





# Community-driven Waste Management: Insights from an Action Research Trial in Yogyakarta, Indonesia

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## Abstract:

**Background:** Yogyakarta is in a waste emergency period. Waste management poses a significant challenge in urban areas, necessitating innovative and sustainable solutions. This article explores the Community-based Waste Management (CBWM) approach implemented in Yogyakarta City, Indonesia, shedding light on valuable lessons from this initiative. Yogyakarta City's experience is a case study for understanding the effectiveness of involving local communities in waste management efforts. Through participatory programs, residents have been empowered to actively contribute to waste reduction, recycling, and proper disposal practices.

**Objective:** This study seeks public health-oriented household waste management options and increases public awareness about trash management while keeping public health in mind to overcome Yogyakarta's waste emergency.

**Methods:** This study employs an action research design mixed with qualitative research. Participants were members of society, government authorities (environmental and health offices), and the Yogyakarta Provincial and City Health Offices. For the trial method, participants comprised four cycles utilizing a standard random sample procedure. An in-depth interview was conducted to evaluate the procedure, and questionnaires were used to determine performance indicators for the procedure.

**Results:** Community-based action research guarantees that waste management is improved by approaching it from a public health standpoint. Waste management innovations include implementing environmental sanitation, clean and healthy lifestyles, implementing occupational health and safety concepts, sorting organic and inorganic waste, as well as innovations in household waste management infrastructure.

**Conclusion:** Innovation in waste management considers that public health is necessary for society. Innovation refines waste processing techniques that were previously in use. This idea is suitable and adaptable to the circumstances of Yogyakarta City residents.

**Keywords:** Participatory programs, Protective equipment, Public health, Households, Hygiene, Garbage.

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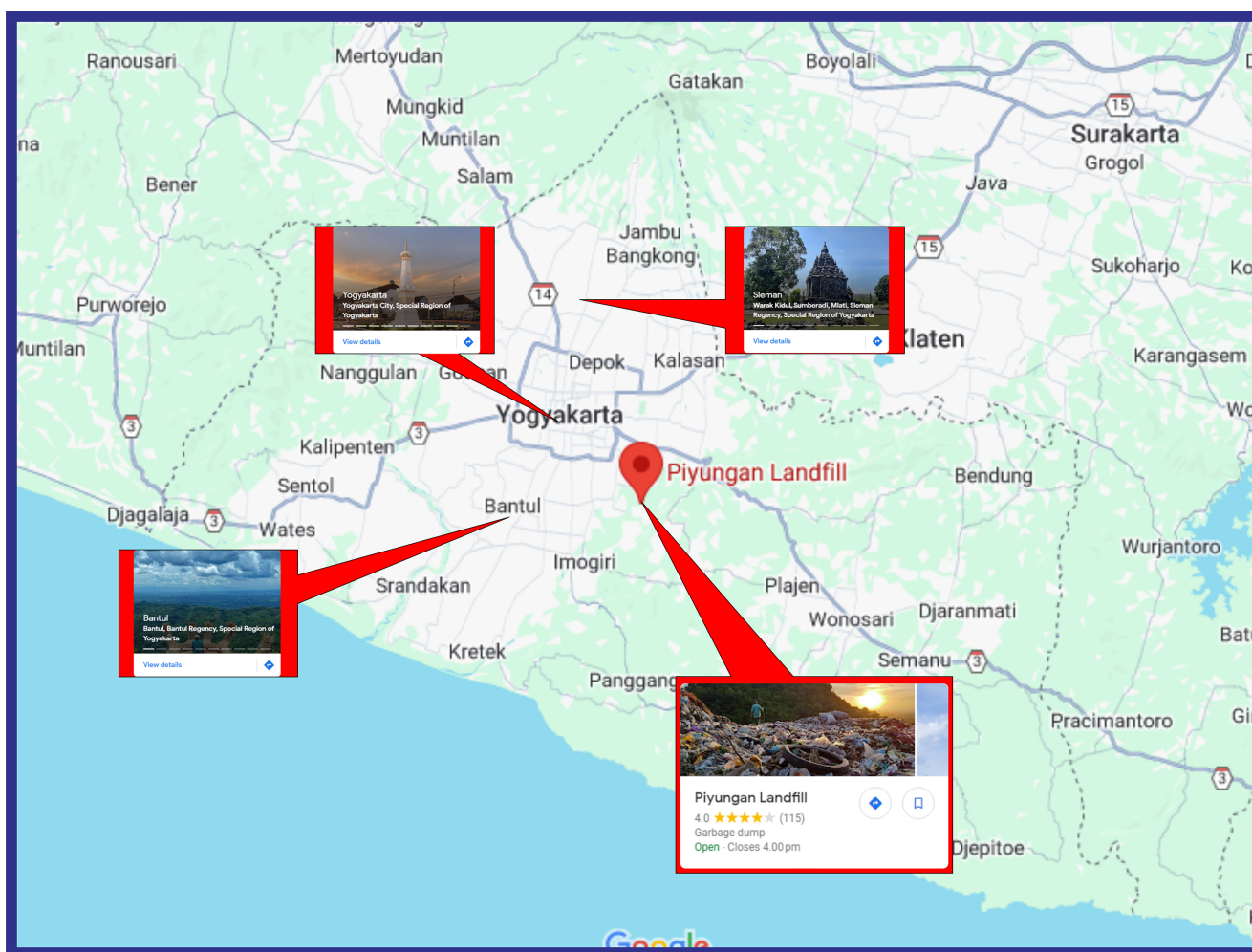
## 1. INTRODUCTION

Active participation is the key to building an empowered society, including waste management [1]; previous research stated Communities that involve their citizens deeply in community development work leverage more resources, achieve more outcomes, and develop more comprehensively and in a valuable way [2]. Waste management is an action that makes waste a resource in improving public health and the environment to reduce waste production and handle waste [3]. The government has a role in creating policies and managing waste management; the private sector plays a role in the business sector as an economic force, while households with good knowledge and skills are the key to successful waste management from the source [4].

The urgent waste problem in Yogyakarta prompted the conduct of this research. Yogyakarta needs a waste management solution that involves the community

because the local government is limited in providing final disposal sites. Based on preliminary studies, The Piyungan Integrated Waste Disposal Site has been a symbol for waste management in Daerah Istimewa Yogyakarta (DIY) province, and the average waste volume is 700 tons/day to 800 tons/day with 200 cycles. The total tonnage of waste that goes to the landfill Piyungan Regional from 2021 to 2023 per month reached 699,821, with the number of transports reaching 700. This waste volume will increase during the holiday season, reaching 15% of the average daily waste generation. The waste disposed of at the Piyungan landfill comes from Yogyakarta City, Sleman Regency, and Bantul Regency (Fig. 1).

DIY waste emergency status is also threatened at this time because the function of the Piyungan Landfill has decreased and cannot function as intended. The technical age of the Piyungan Landfill has reached its limit regarding its capability and capacity to accommodate waste. The development process for the Piyungan Landfill



**Fig. (1).** The piyungan final disposal site is the final dumping site for waste from districts in the DIY.

cannot be easily implemented. There are stages of changing management to the provincial level, exploring cooperation with investors, feasibility studies on waste management methods, and many discussions and opinion polls involving many groups. Panic was evident in several market waste managers and community members whose waste has not been picked up by the waste officials for several days.

Public complaints regarding the overloading of the Piyungan landfill have often occurred (Fig. 2). The waste problem at the Piyungan landfill is affecting the waste emergency in Yogyakarta province. As a solution, an agreement was made regarding environmentally friendly waste management technology solutions that must be operational before 2025, optimization of leachate drainage channels, assessment of residents' clean water, use and utilization of transition zones, land acquisition considering the interests of the population, and paying attention to transport fleets rubbish. The city of Yogyakarta has implemented a household waste management policy involving private and community sectors. As of December 1, 2022, the Yogyakarta City Government implemented a new policy for its citizens to sort waste from their homes. This policy is stated in the Mayor of Jogja circular letter No. 660/6123/SE/2022. There is also a circular letter from the Yogyakarta Special Region Government (DIY) number 658/8312 stating that the Piyungan Landfill will be closed from July 23 to September 5, 2023.

Policies to involve the community are important in dealing with the waste emergency in Yogyakarta. This policy is a vital solution to reduce the volume of waste

entering the Piyungan Landfill. The community is given facilities and training to manage waste independently. Household waste management by the community begins with separating organic and inorganic waste. Organic waste is managed into compost, and inorganic waste is recycled or sold to improve the family's economy. The problem in empowering people to process waste lies in increasing people's motivation and behavior, apart from that there is a fundamental technical problem, namely that the waste management methods previously implemented did not pay attention to the health factors of the waste management community.

The problem is the improvement of the weaknesses of community-based waste management methods. The weakness of this concept is that the focus of community-based waste management is only on the technical side of implementation, yet to pay attention to the public health aspects of household waste management. Even though managing household waste by the community means bringing waste closer to the family and home environment, until now, the Yogyakarta City Government has yet to pay attention to managing the risk of public health problems due to waste management in the household environment.

Household waste management in the home environment risks transmitting waste-borne diseases, breeding disease vectors, and creating environmental health problems. Without sufficient knowledge about waste and personal hygiene, adequate skills, and Personal Protective Equipment (PPE), household waste management will increase the public health risk due to waste. Activities in managing household waste that pose a risk to public health can be seen in Fig. (3).

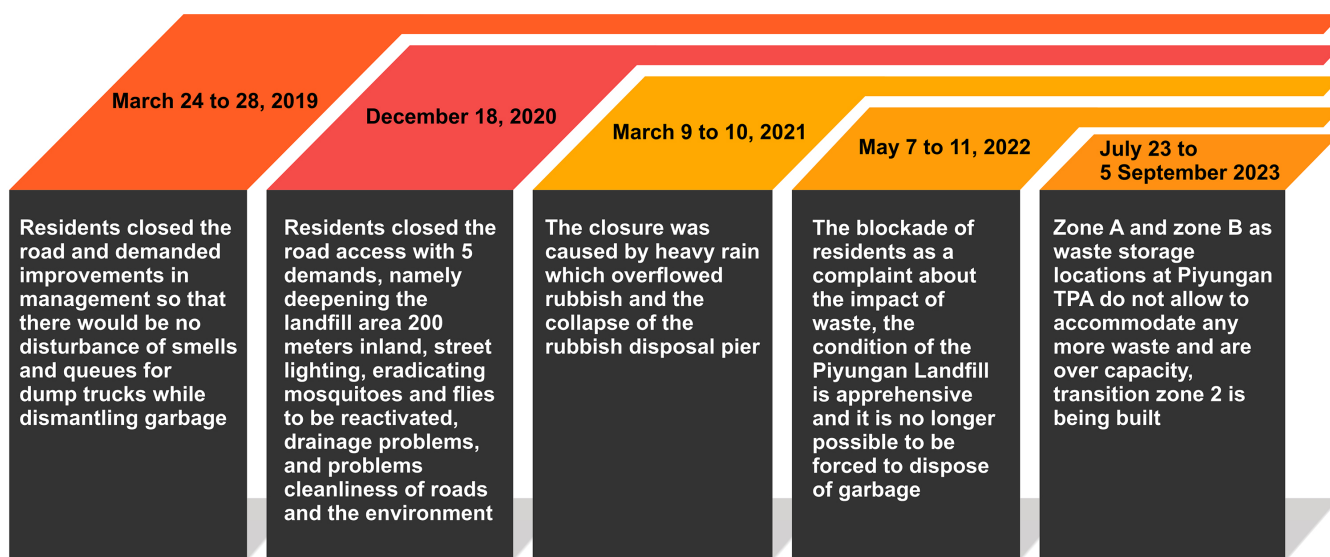


Fig. (2). Causes of piyungan landfill closure 2019-2023.

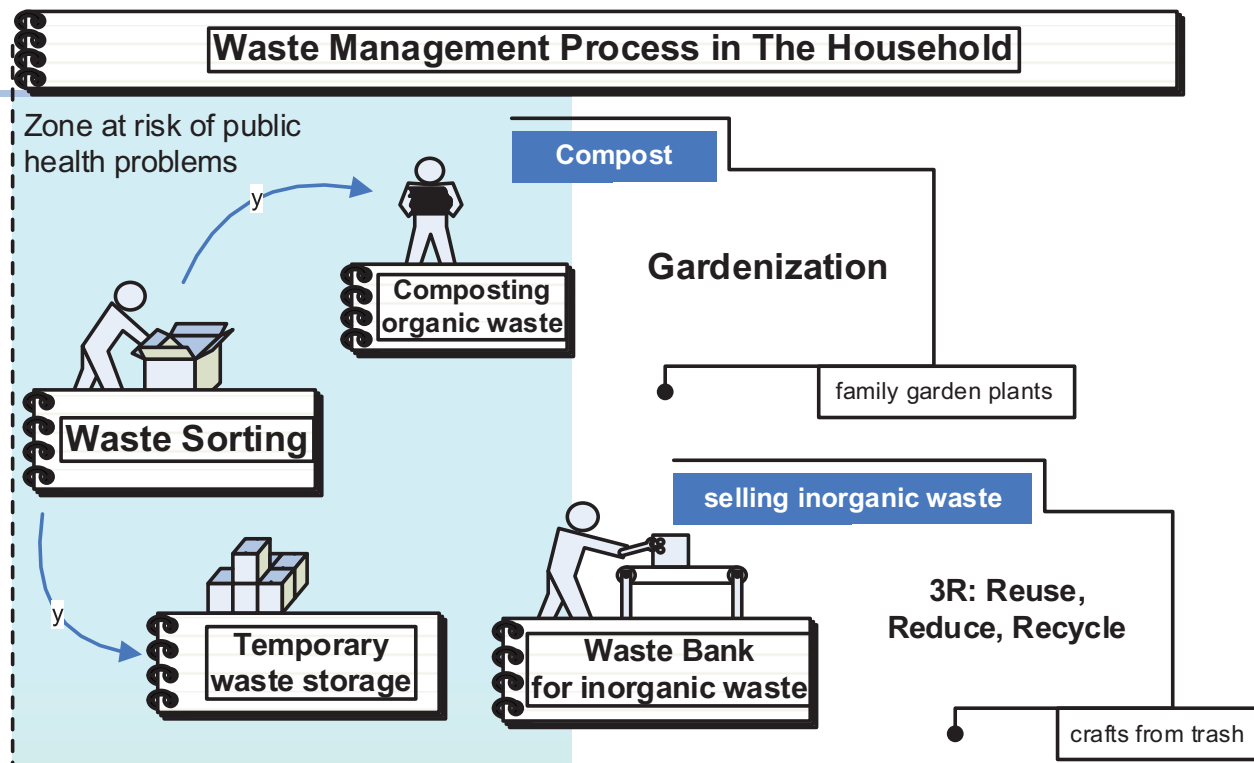


Fig. (3). Results of health risk analysis in household waste management.

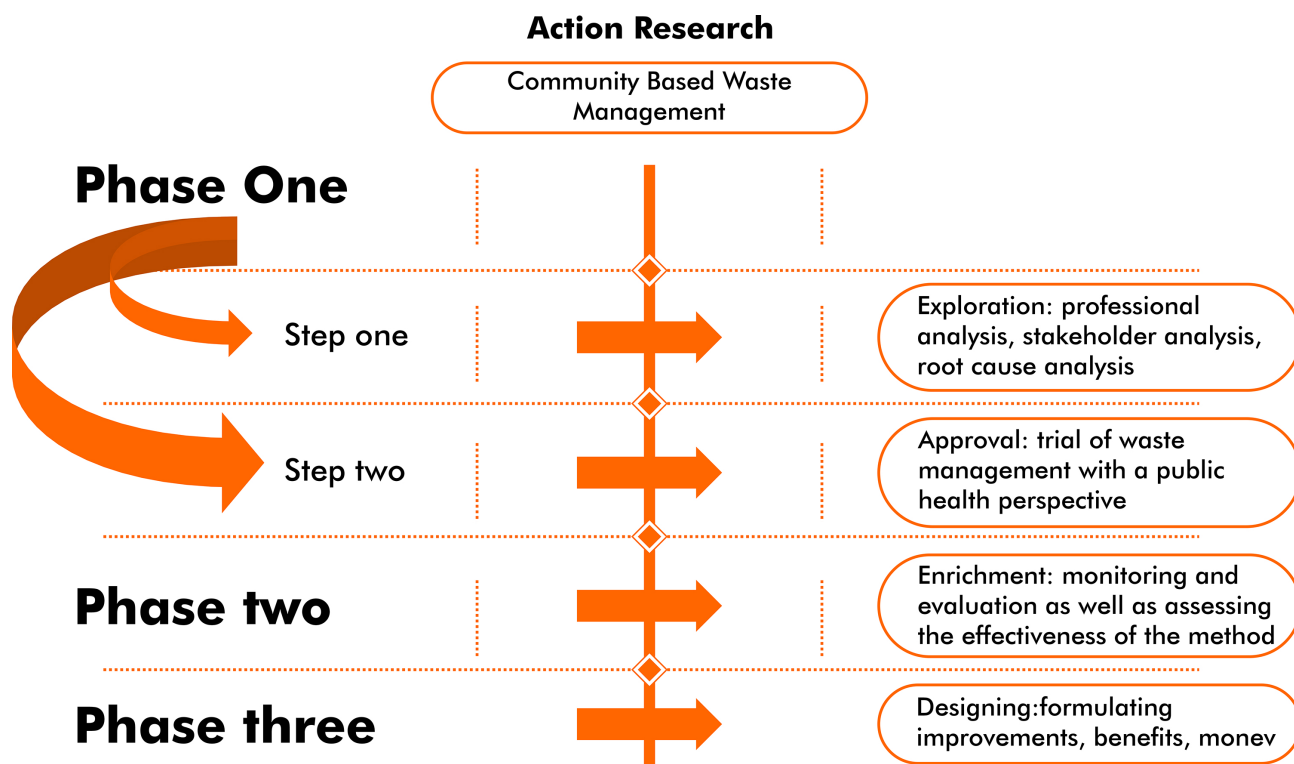


Fig. (4). Action research stages in household waste management.



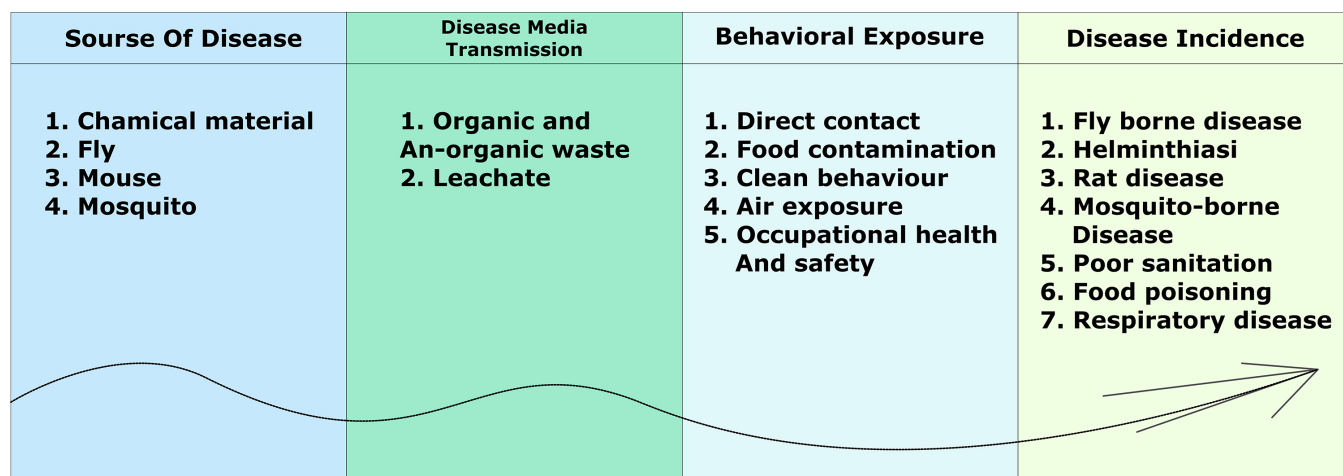


Fig. (5). Household waste management methods as an intervention.

Table 1. Setting and periode of research.

Setting of Research	Periode of Research
Processing research permits and research preparation	1 month
Outreach to potential participants	1 month
Recruitment of participants	
Training of participants	
Distribution of organic and inorganic waste management facilities and infrastructure	
Phase 1: Exploration	1 month
Phase 1: Approval	1 month
Conducting a pre-test	
Method implementation	
Phase 2: Enrichment	3 month
Three cycles with data collection as monitoring every cycle	
Phase 3: Designing	1 month

The goal of this study is to identify the most effective community empowerment strategy for addressing issues related to waste management communities' health and environmental health. The strategy developed attempts to concurrently address Yogyakarta's waste crisis. Specifically, this research aims to develop household waste management methods. By adding the principles of public health in managing waste. The principle of public health in waste management is to sort and manage waste by paying attention to personal hygiene and environmental sanitation to create a healthy environment without the risk of disease transmission due to waste. It is tested directly on the community to obtain the proper waste management method and can be applied. Research using the action research method is also expected to increase public awareness in the research location in managing waste while still paying attention to the health status of the community.

**2. MATERIAL AND METHOD**

**2.1. Study Design and Research Phase**

This research is qualitative research with an action

research design. This action research design involves intensive, systematic, and semi-structured experiential learning focusing on problem identification, prioritization, analysis, and linkage with available sustainable resources for sustainable solutions with community members, as presented in Figs. (4 and 5) [5].

The research was conducted in Bener Tegalrejo Village, RW 10, Yogyakarta City. This research was carried out for six months (Table 1):

**2.1.1. Exploration**

In phase 1, we consulted with professionals and stakeholders, and root cause analysis targeted community members, the Environmental Service, the Yogyakarta Provincial Health Office, and the Yogyakarta City Health Office. Approval: From this process, we produced the "household waste management innovations with a public health perspective" model (Fig. 6), accompanied by indicators. Next, we formulated an agreed model and tested it in phase 2.

**2.1.2. Enrichment**

In phase 2, we carried out the action research stage of

implementing the “household waste management innovations with a public health perspective” model (Fig. 6) in the field in several activity stages (cycles) 3 times over three months. Monitoring and Evaluation of the methods we offer are carried out throughout the cycle, and improvements to the model are made if problems are to be applied to the next cycle. We conducted interviews with informants participating in action research to explore the issues found at each stage, the causes of these problems, and their ideas for solutions to these problems.

### 2.1.3. Designing

In phase 3, we redesigned the method applied based on solutions resulting from discussions with the action research participant community so that the problems found could be immediately corrected and the “household waste management innovations with a public health perspective” method (Fig. 6) became more applicable according to community conditions.

## 2.2. Data Source, Data Collection, Sample and Analysis

Participants in this research were 35 selected people, namely housewives of productive age (15-64 years), with a minimum education of high school or equivalent, members of the waste bank in Bener Tegalrejo, and those who had previously managed organic and inorganic waste. They

were selected using a purposive technique with criteria: the people chosen to participate in this research were determined by first signing their willingness to become participants. The 35 participants who took part in this research met all the criteria mentioned above and had been members of the waste bank for at least 2 years.

Data were collected using observation, in-depth interviews, and focus group discussions using an interview guide, a checklist to observe community behavior and perceptions, and a dummy table for environmental health parameters such as the density of flies and rats, worm numbers, and sanitation of the home environment. All data collected was then analyzed using a grounded theory. The validity of the data was done using source and method triangulation techniques. Participants in validity were members of the public, government officials (Yogyakarta Province Environment and Forestry Service, Provincial Health Office), and the Yogyakarta City Health Department.

## 3. RESULTS AND DISCUSSION

The Piyungan landfill is reaching the end of its useful life, resulting in a trash emergency for Yogyakarta. The community must participate in the government's waste management program despite the government's constraints. Yogyakarta's waste management program has not

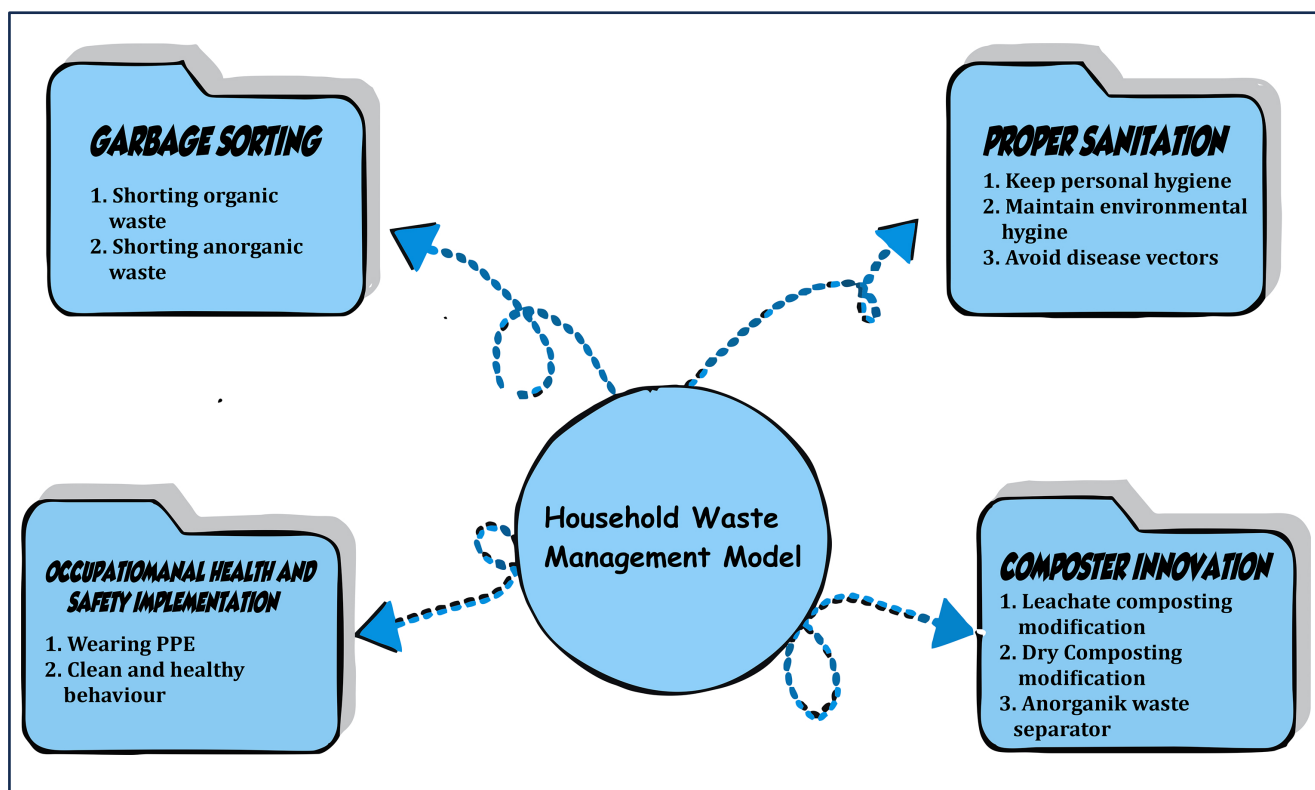


Fig. (6). Development of household waste management innovations with a public health perspective.

taken environmental health and the community's well-being into account. The implementation of waste management empowerment in Yogyakarta necessitates the development of waste management techniques that include public health to maximize waste management efficiency and prevent the escalation of health issues in the future. Research was conducted to develop techniques that may be applied later on in society to make this happen. The action research design implemented was analyzed descriptively using interview guide instruments, observation sheets, and focus group discussion guides. Participants are women, housewives, and are of productive age. Trials to prepare the method were carried out using action research which consisted of 3 phases.

### 3.1. Phase 1: Exploration and Approval

Phase 1 (step 1) developed a concept of household waste management with a public health orientation. The idea is built on professional, stakeholder, and root cause analysis. The concept of household waste management with public health orientation as a form of intervention is based on the idea of node theory (Fig. 5), namely environmental engineering to prevent vectors of disease (source of disease) caused by waste, preventing the spread of disease by managing waste (disease media transmission) as well as improving community behavior in maintaining personal hygiene (behavioral exposure). Disease prevention efforts are still practical based on professional, stakeholder, and root cause analysis.

Dynamics occur in participant involvement. During the trial, some participants dropped out, so they had to replace them with others and return to the action research cycle. In each cycle, we advocate again to the informant. The reduction in participants indicates that their consistency has decreased. In contrast, the increase in the number of participants suggests public interest in the advocacy we carry out.

We captured those who chose not to continue participation because of busyness or time and because they were afraid of the impact of waste.

*"... the problem is that it's busy ... for those from RT 2, because their family is not allowed, they are afraid of flies and smell ..."* (Contributor 1, housewife).

Apart from that, there was a statement that they were reluctant to participate because they needed to learn how to do odorless and easy composting, so they chose not to continue their participation.

*"... Composting requires skill to be successful and not cause odors... if it's like yesterday's explanation, it seems difficult..."* (Contributor 2, housewife)

We explored the benefits obtained during action research, with the results of reducing waste, making the environment clean, reducing expenses for purchasing plant fertilizer, and increasing income by processing waste.

*"Managing waste means reducing waste that is disposed of in landfills"* (Contributor 3, housewife)

*"... Processing trash makes the house clean ..."* (Contributor 4, housewife)

*"... because the garbage is deposited in the garbage bank, the house is clean"* (Contributor 5, housewife)

*"After joining the garbage bank, it is quite good to get additional money"* (Contributor 6, housewife)

*"... with a garbage bank can increase income ..."* (Contributor 7, housewife)

At the end of phase 1 (step 2), the intervention model "household waste management innovations with a public health perspective" that will be implemented in this research is determined. The concept of inefficient household waste processing must be oriented toward public health. Four main components must be present in this concept: waste sorting, implore main components safety, sanitation safety, and activation, which will help process household waste safely (Fig. 6). After the model is agreed upon among the stakeholders, a trial cycle is carried out to ensure that the model can be applied in society to solve the problems. This cycle was carried out 3x until the model was finally declared suitable for use in the field.

### 3.2. Phase 2: Enrichment

Phase 2 consists of monitoring and evaluation processes in research intervention. In phase 2, the trial process of the "household waste management innovations with a public health perspective" model (Fig. 6) was implemented in 3 cycles. Every cycle has two monitoring and evaluation processes for improvement; every two weeks, there is monitoring, and the monitoring and evaluation process is carried out at the end of the month as the start of improvements for the next cycle. Phase 2 includes regular monitoring and evaluation carried out by cadres; This was also done by researchers once a week in the first month and once every two weeks in the second to fourth months. In addition, a focus group discussion was conducted to explore the obstacles and the participants' impressions and messages while participating in the program. Monitoring and Evaluation during the cycle include PPE use, washing hands (personal hygiene), environmental conditions, composting nine locations, waste processing, compost conditions, composting tanks, and garbage customer's activity. This monitoring and Evaluation are carried out by health cadres every two weeks and recorded in the health care logbook. From the monitoring written in the logbook, we summarize our findings in Fig. (7).

### 3.3. Phase 3. Designing

In phase 3, the "household waste management innovations with a public health perspective" model was obtained which has gone through trials in 3 cycles: stages of formulation, development, consideration of monitoring, and evaluation benefits so that the model is ready to be applied with a good level of efficiency. Phase 3 is the Synthesis stage of the household waste management model with a public health orientation. The impact of household waste management is based on Fig. (8). The most felt is the reduced amount of waste disposed of in landfills and unused, a clean environment, reduced spending on organic fertilizer and planting media, and increased income due to being a waste bank customer.

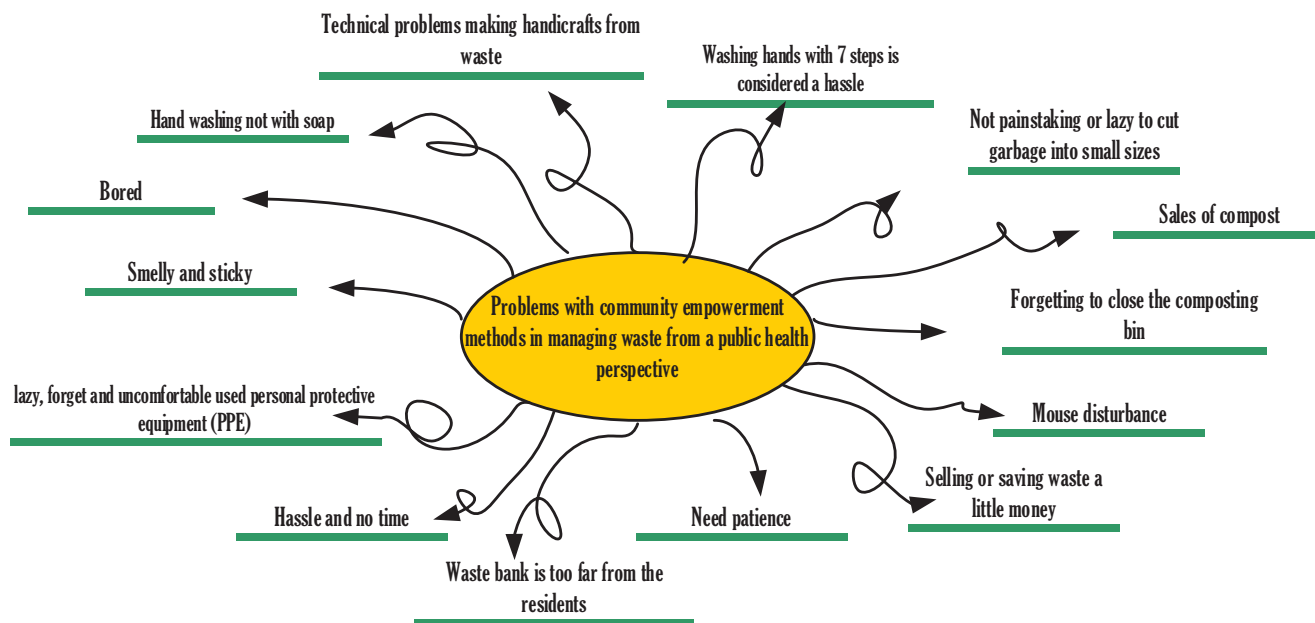


Fig. (7). Problems with community empowerment methods in managing waste from a public health perspective.

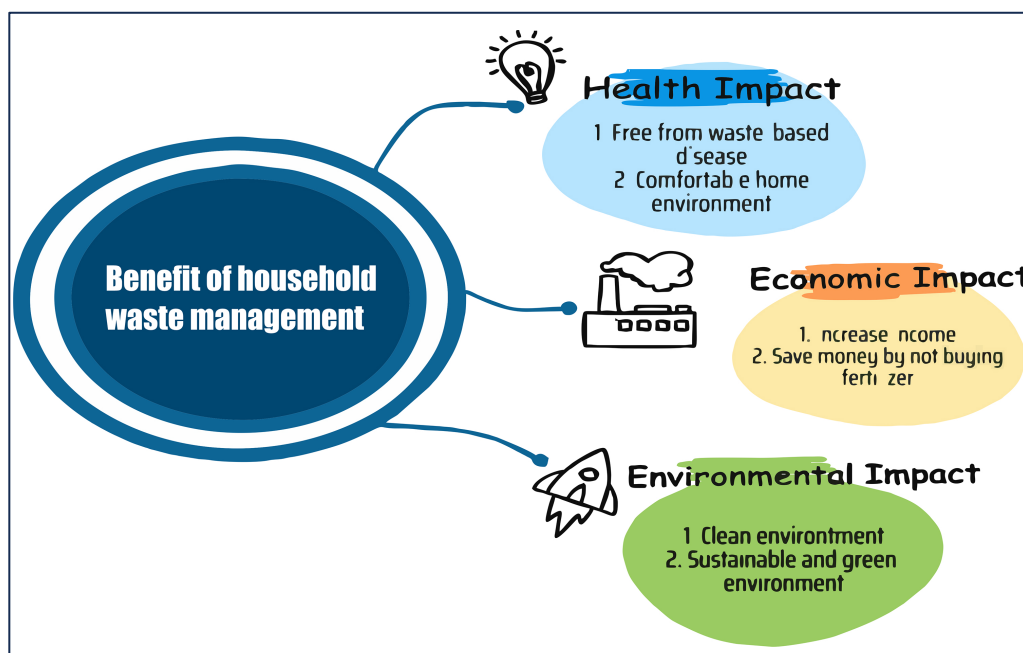


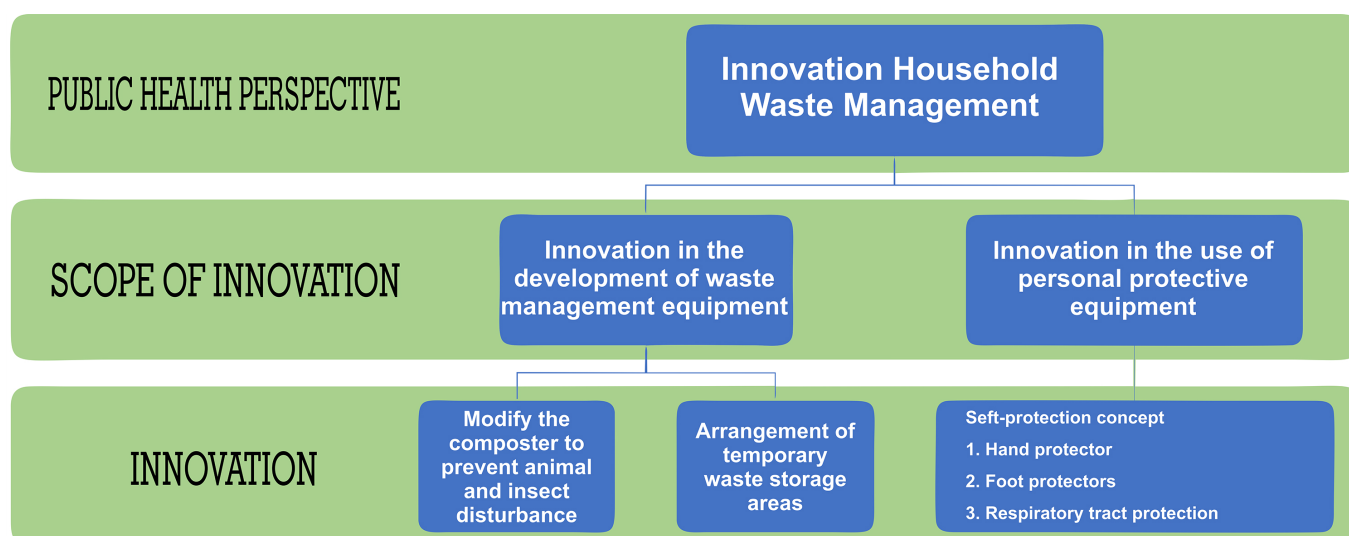
Fig. (8). The benefits of waste management felt by participants.

Fig. (9) formulates the results of this synthesis in the form of Innovation of household waste processing methods.

One of the methods developed at the end of the designing phase is based on the benefits felt by the community. The participants feel the benefits of applying

the method in the community. Communities sort waste and become members of the waste bank. Composted organic waste gets solid organic fertilizer, liquid fertilizer, and planting media to support gardening. In-depth interviews with participants were conducted to reveal the benefits felt after managing household waste using the method developed in this study in Fig. (6).





**Fig. (9).** Synthesis of household waste management model with public health orientation.

The results of the entire action research process start from (1) looking for problems, (2) analyzing the situation/risks of existing waste management programs, (3) developing ideas and innovative waste management methods to overcome problems, (4) conducting trials with intervention methods developed, (5) carrying out activity cycles to improve the method, and (6) determine the method based on the cycle that has been carried out. Innovation in the method for managing household waste with a public health perspective is formulated as shown in Fig. (9).

### 3.4. The Initial Concept of a Household Waste Management Method with a Public Health Perspective

The development of waste management innovations with a public health perspective ensures that participants have minimal risks for waste-borne diseases and health and safety risks due to managing waste. The spread of disease is caused by garbage being a strategic place for breeding disease vectors such as flies, rats, mosquitoes, and pathogenic bacteria. Groups at risk of being affected are people or groups of people who are around the landfill or have direct contact with the waste.

Previous research stated that the amount of waste generated in Nigerian urban cities is a serious threat to the achievement and continuity of public health; if not managed properly, it will affect the sustainability of public health development [6]. This is by the results of research, which states that groups that are vulnerable to disease waste are children under five, garbage workers, and workers working in toxic or infectious industries. Trash can be a breeding ground for rats and insects, increasing the risk of spreading parasitic and zoonotic diseases [7]. Diseases caused by large amounts of waste are malaria, respiratory, cholera, skin irritation, nose irritation, eye

irritation, diarrhea, psychological disorders, and allergies [8]. Emergence Ergonomic injuries include musculo-skeletal disease, sprains, fatigue, muscle pain, and back problems [9].

The collection and separation process can cause severe health hazards and risks to those who work with waste [10]. The risk due to organic waste composting is the development of pathogenic bacteria. Piles of garbage risk polluting the air and impacting health because the air is inhaled, smells, and causes inconvenience to the people around it. Microorganisms found in compost can cause respiratory problems, including allergies, asthma, and bronchitis [11]. This is also reflected in research in Swaziland [12].

Based on this, the intervention for preventing diseases caused by waste in this study focuses on preventing waste accumulation by composting and waste banks; exposure to air or direct contact with waste is prevented by personal protective equipment (PPE). In the node theory, the method of household waste management applied in this study was carried out as a solution to address environmental health problems, namely exposure media (node II) and breaking the chain of transmission (mechanism). Community-based initiatives are becoming increasingly important to address the formal system's deficiencies [13].

### 3.5. The Cycle of Improving Household Waste Management Methods from a Public Health Perspective

This research has a public health concept in household waste management, which is carried out using PPE (Personal Protection Equipment), which is used when managing waste to maintain the health of yourself and others around you. PPE in waste management consists of footwear, gloves, and face masks. The waste management

community does not have intensive direct contact with waste, so it is felt that the PPE needed does not have to be as complex as a garbage worker.

The use of PPE is a technical control for the prevention of occupational diseases. Avoid local causes or contact with agents with administrative control measures. Avoiding direct contact with workers is impossible, so the need for PPE becomes absolute. The results showed the behavior of garbage collectors in protecting themselves against waste-borne diseases: First, garbage collectors' knowledge of the types of Personal Protective Equipment (PPE) they must wear while working is still largely lacking. Second, waste collectors' understanding of waste-borne diseases still needs to be improved. Third, the behavior of waste collectors in protecting themselves against waste-borne diseases still needs to be improved in the efforts made before handling the waste. Still, it is suitable for the efforts made after sorting the waste. Everything is supported by their ignorance of understanding personal health (hygiene sanitation); the conclusion is that knowledge dramatically influences the behavior of using PPE when working for garbage collectors.

Research in Pretoria, South Africa, shows that some garbage collectors have low education, and the majority of scavengers do not use personal protective equipment. However, some used gloves and boots were picked up from the dump. Lack of knowledge about the hazards and health risks associated with scavenging also makes them susceptible to disease [14].

PPE is necessary for officers who handle waste to avoid diseases caused by waste. When working, waste collectors experience direct contact with various types of trash that have accumulated as one. Officers who do not use complete PPE will make it easier for multiple diseases to enter the body through their hands, feet, body, and head. There is a strong relationship between the use of PPE and the personal hygiene behavior of municipal waste workers, with adverse health effects among workers [15].

The concept of empowering cadres is the monitoring and Evaluation carried out using this household waste management method with a public health perspective. The role of waste management cadres in the community can be aligned or even the same as that of health cadres. Cadres are social and are elected by members of the community themselves. A monitoring and evaluation system using cadres will be more effective in overseeing the program than the monitoring and evaluation carried out so far, namely by carrying out actions that are not sustainable and conceptualized within the scope of empowerment. Cadres will be responsible for reporting on progress to the head of the PKK and reporting to the relevant agency. In addition to regular monitoring and Evaluation by cadres, it is also carried out by researchers once a week in the first month, once every two weeks, from the second month until the fourth month. In addition, a Focus Group Discussion (FGD) was conducted to explore the participants' difficulties, obstacles, impressions, and messages while participating in the program.

Monitoring and Evaluation are processes that help improve performance and achieve results [16]. Assessment during monitoring at final disposal sites supports planning and ensures program implementation is as intended. The goal is to reduce health risks and use this information to plan future waste management policies [17]. Policymakers (government) need monitoring and Evaluation to make decisions and overcome problems in waste management [18].

Community participation is vital to waste management programs [19]. In the process of household waste management activities with a public health perspective, there is a change in the conditions of participation. There was a reduction in the number of participants. Participants decreased after the socialization, training, and composting stages. The number of participants decreased due to several reasons. Barriers that prevent someone from participating in household waste management at the research site are because they are busy and there is no time. One person did not continue after the training stage because family reasons would not allow it. The family fears managing waste will cause flies and odors in the home environment. Participants did not carry out the composting process because the participants stated that they did not understand and did not know about the composting process, there was no time to do the composting, and because there was no organic waste (vegetable scraps, food scraps, or leaves) and they rarely cooked. Obstacles in public health-based household waste management are the problem of human resources.

Research results in Zimbabwe show that although most people claim to know about community-based solid waste management, they are not sufficiently informed about the importance of segregating waste at source. As a result, the attitudes and behavior of most of the respondents did not change [20]. Research conducted in Dhaka City, Bangladesh, reported that most people (74%) do not separate the waste they produce due to lack of time, economic incentives, and recycling facilities [21]. Several Asian developing countries are experiencing significant obstacles to household waste management due to weak organization and limited budget allocations [22]. Countries like Germany and Sweden need help with overcapacity, mostly in sorting plants [23]. Typical constraints faced by Ngeria's environmental agencies are a need for more institutional arrangements, inadequate human and financial resources, absence of regulations and standards, insufficient information on the quantity and composition of waste, and inefficient technology [24]. One of the main challenges of waste management in Africa is the creation of sufficient capacity, not only in monetary terms but also in terms of technology and infrastructure [25]. Essential components in waste treatment are awareness, knowledge, equipment, support, and infrastructure [26].

The problems found from the applied model can be divided into several problems, namely technical management problems, external environmental disturbances (flora and fauna), and problems of public

awareness. In Makassar City, implementing waste management in the community is a social and financial problem. The problems faced by the participants in managing household waste from a public health perspective were problems with rat disturbance, motivational problems, smell, and aesthetic problems, sales of post-production compost, technical problems, and economic problems. The problem arises from a classic problem of community-based household waste management [27].

Based on the identified problems, waste is a classic problem. The conclusion is that adding a public health component to community-based household waste management will not cause new problems, so the solution will be the same as the solution for other waste problems. Public health content can be added simultaneously with household waste management techniques without new problems.

### **3.6. The Benefits of Implementing Household Waste Management Methods with a Public Health Perspective**

Waste processing applied in this study is managing organic and inorganic waste. Organic waste processing with composting and inorganic waste management, sorting, waste banks, and waste crafts. The waste processing was chosen because many previous studies can be carried out in the community quite quickly and benefit the environment and socio-economic community. The benefits of household waste management for participants in this study are reducing waste, making the environment clean, reducing family expenses to buy fertilizer, and increasing family income from saving waste in the waste bank.

Composting is beneficial for reducing landfill space [28], making products easy and inexpensive, reducing fertilizer imports, and generating employment and income opportunities for the community [29]. Previous research said that most people benefit from this waste bank, even though it is not very large, but the impact is felt immediately, and their environment becomes clean and green [30]. A waste bank for the community can help clean up the environment and earn extra cash for the community [31]. Recycling and composting prove that all methods as alternatives to waste processing can help the economy [32]. Reduce, Reuse, and Recycle (3R) handles waste by reducing, reusing, and recycling. 3R is an efficient and effective management strategy for garbage because it can be reused [33].

### **3.7. Synthesis of Household Waste Management Methods with a Public Health Perspective**

The innovative waste management method's outcomes differ from those of earlier approaches. Prioritisation of public health concepts such as environmental sanitation, clean and healthy lifestyles, occupational health and safety, organic and inorganic waste sorting, and innovative household waste management infrastructure was lacking in the community's prior waste management methods. The idea of public health-based waste

management is suited for Yogyakarta City's population and may be implemented thanks to the action study that was conducted. This is due to the action research method's capacity to accommodate modifications and enhancements throughout the cycle.

The household waste management method with a public health perspective is refined from the initial concept using 1). sorting dry (inorganic) waste with the idea of public health: the results obtained are money from the sale of waste; 2). sorting wet (organic) waste with the concept of public health: the results obtained are compost. This process can reduce the amount of waste, make the environment clean, reduce family expenses to buy fertilizer, and increase family income from saving waste in the waste bank; 3). The use of personal protective equipment found around the household environment protects the community from the risks of accidents and health due to waste management; 4) clean and healthy living behaviors such as washing hands before and after processing waste and maintaining cleanliness reduces risks due to direct contact with waste; 5) Innovation of household waste management infrastructure.

Sorting is still the most effective way to achieve successful waste management [34]. The personal protective equipment used in the household waste management method with a public health perspective includes hand protective equipment in the form of rubber gloves, respiratory protective equipment in the form of masks to protect breathing from dust, foot protection in the form of footwear to protect from direct contact with garbage, personal protective equipment in the form of work clothes used by waste managers to prevent potential hazards in the work environment [35]. Hand washing hands with soap effectively prevents diseases such as diarrhea and respiratory infections due to waste management [36].

In this research, the Innovation of waste management facilities was carried out on composters and waste sorters. Innovation is based on ideas found by the community as a solution to the waste problem when carrying out waste management practices. Innovation in waste management is needed as a cultural change, but the most important thing is that the idea is embedded and spreads within the community [37]. This ensures the method is applicable and sustainable. From a public health perspective, obstacles experienced in household waste management are rats and other animal disturbances, motivational problems, odor and aesthetic problems, sales after compost production, technical issues, and economic problems. These obstacles are overcome by involving participant's thoughts so that participants feel directly involved. The previously proposed concept underwent modification and improvement in phase two so that the household waste management method is applicable after the action research phase is completed and refines the initial idea in phases one and two.

Empowering cadres monitor and evaluate community health-based household waste management. The concept of supervision helps ensure consistency in the

implementation of household waste management. In addition, the participants felt that there was help and a place to ask if there were any problems while they were managing their waste. This will ensure the continuity of the program.

This study's waste management from a public health standpoint is an advancement over Yogyakarta's earlier waste management practices. Improved waste management practices have resulted in a stronger understanding of environmental health and public health. Long-term community-based waste management will reduce hazards to the health of the waste management community and the environment. One disadvantage of this research is its potential for generalization to other locations with cultural traits distinct from Yogyakarta. It is distinct from other regional cultures because, among other things, Yogyakarta is known for its cooperation and kinship cultures. In addition, participants have experience with community-based waste management, which is something that other regions may find challenging to discuss when it comes to problem-solving. These issues arise by the action research cycle.

## CONCLUSION

Community-based waste management needs to pay attention to the concept of health for waste management communities. Innovation is required to design a community health-based household waste management method to solve the shortcomings of the previous method. These innovations must be applicable and sustainable so that action research is needed to test the proposed method concept. The innovations in waste management include improving environmental sanitation, maintaining a healthy and safe lifestyle, implementing work-related health and safety policies, separating waste into organic and inorganic materials, and developing innovative waste disposal practices for residential areas.

## AUTHORS' CONTRIBUTION

S.M.A: Writing the Paper; A.H.H: Study Concept or Design; S.S: Writing the Paper; T.W.S: Study Concept or Design.

## LIST OF ABBREVIATIONS

CBWM	=	Community-based Waste Management
DIY	=	Daerah Istimewa Yogyakarta
PPE	=	Personal Protective Equipment
FGD	=	Focus Group Discussion

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research is expert research. This research was approved by the Medical and Health Research Ethics Committee (MHREC) of the Faculty of Medicine Gadjah Mada University, Indonesia with Ref: KE/FK/867/EC (in the first stage) and Ethics Approval Letter For Health Research Using Humans as Research subject of Ahmad Dahlan University; Indonesia Number: 012004019 (Second stage).

## HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

## CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

## STANDARDS OF REPORTING

The STROBE guideline has been followed.

## AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during this study will be available from the corresponding authors [S.A.M.] upon reasonable request.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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