



Are There Gender Disparities in Household Kitchen Waste Separation?

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Abstract. Climate narratives are increasingly gaining traction, mobilizing collective action towards a low-carbon future. Previous social norm interventions have predominantly been implemented in Western cultures, neglecting their potential applicability in more collectivist Eastern cultures. Additionally, research on gender disparities in waste separation behaviors has yielded inconsistent findings, with most studies relying on self-reported data from surveys. To address this gap, we conducted a community-based field intervention study. We collected large-scale observation data on 21,555 household waste disposal behaviors and concurrently recorded demographic information of gender groups. During the intervention, we publicly displayed the weekly participation rates of household kitchen waste sorting within the community. Across all study periods, women consistently participated more in separation activities than men. This study underscores the efficacy of social norm interventions in promoting waste separation behaviors among different gender groups, thereby contributing to more sustainable development.

Keywords: Gender disparities; Waste separation behavior; Large-scale observation

1 Introduction

Household kitchen waste (HKW) poses a significant challenge and focal point in the classification of urban household waste in China. Effective differentiation of HKW from other waste types at source is essential for facilitating efficient back-end treatment. This process relies heavily on household actions, as households are the primary contributors to municipal waste generation and are relatively dispersed, making centralized management challenging. Despite the implementation of mandatory waste separation policies in China for several years, the results have been unsatisfactory ^[1]. Statistics indicate that even in major cities where waste separation policies were initial piloted, the average recycling rate of household waste stands at only 30.4% (NDRC).

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In the current context, how can we promote sustainable waste sorting and recycling? Which social groups are more likely to be persuaded to engage in source separation of waste?

Social norms are essential for maintaining collective order and fostering pro-environmental behaviors. Regarding waste separation, some studies suggest that social norms strategies effectively influence residents' waste separation behavior regardless of individual characteristics and family circumstances. For instance, Ling et al. (2023) found that social norms interventions and their interaction effects did not significantly alter the individual characteristics of residents, such as gender, age, political profile, income, education level, occupation. Conversely, other research indicates that personal attributes, including age, gender, and occupation, do influence residents' separation behavior [1]. Previous assessments of waste separation participation have predominantly relied on self-reported data from questionnaires [2], which are susceptible to biases such as social desirability, potentially leading to inaccuracies in reported information. This study seeks to examine the variations in actual waste separation behavior among different gender groups before and after an intervention in two identical communities in China.

Some studies suggest that the gender and age demographics of a population can significantly influence waste separation behaviors. This influence may stem from disparities in lifestyle and consumption patterns between men and women, as well as differences in waste management practices [3]. Previous research consistently indicates that women are more likely than men to adopt environmentally friendly lifestyles and work practices. Women typically devote more time and effort into environmental conservation, participating in activities such as waste separation, recycling, reusing shopping bags, and avoiding disposable items. Furthermore, women, irrespective of income level or age, are more inclined to opt for carbon-free transportation modes, such as walking, cycling, and public transit.

For example, Saphores et al. (2006), Ekere et al. (2009), and Sidique et al. (2010) reported that women are more likely to engage in recycling activities compared to men [4-6]. A cross-national study by Hunter et al. (2004) across 22 nations found that females were more likely to participate in private pro-environmental behaviors such as recycling, purchasing chemical-free food, and reducing driving compared to males [7]. Recent studies by Xiao and Hong (2010) and Swamin et al. (2011) for China, and Xiao and McCright (2014) for the United States, further support these gender variations [8-10]. Earlier research by Tindall et al. (2003) also corroborated these findings, showing that while females were more involved in private pro-environmental behaviors, while there were no significant gender differences in activism levels. Additionally, Goldenhar and Connell (1993) found that the relationship between norms and the intention to recycle was statistically stronger among females than males.

However, this gender disparity tends to diminish when examining public or community-oriented pro-environmental actions, where little to no difference is observed between genders [11-13]. For instance, Gamba and Oskamp (1994) and Werner and Makela (1998) reported no statistically significant correlation between recycling behavior and gender. Conversely, He et al. (2020) noted that men exhibited greater willingness to engage in waste sorting behaviors and expressed stronger support for waste charging

systems compared to women^[12]. Similarly, Hu et al. (2021) found no gender difference in waste sorting behavior^[13]. Oztekin et al. (2017) determined that males' recycling intentions are primarily influenced by their past behaviors and are reinforced by their learned attitudes towards recycling. Conversely, females' lack of recycling intentions is driven by their perceived behavioral control and is supported by their inherent attitudes towards recycling^[14].

Given the inconsistent findings across both national and international studies, further research is necessary to clarify the nuances of gender differences in pro-environmental behaviors.

2 Method

2.1 Context and Participants

This study is a component of our broader research initiative, which is currently under pre-proof for publication^[15]. This study was conducted in Shenzhen, China, where a city-wide mandatory household waste sorting policy has been implemented since 2019. In this context, community residents typically dispose of their waste by placing it in bags and depositing them into public trash bins. Preliminary observations during the baseline period indicate that the peak time for waste disposal generally occurs after dinner, aligning with the government-designated time for household kitchen waste disposal (7:00-9:00 am and 7:00-9:00 pm). During non-designated hours, the kitchen waste bins are locked, thereby preventing residents from disposing of household kitchen waste.

This study focuses on two medium-sized enclosed residential communities that have implemented a range of measures in response to the mandatory separation policy. These measures include in-home publicity, the installation of automatic voice-sensing speakers at sorting points for reminders, and the replacement of household waste sorting bins with government-issued standardized containers. Additionally, residents received guidance on waste sorting from volunteers one year prior to the study. In Study 1, the community consists of three 18-story buildings housing 341 households, which share a single public waste collection station. Study 2 examines a community comprising two adjacent, structurally identical buildings with a total of 692 households, each equipped with its own independent public waste collection station.

2.2 Design and Measures

Measures (Actual waste separation behavior). The actual behavior of household kitchen waste (HKW) separation was evaluated through unobtrusive observation during designated four-hour time slots each day. Data collection was primarily conducted via camera surveillance installed by the community management organization, with occasional on-site observations from a concealed vantage point.

Proper HKW separation was coded according to the following steps: a) emptying the container holding household kitchen waste; b) depositing the kitchen waste into the designated kitchen waste bin; and c) disposing of the empty container in the residual

waste bin. Correct HKW separation behavior was coded as “yes,” while unsorted or incorrect separation behavior was coded as “no.” The dependent variable was the participation rate, calculated as the percentage of individuals correctly separating HKW (yes) out of the total number of people disposing of household waste (both yes and no). The study was approved by the Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences.

The dependent variable in the study was the participation rate, defined as the percentage of individuals correctly disposing of kitchen waste out of the total number of households disposing of household waste. Furthermore, we systematically collected demographic information, including gender. The study predominantly utilized sorting records during fixed daily time periods as the primary data source to compile weekly social norm reports throughout the intervention period. An illustration of the observation record card is provided in Figure 1.

Community: HYJ											
Date : 2022-7-15											
Time period : 7:00-9:00 pm											
Symbol code : Gender: male 1, female 2											
Correct HKW separation behavior						Incorrect HKW separation behavior					
2	1	2	2	2	1	2	1	2	1	1	
1	2	1	1	1	2	2	1	1	2	2	
2	1	2	2	2	1	2	1	1	2	1	
2	2	2	1	1	2	1	2	1	1		
1	2	2	1	1		2	1	1	2		
2	2	2	1	1		1	1	2	2		

Fig. 1. Example of observation record

2.3 Procedures

The baseline phase. The initial baseline period lasted for 2-3 weeks. **The intervention phase.** The intervention period was implemented over a period of 4-5 weeks in two communities. Residents received weekly updates on community collective separation rates and performance metrics categorized by gender group, which were publicly displayed. Social norm was communicated through comparative charts accompanied by textual descriptions. To enhance the visibility and impact of these social norms, a progress sign measuring 297 mm × 420 mm was installed along the pathway leading to the communal waste station. This sign was strategically placed to ensure that all residents disposing of waste would notice it. **The post-intervention phase.** Following the removal of the intervention, daily observations were maintained for 2-3 weeks to assess the immediate impact of the intervention on different genders. **The cooling-off phase.** The cooling-off period lasted for 5-6 weeks, involved no interventions or observations. **The follow-up phase.** To evaluate the sustained behavior change following the post-intervention, a follow-up period of 7 weeks was implemented in Study 1 and 3 weeks in Study 2.

3 Results

Using the chi-square test, we examined the disparities in separation rates among residents of varying genders throughout the study phases.

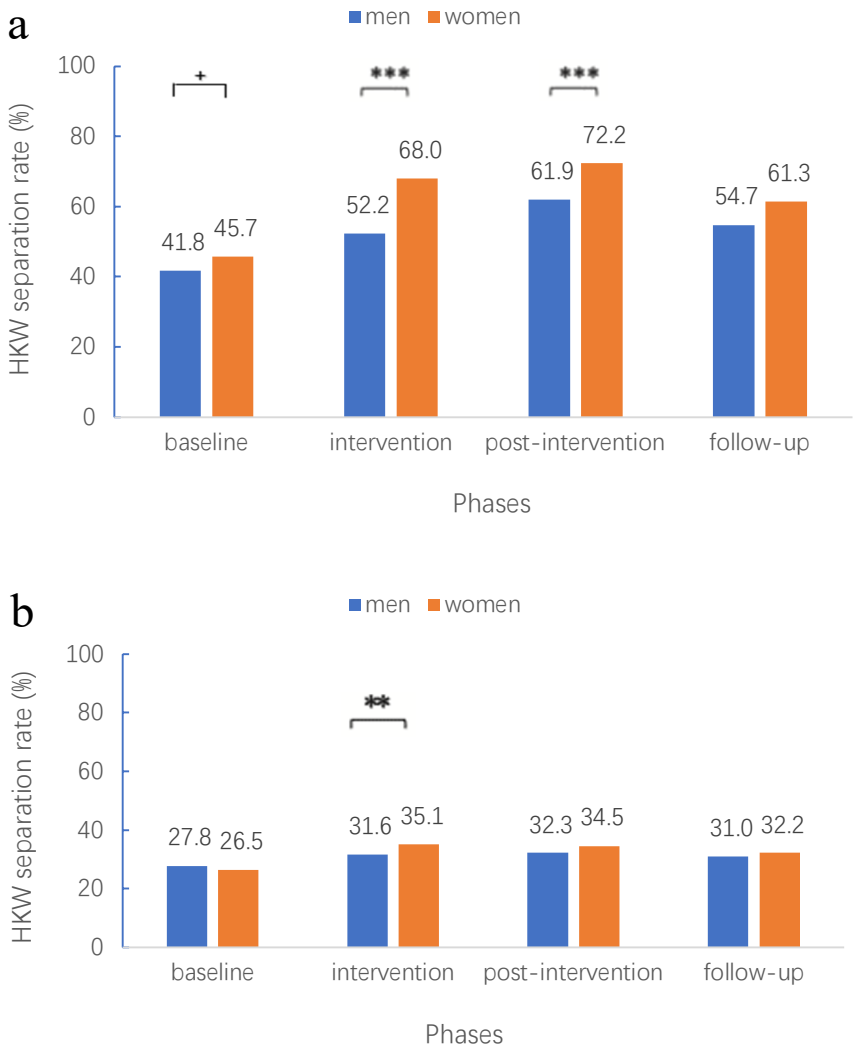


Fig. 2. Participation rates by gender in each study phase in Study 1 (a) and Study 2 (b).
 Note. *** $p < 0.001$, ** $p < 0.01$, $0.05 < p < 0.1$.

In Study 1, the results indicated that there were significant differences in the proportion of residents correctly classifying kitchen waste by gender during the overall study period, $\chi^2(1, N = 7532) = 81.28, p < 0.001$. As shown in Figure 2 (a), the proportion of

female residents correctly sorted kitchen waste (62.7%) was significantly higher than that of male residents (52.5%). At baseline, the proportion of females was marginally higher than that of males ($p = 0.084$), but during the intervention period ($p < 0.001$), post-intervention period ($p < 0.001$), and follow-up period ($p = 0.026$), females were significantly higher than males. This suggests that female residents outperformed males in kitchen waste sorting, particularly in response to the intervention.

In Study 2, the results indicated that there were significant differences in the proportion of residents correctly sorting kitchen waste by gender during the overall study phase in Study 2, $\chi^2(1, N = 14023) = 6.24, p = 0.013$. As shown in Figure 2 (b), the proportion of female residents correctly classifying kitchen waste (32.9%) was significantly higher than that of male residents (30.9%). During the intervention period ($p = 0.003$), the proportion of female residents correctly classifying kitchen waste was significantly higher than that of males, but no statistically significant differences were observed during the baseline ($p = 0.453$), post-intervention ($p = 0.248$), and follow-up periods ($p = 0.610$). This suggests that the intervention had a more pronounced short-term effect on female residents compared to males.

4 Conclusion

This study examines the environmental behaviors of gender groups in China, with a particular emphasis on the relationship between intervention and household kitchen waste separation behavior. Through an analysis of observed waste separation behaviors in communities, our research reveals that women typically exhibit higher levels of pro-environmental behaviors than men, although this pattern is not uniformly observed across all contexts. Additionally, the study finds that women are more persuaded to perform separation in respond to the intervention.

Although this study identified differences in the actual separation behavior of men and women, it has certain limitations. Specifically, the study did not delve into the underlying reasons for these gender differences. Future research should aim to explore the causes of gender disparities in waste sorting behavior to inform more targeted interventions, thereby fostering a more sustainable approach to waste management tailored to different demographic groups.

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