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The Effectiveness of Community-Based Triggering on Waste Management Behavior Change and Fly Density in Tambang Village, Tambang District, Kampar Regency, Indonesia 2026

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Abstract

Inadequate waste management remains an environmental health issue in many rural areas. Unmanaged waste piles can serve as breeding grounds for flies, potentially transmitting environmental-related diseases. Efforts to change community behavior through a community-led triggering approach require evaluation regarding their effectiveness—not only in terms of behavioral change but also the resulting environmental impact. This study aimed to analyze the effectiveness of community-led triggering on waste management behavior and fly density in Tambang Village, Tambang District, Kampar Regency. A quasi-experimental, one-group pretest-posttest design was employed. A sample of 430 respondents was selected using purposive sampling. The intervention consisted of a four-week triggering program comprising problem mapping, transect walks, group discussions, community commitment, and monitoring. Behavior was assessed using a structured questionnaire, while fly density was measured using a fly grill at 20 observation points. Data were analyzed using a paired t-test with a 95% confidence level. The mean waste management behavior score increased from 58.4 ± 10.2 to 79.7 ± 8.5 following the intervention ($p < 0.001$). The percentage of respondents categorized as having "good" behavior rose from 37.2% to 81.4%. The mean fly density index decreased from 12.6 ± 3.8 to 5.2 ± 2.1 ($p < 0.001$). In conclusion, community-led triggering is effective in improving household waste management behavior and reducing fly density in residential areas.

Keywords: triggering, waste management, fly density, environmental health, behavior

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Introduction

The rise in global waste volume has emerged as a critical environmental and public health crisis over the last decade (Hossain et al., 2024). Driven by exponential population growth and rapid urbanization, consumption patterns have shifted significantly toward single-use products, thereby accelerating waste accumulation (Agamuthu & Babel, 2023). This phenomenon places severe strain on the environment's increasingly limited carrying capacity, as the rate of waste generation outpaces downstream management capabilities (Kafle et al., 2025). In developing nations like Indonesia, the complexity of this issue is often compounded by inadequate technical infrastructure and weak integrated waste management systems—spanning from the central government down to rural areas (Glova Végsöová & Straka, 2025). From an ecological perspective, inadequate waste management practices can trigger multi-sectoral environmental degradation (Hajam et al., 2023). Open dumping of organic and inorganic waste poses a risk of soil contamination through the infiltration of toxic substances, as well as the pollution of surface water and groundwater via leachate runoff (Macaulay et al., 2026). Furthermore, the open burning of waste releases greenhouse gases, dioxins, and hazardous particulates, thereby deteriorating local air quality (Gunarathne et al., 2024). Environments polluted by such solid waste accumulations create ideal microhabitats for the proliferation of disease vectors—particularly the housefly (*Musca domestica*)—which can mechanically transmit gastrointestinal pathogens (Akhtar et al., 2021).

This tangible problem is clearly evident at the local level, as revealed by preliminary observations in Tambang Village, Tambang District, Kampar Regency. In this area, illegal accumulations of household waste were found along main roads and riverbanks. Indiscriminate waste disposal practices lead to aesthetic degradation, unpleasant odors, and a significant surge in fly populations near residential areas. High fly density in domestic environments not only diminishes the community's quality of life but also directly increases the risk of transmitting environmental diseases such as diarrhea, typhoid, and dysentery (Okin et al., 2024). Although structural interventions—such as providing temporary waste collection points and transport fleets—are theoretically considered conventional solutions, they often prove ineffective without accompanying behavioral changes at the household level (Adhikari et al., 2023). Source-based waste management requires a cultural transformation and intrinsic awareness among all community members (Amato et al., 2024). Without active community participation, physical infrastructure often falls into disrepair and fails to address the root causes of the waste problem (Segala et al., 2025).

Moving beyond conventional, top-down approaches, Community-Led Total Sanitation (CLTS)—or community-led triggering—has emerged as a new paradigm in health behavior engineering (Syamsiyah et al., 2025). Rather than providing direct material aid, this approach fosters critical awareness within the community through a participatory analysis of their own environmental conditions (Sattayapanich et al., 2022). By employing psychosocial methods that evoke shock, disgust, shame, and fear regarding health consequences, the intervention aims to spark collective action and a self-driven commitment among residents to achieve sustainable

changes in unhealthy behaviors (Wilkie et al., 2026). To date, literature on the effectiveness of community-based triggering has largely focused narrowly on accelerating the elimination of open defecation (SBS/ODF) and basic hygiene and sanitation (Li et al., 2026). There is a clear research gap regarding the extent to which the dynamics of these participatory triggering interventions can be replicated and specifically adapted to transform household solid waste management behaviors in rural riverside communities (Islam et al., 2024). Most studies on rural waste management still emphasize circular economy aspects or one-way information dissemination, without measuring the emotional dynamics and social triggering mechanisms that underpin permanent behavioral change within the community (Saha & Melnik, 2025).

The novelty of this research lies in the application of a community-based triggering methodology specifically adapted to the context of household waste issues in a particular rural setting—specifically, a riverside village characterized by low initial participation levels. This study goes beyond merely measuring theoretical knowledge changes; it comprehensively evaluates concrete shifts in community behavior (practical behavioral shifts) before (pre-intervention) and after (post-intervention) the triggering process, covering aspects ranging from waste sorting and reduction to final household waste handling (Arista et al., 2023). The urgency of this research stems from the pressing need for a social intervention model that is rational, efficient, and capable of delivering long-term impact in resolving the local waste crisis in Tambang Village, Kampar Regency. If indiscriminate waste dumping along riverbanks and roadsides is left unaddressed by appropriate behavioral interventions, the risks of environmentally-linked infectious diseases and aquatic ecosystem damage will escalate massively (Raghu & Rodrigues, 2020). The findings of this study are expected to provide empirical evidence to assist policymakers and local health agencies in formulating community-based environmental health intervention programs.

Based on this comprehensive overview of empirical conditions and the academic gap, the research problem is formulated as follows: "Is community-based triggering effective in improving household waste management behavior in Tambang Village, Tambang District, Kampar Regency?" This study aims to address the need for measurable interventions through quantitative data analysis and a participatory assessment of shifts in residents' behavior. In general, this study aims to analyze the effectiveness of community-based triggering on household waste management behavior in Tambang Village, Tambang District, Kampar Regency. Specifically, the study aims to: Identify community household waste management behavior prior to (pre-test) the community-based triggering intervention; Identify community household waste management behavior following (post-test) the community-based triggering intervention. To analyze the difference (significance of change) in household waste management behavior before and after the implementation of community-based triggering in Tambang Village, Tambang District, Kampar Regency.

Method

Research Type and Design

This study employs a quantitative research approach with a quasi-experimental design using a One-Group Pretest-Posttest method (O1 \rightarrow X \rightarrow O_2$). In this design, initial observations or pretest measurements (O1) are conducted prior to the implementation of a community-based triggering intervention (X). Following the intervention, posttest measurements (O2) are taken to assess and evaluate any changes or effects resulting from the intervention.

Research Location and Time

The research will be conducted in Tambang Village, located within the Tambang District of Kampar Regency, Riau Province. The study is scheduled to take place over a four-month period, running from June to September 2026.

Population and Sample

The population for this study comprises all heads of households residing in Tambang Village, totaling 430 households. Given the manageable size of the population, this study utilizes a total sampling technique (saturated sampling), making the final sample size equal to the entire population of 430 respondents.

Research Variables

This study involves both independent and dependent variables. The independent variable is community-based triggering, which serves as the core intervention. The dependent variables consist of two primary outcome measures: household waste management behavior and local fly density.

Research Instruments

Data collection relies on two primary research instruments. Household waste management behavior is measured using a structured questionnaire consisting of 25 validated items. Meanwhile, environmental fly density is systematically measured using a standard fly grill.

Validity and Reliability Tests

To ensure data accuracy and consistency, research instruments undergo rigorous measurement testing. Instrument validity is assessed using the Pearson Product-Moment correlation test. Instrument reliability is evaluated using Cronbach's Alpha coefficient, adhering to a minimum benchmark criterion of ge 0.70 for acceptable internal consistency.

Research Procedure

The operational execution of this study is structured into four distinct sequential phases: Preparation Phase: Involves preliminary surveys, ethical approvals, and instrument validation; Pretest (O1): Initial baseline measurements of household waste management behavior and fly density are recorded; Intervention (X): Implementation of the community-based triggering intervention over a duration of four weeks; Posttest (O_2): Re-assessment of the dependent variables using the same instruments to determine post-intervention outcomes.

Data Processing

Once data collection is complete, the raw data undergoes systematic data management procedures to ensure cleanliness and usability. This process follows four key steps: editing to check for completeness, coding to categorize responses, data entry into computerized statistical software, and final data cleaning to address missing or inconsistent entries.

Data Analysis

Data analysis includes both univariate and bivariate statistical methods. Univariate analysis is conducted to describe the distribution and demographic profile of the variables. Bivariate analysis is performed to test differences between pretest and posttest measurements. The selection

of the statistical test depends on the normality of the data distribution: a Paired t-test will be utilized if the data is normally distributed, whereas a non-parametric Wilcoxon signed-rank test will be applied if the normality assumption is violated.

Research Operational Framework

The structural flow of this research follows a clear operational pathway: starting with the preliminary survey, followed by the baseline pretest (O_1), execution of the four-week triggering intervention (X), evaluation via posttest (O_2), rigorous data analysis, and concluding with the final research interpretations and conclusions.

Results and Discussion

The following are the results of this study:

Table 1. Respondent Characteristics (n=430)

Variable	n	%
Male	180	41,9
Female	250	58,1
Age 18–35 years	120	27,9
Age 36–55 years	220	51,2
>55 years	90	20,9

Table 2. Changes in Waste Management Behavior

Category	After	Before
Good	160 (37,2%)	350 (81,4%)
Not Good	270 (62,8%)	80 (18,6%)

Table 3. Behavior Score Changes

Variable	Mean	SD	p-value
Pretest	58,4	10,2	
Posttest	79,7	8,5	<0,001

Table 4. Fly Density

Variable	Mean	SD	p-value
Before Intervention	12,6	3,8	
After Intervention	5,2	2,1	<0,001

Table 5. Changes in Waste Management Practices

Indicators	After (%)	Before (%)
Having a covered trash bin	31,6	84,7
Sorting household waste	18,4	73,5
Not disposing of waste into rivers	54,0	92,3
Participating in neighborhood cleanup activities	39,5	88,1

The results show that all behavioral indicators improved following the implementation of the triggering process.

The results of this study empirically demonstrate that the community-led triggering approach contributes significantly to improving household waste management behaviors. The post-intervention surge in average behavioral scores—an increase of 21.3 points—indicates a shift in mindsets and social norms at the local level. The success of this triggering process aligns with fundamental health promotion principles that emphasize the importance of internal community awareness over top-down, instructive approaches (Kar & Chambers, 2008). Communities that previously viewed waste merely as a natural consequence of daily activities began to recognize its direct health implications (Muchanga, 2017). The improvement in community behavior following the triggering process can be comprehensively explained using the Precede-Proceed theoretical framework developed by Lawrence Green. In this context, triggering activities—driven by emotion and self-analysis—serve as predisposing factors that effectively alter community knowledge, risk perceptions, and attitudes toward waste management (Lim, 2025). Triggering does not merely disseminate medical information; it evokes feelings of disgust and shame, leading to a collective intention to change (Midtgård & Selart, 2025). This internalized knowledge establishes a solid psychological foundation for the adoption of improved sanitation practices (Teym et al., 2026). Sustained behavioral change cannot exist in isolation; it requires support from structural elements on the ground, specifically reinforcing factors. The active involvement of community figures, traditional leaders, and local health volunteers has proven to be a key pillar in maintaining positive social dynamics following the triggering process (Qi et al., 2024). Community figures provide social legitimacy and leadership, while health volunteers conduct periodic monitoring and reinforce education through personal engagement (Raghu & Rodrigues, 2020). This collaboration among local figures created a mechanism of spontaneous social control—or peer pressure—that prevented community members from reverting to old habits (Yamin et al., 2019).

The primary novelty of this study lies in its application of a dual-outcome measurement scheme, which simultaneously integrates human behavioral changes with environmental biological parameters. Previous health promotion studies often focused narrowly on evaluating post-intervention levels of knowledge, attitudes, or self-reported behavior (Kreitchmann et al., 2019). Such one-sided evaluations are considered susceptible to response bias (specifically social desirability bias) and often fail to reflect actual conditions in the field (Lavidas et al., 2022). By combining behavioral variables with physical-biological indicators, this study presents scientific evidence that is far more comprehensive and quantifiable. The 58.7% reduction in fly density following the intervention serves as valid empirical evidence that changes in community behavior directly impact environmental quality improvements. Flies—particularly *Musca domestica*—are biological indicators highly sensitive to environmental cleanliness and the presence of exposed organic waste (Koller et al., 2023). The decline in this vector population tangibly confirms that non-physical interventions, such as "triggering" techniques, can effectively alter the micro-ecological conditions of settlements (Surya et al., 2020). This success dramatically reduces the risk of environmentally-linked disease transmission (Liu et al., 2025).

Specifically, the mechanism behind this reduction in fly density is closely linked to the disruption of the chain of nutrient availability and vector breeding. Once triggered, the community collectively shifted to using covered trash bins, practicing organic-inorganic waste segregation at the source, and abandoning the habit of indiscriminate dumping in open areas (Su et al., 2026). Reducing accumulations of wet waste in open areas eliminates the volatile attractants that draw adult flies to lay eggs (Dara et al., 2026). Consistent waste sorting and the use of covered waste containers effectively break the fly larval life cycle (Tariq et al., 2025). Successfully breaking the

fly breeding cycle has a substantial public health impact, given that flies act as mechanical vectors for various gastrointestinal diseases. Flies transfer enteric pathogens—such as *Salmonella*, *Shigella*, and *Escherichia coli*—from waste piles to human food via their body parts and excreta deposits (Niu et al., 2022). A 58.7% reduction in the fly density index can significantly curb the potential incidence of diarrhea, typhoid fever, and other gastrointestinal diseases among vulnerable populations (Su et al., 2025). The study's rural setting—characterized by limited basic waste management facilities—further underscores the urgency and effectiveness of this approach. Rural areas are often beyond the reach of official local government waste collection services, making waste management entirely dependent on local community self-reliance (Sumiyati et al., 2026). Amidst infrastructure limitations, community-based triggering has proven to be an efficient strategy for maximizing local potential and social capital to manage waste independently (Nugraha et al., 2022). Waste accumulation in rural areas, particularly along riverbanks, presents unique and high-risk ecological challenges. The practice of using rivers as informal dumping grounds not only pollutes aquatic ecosystems but also spreads disease exposure to downstream areas (Asih et al., 2026). Implementing community-based triggering in riverbank settlements has successfully fostered a shared sense of ownership regarding river preservation (Rashed, 2025). Communities have begun to view the river as an environmental asset requiring protection, rather than merely a place to dump waste. Overall, this study confirms that community-based triggering is an adaptive, practical, and sustainable modality for environmental health promotion. Its ability to integrate psychosocial changes with measurable biological impacts (fly density) makes it a vital reference for health promotion policymakers. To sustain these effects in the long term, it is necessary to strengthen enabling factors—such as providing adequate waste-sorting facilities and consistently facilitating community-based waste processing (composting) (Sembiring et al., 2024).

Conclusion

Community-based triggering is effective in improving household waste management behavior and reducing fly density in Tambang Village, Tambang District, Kampar Regency. Following the four-week intervention among 430 respondents, mean waste management behavior scores increased significantly (from 58.4 ± 10.2 to 79.7 ± 8.5, $p < 0.001$), good waste management behavior rose from 37.2% to 81.4%, and the mean fly density index decreased by 58.7% (from 12.6 ± 3.8 to 5.2 ± 2.1, $p < 0.001$) across 20 observation points, accompanied by improvements in covered trash bin ownership, waste sorting, river protection, and neighborhood cleanup participation. Integrating behavioral outcomes with biological vector indicators demonstrates that participatory triggering can strengthen local self-reliance in rural and riverside waste management. To sustain these gains, local authorities and health stakeholders should integrate community-based triggering into Community-Based Total Sanitation (STBM) programs, mobilize village environmental cadres, expand community-level waste management and sorting facilities, and incorporate fly density monitoring into routine environmental sanitation surveillance.

Author Contributions

Novita Rany: conceptualized the study, designed the community-based triggering intervention, led fieldwork and data collection in Tambang Village, and drafted the manuscript. **Herniwanti**: contributed to methodology design, statistical analysis, and critical revision of the manuscript. **Mitra Mitra**: assisted with data curation, environmental and fly density monitoring procedures, and result interpretation. **Endang Purnawati Rahayu** contributed to theoretical

framing, discussion refinement, and supervision of the manuscript preparation. All authors have read and approved the final version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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Declaration of generative AI in scientific writing

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