantaged households who can not easily have access to mass media, a good outreach program should be provided for information dissemination.<sup>19</sup>

This study has shown that participants should implement basic safety measures regarding waste management such as washing hands properly after garbage disposal, disposing of garbage every day, putting garbage near an outside door, and sleeping inside mosquito nets. In this study, there were still participants who do not treat water from the unprotected surface, soil and pipe sources before use. In general, inappropriate security behavior was related to age, gender, education level, and household income. In response to this situation, the Banjarmasin government should seek more assistance from development partners to utilize technical assistance and advice to improve community-based health education delivery.

The main strengths of this study were as follows: taking into account confounding factors, and good survey reporting methods. Interestingly, this study can address the need for comprehensive information and tools to help policymakers and stakeholders adjust their current programs and

plan future programs. For educators/health workers, this study would be better promoted handling healthy household waste to a diverse population. And, for researchers, this study will contribute to increasing data comparability. Household waste management may not only be influenced by socioeconomic and sociodemographic factors, but there are still many other factors that have not been studied, so further study is expected to add these factors.

## CONCLUSION

This study provides evidence that people were still less concerned about the environment by littering. The practice of waste disposal by ignoring the likelihood of environmental consequences was affected by certain socioeconomic status (sex, educational level, and household income) and geographic risk factors (distance to dumps). This suggests that participants not only have a poor knowledge of the negative health impacts of improper handling of waste but also have unsafe behavior on safety practices. This study recommends that the promotion of environmental information and education/extension community should be done as an effort to prevent disease, comfort, environmental friendliness, and public safety. Governments can create an environment where innovation and knowledge promotion can flourish. One step the government can take is to build public toilets for people who do not have toilets. In addition, the government can make regulations in the form of sanctions for people who dispose of garbage or dirt on the river or open land. Investing in knowledge and innovation was the key to improving the country's productivity and improving people's lives.

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## REFERENCES

1. Adogu, P.O.U., Uwakwe, K.A., Egenti, N.B., Okwuoha, A.P., and Nkwocha, I.B. Assesment of Waste Management Practices among Residents of Owerri Municipal Imo State Nigeria. *Journal of Environmental Protection*. 2015:6:446-456. Doi: 10.4236/jep.2015.65043.
2. Zagozewski, R., Judd-Henrey, I. Nilson, S., and Bharadwaj, L. Perspective on Past and Present Waste Disposal Practices: A Community-Based Participatory Research Project in Three Saskatchewan First Nations Communities. *Environmental Health Insights*. 2011:5:9-20. Doi: 10.4137/EHI.S6974.
3. Rahmaddin, M.Y., Hidayat, T., Yanuwadi, B., and Suyadi. Knowledge, Attitude, and Action of Community towards Waste Management in River Bank of Martapura. *International Journal of Applied Psychology*. 2015:5(4):96-102. Doi: 10.5923/j.ijap.20150504.03.
4. Giusti, L. A Review of Waste Management Practices and Their Impact on Human Health. *Waste Management*. 2009:29:(8):2227-2239. Doi: 10.1016/j.wasman.2009.03.028.
5. Ahsan, A., Alamgir, M., Sergany, M.M., et al. Assesment of Municipal Solid Waste Management System in A Developing Country. *Chinese Journal of Engineering* 2014:561935: Doi: 10.1155/2014/561935.
6. Sankoh, F.P., Yan, X., and Tran, Q. Environmental and Health Impact of Solid Waste Disposal in Developing Cities: A Case Study of Granville Brook Dumpsite, Freetown, Sierra Leone. *Journal of Environmental Protection*. 2013:4:665-670. Doi: 10.4236/jep.2013.47076.
7. Mukarna, T., Ndejjo, R., Musoke, D., Musinguzi, G., Halage, A.A., Carpenter, D.O., and Ssempebwa, J.C. Practices, Concerns, and Willingness to Participate in Solid Waste Management in Two Urban Slums in Central Uganda. *Journal of Environmental and Public Health*. 2016. Article ID 6830163:7 Pages. Doi: 10.1155/2016/6830163.
8. Malik, N.K.A., Abdullah, S.H., and Manaf, L.A. Community Participation on Solid Waste Segregation through Recycling Programmes in Putrajaya. *Procedia Environmental Sciences*. 2015:30:10-14. Doi: 10.1016/j.proenv.2015.10.002.
9. Okechukwu, O.I., Okechukwu, A.A., Noye-Nortey, H., and Agyei, O. Health Perception of Indiscriminate Waste Disposal-A Ghanaian Case Study. *Journal of Medicine and Medical Sciences*. 2012:3:(3):146-154.

10. Banga, M. Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala. *Zambia Social Science Journal*. 2011:1:(2):27-39.
11. BPS Kota Banjarmasin. Proyeksi Penduduk Kota Banjarmasin Menurut Kelompok Umur Tahun 2010-2015 [Population Projection of Banjarmasin City by Age Group Year 2010-2015]. [Accessed date: 29<sup>th</sup> March 2017].
12. Wikipedia. Profil Kota Banjarmasin [Profile of Banjarmasin City]. [https://id.wikipedia.org/wiki/Kota\\_Banjarmasin](https://id.wikipedia.org/wiki/Kota_Banjarmasin). [Accessed date: 29<sup>th</sup> March 2017].
13. Aroj, B., Muhammad, A., Ushahid, A., and Qasim, M. Epidemiology Impact of Solid Waste and Assessment of Awareness Level Among Rural Areas of Pakistan. *American-Eurasian Journal of Agricultural & Environmental Sciences*. 2004:14:(9):831–837.
14. Addo, H.O., Dun-Dery, E.J., Afoakwa, E., Elizabeth, A., Ellen, A., and Rebecca, M. Correlates of Domestic Waste Management and Related Health Outcomes in Sunyani, Ghana: A Protocol towards Enhancing Policy. *BMC Public Health*. 2017:17:615. Doi: 10.1186/s12889-017-4537-8.
15. Awunyo-Vitor, D., Ishak, S., and Jasaw, G.S. Urban Households' Willingness to Pay for Improved Solid Waste Disposal Services in Kumasi Metropolis, Ghana. *Urban Studies Research*. 2013:Article ID 659425:8 Pages. Doi: 10.1155/2013/659425.
16. Sessa, A., Giuseppe, G.D., Marinelli, P., and Angelillo, I.F. Public Concerns and Behaviours towards Solid Waste Management in Italy. *European Journal of Public Health*. 2009:20:(6):631-633. Doi: 10.1093/eurpub/ckp204.
17. Desa, A., Kadir, N.B.A., Yusoooff, F. A Study on The Knowledge, Attitudes, Awareness Status An Behavior Concerning Solid Waste Management. *Procedia-Social and Behavioral Sciences*. 2011:18:643-648. Doi: 10.1016/j.sbspro.2011.05.095.
18. Addo, L.B., Adei, D., and Acheampong, E.O. Solid Waste Management And Its Health Implications on The Dwellers of Kumasi Metropolis, Ghana. *Current Research Journal of Social Science*. 2015:7:(3):81-93.
19. Zhang, D., Huang, G., Yin, X., and Gong, Q. Residents' Waste Separation Behaviors at The Source: Using SEM with The Theory of Planned Behavior in Guangzhou, China. *International Journal of Research and Public Health*. 2015:12:9475-9491. Doi: 10.3390/ijerph120809475.