Hindawi
Advances in Public Health
Volume 2022, Article ID 6134161, 8 pages
https://doi.org/10.1155/2022/6134161

Research Article

Solid Waste Management Practice and Its Associated Factors among Households in Gessa Town, Dawuro Zone, Southwest Ethiopia

Matiwos Maldaye,[1] Desta Haftu,[2] Sewunet Sako,[2] Zenebe Jebero ,[2] Fikre Moga ,[2] and Ayichew Alemu[3]

[1]*Dawro Zone, Tarcha, Southwest Ethiopia, Ethiopia*
[2]*Arba Minch University, Arba Minch, Ethiopia*
[3]*Haramaya University, Dire Dawa, Ethiopia*

Correspondence should be addressed to Zenebe Jebero; zenebe.jebero@amu.edu.et

Received 6 April 2022; Revised 22 July 2022; Accepted 24 August 2022; Published 19 September 2022

Academic Editor: Swati Sakhuja

Introduction. Human activities create waste, and the improper ways that waste is handled, stored, collected, and disposed of can pose risks to public health. The highest proportion of households practice their solid waste improperly in many developing countries, and the household's status of solid waste management practices and its association with sociodemographic, knowledge, and institutional-related factors have never been clearly understood in Ethiopia, particularly in the study area. Therefore, this study aimed to assess the status of solid waste management practice and its associated factors among households in Gessa town, Dawro Zone, Southwest Ethiopia. *Methods*. A community-based cross-sectional study was conducted among 686 study participants from April 30 to June 15, 2021. Study participants were selected by using a computer-generated simple random sampling technique. The interviewer administered a semistructured questionnaire that comprised sociodemographic, household-related, and institutional-related factors were used for data collection. All collected data were entered into epi data version 4.6 and then exported to STATA version 14.0 for further analysis. Each independent variable with a p value <0.25 in the bivariable logistic regression was included in the multivariable logistic regression model. In multivariable logistic regression, variables having a p value <0.05 were considered statistically significant. *Result*. In this study, improper solid waste management practice was 86.2%. Unpracticed solid waste reduction at source (AOR = 5, 95% CI 2.9–8.9), householders' poor knowledge about solid waste management (AOR = 5.2, 95% CI 2.6–10.3), and distance to the municipality disposal site greater than 30 minutes to one hour from householders' (AOR = 2.6, 95% CI 1.3–5.0) were found to be statistically significant associated factors for improper solid waste management practices of the households. *Conclusions and Recommendations*. The magnitude of improper solid waste management practices was high. Unpracticed solid waste reduction at source, householders' poor knowledge about solid waste management, and distance from home to the waste disposal site were significantly associated factors. Therefore, policymakers, local government, and Gessa town health work units have to teach the community about solid waste management and solid waste generation minimization at the source and prepare standardized near-distance waste disposal sites to tackle contributing factors of improper solid waste management practice.

1. Introduction

The Global Waste Management Outlook (GWMO) describes the word waste as unwanted or discarded materials rejected as useless, unneeded, or excess to requirements, and it can be viewed as the combination of the wrong substance, of the wrong quality, and in the wrong place at the wrong time [1]. Solid waste management practice is a process of integrated management of waste minimization at the generation point and safe disposal in a proper manner [2]. Types

of solid waste are categorized as different items of waste such as paper, packaging materials, plastic, textiles, glass, food-related, metals, and kitchen-related waste [3].

In the developing world, poor solid waste management practice from generation point to final acceptable disposal are observed [4]. This poor practice of solid waste management causes severe damage to human health and becomes a source of pollution, which is the largest environmental cause of disease and one of the contributors to premature death globally [5].

According to current reports, solid waste management practices among households have a large practical gap, particularly in developing countries. The low level of solid waste management practice in developing countries is frequently observed due to a lack of infrastructure, shortage of manpower, and technological advancements [6, 7].

Ethiopia is one of the developing African countries that stands second in population on the continent. Due to its highly increasing population size and urbanization, solid waste management practices continue to be one of the major public challenges that many urban parts of the country, including the capital city (Addis Ababa), face. In the country, unregistered migration of the population from rural to urban areas, unplanned waste management practices related to open dumping, using private pits for disposal, not preparing waste storage materials, and no waste minimization at generation points have contributed to improper solid waste management practices [8].

Gessa town is one of the old urban centers in Ethiopia and also one of the three municipality towns in the Dawro zone. The municipal disposal sites are not assigned in different parts of the town, as a result, solid waste produced by every household was thrown at roadsides and residential sites. Even though solid waste management practices are considered to be one of the major public problems in the town, there was no study conducted in the town as well as in the zone. Therefore, this study aimed to assess solid waste management practice and its associated factors among households in Gessa town, Southwest Ethiopia, in 2021. Directly/indirectly knowing the status of solid waste management practices at the household level helps responsible bodies to set plans for problem-solving approaches, and it may alarm householders to keep their homes neat and safe for their lives.

2. Method and Materials

2.1. Study Area and Study Period. Gessa town is found in Dawro zone, Southwest Ethiopia, and is located 478 KM away from the capital city of Ethiopia, Addis Ababa, and 248 KM away from the regional capital city, Hawassa. According to the town municipality report, the town has one Kebele, which consists of ten villages. It has 28 government sectors, one primary hospital, two health posts, three private clinics, one municipality waste disposal site, total households of 4502, and a total population of 22060 [9]. Of these, 11248 were males, while 10812 were females. The economic activities in the town were mixed agriculture, such as production and animal rearing, and the major part was dominated by commercial activity (trading), which accounts for about 70% [9]. The study was conducted from April 30, 2021, to June 15, 2021 GC.

2.2. Study Design. A community-based cross-sectional study design was applied.

2.3. Study Population. The source population were all households in the Gessa town, and all households in selected villages in the Gessa town were the study population.

2.4. Inclusion and Exclusion Criteria. Householders who lived at least six months and above in the study area were included, and those who were ill at the time of data collection and children aged less than 18 years were excluded.

2.5. Sample Size Determination. The sample size to determine the magnitude of solid waste management practices was determined by using the single population proportion formula based on the 82.8% proportion from the previous study [10], with a confidence level of 95% CI and a margin error of 5%. The minimum sample size calculated was 219 and with a 10% increase to allow nonresponse rate, a total of 241 households.

$$n = \frac{Z\alpha}{2^2 p(1-p)/d^2} = 1.96 \times 0.36 \times \frac{0.64}{0.05^2} = 219 + 10\%\ \text{non} - \text{response rate} = 241\ \text{HH}. \quad (1)$$

For the second specific objective, the sample size was calculated to identify contributing factors using EPI INFO version 7.1. By taking lack of access to the door-to-door collection service as an independent explanatory variable with an assumption of 95% CI, power of 80%, the ratio of exposed to unexposed was 1, the proportion of outcomes among unexposed was 44.4%, the outcome among exposed was 55.6%, and 10% was added for nonresponse rate. Finally, the calculated sample size was 686 [10].

2.6. Sampling Procedures. From the total of ten villages in Gessa town, five were selected by the lottery method. The number of households in the villages was coded by Parker. Samples were proportionally allocated to each randomly selected village based on the number of households. A simple random sampling technique was applied to select study households from each selected village.

2.7. Operational Definition

2.7.1. Proper Status of Solid Waste Management Practice. This refers to the household storing their waste in a covered plastic bag or sack with a cover and handing it over to the door-to-door collector for less than a month at least once and using a municipality disposal site for disposing of their solid waste [11].

2.7.2. Households' Availability of Solid Waste Storage Materials and Storage. This refers to households who have their solid waste storage materials exist physically and are used to store waste [12].

2.7.3. Knowledge towards Solid Waste Management. It refers to householders who answered six structured interviews of knowledge questions; those who answered 4 and above were ranked as good knowledge, and less than 4 questions were ranked as poor knowledge [13].

2.7.4. Improper Solid Waste Management Practice. It refers to the household not storing their waste in covered plastic bags and/or not having a hand over door-to-door collection for less than a month at least once a month and/or not using a municipality disposal site for disposing of their solid waste.

2.7.5. No Access to a Door-to-Door Collection of Solid Waste. There is no access to municipality collection service or door-to-door private collectors at least once in less a month's duration or greater than a month's duration [14].

2.7.6. Distance of Municipality Disposal Site from Home. It refers to a solid waste disposal site present less than 30 minutes' walking distance from the nearest disposal site, and 30 minutes to 1 hour is considered far away from home [15].

2.7.7. Reduction of Waste from the Source. By using stove and electricity in replacement of excess utilization of crop residue, wood, and charcoal for cooking purposes [4], waste can be reduced.

2.8. Data Collection Methods. Adapted and modified standardized structured questionnaires, aided with observation [12, 16], were used for data collection. Before the actual data collection, five nursing students (data collectors) and two BSc. students in environmental and occupational health (supervisors) were trained for three consecutive days on the objectives of the study, the contents of the tools, and the way to collect data. To gain exact information, the household head, father, mother, or representative of the household was interviewed. Missed householders were revisited by data collectors before the submission of collected data.

2.9. Data Quality Management. The questionnaire was prepared first in English and then translated to Amharic and then to the local Dawrogna language by different expert individuals to keep consistency of the information.

Then, a pretest was conducted on 5% of the sample population in a Chicho kebele, which was not a part of the data collection site for this study. In addition, corrections were made to clear out difficult things based on the feedback from the pretest. Finally, the data were checked and cleaned for completeness and consistency. Supervisors closely followed the data collection process to ensure the process of data collection and completeness of data.

2.10. Data Processing and Analyzing. The data were entered into Epi data version 4.6 and then exported into STATA version 14.0 for further analysis. Data were initially computed for summary descriptive statistics such as percentage, mean, and standard deviation, which are applied to general characteristics of the status of solid waste management practices. Cross tabulations were made for the dependent and independent variables. Binary logistic regression was applied to find the relationship between outcome variables and independent variables. Independent variables with a p value less than 0.25 in bivariable logistic regression were candidates for multivariable logistic regression. Finally, an adjusted odds ratio (AOR) with a 95% confidence level and a p value less than 0.05 was considered for the measurement of the association between dependent and independent variables. The model fitness test was checked by using the Hosmer–Lemeshow goodness of fit test, which showed a test value of 0.88 and the model was fit. The multicollinearity issue and interaction terms were checked by using the variance inflation factor (VIF), which showed no interaction between independent associated variables with a total mean value of 1.28 and a value less than 10 for each independent variable. The results were presented in narrations, tables, and graphs. Summary statistics such as frequency, proportions, and mean with standard deviation were used to present the result.

3. Results

3.1. Sociodemographic Characteristics of Study Participants. A total of 686 householders were interviewed, with a response rate of 100%. Of the total respondents, the majority 439 (64%) were females, and 250 (36.4%) belonged to the age group of 38–47 years. The mean age of householders was 40 years, with a standard deviation of ±0.4 years. More than three-fourths (76.4%) of the respondents were married. A majority (36.3%) of participants had an educational status of a diploma or above, and approximately 31% of householders were government workers. About 63% of respondents lived in their own homes, and more than half (51.2%) of the participants were followers of the Protestant religion. Regarding the income status, about 43.9% of participants earn more than 2000 Ethiopian birr. Concerning family size, approximately 42% of participants had a family size of 5–6 members. A majority (53.1%) of participants dwelled in the town for more than 10 years (Table 1).

3.2. Household-Related Factors of Solid Waste Management Practice. Of the total 686 study householders, 394 (57.4%) generated food-related solid waste and 167 (24.3%) generated plastic-related solid waste, respectively (Figure 1).

Of the total 686 study participants, about 371 (54.1%) have no available storage equipment and do not store solid waste. Among the rest, 45.9% of participants stored their

Table 1: Sociodemographic characteristics of householder's status of solid waste management practices in Gessa town, Dawro zone, Southwest Ethiopia, in 2021.

Variable	Category	Frequency	Percent
Sex	Male	247	36.0
	Female	439	64
Age	18–27 years old	89	13
	28–37 years old	131	19.1
	38–47 years old	250	36.4
	>47 years old	216	31.5
Marital status	Single	86	12.5
	Married	524	76.4
	Divorced	52	7.6
	Widowed	24	3.5
Educational status	Cannot read and write	103	15.0
	Read and write	113	16.5
	Primary level	114	16.6
	Secondary level	107	15.6
	Diploma & above	249	36.3
Occupation	Unemployed	172	25.1
	Private work	182	26.5
	Government employee	212	30.9
	Merchant	120	17.5
Religion	Orthodox	177	25.8
	Protestant	351	51.2
	Catholic	120	17.5
	Muslim	38	5.5
House ownership status	Private	434	63.3
	Rental house	209	30.5
	Kebele house	43	6.3
Family size	1-2	85	12.4
	3-4	254	37.0
	5-6	285	41.6
	>6	62	9.0
Income status	<1000 birr	121	17.6
	1000–2000	264	38.5
	Greater than 2000	301	43.9
Year of stay in Gessa town	6 month–5 years	99	14.4
	5–10 years	223	32.5
	Greater than 10 years	364	53.1

solid waste on cover equipment, and about 227 (72.1%) used sacks for storing their solid waste (Figure 2).

Among a total of 686 study participants, the majority (72.3%) of householders did not reduce solid waste at the source. Among the householders who were practicing source reduction, 35.3% of the reason for practicing their source reduction was solid waste for reuse (Table 2).

Of the total 686 study participants, 368 (53.6%) were practicing solid waste disposal. Among those who were practicing disposal, the majority (49.5%) were using municipality disposal sites (Figure 3).

Of the 686 study participants, only 260 (37.9%) have good knowledge of solid waste management practices (Table 3).

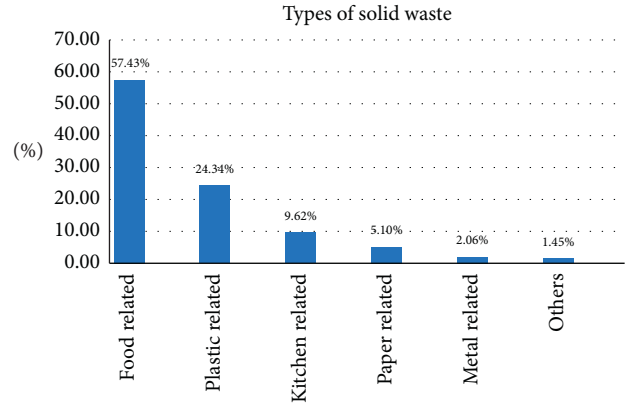

Figure 1: Types of solid waste generated by householders in Gessa town, Dawro zone, Southwest Ethiopia, in 2021.

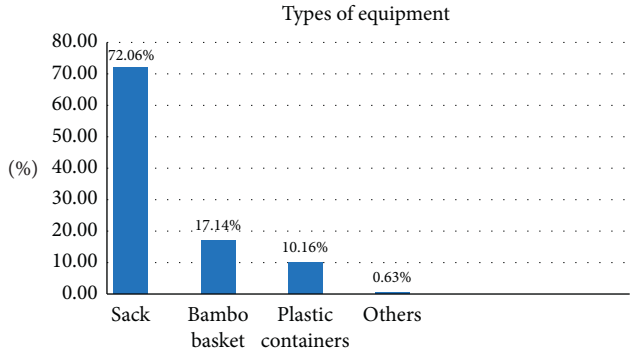

Figure 2: Types of equipment for storing solid waste by householders in Gessa town, Dawro zone, Southwest Ethiopia, in 2021.

3.3. Institutional-Related Factors. Out of 686 study participants, more than half (54.8%) of the participants had no door-to-door solid waste collection access from any concerning body. Among those participants who had access to door-to-door solid waste collection service, approximately 65% of participants had no timely collection service. Of the total 686 participants, 56.4% of the study participants' houses were 30–60 minutes away from the municipality's solid waste disposal site, and more than half (52.6%) of the solid waste collection services were held by private waste collectors (Table 4).

3.4. Status of Solid Waste Management Practice. In this study, the overall improper solid waste management practice in the study area was 86.2% (95% CI: 83.3–88.5).

3.5. Associated Factors with the Status of Solid Waste Management Practice. In bivariable analysis, the following variables were: candidates for multivariable binary logistic regression, sex, educational status, house ownership, source reduction, knowledge status of the householder, and distance of the municipality disposal site from home. In multivariable binary logistic regression, three variables were significantly associated with improper solid waste management practice. Participant householders who did not

Table 2: Householder's practice of source reduction in Gessa town, Dawro zone, Southwest Ethiopia, in 2021.

Variable	Category	Frequency	Percent (%)
Practicing source reduction	Yes	190	27.7
	No	496	72.3
Reasons for practicing source reduction ($N = 190$)	Reuse	67	35.3
	To sell or exchange	61	32.1
	To help others	62	32.6
Reasons for not practicing source reduction ($N = 496$)	Absence of money	132	26.6
	Not understanding its advantage	198	39.9
	Types of waste generated	110	22.2
	It is not my responsibility	56	11.3

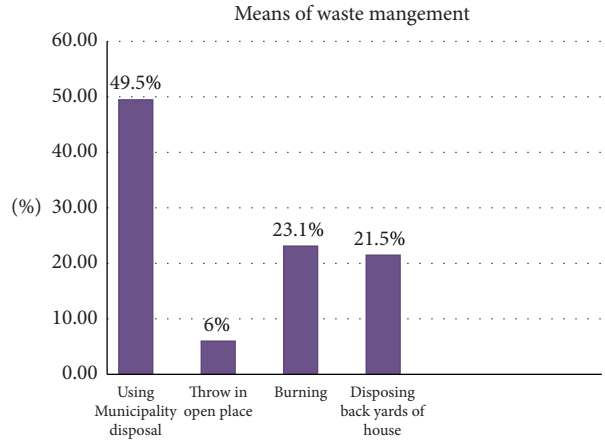

Figure 3: Householder's means of disposing of solid waste management practices in Gessa town, Dawro zone, Southwest Ethiopia, in 2021.

Table 3: The level of householders' knowledge towards solid waste management practice in Gessa town, Dawro zone, southwest Ethiopia, in 2021.

Variables	Category	Frequency	Percent (%)
Waste storage with plastic bag or sack with cover	Yes	474	69.1
	No	212	30.9
Sorting and separating based on biodegradability	Yes	283	41.3
	No	403	58.8
Solid waste disposal place either municipality disposal site or out of the municipality	Yes	274	39.9
	No	412	60.1
Collection service any form once a month	Yes	261	38.1
	No	425	61.9
Source minimization by either reuse, reduce, or recycle	Yes	254	37.0
	No	432	63.0
Removal of stored solid waste at least less than a month one time	Yes	265	38.6
	No	421	61.4

reduce solid waste at source were 5 times more likely to improperly practice solid waste management compared to their counterparts (AOR = 5.0, 95% CI 2.9–8.9). Improper solid waste management practice among participants who resided 30 minutes to 1 hour away from the municipal solid waste disposal site was 2.6 times higher compared to participants who resided less than 30 minutes away from the municipal solid waste disposal site (AOR = 2.6, 95% CI 1.3–5.0). Those who have poor knowledge of solid waste management were almost 5.2 times more likely to practice improper solid waste management compared to their counterparts (AOR = 5.2, 95% CI 2.6–10.3) (Table 5).

4. Discussion

This study identified the level of solid waste management practice and its associated factors in Gessa town. Improper solid waste management practice in the study area was

Table 4: Institutional-related factors of solid waste management practice in Gessa town, Dawro zone, southwest Ethiopia, in 2021.

Variables	Category	Frequency	Percent (%)
Access to door-to-door collection	Yes	310	45.2
	No	376	54.8
Time $N = (310)$	Less than a month	110	35.5
	Greater than a month	200	64.5
Responsible body accessed door-to-door service ($N = 310$)	Municipality worker	61	19.7
	MSSE	78	25.2
	Private collectors	171	55.2
Distance in minutes from municipality disposal site	Less than 30	285	41.6
	30–60 minutes	387	56.4
	Greater than 1 hour	14	2.0

Table 5: Bivariable and multivariable analysis of improper solid waste management practice in Gessa town, Dawro zone, southwest Ethiopia, in 2021.

Variables	Category	SWMP		COR (95% CI)	AOR (95% CI)
		Proper status (%)	Improper status (%)		
Sex	Male	29 (11.74)	218 (88.26)	1.3 (0.83–2.1)	1.35 (0.77–2.38)
	Female	66 (15)	373 (85)	1	1
Educational status	Cannot read	13 (12.6)	90 (87.4)	1.2 (0.6–2.5)	1.4 (0.6–3.2)
	Read and write	11 (9.7)	102 (90.3)	1.7 (0.8–3.4)	1.2 (0.48–2.6)
	Primary	12 (10.5)	102 (89.5)	1.5 (0.8–3.1)	1.1 (0.5–2.4)
	Secondary	21 (19.6)	86 (80.4)	0.7 (0.4–1.3)	0.8 (0.3–1.4)
	Diploma & >	38 (15.3)	211 (84.7)	1	1
House ownership	Own house	70 (16.1)	364 (83.9)	1	1
	Rent house	23 (11)	186 (89)	1.6 (0.9–2.6)	1.7 (0.9–3.1)
	Kebele	2 (4.7)	41 (95.3)	3.9 (0.93–16.7)	0.4 (0.7–16)
Source reduction distance to municipality's disposal site knowledge	Yes	71 (37.4)	119 (62.6)	1	1
	No	24 (4.8)	472 (95.2)	11.7 (7.1–19.4)	**5.0 (2.9-8.9)***
	<30 minute	79 (27.7)	206 (72.3)	1	1
	30 min–1 hr	15 (3.9)	372 (96.1)	9.5 (5.3–16.9)	**2.6 (1.3-5.0)***
	1-2 hr	1 (7.1)	13 (92.9)	5.0 (0.6–38.7)	1.6 (0.2–13.6)
Knowledge of solid waste reduction at source	Yes	82 (31.5)	178 (68.5)	1	1
	No	13 (3.1)	413 (96.9)	14.6 (7.9–26.9)	**5.2 (2.6-10.3)***

SWMP: solid waste management practice; COR: crude odds ratio; AOR: adjusted odds ratio; * statistical significance at p value <0.05.

86.2%. This result was higher when compared to studies conducted at households in Assela and Debre Berhan towns of Ethiopia, Kenya, and Ghana that showed 82.8%, 67.4%, 73.8%, and 39% of improper solid waste management practices, respectively [10, 17–19]. To our knowledge, there were no existing pieces of literature that revealed greater improper solid waste management practice prevalence than in this study. The possible rationale for the high prevalence of improper solid waste management practice in the town might be due to differences in sociodemographic characteristics of the participants, lack of program-specific supportive supervision, lack of infrastructure, distance from the municipality disposal site, poor knowledge status of residents, and weak linkage of institutions such as municipality workers, health extension workers, and related stakeholders with householders. This high improper solid waste disposal practice in our study area could also be because of the lower door-to-door solid waste collection access, in which 54.8% of the households had no access to the door-to-door collection.

Householders who did not practice solid waste reduction at source were 5 times more likely to improperly practice solid waste management compared to those who were practicing solid waste management at source. The study's findings were similar to studies conducted in Malaysia and Nigeria [20, 21]. This could be explained by considering that source reduction at generation points is important to householders to keep their home and environment clean and safe. In addition, the householder's unfavorable attitude, poor knowledge, and weaknesses to taking part in solid waste source separation and recycling plans, accompanied

by the influence of sociodemographic factors such as age, education level, gender, and occupation, might contribute to not practicing solid waste management [4, 22].

In this study, participants who had poor knowledge of solid waste management were almost five times more likely to improperly practice solid waste management compared to those participants who had good knowledge. This finding is supported by a study conducted in Coastal Karnataka and Asela towns in Ethiopia [10, 23], which found that the practice of participants' knowledge status and the practice of solid waste management had a positive relationship. This might be due to participants who have poor knowledge of solid waste management, failing to keep their environmental sanitation, and discharging solid waste to open places in their environment, which in turn reduces the level of proper solid waste management practices and may expose inhabitants to different types of preventable health-risk factors.

An improper status of solid waste management practice among participants who resided thirty minutes to one hour away from the municipality's solid waste disposal site was approximately 3 times more likely compared to participants who resided less than 30 minutes away from the municipality's solid waste disposal site. This study's result was consistent with studies conducted in the urban Ghana district, Barakau village, Central Province, and Wolkite town, Ethiopia [24–26]. The possible reason for this might be that, due to the distance barriers, most residents discharge their solid waste in open places at night. Also, when participants with higher educational status discharge solid waste in the open places, the participants with poor knowledge accept the practice carried out by those educated participants as normal and dispose of more solid waste openly in their environment.

5. Conclusion

In this study, improper solid waste management practices were high, which seriously raised the risk of the negative impact on human health. Unpracticed solid waste reduction at the solid waste generation point, householders' poor knowledge of solid waste management practice, and the far distance of municipal solid waste disposal sites from householders have significantly contributed factors to the high magnitude of improper solid waste management practice.

6. Recommendation

6.1. Institutional-Based Measures. Encouraging strong linkage with the municipality, town health unit, health extension workers, and other stakeholders with householders and regular follow-up with near-distance (less than thirty minutes) legal solid waste disposal sites required to reduce the magnitude of improper solid waste management practice. In addition, the local government and policymakers should incorporate strategies and should prepare guidelines along with other regular health programs to evaluate and measure their improvements.

6.2. Health Extension Workers. We have to create awareness and educate the community about solid waste management practice to increase the knowledge of householders regarding waste management practices.

6.3. Researchers. Interested researchers have to consider the health-related impact of improper solid waste management practice at the household level and in the community in the future.

Abbreviations

AOR: Adjusted odds ratio
CI: Confidence interval
COR: Crude odds
GWMO: Global waste management outlook
HH: Household
MSSE: Micro small-scale enterprise
SWMP: Solid waste management practice
3R: Reduce, reuse, recycle
SDG: Sustainable development goal
SNNPR: South nation nationalities people region
UNEP: United Nations Environment Program.

Data Availability

All data generated or analyzed during this study are available from the corresponding author on reasonable request.

Additional Points

Strength. This study showed the current level of solid waste management practice and presented its associated factors. *Limitation of the study*. In this study, some of the variables that need qualitative study were excluded due to COVID-19 fears to conduct focused group discussion.

Ethical Approval

Ethical clearance was obtained from the ethical review board of Arba Minch University, College of Medicine and Health Sciences. A letter of permission was obtained from Dawro zone, Loma woreda health bureau, and finally, written consent and willingness from study participants were obtained before interviewing them. All methods used in this study were performed under the guidelines and regulations of the Declaration of Helsinki and the institutional review board of the College of Medicine and Health Sciences. The study introduces no harm to the participants, and the confidentiality and anonymity of data during collection and after collection are kept secure by investigators.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors would like to thank Arba Minch University for allowing this research work. They would also like to thank Loma woreda, Gessa town, municipality workers, data collectors, supervisors, and participants of the study for their devotion during the data collection period.

References

[1] A. U. Zaman, "A comprehensive study of the environmental and economic benefits of resource recovery from global waste management systems," *Journal of Cleaner Production*, vol. 124, pp. 41–50, 2016.

[2] P. Asnani and C. Zurbrugg, *Improving Municipal Solid Waste Management in India: A Sourcebook for Policymakers and Practitioners*, World Bank Publications, Washington, D.C., USA, 2007.

[3] M. A. Salam, M. L. Hossain, S. R. Das, R. Wahab, and M. K. Hossain, "Generation and assessing the composition of household solid waste in commercial capital city of Bangladesh," *International Journal of Environmental Science, Management and Engineering Research*, vol. 1, no. 4, pp. 160–171, 2012.

[4] A. A. Babaei, N. Alavi, G. Goudarzi, P. Teymouri, K. Ahmadi, and M. Rafiee, "Household recycling knowledge, attitudes and practices towards solid waste management," *Resources, Conservation and Recycling*, vol. 102, pp. 94–100, 2015.

[5] R. C. Estoque, "A review of the sustainability concept and the state of SDG monitoring using remote sensing," *Remote Sensing*, vol. 12, no. 11, p. 1770, 2020.

[6] A. A. H. A. Latef, *Organic Solutes, Oxidative Stress, and Antioxidant Enzymes under Abiotic Stressors*, CRC Press, Boca Raton, FL, USA, 2021.

[7] Y. Dhokhikah and Y. Trihadiningrum, "Solid waste management in Asian developing countries: challenges and opportunities," *Journal of Applied Environmental and Biological Sciences*, vol. 2, no. 7, pp. 329–335, 2012.

[8] C. N. Luwesi, J. K. Katsiatsia, and C. K. Mikumba, "The issue of solid household waste management in the mateba health area (Ngaba), Kinshasa, DRC," *Biomedical Journal of Scientific & Technical Research*, vol. 18, no. 2, pp. 13485–13491, 2019.

[9] Gessa Town Administration Office, *Sociodemographic Data of Gessa Town Residents*, 2021.

[10] G. Lema, M. G. Mesfun, A. Eshete, and G. Abdeta, "Assessment of status of solid waste management in Asella town, Ethiopia," *BMC Public Health*, vol. 19, no. 1, pp. 1261–1267, 2019.

[11] D. S. Alemayehu, M. S. Regasa, B. Mengestie, and T. Alemayehu, "Household solid waste management practice associated factors and service delivery performance of private solid waste collectors in Dire Dawa city, eastern Ethiopia," *International Journal of Innovative Research in Science, Engineering and Technology*, vol. 6, no. 10, pp. 1–12, 2017.

[12] J. Lella, V. R. Mandla, and X. Zhu, "Solid waste collection/transport optimization and vegetation land cover estimation using geographic information system (GIS): a case study of a proposed smart-city," *Sustainable Cities and Society*, vol. 35, pp. 336–349, 2017.

[13] F. K. Duguma, Z. Kahsay, Z. Ermias et al., "Assessment of solid waste management trends of bishoftu households community, Ethiopia, June 2017," *International Journal of Environmental Sciences & Natural Resources*, vol. 21, no. 3, pp. 98–110, 2019.

[14] E. Birara and T. Kassahun, "Assessment of solid waste management practices in Bahir Dar City, Ethiopia," *Pollution*, vol. 4, no. 2, pp. 251–261, 2018.

[15] P. O. Mbah and T. C. Nzeadibe, "Inclusive municipal solid waste management policy in Nigeria: engaging the informal economy in post-2015 development agenda," *Local Environment*, vol. 22, no. 2, pp. 203–224, 2017.

[16] Abrhame EAoMSWMPAcSoBCAAA Ethiopia 2018; https://etd.aau.edu.et/bitstream/handle/123456789/13154/Endalka-chewAbrhame.pdf?sequence=1&isA.

[17] G. Genati, M. Ahmednur, G. Berihun, and A. Teym, "Assessment of household solid waste management practice and associated factors in Debre Berhan town, Amhara regional state, Ethiopia," *International Journal of Wine Research*, vol. 11, p. 416, 2021.

[18] S. J. Mukui, "Factors influencing household solid waste management in urban Nyeri municipality," *Ethiopian Journal of Environmental Studies and Management*, vol. 6, no. 3, pp. 280–285, 2013.

[19] R. M. Yoada, D. Chirawurah, and P. B. Adongo, "Domestic waste disposal practice and perceptions of private sector waste management in urban accra," *BMC Public Health*, vol. 14, no. 1, pp. 697–710, 2014.

[20] Z. Abdullah, M. Salleh, and K. Ismail, "Survey of household solid waste management and waste minimization in Malaysia: awareness, issues and practices," *International Journal of Environmental & Agriculture Research (IJOEAR)*, vol. 3, no. 12, pp. 38–48, 2017.

[21] H. Achi, C. Adeofun, A. Gbadebo, G. Ufoegbune, and J. Oyedepo, "An assessment of solid waste management practices in Abeokuta, south west Nigeria," *Journal of Biological and Chemical Research*, vol. 29, no. 2, pp. 177–188, 2012.

[22] N. Ferronato and V. Torretta, "Waste mismanagement in developing countries: a review of global issues," *International Journal of Environmental Research and Public Health*, vol. 16, no. 6, p. 1060, 2019.

[23] K. Eshwari, R. S. Shetty, D. Akhila, B. S. James, and A. K. Pandey, "Knowledge, attitude and practices towards household solid waste management among semi-urban residents-a community based cross sectional study from southern part of coastal Karnataka, India," *Indian Journal of Public Health Research & Development*, vol. 10, no. 9, p. 385, 2019.

[24] S. T. Odonkor, K. Frimpong, and N. Kurantin, "An assessment of house-hold solid waste management in a large Ghanaian district," *Heliyon*, vol. 6, no. 1, Article ID e03040, 2020.

[25] M. N. Raga, *Reef and Mangrove Survey Reports, Barakau Village, Central Province, PNG*, SPREP, Apia, Samoa, 2006.

[26] Y. H. Weldeyohanis, A. B. Aneseyee, and T. H. Sodango, "Evaluation of current solid waste disposal site based on socio-economic and geospatial data: a case study of Wolkite town, Ethiopia," *Geojournal*, vol. 87, no. 2, pp. 585–601, 2020.