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Regional Case Study

The Analysis of the Household Wastewater Sewerage Ownership Factor in the Working Area of Pamotan Health Center, Rembang Regency, Central Java

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Abstract

Households with access to wastewater sewerage in Pamotan in 2022 only be 69.9%. This study aims to find out the factors related to household wastewater sewerage ownership in the Pamotan Community Health Center Working Area. This research was an observational analytic using a cross-sectional design. The research population was all families in Pamotan subdistrict villages with the lowest ownership of wastewater sewerage, with a sample size of 90 families. The independent variables are land availability, length of year residence, knowledge, education, and income for the dependent variable, that are ownership of the Waste Water Sewerage. The data were analyzed using univariate and bivariate statistics, employing the Chi-Square test. The results of the study showed that land availability (p=0.04), education level (p=0.018), knowledge level (p=0.003), and income (p=0.00) are related to household wastewater disposal ownership while the length of year residence (p=0.257) is not related to ownership of household wastewater sewerage in the Pamotan Subdistrict. Based on the research results, the length of year residence is not related to household wastewater sewerage ownership because people's old habits that are not good at managing household wastewater result in wastewater sewerage ownership behavior not fulfilling standards.

Keywords: Gray water; sanitation; wastewater sewerage

1. Introduction

Hygiene and sanitation are still big challenges in health development facing Indonesia. WHO/UNICEF stated that as many as 60% of rural communities in Indonesia experience difficulties in accessing sanitation, including household wastewater sewerage, resulting in the open discharge of household wastewater into land and rivers without treatment (WHO and Unicef, 2020). Households with access to adequate sanitation in Indonesia in 2021 amounted to 80.29%, which is still below the SDG's target of realizing 90% access to adequate sanitation, including 15% of households having access to safe sanitation. Based on the results of the Central Statistics Agency's Susenas in 2021, the proportion of households that have access to adequate sanitation services according to a place of residence in rural areas is lower, which is 75.95% compared to urban areas of 83.58%. Access to proper sanitation services for households categorized as safe management is measured by indicators, one of which is access to a centralized domestic wastewater management system (Kementerian Kesehatan Republik Indonesia, 2021).

The proportion of household wastewater disposal sites in Rembang that manage waste from bathrooms or washing places is mostly channeled into sewers/streams/rivers using pipes or pipes as much as 63.55%. Other facilities used were 23.35% of extension channels without shelter or on the ground, 7.66% of open shelters, and 5.45% of closed shelters (Badan Penelitian dan Pengembangan Kesehatan,

2018). Wastewater that is dumped openly in the backyard without being treated can cause puddles that are muddy, dirty, and smelly (Ahyanti & Rosita, 2022). Disposing of wastewater openly or without wastewater sewerage can cause wastewater to seep into the land it passes through and cause pollution to surrounding clean water sources (Mukti et al., 2016).

Community-Led Total Sanitation is established as a national strategy for sanitation development to realize SDG's program point 6, which is ensuring universal access to clean water and sanitation for the community through Minister of Health Regulation Number 3 of 2014 concerning "Community-Led Total Sanitation (CLTS), an approach to changing hygiene and sanitary behavior through community empowerment with the trigger". The CLTS pillars used as a reference in implementing hygienic and sanitary behavior include 1) Stop Open Defecation, 2) Wash Hands with Soap, 3) Management of Household Drinking Water and Food, 4) Safeguarding Household Waste, and 5) Safeguarding Household Wastewater (Kementerian Kesehatan Republik Indonesia, 2014). Community-Led Total Sanitation Programs have the benefit of changing people's behavior from the aspect of awareness of a clean environment and not disposing of water carelessly (Stiawati, 2021). The main point of development that is based on society or community is related to community empowerment (Muaja et al., 2020). The government's role in the CLTS program is to facilitate which in the end the management is completely handed over to community self-help (Sitra and Agustar, 2019).

Pamotan has the lowest Community-Based Total Sanitation Village achievement in Rembang, which is 13.4%. The achievement of the Community Based Total Sanitation pillar) which is still below the minimum standard according to the provisions of the Ministry of Health in the Pamotan Community Health Center Working Area is the pillar of Safeguarding Household Liquid Waste. The management of household liquid waste in five villages within the Pamotan Community Health Center Working Area falls short of the minimum achievement standards set by the Ministry of Health, which require a 50% compliance rate. This is evidenced by the presence of untreated pools of household liquid waste and the absence of proper treatment before disposal. The achievements of the liquid waste security pillar that are still below standard include Megal Village, Sendangagung Village, Segoromulyo Village, Mlagen Village, and Bamban Village. The low achievement indicates the low use of wastewater sewerage in managing household waste so that puddles of domestic wastewater are found around the house (Dinas Kesehatan Kabupaten Rembang, 2022).

The percentage of households with ownership of wastewater disposal facilities in Pamotan according to the 2022 Pamotan Community Health Center Health Report is only 57.9%. Households with access to wastewater sewerage in Pamotan in 2022 will only be 69.9% (Dinas Kesehatan Kabupaten Rembang, 2022). The villages with the lowest percentage of sewerage ownership in Pamotan are Bamban Village and Mlagen Village at 19.72% and 0% respectively. Wastewater sewerage is a means of disposing of washing water, used bath water, and other dirty water in the form of excavated soil or pipes made of cement or prison. The facilities used for distributing household wastewater use infiltration wells with septic tanks for feces and urine waste or black water and household wastewater drains for wastewater from kitchens, bathrooms, and hand washing facilities or gray water (Kementerian Kesehatan, 2014).

Pamotan is an area consisting of 23 villages. Based on land use, 2,245.8 hectares are rice fields and 5,910.37 hectares are dry lands. The availability of existing land will influence its use for providing simple wastewater sewerage compared to not having available land which will cause difficulties in providing simple wastewater sewerage (Ansori et al., 2022). The population of Pamotan is 50,266 people in 16,726 families. The population density in Pamotan is 145.74 people per km^2. The distribution of the population is based on final education, the majority have primary education, that is 62.89%, 11.64% secondary, and 3.79% higher education (BPS Kabupaten Rembang, 2022). A higher level of education results in a better ability to interpret an explanation of information (Novitry and Agustin, 2017). Good and sufficient financial capacity in the community will have a higher ability to fund the provision of adequate sanitation facilities in households (Sidabutar and Chotib, 2020). The length of year of residents is related to the form of community participation which has a positive influence on the longer they stay

in an area for the psychological development of life to maintain, manage, and develop improvements in facilities and infrastructure (Sigit Wijaksono, 2014).

Lawrence Green (1980), the health of a person or community is influenced by behavioral factors, namely predisposing factors, enabling factors, and reinforcing factors. Predisposing factors serve as the foundation or motivation for behavior, evident in one's knowledge, attitudes, beliefs, and values. Enabling factors facilitate behavior, including the physical environment and access to health facilities. Reinforcing factors strengthen behavior. Environmental health behavior, such as individual waste management at home, is shaped by factors motivating the behavior, such as education, knowledge, income, and length of residence. Additionally, factors that facilitate the provision of household wastewater sewerage, like the availability of land, support and enhance this behavior (Notoatmodjo, 2014). Research by C. Ssemugabo et al (2020), shows that there is a relationship (p-value 0.028) between the duration of residence in the area (years) and improvements in household sanitation facilities in Kampala, Uganda (Ssemugabo et al., 2020). Research by Sidabutar and Chotib (2020), shows that the majority, namely 70.78% of households in the non-migrant population who have lived for more than 5 years have adequate household sanitation facilities, meaning that the length of stay of migrants influences the ownership of adequate fecal disposal facilities in households in Jakarta, Indonesia (Sidabutar and Chotib, 2020). This research adds a length of years residence variable to find out whether the number of years of residence is related to the ownership of household wastewater sewerage in rural communities, namely Bamban Village and Mlagen Village, Pamotan District, Rembang Regency, Central Java. Based on this description, this study analyzes the factors related to household wastewater sewerage ownership in the Pamotan Community Health Center Working Area. These factor variables are land availability, knowledge, education, income, and the community's length of years residence. Therefore, the author wants to research "Analysis of Ownership Factors for Household Wastewater Sewerage in the Working Area of Pamotan Health Center, Rembang Regency".

2. Methods

This type of research was observational analytic and used a cross-sectional research design. This research was conducted in the Pamotan Community Health Center Work Area where the pillars of Safeguarding Household Liquid Waste did not fulfill the standards. The independent variables in this research were land availability, length of years of residence, knowledge, education, and income. The dependent variable was ownership of wastewater sewerage. The research was done in July-August 2023.

The research population was all families who lived in villages with the lowest ownership of waste water drainage in the Pamotan Community Health Center Working Area, which are Bamban Village and Mlagen Village, which are 881 families. The basis for selecting two villages as the research population was the poor practice of the pillar of safeguarding household liquid waste and the low ownership of household wastewater sewerage in Bamban Village and Mlagen Village. This research will only focus on analyzing factors related to the ownership of wastewater sewerage in two villages, namely Bamban Village and Mlagen Village from several villages in Pamotan District. The sample for this study was all families with heads of families aged 21-57 years. The number of samples in this research was obtained using the Lemeshow research sample size formula following equation (1) In survey research, the sample size formula uses binominal proportions using the Lemeshow formula. If the population is greater than 100 people then 10-15% of the total population is taken. The minimum sample size for research using the Lemeshow formula for standard deviation $[Z(1-\frac{a}{2})]$ with a confidence level of 95% and a degree of accuracy (d) of 90% (0.1) (Lemeshow et al., 1997).

$$n = \frac{N.Z\left(1-\frac{a}{2}\right)^2.P.(1-P)}{Nd^2+Z\left(1-\frac{a}{2}\right)^2.P.(1-P)} \quad \text{.....(1)}$$

$$n = \frac{881.1{,}96^2.0{,}5.(1-0{,}5)}{881.0{,}1^2+1{,}96^2.0{,}5.(1-0{,}5)} = 87 \text{ families}$$

The minimum sample size for research using the lemeshow formula was 87 families so the sample is set at 90 families. The research sampling technique used proportionate stratified random sampling which proportionally obtained Bamban Village as many as 29 families in Mlagen Village there are 61 families.

Research data collection techniques were done through interviews and direct observations in the field using questionnaire instruments and checklist sheets. The questionnaire as a research instrument contains questions and statements given directly to respondents to collect data about the respondent's identity, education, income, length of years of residence, and level of knowledge. The questionnaire as a research instrument for collecting data contains two parts of questions, namely the first part about the respondent's identity, education, income, and length of years of residence and the second part contains 13 questions about the respondent's knowledge about gray water and household wastewater sewerage. Interviews were carried out by distributing questionnaires to be filled in by each head of the target family. A checklist sheet was used as a research instrument to collect data regarding ownership of wastewater sewerage and the availability of land for processing household liquid waste. The researcher will fill in the subject's identity and provide a checkmark on the list indicating the characteristics of the target of observation.

The operational definition of the land availability variable was categorized into two, that are available (value 1) and not available (value 0). According to Minister of Health Regulation No. 3 of 2014 concerning Community-Led Total Sanitation (CLTS) and Technical Guidelines for Making Absorption Wells in 2021, the Environment and Forestry Service, the requirements for land availability for providing wastewater sewerage are flat land topography, distance to building foundations 1 meter, distance to septic tank absorption and waste disposal 5 meters, and distance to clean water wells 10 meters. The category was not available if the respondent did not fulfill the 5 conditions for the availability of land to provide waste water drainage. The length of years residence variable was categorized into two, that are the old category (value 1) if the residence is >5 years and the new category (value 0) if the residence is ≤ 5 years. The level of knowledge was categorized into two, which are good (value 1) if the value is ≥ mean and poor (value 0) if the value is <mean. The level of education is categorized into three, that were primary education (value 0), secondary education (value 1), and higher education value 2). Income level was categorized into two, that are high (value 1) if income ≥ IDR 2,015,927 and low (value 0) if income < IDR 2,015,927. According to the Ministry of Health's Healthy Home Assessment Guidelines, ownership of wastewater sewerage was categorized into two, that are fulfilling the standard with a value of 1 if the household wastewater sewerage nel uses the type 1) open gutter, 2) infiltration hole > 10 meters from the water source and 3) closed gutter while the category is not. fulfills the standard with a value of 0 if 1) it does not have wastewater sewerage and 2) the infiltration hole is <10 meters from the water source.

The data analysis technique used descriptive statistics with univariate analysis to get an overview of the frequency and percentage distribution of each variable as well as inferential statistics with bivariate analysis using the Chi-Square test. If this is not fulfilling then the Fisher Exact Test is used on a categorical scale with a significance test using the significance limit α =0.05 with a significance level of 95%.

3. Result and Discussion

The proportion of household wastewater sewerage owners that mostly do not fulfill the requirements, that are 65 respondents (72.2%) while only 25 respondents (27.8%) fulfill the standards. Availability of land for providing household wastewater sewerage most of them were categorized as not available to as many as 64 respondents (71.1%) while land was available to as many as 26 respondents (28.9%). The level of knowledge of respondents in the good category was 62 respondents (68.9%) more than the poor knowledge of 28 (31.1%). The education level of most of the respondents was in the basic category at 57.8%, then secondary education at 30% while tertiary education was only 12.2%. Most respondents' income levels were in the low category, with 65 respondents (72.8%) while 25 respondents (27.2%) had high income. The proportion of the duration of years of residence for respondents in the old

category was 81 respondents (90%) compared to the category of new residence, which was 9 respondents (10%).

Table 1. Descriptive statistic characteristics of the respondent

Variable	Frequency	Percentage
Wastewater Sewerage Ownership		
Fulfills standards	25	27.8
Does not comply with	65	72.2
Land availability		
Available	26	28.9
Not available	64	71.1
Education		
Basics	52	57.8
Intermediate	27	30
Height	11	12.2
Knowledge		
Good	62	68.9
Less	28	31.1
Income		
Height	25	27.2
Low	65	72.8
Length of years residence		
Old	81	90
New	9	10

Based on Table 2, the results of bivariate analysis using the Chi-square test show that the variables related to household wastewater sewerage ownership (p<0,05) are land availability(p=0,00), an education level(p=0,018), knowledge level (p=0,03), and income level (p=0,00). The length of years of residence (p=0,257) is not related to ownership of household wastewater sewerage.

Table 2 Bivariate analysis of factors associated with ownership of waste water sewerage in the pamotan community health center working area

Independent variable	Wastewater Sewerage Ownership (SPAL)				Total		*p-value*	OR (95%CI)
	Does not fulfill		Fulfills standards					
	N	%	N	%	N	%		
Land Availability								
Not available	59	92.2	5	7.8	64	100	0.000	3.995
Available	6	23.1	20	76.9	26	100		(1.973 – 8.088)
Education								
Basic	40	76.9	12	2.,1	62	100	0.018	
Intermediate	21	77.8	6	22.2	27	100		
Height	4	36.4	7	63.6	11	100		
Knowledge								
Less	26	92.9	2	7.1	62	100	0.003	1.475
Good	39	62.9	23	37.1	28	100		(1.188 – 1.834)
Income								

Low	55	84.6	10	15.4	65	100	0.000	2.115
High	10	40	15	60	25	100		(1.294 – 3.457)
Length of year residence								
New	5	55.6	4	44.4	9	100	0.257	
Old	60	74.1	21	26.9	81	100		

Gray water is household liquid waste in the form of used water produced from the kitchen, bathroom, and hand-washing facilities (Kementerian Kesehatan, 2014). Gray water has a high ability to cause threats to the environment, especially water bodies (Dwumfour-Asare et al., 2018). The facility used to distribute gray water is a wastewater drainage sewerage (Kementerian Kesehatan, 2014). The results of the research show that the majority, that are 65 respondents (72.2%), do not have household wastewater sewerage that fulfills standards, meaning that 72.2% of people dispose of gray water openly without storage. Untreated gray water and the practice of disposing of wastewater without sewers pose a risk of disturbance and danger to public health (Dwumfour-Asare et al., 2018). The community at the research location lacks access to sanitation because rural communities live far from built-up areas where sanitation facilities are available. Research by Nurzanah et al. (2020) in Bengkulu Province, the percentage of proper sanitation, namely waste disposal, in urban areas, is higher, 82.4% compared to rural areas of 33.8% (Nurzanah et al., 2020). Research by Azanaw et., al (2023) in Etiopia, shows that on average urban households have a higher level of access to sanitation service provision, namely 20.48% compared to rural households of 6.97%. This condition occurs because urban communities have greater opportunities to access infrastructure, skilled labor, and technological resources that enable improved sanitation services. Urban communities have access to improved sanitation services compared to rural communities because city governments can collaborate with government organizations, have adequate sanitation infrastructure, and have public awareness of sanitation. This advantage causes urban households to have better sanitation to maintain health and create an aesthetic city compared to rural areas (Azanaw et al., 2023).

There were 26 respondents or 76.9% more households that had wastewater pipes than respondents who had household wastewater pipes that did not meet standards, namely 23.1%. Availability of land is related to ownership of household wastewater sewerage with a p-*value*=0.000 and OR 3.995, meaning that respondents who do not have land are 3.995 times more likely to have no household wastewater sewerage than those who have land available. Availability of land can make it possible to have household wastewater sewerage because the availability of land can be used to construct simple sewers, compared to not having available land which can hinder the provision of simple sewers. Land ownership, land rights, and space planning are related to the success of sanitation investment. The reduced availability of land makes it difficult to find available locations to provide sanitation facilities (Awunyo-Akaba et al., 2016).

The majority of respondents with no available land, that are 59 respondents (92.2%), had household wastewater sewerage that did not fulfill standards or did not have household wastewater sewerage. The lack of land availability has resulted in hampered use for constructing sewers, resulting in the disposal of gray water without storage or openness. Poorly treated gray water can reach groundwater and surface water through infiltration, leakage, or direct discharge. The problem of domestic wastewater pollution to the environment is mainly caused by inadequate on-site wastewater treatment and direct discharge of wastewater into water bodies (Widyarani et al., 2022). Previous studies in India suggested that lack of space sufficient housing and lack of funds resulted in a halt to the building of the sanitary facilities of toilets (Mehta et al., 2021).

Land availability is a physical environment that to a certain extent can have an impact on the ability to use land (Irjad et al., 2020). household wastewater sewerage is facilities in the form of excavated soil or pipes made of cement or pralon which are used to channel washing water, used bath water, and

other dirty water. Availability of land for the use of household wastewater sewerage takes into account the physical factors of the home environment, which are flat land topography, distance to foundations of 1 meter, distance to clean water wells of 10 meters, distance to septic tank infiltration and waste disposal of 5 meters (Dinas Lingkungan Hidup, 2021). The availability of land for the people of the Pamotan Community Health Center working area, especially Bamban Village and Mlagen Village, is limited to the distance between the house foundation and the yard area, the distance to clean water wells, and the distance to septic tank infiltration which does not fulfill the requirements for providing household wastewater sewerage. The environmental aspect of poor soil conditions can hamper investment in sanitary facilities (Malima et al., 2022).

The education level of respondents in the basic category was 62 respondents with the proportion of wastewater sewerage ownership not fulfilling the urban standards which are 76.9% greater than household wastewater sewerage ownership fulfilling standards of 23.1%. The research result shows that education is related to household ownership of wastewater sewerage (*p-value*=0.018) in Pamotan. Education can increase knowledge about healthy living habits and make it easier to understand health information (Jannah and Laelasari, 2022). The respondent's level of formal education can influence the extent of their insight, knowledge, and thought patterns. Communities with low levels of education are more likely to have low dependency on practicing hygiene (Barakat and Kasemy, 2020). Households that have an educated head of family have a higher chance of maintaining and gaining access to sanitation compared to households that have no education (Legge et al., 2021). Higher education and awareness regarding the impact of this type of disposal on the environment can cause citizens to choose safer and more environmentally friendly methods as disposal mechanisms (Kong et al., 2020).

The proportion of wastewater sewerage owners who do not fulfill the requirements with a basic education level of 76.9% is greater than the higher education category of 36.4%. Higher levels of education tend to enhance public awareness and concern, encouraging individuals to prioritize both their well-being and environmental conservation. (Rayhana and Triana, 2016). The level of education is an internal aspect that can influence an individual, including lifestyle behavior, most importantly in encouraging participation in development. Respondents' low education is related to people's thought patterns and behavior that are difficult to improve according to what we want. According to Fredrick et al. (2018), the higher education community has an awareness of improving good waste disposal practices (Fredrick et al., 2018).

The level of knowledge of respondents in the poor category was 62 respondents with ownership of wastewater sewerage not fulfilling standards of 92.9%, greater than those with ownership of wastewater sewerage fulfilling standards of 7.1%. Ownership of household wastewater sewerage in Pamotan correlates with knowledge with a *p-value*= 0.003 and OR=1.475, meaning that poor knowledge are 1.475 times more likely to have no wastewater drains compared to those with good knowledge. Poor public knowledge is caused by a lack of information regarding proper wastewater management and graywater drainage. Knowledge is the result of an individual knowing after detecting certain objects and is very important in creating a person's attitudes and actions. Knowledge is human reasoning, explanation, and understanding of various information, as well includes the practice or technical ability to complete various life problems (Preztiana et al., 2022). Knowledge greatly influences a person's interpretation to understand the important benefits of owning a wastewater disposal channel so that they do not practice disposing of gray water carelessly. Community knowledge regarding environmental conservation and good greywater management can be increased through outreach and mentoring (Ibrahim, 2017). Environmental knowledge has a positive effect on attitudes toward managing the environment of 0.68 with a probability value (P) of 0.001 with a tendency for people's attitudes toward handling sanitation along with increasing environmental knowledge (Miswan and Rasyid, 2020).

The proportion of respondents whose ownership of wastewater sewerage does not fulfill standards and good knowledge is 62.9%. There are still findings that some people have good knowledge but their household wastewater sewerage ownership does not fulfill the standards. Knowledge does not

play an important role in hygiene, and sanitation practices, it can be influenced by other factors such as the environment and a person's habits (Hartini, 2022). This result indicates that good knowledge without awareness of clean and healthy living behavior can result in wastewater management and the condition of household graywater drains being ignored.

The low-income level of respondents was 65 respondents whose ownership of wastewater sewerage did not fulfill the standards was 84.6% greater than that of wastewater sewerage that met the requirements of 15.4%. Income is related to household wastewater sewage ownership (*p-value*=0.00) in Pamotan and respondents who have low incomes are 2.115 times more likely to not wastewater sewerage livelihood or something obtained (Meliyanti, 2018). The high costs of wastewater treatment make it difficult for low-income communities to provide adequate wastewater management. High installation costs also prevent many cities in low-income areas from building good facilities for wastewater treatment. The high implementation costs also make many communities reluctant to build small wastewater treatment facilities (Silva, 2023).

The proportion of wastewater sewerage owners that do not fulfill standards with low income is 84.6%, which is greater than ownership of wastewater sewerage that do not fulfill standards with high income, which is 15.4%. The income of the people of Bamban Village and Mlagen Village is related to the ownership of gray water disposal facilities because income tends to be lower so opportunities to provide facilities are difficult. Low family income makes people think about other needs apart from basic needs. When viewed from a socio-economic aspect, income is one aspect that influences increasing people's insight regarding the environment, basic sanitation, and housing. A better income level will enable each family member to have a better life, for example in terms of health, education, and career development. Likewise, if income is low, there will be a gap in meeting family needs (Anggrayni et al., 2022). It is hoped that with incomes that tend to be high, people will have greater concern for environmental health, including wastewater drainage (Meliyanti, 2018).

As many as 25 respondents have gray water sewerage ownership that fulfills the standards of the proportion of permanent residents in the old category is 84%, compared to the new category of permanent residents, which is 16%. The length of years of residence is not related to household gray water sewer ownership in Pamotan. Based on the research results, show that there is no relationship between graywater sewerage ownership and the respondent's length of year residence with a *p-value*=0.257, meaning that the number of years the community has lived does not affect household graywater sewerage ownership behavior. The low ownership of gray water sewerage in Bamban Village and Mlagen Village in the Pamotan Community Health Center working area has resulted in poor wastewater management habits. Habits have a strong position in behavior (Ibrahim, 2017). Habits are greatly influenced by individual behavior in fostering motivation to learn in a given condition (Samosir and Ramadhan, 2019). Comparing good and right habits with bad and wrong habits, there is a greater tendency among people that these bad and wrong habits become more attractive, more legitimate, more enjoyable, more stylish, and easier to achieve even though at a certain threshold they are more harmful (Ibrahim, 2017).

Research in Kwale, Kenya showed that there was an increase in sanitation status over a 2-year duration of 22.4% of access to sanitation as a whole in the community (Legge et al., 2021). Research by Sidabutar and Chotib (2020), shows houses with non-migrant types or categories of staying for a long time, namely 70.78% have a proper and safe category of sanitation at their own home in Jakarta, Indonesia (Sidabutar and Chotib, 2020). According to Suroso et al. (2014), the longest year people live in the village, the sense that having a neighborhood tends to increase participation in each ward activity (Suroso et al., 2014). Length of years residence is related to mastery in communication, both to obtain explanatory information and to present information in the form of suggestions and decision-making. The longer the duration of permanent residence, the greater the level of participation as measured by the type of participation in environmental management. Length of years residence is closely related to the form of community participation because the longer an individual lives and stays in an area, the more positive

impact it will have on the progress of his psychological life so that it can encourage awareness to maintain, organize, and improve existing infrastructure and facilities (Sigit Wijaksono, 2014).

Poor wastewater management habits among the people in Bamban Village and Mlagen Village are related to the lack of awareness to participate in improving household wastewater disposal facilities that fulfill health requirements. This is shown by the ratio of gray water sewerage ownership not fulfilling standards in the old permanent residence category of 74.1% more than the new permanent residence category of 55.6%. According to Yuliana and Haswindy (2017), no significant relationships (*p-value*=0.559) between the length of years of residence with community participation levels in residential waste management. The length of year residence variety does not give rise to the level of participation in the garbage because of low concern for its environment, so cultures dispose of garbage under homes and around residential neighborhoods (Haswindy and Yuliana, 2017).

The low ownership of household wastewater sewerage in the Pamotan Health Center Working Area, namely Bamban Village and Mlagen Village, can be improved by taking an educational approach to increase community knowledge and awareness to manage gray water well through socialization and mentoring. Research by Muslim and Indarwati (2022), shows that there is a significant difference (p-*value* = 0.00) between knowledge before triggering the transfer of knowledge from the community which is very important for the formation of a person's behavior. Triggering a Community-Led Total Sanitation program can change people's behavior by increasing knowledge with an effort to convey information both directly and indirectly through communication media (Muslim and Indarwati, 2022).

Sanitation improvement policies for domestic wastewater producers should be designed to provide innovations in creating simple wastewater sewerage in communities with limited land and low costs. The local government plays a role in planning the wastewater management system network, both locally and centrally, to meet the sanitation infrastructure needs of an area with appropriate wastewater management (Rachman, 2020). Considerations in selecting a wastewater disposal system depend on factors such as population density, clean water supply, and topography. the condition of soil permeability, the condition of the groundwater level, the level of ability and willingness of the population to manage as a group, and the level of investment capacity of the government (Salman et al., 2021). In areas with dense populations and limited land, greywater processing can be used with a centralized processing system (off-site system) using a pipeline network managed by the government (Rachman, 2020). Gray water is channeled through a network of pipes and control tank buildings, grease traps, and manholes at each end of alleys, turns, and intersections. The PVC pipe used is a 3-inch diameter type to drain kitchen and bathroom waste to the control tub, while a 4-inch diameter pipe is to drain waste from the control tub to the main pipe, and a 6-inch diameter pipe is to drain waste from the main pipe to the building Wastewater Treatment Plant (WWTP). The best WWTP system used is Anaerobic WWTP because the investment costs and operational costs are cheaper and the category and implementation of building maintenance are easier than other systems (De Side and Akraboelittaqwa, 2021).

The weakness of this research is that the results of the research cannot be generalized to all villages in the Pamotan District area because it focuses on two villages with poor security practices and ownership of wastewater sewerage Bamban Village and Mlagen Village. The results of this limited research can still be considered because every village in an area is inhabited by a homogeneous population. The researcher suggests to future researchers to increase the research population by determining an appropriate sample because statistically it is stated that a larger sample size is expected to provide better results. With a large sample, the mean and standard deviation obtained have a high probability of resembling the mean and standard deviation of the population which is related to statistical hypothesis testing (Simbolon et al., 2023).

4. Conclusions

Based on the research results, it was concluded that the factors related to household wastewater sewerage ownership in Bamban Village and Mlagen Village, Pamotan Health Centre Working Area were land availability (*p-value*=0.00), education level (*p-value*=0.018), knowledge level (*p-value*=0.003), and income level (*p-value*=0.00). Meanwhile, the length of years of residence (*p-value*=0.257) is not related to household wastewater sewerage ownership because people's old habits that are not good at managing household wastewater result in wastewater sewerage ownership behavior not fulfilling standards. The level of education affects employment and income levels so an inadequate income level can hinder funding for planning wastewater pipe networks that can be treated before being discharged into the environment according to wastewater quality standards. Low ownership of wastewater disposal is related to limited land availability, the majority of the community's education is primary-medium, low knowledge about wastewater disposal, and low income of the people of Bamban Village and Mlagen Village. Changing people's behavior in managing household wastewater can be done through the measures of the Community-Led Total Sanitation program.

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