
Household Behavioral Factors in the Implementation of STBM Pillar V: Household Wastewater Management Based on Snehandu B. Kar's Theory

Mas Damang Gumelar¹, Sri Anggraeni¹, Rusmiati¹, Hadi Suryono¹, Setiawan¹

¹Department of Environmental Health, Poltekkes Kemenkes Surabaya, Jl. Pucang Jajar Tengah No. 56, Surabaya, East Java, Indonesia

*Corresponding Author: Mas Damang Gumelar

*Email: masdamangg@gmail.com

Abstract. Household wastewater management is an important component of environmental sanitation because inappropriate disposal may contribute to environmental pollution and health risks. Community-Based Total Sanitation (STBM) Pillar V focuses on the safe management of household wastewater. Based on STBM verification data from 2025, the implementation of STBM Pillar V in Bongkaran Urban Village, within the working area of Perak Timur Community Health Center, Surabaya City, remained low. This condition indicates the need to examine behavioral factors related to household wastewater management. This study aimed to analyze the relationship between behavioral factors based on Snehandu B. Kar's Theory and the implementation of STBM Pillar V in Bongkaran Urban Village. An analytical observational study with a cross-sectional approach was conducted among 98 households selected using simple random sampling. Data were collected through interviews using a structured questionnaire and analyzed using the Chi-Square test at a significance level of 5% ($\alpha=0.05$). The results showed significant relationships between behavior intention ($p<0.001$), social support ($p<0.001$), accessibility of information ($p=0.001$), personal autonomy ($p=0.001$), and action situation ($p=0.005$) and the implementation of STBM Pillar V. The five behavioral components of Snehandu B. Kar's Theory were associated with the implementation of household wastewater management. Improving the implementation of STBM Pillar V requires attention to behavioral intention, social support, access to information, household decision-making capacity, and conditions that enable action.

Keywords: Community-Based Total Sanitation; household wastewater; behavior; Snehandu B. Kar; environmental health

INTRODUCTION

Sanitation is an important component of public health and environmental protection. Inadequate sanitation can contribute to environmental contamination and the transmission of infectious diseases. Globally, household wastewater remains an important sanitation concern; in 2022, approximately 42% of household wastewater was not safely treated before discharge.(1) Safe sanitation and wastewater management are therefore important to protect human health and reduce environmental risks.(2)

In Indonesia, Community-Based Total Sanitation (STBM) is implemented as an approach to promote hygienic and sanitary behavior through five pillars. The fifth pillar focuses on household wastewater management, including the proper collection, disposal, and management of wastewater generated from household activities.(3) Household wastewater management is important because

inadequately managed wastewater may contribute to environmental contamination and deterioration of sanitation conditions.(2) The Indonesian Ministry of Health also includes household wastewater management as one of the components assessed in STBM implementation.(3)

The implementation of STBM Pillar V is not determined solely by the availability of sanitation facilities but also involves household behavior. Behavioral factors may influence whether households are willing and able to adopt appropriate wastewater management practices. Snehandu B. Kar's Theory provides a psychosocial framework for understanding health behavior through five components: behavior intention, social support, accessibility of means for action, personal autonomy, and action situation.(4) Previous research by Cahyani and Widati also examined behavior intention, personal autonomy, accessibility of information, and social support as behavioral factors related to health behavior, demonstrating the application of Kar's framework in behavioral research.(5)

Previous studies have examined household wastewater management from several perspectives, including greywater characteristics,(6) household wastewater sewerage ownership,(8) community participation in wastewater infrastructure management,(8) greywater treatment and domestic wastewater distribution systems,(9) community willingness to participate in wastewater management,(10) household wastewater disposal and water quality,(11) factors related to household wastewater sewerage ownership,(12) household wastewater management facilities and community education,(13) factors associated with household wastewater channels,(14) and education related to household wastewater management and environmental sanitation.(15) However, studies specifically examining household wastewater management within the framework of Snehandu B. Kar's Theory, particularly at the urban village level, remain limited.

Based on STBM verification data from 2025, the implementation of STBM Pillar V in the working area of Perak Timur Community Health Center remained below the expected level. Bongkaran Urban Village was one of the areas with a relatively low level of household wastewater management implementation. This condition indicates that household wastewater management remains a challenge and requires attention to behavioral factors that may be associated with its implementation.

Therefore, empirical evidence regarding the relationship between behavioral factors and the implementation of STBM Pillar V is needed. Such evidence may provide a basis for developing health promotion and community empowerment approaches that are relevant to household wastewater management.

This study aimed to analyze the relationship between behavioral factors based on Snehandu B. Kar's Theory, consisting of behavior intention, social support, accessibility of information, personal autonomy, and action situation, and the implementation of STBM Pillar V for household wastewater management in Bongkaran Urban Village, within the working area of Perak Timur Community Health Center, Surabaya City.

METHODS

Study Design and Setting

This study used an analytical observational design with a cross-sectional approach. The study was conducted in Bongkaran Urban Village, within the working area of Perak Timur Community Health Center, Surabaya City, East Java, Indonesia, in 2026. The study aimed to analyze behavioral factors associated with the implementation of STBM Pillar V for household wastewater management based on Snehandu B. Kar's Theory.

Population and Sample

The study population consisted of 3,815 households in Bongkaran Urban Village. The sample size was determined using the Slovin formula with a 10% margin of error, resulting in a sample of 98

households. Respondents were selected using simple random sampling. The respondents were household heads or household members who were knowledgeable about household wastewater management.

Variables and Operational Definitions

The dependent variable was the implementation of STBM Pillar V for household wastewater management. Implementation was assessed using five yes/no items. Households were categorized as implementing STBM Pillar V when they obtained a score of ≥ 4 and as not implementing when they obtained a score of < 4 .

The independent variables were behavior intention, social support, accessibility of information, personal autonomy, and action situation, based on the components of Snehendu B. Kar's Theory.(4) Behavior intention was measured using seven Likert-scale items and categorized as intention when the score was > 17 and no intention when the score was ≤ 17 . Social support was measured using eight yes/no items and categorized as support when the score was > 4 and no support when the score was ≤ 4 . Accessibility of information was measured using seven yes/no items and categorized as available when the score was > 3 and not available when the score was ≤ 3 . Personal autonomy was measured using six Likert-scale items and categorized as favorable when the score was > 14 and less favorable when the score was ≤ 14 . Action situation was measured using six yes/no items and categorized as enabling when the score was > 3 and not enabling when the score was ≤ 3 .

Validity and Reliability

The validity of the questionnaire was assessed using a two-tailed bivariate Pearson correlation test at a significance level of 0.05. Based on 30 respondents included in the validity testing, the critical correlation value was 0.361. All questionnaire items had correlation coefficients greater than 0.361 and were therefore considered valid.

The reliability of the questionnaire was assessed using Cronbach's alpha. The Cronbach's alpha coefficients were 0.837 for behavior intention (7 items), 0.792 for social support (8 items), 0.854 for accessibility of information (7 items), 0.819 for personal autonomy (6 items), and 0.819 for action situation (6 items). These results indicated acceptable internal consistency of the instruments.

Data Analysis

Data were analyzed using IBM SPSS Statistics. Univariate analysis was used to describe the distribution of each study variable. Bivariate analysis was performed using the Chi-Square test to examine the association between each behavioral factor and the implementation of STBM Pillar V. Statistical significance was determined at $\alpha=0.05$.

Ethical Considerations

This study received an ethical eligibility decision from the Ethics Committee of Poltekkes Kemenkes Surabaya (KEPK Poltekkes Kemenkes Surabaya), with ethical document number 00571/EE/2026/0067223578, dated 16 June 2026. The study was classified as exempted from further ethical review and was declared ethically eligible.

RESULT

A total of 98 households participated in this study. The results are presented to describe household wastewater management, the implementation of STBM Pillar V, the distribution of behavioral factors based on Snehendu B. Kar's Theory, and the associations between the behavioral factors and STBM Pillar V implementation.

Implementation of STBM Pillar V

The overall implementation of STBM Pillar V was assessed using five items. Households obtaining a score of ≥ 4 were categorized as implementing STBM Pillar V, whereas households obtaining a score of < 4 were categorized as not implementing.

Table 1. Implementation of STBM Pillar V for Household Wastewater Management in Bongkaran Urban Village

Category	Frequency (n)	Percentage (%)
Not Implementing	52	53,1%
Implementing	46	46,9%
Total	98	100%

Source: Primary Data

The majority of households in Bongkaran Urban Village were categorized as not implementing STBM Pillar V, comprising 52 households (53.1%), while 46 households (46.9%) were categorized as implementing. These findings indicate that the implementation of household wastewater management remains suboptimal in the study area.

Behavioral Factors According to Snehandu B. Kar's Theory

Five behavioral components based on Snehandu B. Kar's Theory were assessed: behavior intention, social support, accessibility of information, personal autonomy, and action situation.(4)

Table 2. Behavioral Factors According to Snehandu B. Kar's Theory in Bongkaran Urban Village

Variable	Frequency	Percentage
Behavior Intention		
No Intention	22	22.4%
Intention	76	77.6%
Social Support		
No Support	26	26.5%
Support Available	72	73.5%
Accessibility of Information		
Not Available	59	60.2%
Available	39	39.8%
Personal Autonomy		
Not Favorable	21	21.4%
Favorable	77	78.6%
Action Situation		
Not Enabling	55	56.1%
Enabling	43	43.9%

Source: Primary Data

Most respondents were categorized as having behavior intention, with 76 respondents (77.6%). Regarding social support, 72 respondents (73.5%) reported receiving social support. For accessibility of information, 59 respondents (60.2%) were categorized as having information that was not available, while 39 respondents (39.8%) were categorized as having available information. Furthermore, 77 respondents (78.6%) were categorized as having favorable personal autonomy. Regarding action situation, 55 respondents (56.1%) were categorized as being in a non-enabling situation.

Bivariate Analysis of Behavioral Factors and the Implementation of STBM Pillar V

Bivariate analysis was conducted to examine the association between the five behavioral components based on Snehendu B. Kar's Theory and the implementation of STBM Pillar V for household wastewater management. The analysis was performed using the Chi-square test with a significance level of 0.05. The results are presented in Table 3.

Table 3. Association Between Behavioral Factors and the Implementation of STBM Pillar V

Variable	Category	Not Implementing n (%)	Implementing n (%)	Total n (%)	p-value	Crude OR (95% CI)
Behavior Intention	No intention	21 (95.5%)	1 (4.5%)	22 (22.4%)	<0.001	30.48 (3.89–238.61)
	Intention	31 (40.8%)	45 (59.2%)	76 (77.6%)		Reference
Social Support	No social support	23 (88.5%)	3 (11.5%)	26 (26.5%)	<0.001	11.37 (3.12–41.38)
	Social support	29 (40.3%)	43 (59.7%)	72 (73.5%)		Reference
Accessibility of Information	Not available	39 (66.1%)	20 (33.9%)	59 (60.2%)	0.001	3.90 (1.66–9.19)
	Available	13 (33.3%)	26 (66.7%)	39 (39.8%)		Reference
Personal Autonomy	Not favorable	18 (85.7%)	3 (14.3%)	21 (21.4%)	0.001	7.59 (2.06–27.91)
	Favorable	34 (44.2%)	43 (55.8%)	77 (78.6%)		Reference
Action Situation	Not enabling	36 (65.5%)	19 (34.5%)	55 (56.1%)	0.005	3.20 (1.39–7.34)
	Enabling	16 (37.2%)	27 (62.8%)	43 (43.9%)		Reference

Source: Primary Data

The bivariate analysis showed statistically significant associations between all five behavioral components and the implementation of STBM Pillar V for household wastewater management ($p < 0.05$). For behavior intention, the proportion of implementation was 59.2% among respondents with intention, compared with 4.5% among those with no intention ($p < 0.001$). For social support, implementation was observed in 59.7% of respondents who received support and 11.5% of those who did not receive support ($p < 0.001$).

Regarding accessibility of information, 66.7% of respondents with available information implemented household wastewater management, compared with 33.9% among those without available information ($p = 0.001$). For personal autonomy, implementation was observed in 55.8% of respondents with Favorable and 14.3% among those with not favorable ($p = 0.001$). Similarly, implementation occurred in 62.8% of respondents in an enabling action situation, compared with 34.5% among those in a non-enabling situation ($p = 0.005$).

DISCUSSION

Implementation of Household Wastewater Management in Bongkaran Urban Village

The implementation of STBM Pillar V for household wastewater management in Bongkaran Urban Village was still suboptimal, with 53.1% of households categorized as not implementing appropriate household wastewater management. This finding indicates that household wastewater management remains a challenge at the household level. Household wastewater management is not determined solely by the availability of sanitation facilities but may also be related to behavioral and environmental conditions. Therefore, efforts to improve STBM Pillar V implementation need to consider both household behavioral factors and the conditions that support households in carrying out appropriate wastewater management practices.

Household wastewater characteristics may vary according to the sources of domestic activities. Khotimah et al. reported differences in the characteristics of household greywater according to its source (6). In addition, Arsanata and Paweneng reported an association between household wastewater sewerage ownership and household and environmental factors (8). These findings support the importance of considering both behavioral and environmental aspects in household wastewater management. In the context of Bongkaran Urban Village, the implementation of STBM Pillar V therefore requires not only behavioral improvement but also adequate wastewater management facilities and environmental conditions.

Behavioral Factors According to Snehandu B. Kar's Theory

The results showed that all five behavioral components based on Snehandu B. Kar's Theory behavior intention, social support, accessibility of information, personal autonomy, and action situation were significantly associated with the implementation of STBM Pillar V. Snehandu B. Kar's Theory provides a psychosocial framework for understanding health behavior through behavioral intention, social support, accessibility of means for action, personal autonomy, and action situation (4). In this study, the theoretical component of accessibility of means for action was operationalized as accessibility of information. These components provide a framework for understanding why individuals may or may not translate health-related intentions into actual behavior.

Behavior Intention

Behavior intention was significantly associated with the implementation of STBM Pillar V ($p < 0.001$). Most respondents (77.6%) were categorized as having an intention to implement appropriate household wastewater management. Among respondents with an intention, 59.2% implemented appropriate wastewater management, whereas only 4.5% of respondents without intention implemented it.

This finding is consistent with Snehandu B. Kar's Theory, in which behavior intention represents an individual's intention to undertake health-related action (4). Cahyani and Widati also examined behavior intention as one of the behavioral components related to health behavior (5). Although their study focused on compliance with the use of personal protective equipment rather than household wastewater management, their findings provide supporting evidence for considering behavioral intention when examining health-related behavior.

In the context of STBM Pillar V, strengthening household intention should therefore be accompanied by health promotion that provides clear information about the benefits and risks associated with household wastewater management. However, intention alone may not be sufficient to produce appropriate behavior when households face limitations in information, social support, autonomy, or enabling environmental conditions.

Social Support

Social support was significantly associated with the implementation of STBM Pillar V ($p < 0.001$). Most respondents (73.5%) reported having social support. The proportion of implementation was higher among respondents who received social support (59.7%) than among those who did not (11.5%).

This finding is consistent with Snehandu B. Kar's Theory, which identifies social support as one of the factors associated with health behavior (4). Cahyani and Widati also included social support as one of the behavioral components examined in relation to health behavior (5). In addition, Hidayat et al. emphasized the importance of community participation in the management of wastewater infrastructure (8). Community involvement can provide practical support, encourage participation, and strengthen collective responsibility for maintaining sanitation facilities and wastewater management systems.

Therefore, efforts to improve STBM Pillar V implementation should not rely solely on individual households. Family involvement and community participation should also be strengthened. Health workers and community health cadres can facilitate discussions, provide assistance, and encourage households to participate in collective wastewater management activities.

Accessibility of Information

Accessibility of information was significantly associated with the implementation of STBM Pillar V ($p = 0.001$). In the univariate results, 60.2% of respondents were categorized as having information that was not available.

Information about appropriate household wastewater management can help households understand the potential environmental consequences of improper wastewater disposal and the practices required to manage wastewater safely. The theoretical component of accessibility of means for action in Snehandu B. Kar's Theory was operationalized in this study as accessibility of information (4). Cahyani and Widati also examined accessibility of information as a component associated with health behavior (5).

The findings suggest that providing relevant information should be an important component of STBM Pillar V implementation. Information should be delivered through communication channels that are accessible and understandable to the community. Health workers, cadres, and local authorities can provide practical information concerning wastewater disposal, wastewater drainage, maintenance of wastewater facilities, and the environmental consequences of inappropriate wastewater disposal. Improving access to relevant information may help households understand not only what should be done but also why appropriate wastewater management is necessary.

Personal Autonomy

Personal autonomy was significantly associated with the implementation of STBM Pillar V ($p = 0.001$). Most respondents (78.6%) had favorable personal autonomy. Among respondents with favorable personal autonomy, 55.8% implemented appropriate household wastewater management, compared with 14.3% among those with less favorable personal autonomy.

Personal autonomy refers to the ability of individuals to make decisions and take action concerning their health-related behavior. In household wastewater management, autonomy may provide household members with an opportunity to determine and implement wastewater management practices according to their household circumstances.

This finding is consistent with Snehandu B. Kar's Theory, which identifies personal autonomy as one of the components associated with health behavior (4). Cahyani and Widati also included personal autonomy as a behavioral component in their analysis of health-related behavior (5). The similarity of the behavioral components examined in the two studies supports the relevance of personal autonomy as a factor to consider when interpreting health behavior.

In relation to STBM Pillar V, household empowerment is therefore important. Households need sufficient opportunity to participate in decisions concerning wastewater management and to determine appropriate actions based on their environmental and household conditions. Nevertheless, autonomy should be accompanied by adequate information, social support, and enabling conditions so that household decisions can be translated into appropriate wastewater management practices.

Action Situation

Action situation was significantly associated with the implementation of STBM Pillar V ($p=0.005$). In this study, 56.1% of respondents were categorized as being in a non-enabling action situation. Among respondents in an enabling action situation, 62.8% implemented appropriate wastewater management, compared with 34.5% among those in a non-enabling situation.

The concept of action situation in Snehandu B. Kar's Theory emphasizes the importance of conditions that enable or hinder individuals from carrying out health-related actions (4). In the context of household wastewater management, such conditions may include the availability and condition of wastewater drainage facilities, the physical environment surrounding the household, and opportunities for community participation.

Arsanata and Paweneng reported an association between household wastewater sewerage management and household and environmental factors (8). Hidayat et al. also highlighted the importance of community participation in wastewater infrastructure management (8). These findings support the interpretation that behavioral change cannot be separated from the conditions in which households are expected to act.

Therefore, interventions to improve STBM Pillar V should include efforts to create enabling conditions at the household and community levels. Providing or improving wastewater drainage facilities, maintaining existing infrastructure, and strengthening community participation may help households translate their intentions into actual wastewater management practices.

Overall Interpretation

Overall, the findings demonstrate that the implementation of STBM Pillar V is related to multiple behavioral components rather than a single factor. Behavior intention and personal autonomy represent individual-level components, while social support, accessibility of information, and action situation reflect important social, informational, and environmental conditions. This is consistent with the conceptual framework of Snehandu B. Kar's Theory, which views health behavior as being associated with intention, social support, information accessibility, personal autonomy, and situations that enable action.

The findings also indicate that interventions aimed at improving household wastewater management should be implemented comprehensively. Health education can be used to strengthen behavioral intention and improve access to information, while family and community involvement can strengthen social support. At the same time, household empowerment can strengthen personal autonomy, and improvements in environmental conditions and sanitation facilities can create situations that enable households to act.

However, because this study used a cross-sectional design, the observed associations should not be interpreted as causal relationships. The findings describe the relationship between the behavioral factors and the implementation of STBM Pillar V at the time of the study. Further studies using longitudinal or intervention designs may be needed to examine whether changes in these behavioral factors lead to improvements in household wastewater management practices.

CONCLUSION

The implementation of STBM Pillar V for household wastewater management in Bongkaran Urban Village, Surabaya City, in 2026 remains suboptimal. Behavioral factors based on Snehendu B. Kar's Theory, comprising behavior intention, social support, accessibility of information, personal autonomy, and action situation, were significantly associated with the implementation of STBM Pillar V. The findings indicate that household wastewater management is associated with intention to take action, social support, access to information, household decision-making capacity, and conditions that enable action. Improving the implementation of STBM Pillar V therefore requires an integrated approach that addresses individual, social, informational, and environmental factors.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Perak Timur Public Health Center and the Bongkaran Urban Village Government for their support and assistance in facilitating this research. The authors also extend their appreciation to all respondents who participated in the study and provided the information required for this research.

REFERENCES

1. World Health Organization. Progress on the proportion of domestic and industrial wastewater flows safely treated: mid-term status of SDG Indicator 6.3.1 and acceleration needs, with a special focus on climate change, wastewater reuse and health. Geneva: World Health Organization; 2024.
2. Widyarani W, Wulan DR, Hamidah U, Komarulzaman A, Rosmalina RT, Sintawardani N. Domestic wastewater in Indonesia: generation, characteristics and treatment. *Environ Sci Pollut Res Int*. 2022;29(22):32397-32414. doi:10.1007/s11356-022-19057-6.
3. Kementerian Kesehatan Republik Indonesia, Direktorat Penyehatan Lingkungan. Pedoman pelaksanaan monitoring dan verifikasi STBM 5 pilar. Jakarta: Kementerian Kesehatan Republik Indonesia; 2022.
4. Kar SB. Psychosocial environment: a health promotion model. *Int Q Community Health Educ*. 1983;4(4):311-341. doi:10.2190/5N5Y-A1XU-7TN0-9E89.
5. Cahyani FT, Widati S. The influence of behavior intention, personal autonomy, accessibility of information, and social support on the compliance of the use of PPE at PT. PLN. *Indones J Public Health*. 2021;16(1):112-123. doi:10.20473/ijph.v16i1.2021.112-123.
6. Khotimah SN, Mardhotillah NA, Arifaini N, Sumiharni. Karakterisasi limbah cair greywater pada level rumah tangga berdasarkan sumber emisi. *J Saintis*. 2021;21(2):71-78. doi:10.25299/saintis2021.vol21(02).7876.
7. Arsanata KM, Paweneng ET. The analysis of the household wastewater sewerage ownership factor in the working area of Pamotan Health Center, Rembang Regency, Central Java. *J Presipitasi*. 2024;21(1):264-275. doi:10.14710/presipitasi.v21i1.264-275.
8. Hidayat R, Milanie F, Nuraini C, Azhari I, Sugiarto A. Success factors in managing wastewater infrastructure through community participation: case study of wastewater infrastructure in residential areas of Medan Deli Subdistrict, Medan. *Int J Papier Adv Sci Rev*. 2023;4(4):26-44. doi:10.47667/ijpasr.v4i4.256.
9. Pratama MBW, Hutasoit EO, Budhi WS. Desain ulang instalasi pengolahan limbah greywater dan sistem penyaluran air limbah (SPAL) domestik pada Rusunawa Gunung Anyar Surabaya. *J Sumberd Alam Lingkung*. 2023;8(3):203-212. doi:10.29244/jsil.8.03.203-212.

10. Rohendi A, Faridy F, Adinata BR, Kadafi M, Iqra AP, Rahmawan I. Community's willingness to participate in wastewater management in Aceh. *J Community Based Environ Eng Manag.* 2025;9(1). doi:10.23969/jcbeem.v9i1.21051.
11. Eliza L, Rodhiyah Z, Hutagalung WLC. The relationship between the household wastewater disposal system and the quality of well water in the Puri Angsa Asri 2 housing areas in Muaro Jambi. *Lingkar J Environ Eng.* 2025;6(2):18-30. doi:10.22373/ljee.v6i2.8639.
12. Setiawati Y, Suryani L, Wahyudi A, Ulfah M. Analisis faktor kepemilikan saluran pembuangan air limbah rumah tangga. *Cendekia Medika.* 2024;9(2):368-376.
13. Sapta WA, Murwanto B. Penyuluhan pembuatan sarana pembuangan air limbah (SPAL) rumah tangga di Dusun Bangun Rejo Desa Sidosari Kecamatan Natar. *Community Development Journal.* 2024;5(2):3256-3261. doi:10.31004/cdj.v5i2.26545.
14. Amir A, Dinda AQ, Putri FE, Noerjoedianto J, Lesmana OS. Factors related to household waste water channels (SPAL) in the working area of the Sanggaran Agung Community Health Center, Kerinci Regency in 2023. *Int Sci Health J.* 2023;1(3). doi:10.59680/ishel.v1i3.767.
15. Alamsyah MF, Dwicahya B. Edukasi pengelolaan saluran pembuangan air limbah (SPAL) rumah tangga untuk meningkatkan sanitasi lingkungan di Desa Sakay Tahun 2025. *J Pengabdian MALEO.* 2026;4(2):93-101. doi:10.51888/maleo.v4i2.450.