

Social- Cultural Factors Associated with Household Solid Waste Management in a Kenyan Informal Settlement

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Abstract

Background: The way solid waste is handled, sorted, stored and disposed of has an overall health and environmental impact. This paper examines whether knowledge and attitude were related to household solid waste management in an informal settlement.

Methodology: We used a cross-sectional correlational, design. Quantitative data was collected using a structured questionnaire through face to face interviews. Cluster sampling was used to identify households to be included in the study. Knowledge of proper waste management was measured through a true or false or don't know statement, while attitude was measured using a 5 point Likert scale of strongly agree, neutral and disagree and strongly disagree. The study was guided by the Health Belief model. Pearson Chi-square statistics were used to test for associations between the independent variables [knowledge and attitude] and the dependent variable [solid waste management]. Binary logistic regression was used to show which of the categorical variables was important in explaining the solid waste management practices. A significance p-value of less than .05 was used. The odds ratio (OR) > 1 was used to measure of effect size. A simple linear regression was calculated to predict household solid waste management as the dependent variable.

Results: The study sample comprised of 302 household heads with a mean age of 38.4 ± 13.6 years. Half (53.3%) of the sample had primary education, 31.1 percent of the households scattered their waste, while 22 percent used a communal bin. Only 9 percent of the households composted the waste. One third (32.6%) were classified having good solid waste management practices; 54.8 percent had sound knowledge; while 58.8 percent had a positive attitude. No significant relationship was found between household waste management practices and social demographic characteristics. However, there was a positive correlation between attitude ($r=.127$) and knowledge ($r=.274$) and household waste management practices. These two variables significantly predicted household waste management practices.

Conclusion: There need for innovative interventions that aim to improve household solid waste management practices with a focus on changing people's attitude using action research approach.

I. Background

Solid waste management (SWM) consists of waste generation, source separation, storage, collection, treatment, recycling, transfer and transport, processing and final disposal of solid waste materials [1]. The major types of solid waste management are, Municipal Solid Waste (MSW), hazardous wastes, industrial wastes, agricultural wastes, and bio-medical wastes, and household solid waste. The consequences of poor solid waste management are the emergence of communicable and non-communicable diseases which add to the national burden of illness. The other public health problems include odor and aesthetics.

Studies carried out in Africa show poor solid waste sorting, separation and disposal practices at the household level [2,3,4,5]. Waste is thrown into rivers/streams/drains, open plots/space, roads, drains, gullies, incinerated/or burnt around houses. Few households compost or sort waste into decomposable and non-decomposable. Available evidence from recent African studies indicates a tendency for Household Solid Waste Management (HSWM) practices to differ by social demographic background (sex, education, and age). Women or women headed households have been found to be better managers of waste than men [2,3,6,7]. Some studies found a positive and significant association between (HSWM) practices and age. There is also evidence that older people were better managers of (HSWM) than younger ones [6,8]. On the other hand, studies have found contrary results showing that as household head age increases, the effectiveness of household solid waste management would decrease. [3,6].

Awareness and knowledge were shown to be related to household solid waste management. The level of education attained by the head of household has been shown to have a significant effect on the effectiveness of solid waste management at the household level, [6,8]. Respondents with a higher level of education have been shown to possess correct knowledge of the impact of improper waste management on health than those with a lower level of education. On the other hand, the education level did not influence household solid waste disposal. Those respondents with lower levels of education were more likely to separate solid waste than those with higher education levels [2,9]. Household's awareness of solid waste was another important variable that influenced the households to manage their solid wastes effectively. The effectiveness of solid waste management at household level was shown to increase with the increase in the level of awareness [3,10]. However, other studies have shown that high knowledge is not translated into practice [4,6,8]. Qualitative studies done on attitude towards management of solid wastes indicate that the perception and attitude of the people towards waste can affect the way they managed it [3,6].

Most studies on knowledge and attitude conducted at the household level have been mainly descriptive. Our study therefore aimed at adding to the current knowledge through an analytical study design which aimed at establishing the relationship between knowledge, attitude and household solid waste management using the Health Belief Model (HBM) to guide the study [11].

II. Methodology

The Design and Setting of the Study

We used a cross-sectional correlational design to examine the relationships between knowledge, attitudes as independent variables, social demographic variables as intervening variables and household solid waste management as the dependent variable. Quantitative data was collected using a structured questionnaire through face to face interviews. The study was carried out in an informal settlement in Majengo sub location, Nyeri County, Kenya. The sub location has a population of 25,018 people and 8,618 households [12]. It has two government health facilities. Most of the community members are engaged in casual labor and small scale businesses. In this area, a person generates approximately 0.77kgs of waste daily while the community generates about 19,264kgs of solid wastes daily. The prevalence of diseases related to improper solid waste management in the study area are upper respiratory tract infection (URTI), 50%; diarrheal diseases, 3.5%; malaria, 0.14%; typhoid, 0.082%, and dysentery, 0.008% [12].

The Study Participants

The study respondents were male and female household heads. Fisher et al. (1998) Formulae $n = z^2 \frac{pq}{d^2}$ was used to calculate the sample size. n = sample size. z = standard derivation which corresponds to the confidence interval (1.96), p = proportion of study population with proper household management practices 26% [13], and d = degree of accuracy (0.05). Since the target population was less than 10,000 households, a correction formula was applied. $nf = \frac{n}{1 + \frac{n}{N}}$. To take care of missing respondents and non-responses, an addition of 5% of the households were added in the sample giving a sample size of 302 households. Cluster sampling which is a multistage process was used to identify households. Majengo sub location which was purposively selected has 33 villages which formed the primary sampling unit. Probability proportion to size was used to select the households within these villages. The first household to be interviewed in each chosen village was selected at random.

Data Collection Methods

A quantitative data collection instrument using close ended questions which covered all the study variables was used to collect the necessary data. The interviews were face to face. Before data collection, research assistants were trained to ensure standardization of procedures and integrity of the data. The training included reviewing the tool and interviewing skills to ensure accuracy and reliability. Specific practices included: review of procedures for recruitment of the sample; overview of the data collection tool; interviewing techniques; seeking consent, maintaining confidentiality, and survey administration. The study aims, the interview process, and the approximate length of time it would take to complete the interview were explained to the participants who were also given an opportunity to ask questions and give their consent before the interview.

Measurement of variables

Knowledge of proper waste management was measured through a true or false or don't know statements for example; *Household solid waste should be separated at source (household)/proper solid waste management helps in preventing vector borne disease, etc.* A higher score was given for true and lower score for false. Attitude was measured using a 5 point Likert scale (1) strongly disagree (2) Disagree (3) Unsure (4) Agree (5) Strongly agree. Statements used included, *'Some people have no time to separate solid waste even if containers are available/Some people would dispose of waste to designated places, etc.*

The research proposal was submitted to the Great Lakes University of Kisumu's, Institution Review Board (IRB) for ethical review. Permission to conduct the research was requested from the Ministry of Health, Nyeri County. A voluntary and informed consent were sought before the interview. The respondents had the option to refuse to answer sensitive questions and were free to withdraw from the study at any time. The respondents were also assured of confidentiality and anonymity. No information collected was given to third parties without informing the participants.

Data Management and Analysis

Data was cleaned on a daily basis to make sure all the questionnaires were correctly filled and coded. Missing information was given a code. The records were kept under lock and key. Statistical Package for the Social Science (SPSS) version 19 was used to enter, clean and analyse the data. The analysis was based on the type and the distribution of the data. Likert scores derived attitude and knowledge scores were used as continuous variables. Composite scores were calculated for the HSWM practices, knowledge and attitude. Results were displayed using tables.

Pearson Chi-square was used to measure associations between categorical data. Fisher test was used when a category in the cells had less than five counts. P values less than 0.05 was considered significant. The odds ratio (OR) > 1 was used to measure of effect size. Binary logistic regression was used to show which of the categorical variables were important in explaining the HSWM practices. The Wald statistic which has a chi-square distribution provided an index of the significance of each predictor in the equation. Descriptive statistics such as mean, mode, and median were used to describe continuous data such as age and Likert scales. Correlation coefficient was used for continuous variables to show the strength and direction of the relationships between the dependent and independent variables. ANOVA was used to show whether the regression model explained a statistically significant proportion of the variance. A simple linear regression was calculated to predict HSWM practices [dependent variable] based on the independent variables knowledge and attitude. Unstandardized or standardized slope (beta) are presented along with the t-test, and the corresponding significance level, the percentage of variance explained by the predictor variables along with the appropriate F test are included in the simple regression analysis.

III. Results

Social Demographic Characteristics of the Study Respondents

The study sample comprised of 302 household heads. Two-thirds (65.2%) of the sample were women. Only 5.3 percent of the household head had any formal education, and 53.3% had a primary level education. The mean age of the respondents was 38.4 ± 13.6 years ranging from 18 to 90 years. The median number of family size was 3, and the mode was 4. These results are shown in Table 1.

Household Solid Waste Management Practices

Table 2. shows the distribution of the household Waste Management Practices of household heads. Half (55%) of the households reported separating waste. Among those who did not separate, 2/3rd (64.8%) did not think it was necessary while 28.5 percent did not have time. Only 18.2 percent of the households stored the refuse in a closed container; 60 percent of the household heads threw away their rubbish immediately while 16 percent stored it in open containers. Close to 1/3rd of the households kept their garbage for more than two days. One third (31.1%) of the households scattered their waste, while 22 percent used a communal bin. Only nine percent of the households composted the waste. When the composite score for management practices was categorized into two using the 50th percentile, only 1/3rd (32.6%) were classified having good household solid waste management practices.

Factors Associated with Household Solid Waste Management

Composite scores were calculated from the management practices. These indicated a higher score for good practices and a lower score for bad practices; good knowledge and poor knowledge, positive attitude and negative attitude based on the 50th percentile of the frequency distributions. Only 1/3rd (32.6%) of the respondents were classified as having good household waste practices; 54.8% had good knowledge; while 58.8% had a positive attitude. Results of the Chi-square statistics testing for associations between the various independent categorical data and household waste management as categorical variable are given in Table 3. No significant association was found between household solid waste management and social demographic factors of sex, family size and education. However, there were significant associations between household waste management with attitude and knowledge. The results show that the odds of a person with a positive attitude practicing proper household waste management was twice that of a person with negative attitude. The odds of a person who was knowledgeable of proper household waste management practicing proper household waste management was also twice that of a person with less knowledge. Binary logistic regression used to show

which of the categorical variables were important in explaining the waste disposal practices are given in Table 4. Statistical tests of each regression coefficients (i.e., β s) were tested using the Wald chi-square statistic. The results show that knowledge and attitude explained the practices ($p < .05$). The coefficients (i.e., β s) were however less than 1.

A Pearson product-moment correlation coefficient for continuous data. The result indicated a positive correlation of attitude ($r = .127$) and knowledge ($r = .274$) with household solid waste management practices. A simple linear regression was calculated to predict household waste management practices. One-way analysis of variance (ANOVA) was conducted to compare the effect of knowledge and attitude on household waste management. A significant interaction between these independent variables was observed ($F(df1\ 2, df2, 296) = 14.56, p = .001$). This interaction accounted for only 8% of the variance. A significant regression equation was found on the two showing that they significantly predicted household waste management as shown in Table 5.

IV. Discussion

Findings from this study indicated poor household solid waste management practices, poor knowledge of proper solid waste disposal and negative attitude towards proper waste management. Poor solid waste management practices were not related to social demographic characteristics such as education, age, sex, or family size but were related to knowledge and attitude. Attitude and knowledge predicted household solid waste management.

Poor solid waste sorting, separation, and disposal practices found in our study have been reported by other African researchers in Uganda, Ethiopia and Nigeria [2,3,5,6]. Contrary to other studies [2,3,6,7] that showed females tended to be better solid waste managers than male counterparts, we did not find any significant association between solid waste management practices and gender. Some studies have found that older people were better managers of waste than younger ones [6,8]. Others have shown that as household head age increases, the effectiveness of household solid waste management decreases [3,6]. We however, found no significant association between age and practice. We also found no association between education of the household head and solid waste management, contrary to other findings that indicated household heads in the lowest education category (no education and primary level education) were more likely to separate solid waste than those with tertiary education [2,7,8,9,10]. Furthermore, higher education does not mean higher environmental education as environmental education is mainly gained through informal training and education. Our study showed a positive correlation between knowledge and household solid waste management. This contradicts studies which found that awareness of proper solid waste management did not translate into practice [4,6,8]. We also found that attitude was positively associated with practices which was in agreement with qualitative studies which indicated that respondents with a positive attitude are likely to manage waste more effectively [3,6].

Strength of this study

One of the strengths of our study was the use of a model –Health Belief Model which is based on suggestions that peoples' attitude can explain engagement or lack of engagement in health promoting behavior. In addition, since most studies on knowledge and attitude conducted at the household level have been mainly descriptive, our study adds to the current knowledge through the analytical study design employed which demonstrated correlations between knowledge, attitude and household solid waste management.

Limitation of the study

The main limitation of our study is that it was quantitative and did not include qualitative aspects which would have explained the various household solid waste management practices.

V. Conclusion

Knowledge and attitude were shown to be predictors of household waste management practices. Thus there is a need for innovative interventions that aim to improve household solid waste management practices with a focus on changing attitude, using action research approach.

List of Acronyms/ Abbreviation

AIDs	Acquired Immune Deficiency Syndrome
ANOVA	Analysis of variance
CHIRO	County Health Information and Record Officer
EE	Environmental Education
GLUK	Great Lakes University of Kisumu
HBM	Health Belief Model
IRB	Institution Review Board
MOH	Ministry of health

OR	Odds ratio
SPSS	Statistical Package for the Social Science
URTI	Upper Respiratory tract infection

Declarations

Ethics approval and consent to participate

Certificate of Approval of Research Protocol was given by the Great Lakes University of Kisumu, Research Ethics Committee (GREC) Ref: No. GREC/185/54/2014. The consent statement to participate in the study requested from the study participants after introducing the purpose of the study, the study procedure, the benefits and risks, issues of confidentiality, voluntary participation, and withdrawal from the study.

Consent for publication

Not applicable.

Availability of data and materials

The raw data used in this study can be obtained from The Great Lakes University of Kisumu library or the corresponding author.

Competing interests

The authors declare that they have no competing interests. They do not hold any stocks or shares in any organization that may in any way gain or lose financially from the publication of this manuscript, either now or in the future.

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Authors' contributions

LK conceptualized the study and was responsible for data acquisition, analysis; AMP participated in study design, data analysis, interpretation of data and facilitated drafting the manuscript. IOO provided technical input and participated in study design and wrote up. LK, AMP, and IOO collaboratively wrote the paper. All authors read and approved the final manuscript.

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References

- [1]. Rouse, J: Planning For Sustainable Municipal Solid Waste Management: Practical Action; the Schumacher Centre for Technology and Development Bourton-on-Dunsmore Rugby, Warwickshire, CV23 9QZ United Kingdom 2008. <http://www.practicalaction.org>.
- [2]. Banga M: Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala, Zambia Social Science Journal 2011, Volume 2 Number 1
- [3]. Haile A: Determinants of effective household solid waste management practices; a case of ambo town- West Showa Zone, Ethiopia; Masters of Arts Degree In Development Studies (Business and Development) Mekelle University College of business and economics, Department of Management, 2011.
- [4]. Olojide A.K: Household environmental sanitation practices in Katsina metropolis in Nigeria International letters of Natural Sciences 2014). www.iins.pc
- [5]. Ohakal AR., Ozor PE. and Ohaka CC: Household Waste Disposal Practices in Owerri Municipal Council Of Imo State. Nigerian Journal of Agriculture, Food and Environment 2013, 9(2):32-36
- [6]. V Agwu MO: Issues and Challenges of Solid Waste Management Practices in Port-Harcourt City of Nigeria: a Behavioral Perspective. American Journal of Social and Management Sciences 2012.
- [7]. Bizatu M, Negga B: Community-based assessment on household management of waste and hygiene practices in Kersa Woreda, Ethiopia. Ethiop. J. Health Dev. 2010; 24(2):103-109
- [8]. Jatau AA: Knowledge, Attitudes and Practices Associated with Waste Management in Jos South Metropolis, Plateau State Nigeria. Mediterranean Journal of Social Sciences 2013, Vol 4 No 119
- [9]. Kamara AJ: Household participation in domestic waste disposal and recycling the Tshwane Metropolitan area: an environmental education perspective. A master's thesis presented to the department of environmental education, at the University of South Africa 2006.
- [10]. Solomon A: *Solid Waste Management: A Case Study of Household Solid Waste Management in Arada Sub-City, Addis Ababa*. A Master's Thesis presented to the school of graduate studies of Addis Ababa University. Addis Ababa, Ethiopia 2006
- [11]. Glanz K, Rimer BK, Viswanath K, eds. Health Behavior and Health Education. Theory research and practice. 4th edition 2008.
- [12]. Republic of Kenya: Kenya Population and Housing Census 2009.
- [13]. Rotich KH, Zhao YDJ. Municipal solid waste management challenges in developing countries – Kenyan case study, Waste Management 2006, 26: 92–100
- [14]. Mukui SJ: Factors Influencing Household Solid Waste Management In Urban Nyeri Municipality, Ethiopian Journal Of Environmental Studies And MaNAGEMENT: 2013 (6), NO 3

Table 1. Distribution Of Social Demographic Variables Of The Household Members In Nyeri County, Kenya, 2015 N=302

Characteristics	Variables	Percentage
Sex	Male	34.8
	Female	65.2
Education	None	5.3
	Basic	53.3
	High School	30.1
Age	Tertiary	11.3
	18 to 29	30.8
	30 to 40	32.4
Family size	40 to 49	36.8
	1 -3	51.7
	4 -	27.1
	>4	21.2

Table 2. Distribution of Household Waste Management Practices in Nyeri County, Kenya, 2015 N=302

Characteristics	Variables	Percentage
Waste disposal	Scatter	31.1
	Burn	38.4
	Compost	8.6
Storage of garbage	Dump in a communal dustbin	21.9
	Open container	16.2
	Throw away immediately	59.6
Frequency of disposal	Closed container	18.2
	Others	6.0
	after two days	32.8
Reasons for not separating	After one day	36.8
	Daily	30.5
	No container	51.7
	Collectors don't come	4.2
	No time to do it	2.4
	Not necessary	28.5
		64.8

Table 3 Associations Between solid waste Practices and social Cultural Factors

	Pearson χ square	Df	P value	Odds ratio	Confidence interval
Sex	3.44	1	.064	1.641	.97, 2.78
Education	4.81	3	.186		
Family size	8.64	9	.47		
Attitude	6.899	1	.009	1.973	1.184
Knowledge	11.024	1	.001	2.340	1.409,3.886
Age	2.393	2	.302		

Table 4. Binary Logistic Regression Analysis of Attitude and knowledge and household waste management

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Attitude	-.638	.262	9.853	1	.002	.440
	Knowledge	-.821	.262	5.779	1	.016	.529
	Constant	-.131	.185	.500	1	.479	.878

a. Variable(s) entered on step 1: attitude, knowledge

Table 5. Simple Linear Regression Analysis of Factors predicting clean home delivery

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.267	.516		10.202	.000
Attitude score	.065	.031	.118	2.124	.000
Knowledge score	.128	.026	.269	4.838	.034