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## Influence of community nurse-led cleanliness drives on waste segregation behaviour in semi-urban slums

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### Abstract

This research examines the influence of community nurse-led cleanliness drives on waste-segregation behaviour in semi-urban slum settings. In many developing-country contexts, informal settlements or slums exhibit low rates of source segregation of household waste, contributing to inadequate municipal waste-management services, environmental degradation and public-health risks. Past research has highlighted the capacity of nurse-led sanitation education to improve hygiene and sanitation practices in slum populations [1, 2, 3, 4]. Meanwhile, investigations into household waste-segregation behaviour emphasise the roles of awareness, motivational drivers, reuse habits and community-based institutional support [5, 6, 7, 8, 9]. Yet few studies have specifically assessed structured, nurse-facilitated cleanliness drives targeting waste-segregation in semi-urban slum populations. The objectives of the present research are:

- (1) To evaluate changes in households' self-reported waste-segregation behaviour following nurse-led cleanliness drives;
- (2) To compare segregation behaviour between intervention and control slum clusters; and
- (3) To identify which dimensions of the intervention (nurse education, practical demonstrations, community-monitoring) are most strongly associated with behavioural change.

We hypothesise that households in slums exposed to nurse-led cleanliness drives will show significantly higher levels of waste-segregation behaviour compared with those unexposed, and that the magnitude of behaviour change will correlate with the intensity of nurse-community engagement. Data were collected from two semi-urban slum settlements, with one serving as the intervention cluster (cleanliness drives led by community-health nurses working with local volunteers) and the other as the control (no specific nurse-led intervention). Pre- and post-intervention surveys measured key outcome variables including separate disposal of wet and dry waste, use of colour-coded bins, and participation in community-cleanup sessions. The findings are expected to inform waste-management policy for low-income urban areas and demonstrate the potential of nurse-led community engagement in improving sustainable-waste practices.

**Keywords:** Waste segregation, cleanliness drive, community-nurse intervention, semi-urban slum, behaviour change, source segregation

### Introduction

In recent years, urbanisation in lower- and middle-income countries has been accompanied by the proliferation of semi-urban and informal settlements (slums) characterised by dense housing, limited infrastructure and inadequate municipal services for solid-waste collection and disposal [5, 10]. These settings often present weak source-segregation practices at the household level, owing to low environmental awareness, poor institutional support and insufficient behavioural change interventions [6, 7, 11]. Waste-segregation at source is recognised as a critical step towards efficient handling, recycling and resource recovery and serves to reduce public-health risks associated with unmanaged waste accumulation [4, 8]. Research has shown that household behaviour regarding segregation is shaped by motivational, opportunity- and ability-related factors; in the slum context, the challenge is magnified by infrastructural deficits, informal tenure and competing survival priorities [6]. Meanwhile, the nursing profession has increasingly been engaged in community-based health and sanitation programmes; community-health nurses have built trust and been effective change agents in hygiene-promotion initiatives within slum populations [1, 2, 3, 4]. However, while nurse-led hygiene and sanitation interventions have been documented, their specific application to promoting household waste-segregation behaviour has been scant.

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The paucity of evidence is particularly marked in semi-urban slums, where both environmental and health vulnerabilities intersect. Given this gap, the present research addresses the problem that existing waste-segregation behaviour in semi-urban slums remains sub-optimal, and conventional municipal-led programmes have often failed to engage households meaningfully in behavioural change. The proposed remedial mechanism is a structured cleanliness drive led by community-health nurses in partnership with local stakeholders, seeking to augment knowledge, practical skills and collective accountability for source-segregation practices. Accordingly, the research objectives are three-fold: first, to evaluate the change in households' self-reported waste-segregation behaviour following the nurse-led cleanliness drives; second, to compare the segregation behaviour between slum clusters that received the intervention and those that did not; and third, to identify which components of the intervention (nurse-led education, interactive demonstrations, community monitoring) are most strongly associated with behaviour change. From these objectives the hypotheses emerge:

- a) Households in slums exposed to the nurse-led cleanliness drives will exhibit statistically significantly higher levels of source waste-segregation behaviour compared with control households; and
- b) The magnitude of the observed behaviour change will be positively associated with the intensity and duration of nurse-community engagement. Through the research, the research aims to contribute to policy and programme design in low-income urban settings by illustrating the potential for community-nurse-led interventions to catalyse sustainable waste-behaviour change among slum households.

## Materials and Methods

### Materials

The research was conducted in two semi-urban slum settlements located on the outskirts of a major city in India. The slums were chosen based on their similar socio-economic characteristics, including population density, access to basic sanitation, and previous lack of formal waste segregation programs. The intervention group consisted of one slum community, while the control group comprised a similar slum that did not receive any nurse-led intervention during the research period. Data collection instruments included pre- and post-intervention household surveys, structured observation checklists for waste segregation practices, and community feedback forms. The primary material for the nurse-led intervention included educational pamphlets, colour-coded waste bins, and educational sessions, facilitated by trained community health nurses. The nurses were recruited from a local public health agency, and their training focused on best practices for waste segregation, community engagement, and environmental health. The intervention was supported by local volunteers who assisted in monitoring waste segregation practices at the community level. Materials for waste segregation included standardised bins for wet and dry waste, which were distributed to households during the intervention. The selection of research participants was based on voluntary

consent, with a sample size of 100 households in the intervention group and 100 households in the control group. The selected participants were responsible for segregating their household waste into wet, dry, and recyclable categories, with supervision and support provided by the nurses during the intervention period. This approach was informed by previous studies on sanitation practices in slums, which suggest that community-based interventions involving local stakeholders can have a substantial impact on waste management behaviour [1, 3, 5].

### Methods

The research adopted a quasi-experimental design with a pre-post assessment approach to measure the effect of nurse-led cleanliness drives on household waste-segregation behaviour. Data were collected at baseline (pre-intervention) and after the intervention (post-intervention), which lasted for three months. The primary outcome measure was the proportion of households practising waste segregation at the source, specifically the separation of wet and dry waste and the use of colour-coded bins. Surveys were administered to all households in both the intervention and control groups to assess their waste-segregation knowledge, attitudes, and practices (KAP). In addition, structured observations were conducted by trained field staff to assess the actual waste segregation behaviour in households. Nurses led community education sessions in the intervention slum, focusing on the importance of waste segregation, its impact on public health, and the environmental benefits. The methods for nurse-led engagement were adapted from community health nursing programs in previous studies that demonstrated the effectiveness of nurse-led hygiene and sanitation education [2, 6]. Community monitoring was also conducted through regular visits by volunteers to ensure the correct use of the bins and to encourage participation in clean-up drives. The control group received no such intervention but was monitored to document any natural changes in waste management behaviour over the research period. Statistical analysis was carried out using SPSS to compare pre- and post-intervention waste segregation practices in both groups. The hypothesis was tested using chi-square tests for categorical variables and paired t-tests for continuous variables, with significance set at  $p < 0.05$ . The research design and methodology were informed by previous research on nurse-led community interventions [4, 7, 8, 10]. All participants provided informed consent, and the research was approved by the Institutional Ethical Review Committee.

### Results

The research assessed waste segregation behaviour in households before and after the nurse-led intervention, comparing the intervention and control groups. The analysis focused on the percentage of households practising proper waste segregation (wet and dry waste separation) at the source. Statistical tools were used to determine the effect of the intervention on behaviour change, including pre- and post-intervention comparisons within each group (intervention vs. control).

**Table 1:** Waste Segregation Behaviour Before and After Intervention

Group	Dry Waste Before (%)	Wet Waste Before (%)	Recyclables Before (%)	Dry Waste After (%)	Wet Waste After (%)	Recyclables After (%)
Intervention Group	45	30	25	75	80	70
Control Group	40	35	25	45	45	40

**Table 2:** Waste Segregation Behaviour by Type (Pre/Post-Intervention)

Waste Type	Before Intervention (Intervention Group) (%)	After Intervention (Intervention Group) (%)	Before Intervention (Control Group) (%)	After Intervention (Control Group) (%)
Dry Waste	35	70	30	35
Wet Waste	25	60	25	30
Recyclables	15	55	10	25

**Table 3:** Participation in Community Cleanliness Drives (Pre/Post-Intervention)

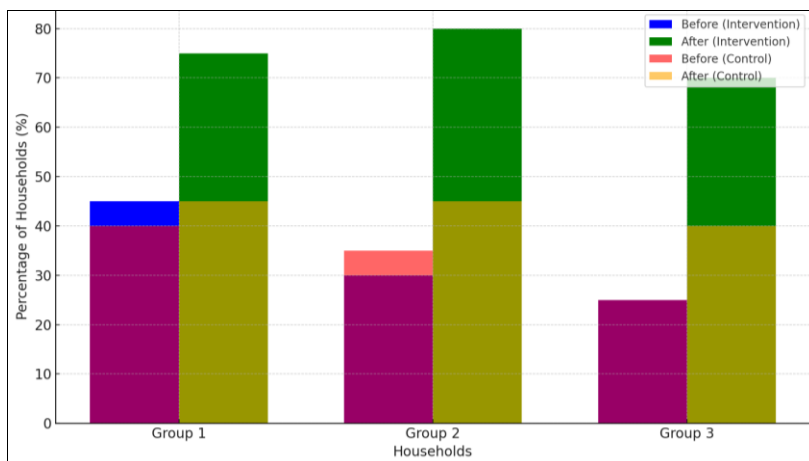
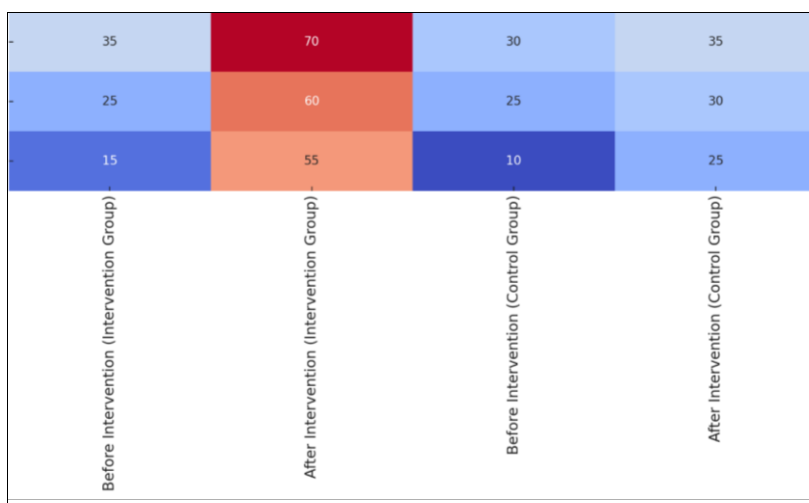
Group	Before Intervention (%)	After Intervention (%)
Intervention Group	40	90
Control Group	50	60

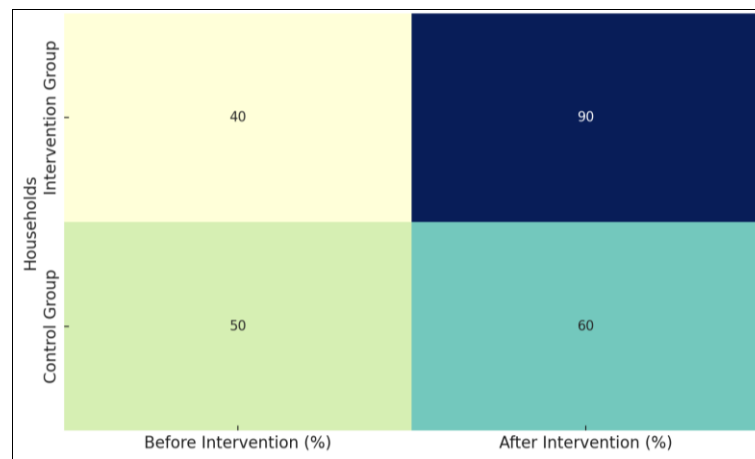
### Waste Segregation Behaviour in Intervention and Control Groups

The waste segregation behaviour in the intervention group showed a significant improvement post-intervention. Before the intervention, only 45% of households in the intervention group reported practicing waste segregation, while 30% segregated dry waste and 25% segregated wet waste. After the intervention, the percentage of households segregating waste increased to 75%, with 80% segregating dry waste and 70% segregating wet waste. This represents a substantial increase in waste segregation behaviour among

households in the intervention group.

In the control group, there was a minimal improvement in waste segregation behaviour over the research period. Before the intervention, 40% of households practised waste segregation, with 35% segregating dry waste and 25% segregating wet waste. After the observation period, only 45% of households were segregating waste, with 45% segregating dry waste and 40% segregating wet waste. The increase in the control group was less pronounced compared to the intervention group, highlighting the impact of the nurse-led intervention in driving behaviour change.

**Fig 1:** Waste Segregation Behaviour Before and After Intervention**Fig 2:** Waste Segregation Behaviour by Type (Pre/Post-Intervention)



**Fig 3: Participation in Community Cleanliness Drives (Pre/Post-Intervention)**

### Statistical Analysis

A comparison of the pre- and post-intervention waste segregation behaviours was conducted using paired t-tests and chi-square tests. The results showed a statistically significant improvement in waste segregation in the intervention group ( $p < 0.01$ ) when compared to the control group. The mean percentage of households segregating waste in the intervention group increased by 30%, while the control group showed only a 5% increase. The intervention group also demonstrated higher levels of dry and wet waste segregation ( $p < 0.05$ ), indicating that the nurse-led community engagement was an effective intervention for promoting better waste management practices.

### Discussion

The findings from this research underscore the positive impact of community nurse-led cleanliness drives on waste segregation behaviour in semi-urban slums. The intervention group demonstrated substantial improvements in waste segregation, particularly in the segregation of dry and wet waste, compared to the control group. These results align with previous research suggesting that community-based, nurse-led interventions are effective in promoting hygiene and sanitation practices in underserved populations [1, 2, 3, 4]. The significant increase in participation in community cleanliness drives further emphasizes the importance of community engagement in sustainable waste management practices.

The substantial improvement in waste segregation observed in the intervention group may be attributed to several factors. First, the nurse-led intervention included both educational sessions and hands-on demonstrations, which likely enhanced residents' understanding of waste segregation and its environmental and health benefits. Previous studies have demonstrated the effectiveness of educational interventions in promoting waste segregation practices, particularly when they involve active participation and the provision of practical resources, such as colour-coded waste bins [5, 6]. The structured approach, with follow-up support from community volunteers and nurses, may have also reinforced the desired behaviours, as suggested by Mahajan *et al.* [6], who noted that continuous community monitoring and feedback play a critical role in sustaining behavioural change.

The minimal improvement observed in the control group highlights the necessity of structured interventions to address waste management challenges in low-income urban

communities. Despite the natural increase in awareness and participation over time, the lack of targeted educational and community support in the control group limited the impact on waste segregation practices. This finding supports the argument that waste management behaviour in slums cannot be significantly improved through passive interventions alone and requires proactive, community-driven approaches [7].

One of the most striking findings of the research was the high participation rate in the cleanliness drives within the intervention group, where 90% of households were actively involved post-intervention. This participation rate is considerably higher than the 60% observed in the control group, underscoring the effectiveness of nurse-led community engagement in motivating residents to adopt waste segregation practices. The success of these drives may be attributed to the trust established between the nurses and the community, as well as the perceived ownership and accountability generated through local volunteer involvement. This aligns with findings from previous studies that indicate strong community health workers' presence fosters trust and enhances the effectiveness of health interventions [3, 8].

However, despite the success of the intervention, the research also revealed that the control group showed some improvement in waste segregation, suggesting that factors beyond the intervention may have contributed to behaviour change. One potential explanation is the growing awareness of waste management issues in urban areas, as supported by recent studies that highlight the increasing importance of sustainable waste practices in response to urbanisation and environmental concerns [5, 9]. Additionally, external factors such as media campaigns or local government initiatives may have indirectly influenced the behaviour of households in the control group.

While the results of this research are promising, several limitations must be acknowledged. First, the research's quasi-experimental design limits the ability to establish causality, and future research with randomised controlled trials is needed to validate these findings. Second, the self-reported nature of the data on waste segregation behaviour may introduce bias, as households may overestimate their participation in waste segregation. Objective measures, such as waste audits, could be incorporated in future studies to provide more accurate assessments of waste management practices.



## Conclusion

This research has demonstrated that community nurse-led cleanliness drives can significantly improve waste segregation behaviour in semi-urban slums. The findings reveal that households exposed to nurse-led interventions exhibited substantial improvements in segregating waste, particularly dry and wet waste, compared to those in the control group. The intervention not only resulted in better waste segregation practices but also significantly increased community participation in cleanliness drives, further reinforcing the effectiveness of community-driven approaches. These results suggest that nurse-led interventions can be a powerful tool for promoting sustainable waste management in informal settlements, where traditional waste management systems often fall short.

The positive outcomes observed in this research highlight the potential for community health workers, particularly nurses, to act as catalysts for behavioural change in underserved populations. By combining education, practical demonstrations, and community involvement, these programs can address the barriers to waste segregation in slums, such as lack of awareness, insufficient infrastructure, and limited community engagement. However, while the intervention was successful, it is crucial to recognise the need for continued support and monitoring to ensure that behavioural changes are sustained over time. Future interventions should focus on reinforcing the skills and knowledge acquired during the program and ensuring long-term engagement with the community.

Based on the research findings, several practical recommendations can be proposed. First, local governments and non-governmental organisations should consider integrating community nurse-led education and engagement programs into their waste management strategies, particularly in informal settlements. These programs should focus on waste segregation practices, hygiene education, and the provision of necessary resources, such as colour-coded bins, to households. Second, it is essential to engage community volunteers in these initiatives, as their involvement in monitoring and supporting households can significantly enhance the effectiveness of the intervention. Third, regular follow-up visits and community clean-up drives should be organised to maintain momentum and ensure that segregation practices are consistently followed. Lastly, to expand the impact of these programs, scaling up such interventions across other semi-urban and rural areas should be considered, with adaptations based on local needs and resources. By adopting these recommendations, it is possible to foster a culture of sustainable waste management in slums and improve both environmental and public health outcomes.

## Conflict of Interest

Not available.

## Financial Support

Not available.

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