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Research Article

# Designing to minimize the administrative burden of trash disposal: Evidence from a randomized controlled trial in New York City public housing

**Sara V. Flanagan[*], Nuha Saho[*], Deepti Nagulapally[*], Matthew Darling[*]**

**Abstract:** The New York City Housing Authority (NYCHA) is the largest public housing manager in North America. One widespread concern for residents and staff is the improper disposal of household trash and litter on NYCHA grounds. Here we present the co-produced service of trash disposal through the lens of administrative burden; official policy is unclear for residents and options are confusing or inconvenient, resulting in significant learning, compliance, and psychological costs. To reduce this burden, we redesigned the trash disposal infrastructure – new large containers placed at convenient locations – and introduced a package of indoor and outdoor posters communicating the new policy. 53 NYCHA developments, randomly assigned to treatment or control groups, were broken into 79 smaller observation sites. Weekly counts of visible trash bags and litter were collected pre-intervention and post-intervention, over a period of 21 weeks. The average number of household trash bags decreased by 25% ($p < .05$) in treatment sites after the intervention, and the average amount of litter decreased by 16% ($p < .05$). Providing easier access to disposal infrastructure, complemented by community-oriented and instructional communications, significantly reduced visible trash on NYCHA grounds, demonstrating that new structures and resources can effectively reduce burdens and change behavior.

Keywords: Behavior, Trash, Litter, Infrastructure, Intervention, Administrative burden, Public housing

Supplements: Open data, Open materials

The New York City Housing Authority (NYCHA) is the largest manager of public housing in North America; 1 in 15 New Yorkers live in NYCHA properties (New York City Housing Authority, 2019). One widespread concern for NYCHA residents, and for public health, is the improper disposal of household trash and litter on NYCHA developments; trash is a constant presence. Residents and staff alike complain that small collections of household trash left in hallways, staircases, and outside buildings make the areas smell bad and attract rats (Barrows, Darling, Flanagan, Haqqi, & Saho, 2020). Piles of large trash items can be found in front of most buildings, even when signs are posted urging tenants to place bags elsewhere. Residents often throw items of household waste out of their apartment windows, contributing to the litter on the grounds (Sullivan, 2018). Development caretakers report they are often unable to complete all their work duties because of the time spent clearing trash.

* ideas42 80 Broad St Fl30, New York, NY 10004
Address correspondence to Sara Flanagan at (Sara@ideas42.org)

Trash disposal is a basic public service that requires co-production of residents to be effective; although NYCHA administrators and residents alike want less trash in their environment, official policy for trash disposal is unclear and options for disposal are confusing or inconvenient (Barrows et al., 2020; Public Works Partners, 2019). Here we describe the resulting learning, compliance, and psychological costs as an administrative burden for residents (Moynihan, Herd, & Harvey, 2015), and present empirical evidence that a behavioral intervention designed to lessen the burden of trash disposal successfully reduced waste observed on NYCHA development grounds.

## Trash Disposal as an Administrative Burden

Administrative burden, defined as an individual's experience of policy implementation as onerous (Burden, Canon, Mayer, & Moynihan, 2012), suggests inherent costs imposed on individuals in order to access their political and social rights. Whether resulting from the intentional design of policymakers or emerging by accident, administrative burden is often disproportionately experienced by disadvantaged groups (Moynihan & Herd, 2010). Common examples in the literature include voting, abortion, social security, and welfare services (Herd & Moynihan, 2019) where the burdens on individuals to access these rights can be broadly categorized into learning costs, psychological costs, and compliance costs (Moynihan et al., 2015). There is empirical evidence that reducing such policy costs to individuals can alter behavior to increase uptake of public programs (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Hanratty, 2006; Herd, DeLeire, Harvey, & Moynihan, 2013; Kopczuk & Pop-Eleches, 2007; Lopoo, Heflin, & Boskovski, 2020). Recently, the administrative burden framework and insights from behavioral science have been applied to improve compliance with housing regulations where burdensome administrative processes can also make it difficult for those who otherwise want to follow the rules to comply (Linos, Quan, & Kirkman, 2020). Such field experiments may allow for identifying the causal effects of reducing burdens to individuals in realistic public administration settings (Hansen & Tummers, 2020; Jilke, Walle, & Kim, 2016)

Here we provide empirical results from a behavioral intervention to reduce administrative burden in one of the most basic, everyday public services – trash disposal - which requires an element of active co-production on the part of citizens to be successful (Alford, 2009). Unlike the individual benefits conferred by participation in many public welfare programs, the benefits of this public service collaboration between administrators and residents are experienced collectively; effective trash disposal results in a cleaner environment for the whole community. Policy that does not consider the costs imposed on residents can instead create undue burdens that act as barriers to prosocial behavior and, in this case, a cleaner environment. The intervention described here was informed by a 2018 assessment of quality of life concerns which included interviews with residents and staff members as well as direct observations of behavior on NYCHA properties, and generated a number of behavioral insights reported elsewhere (Barrows et al., 2020). Importantly, that formative work and other recent reports (Public Works Partners, 2019) have found that official NYCHA policy for trash disposal is unclear; options for disposal are confusing and often inconvenient for public housing residents. This results in significant compliance, learning, and psychological costs to follow official procedures – an administrative burden, exacerbated by the punitive approach to behavior change NYCHA policymakers and administrators have adopted in the past.

Compliance costs refer to the burden of following administrative rules (Moynihan et al., 2015). While NYCHA buildings are equipped with compactor chutes meant for household trash on each floor, they were built 40 to 80 years ago and are too small to accommodate modern kitchen trash bags (Barrows et al., 2020). The only official alternative to those chutes is to carry trash bags to external drop sites, which are meant for large, bulky items and can be up to 10 minutes away from a building. As NYCHA infrastructure is not designed for frequent disposal of standard sized trash bags, residents are left without a practical and convenient option to dispose of their trash according to policy. In a community where low income is a requirement for residence, the cognitive consequences of chronic scarcity mean that the time and effort tradeoffs necessary to learn and comply with rules can feel more consequential (Mullainathan & Shafir, 2013). In the absence of clearly communicated policy or infrastructure solutions to reduce learning and compliance costs, residents have developed their own norms for trash disposal by dropping garbage bags in more accessible locations near building exits—often explicitly marked to be not for disposal. Yet, NYCHA caretaking staff routinely clean up from these

informal drop sites, sending the mixed signal to residents that they are in fact acceptable trash disposal locations (Barrows et al., 2020). Studies on public littering find that dirty places tend to get dirtier (Cialdini, Reno, & Kallgren, 1990; Reiter & Samuel, 1980), and these informal drop sites provide social proof to residents of how they should be acting. Without clear and enforced guidance, people look to others' behavior as the best indicator of what is appropriate and expected of them (Cialdini, 2009).

Given high population density, even a small amount of misplaced trash around NYCHA grounds is highly visible, creating misperceived community norms about disposal and perpetuating problematic behaviors. Because of the high visibility, residents will impractically perceive that a majority of people must be improperly disposing of their trash (Public Works Partners, 2019), even if it is only a minority that are doing so (Prentice & Miller, 1996). NYCHA administrators' punitive messaging, threatening fines or eviction, as a strategy to address quality of life concerns has had little noticeable effect on compliance; instead it may further exacerbate negative perceptions of other residents guilty of the problem behavior (Public Works Partners, 2019). Moreover, posted signs often leave the desired behavior unspecified to residents; as one resident expressed it, "They have signs where we can't put them [garbage bags], but we don't know where to put them" (Barrows et al., 2020). Residents complain about the paternalistic and bureaucratic tone of these NYCHA signs and may be more likely to ignore or respond negatively to such notices. Furthermore, framing trash disposal decisions around extrinsic penalties and fines that are not – and cannot be – effectively enforced, can undermine any intrinsic motivation to take care of a shared environment (Gneezy, Meier, & Rey-Biel, 2011).

Finally, such negative framing may contribute to a psychological burden on residents, who might already feel a loss of autonomy and power when dealing with a paternalistic landlord like NYCHA (Bellafante, 2018). For example, in interviews residents report instances of staff unilaterally removing trashcans from developments in attempts to curb rat problems, while leaving residents with even fewer convenient places to dispose of their household trash and litter (Barrows et al., 2020). Such measures are taken in a context where residents often fail to see the benefit of compliance with other NYCHA administrative processes; many cite that the official work orders they submit to request infrastructure fixes are chronically left unaddressed by management (Bellafante, 2018; Board, 2019). Given the continued burdens on tenants, it is unsurprising that improper disposal of trash is an ongoing problem within NYCHA despite the complaints and best intentions of residents and staff. In this study we test whether a behavioral intervention aimed at reducing the burden on residents can have positive effects on co-produced trash disposal.

## Methods

### Intervention Design

To reduce the burdens associated with trash disposal in public housing identified by Barrows et al. and others, we designed a 2-part intervention: a redesign of the trash disposal infrastructure – new large trash containers placed at convenient locations to residential buildings – to reduce compliance costs for residents and a package of indoor and outdoor posters communicating the new policy, to reduce learning costs. The full intervention package, decided in consultation with NYCHA property managers based on potential impact and feasibility and designed with direct input from residents (Barrows et al., 2020), included providing 100-gallon Tough Guy or Rubbermaid tilt trucks (1-2 per building), 50-gallon Rubbermaid trashcans (2-3 per building), and a full suite of posters (6 inside versions for lobbies and hallways and 3 outside versions) to provide sufficient coverage to reach all residents in the development. The design, tone, and content of the posters were informed by insights emerging from interviews and user-testing with residents and staff. They were intended to stand out from existing NYCHA messaging, which residents perceived to be overabundant, punitive, and bureaucratic in tone. Furthermore, the new signs gave clear guidance on what residents should do to dispose of waste, recognizing that people were already motivated to take care of their environment and removing learning costs to compliance (see Appendix A for examples).

NYCHA developments targeted for Neighborhood Rat Reduction[1] programs in the Bronx, Brooklyn, and Manhattan were randomly assigned to be treatment (n=27) and control (n=26) groups. Property managers for each NYCHA development in the treatment group were given recommendations on where to place intervention materials within and around residential buildings but were ultimately given discretion on which of the materials supplied were installed, when, and where. Developments were asked to install all tilt trucks, trashcans,

and posters starting the same week; however, delays in procurement and varied installation efforts by staff resulted in a much more gradual roll-out across sites. It took several weeks, and follow-up reminders from NYCHA, for the majority of treatment sites to rollout the intervention. Delays between when sites were instructed to install the materials and when research assistants observed that materials were in place varied from site-to-site.

**Data Collection**

A team of 12 research assistants (RAs) were trained to collect weekly observational data on the number of individual trash bags and pieces of litter seen at every development's grounds over a period of 21 weeks in 2019, starting at least 11 weeks prior to intervention implementation. RAs were given hand-held tally counters to keep separate track of trash and litter counts as observations often reached into the hundreds of pieces. Total counts for each site visit were reported via digital form. RAs also conducted checks during each week's visit to report whether intervention tilt trucks, trashcans, and posters were seen on site, to monitor for implementation fidelity and potential spillover to control sites.

RAs were given weekly assignments consisting of 3 lists of 3 sites each that would be reasonable to travel to within the same day. Site assignments were systematically rotated among RAs to account for differences in counting practices and days/times of data collection. All RAs visited all sites and rarely revisited a site; the rotation meant a repeat assignment would only happen 10 weeks later, although occasionally RAs volunteered to cover for another's shift. RAs had discretion of when they visited assigned sites during the week (including weekends) and in the day; as a result, data was collected on all days between the hours of 7am and 8pm, introducing significant variability in counts. Prior to roll-out of intervention materials, RAs were not aware of the treatment assignment of the developments they visited. Treatment assignments were never disclosed to RAs, but once intervention materials were installed and visible on developments it was not possible to stay blinded. We find no difference in days of the week that RAs visited treatment and control sites (chi square, $p = .27$), although we do observe a marginally significant (chi square test, $p = .097$) difference in the hour of the day observations were made (Appendix B). However, the fact that most RAs visited each treatment site only once during the intervention period and were not aware of assignment prior suggests low risk of manipulating observation time based on treatment status.

**Sample**

The study included 53 NYCHA developments, which were randomized to treatment assignment. Larger developments were then split into smaller units for data collection based on the number of buildings and ground area that one RA could reasonably assess on their own, and thus were assigned to different RAs. In order to control for time of data collection, these 79 smaller observation sites (43 treatment and 36 control) were the unit of analysis for the evaluation. Over 21 weeks of data collection, each site was visited approximately once per week, for a total of 1,641 site observations. The average site was visited 20.8 times (standard deviation 1.2), with a range of 17 through 25. The average number of observations for control sites ($M = 20.7$) and treatment sites ($M = 20.8$) were not significantly different.

**Variables**

Outcome variables include the count of trash bags and pieces of litter visible to RAs when systematically walking a site's grounds. Trash bags could be of any size (grocery bags, large black trash bags, etc.); loose pieces of un-bagged trash were not to be counted as "trash bags" unless RAs were confident that loose trash around a bag was the result of a spill. Pieces of litter were only counted if they were more than 2 inches in diameter and were not counted if they were spilled trash from bags, recycling materials left outside a recycling bin, or naturally occurring waste like twigs and leaves.

We considered a treatment site as having "implemented" the intervention once an RA first reported seeing at least one tilt truck on site, since that infrastructure was unique to this project. That site was only considered to have "received" the intervention during subsequent observations starting the following week, because trash counted during the initial observation visit would at least partly reflect trash generated prior to the installation. For this reason, our regressions include the dummy variable "Implementation Week" for observations recorded on the date the intervention was first observed. Of the ten weeks of data collection that took place after sites

were directed to implement the intervention, we observed the interventions installed for an average of 5.5 weeks (SD = 2.4) at treatment sites with a range between 0 and 10 weeks.

**Statistical Analysis**

Given significant delays in roll-out, our primary analysis estimated the effect of the intervention being installed using difference-in-difference (Goodman-Bacon, 2018) negative binomial regressions in the form of:

$$Y_{i,t} = \beta_0 + \beta_1 Intervention_{i,t} + \beta_2\, Implementation_{i,t} + \beta_3\, week_t + \beta_4 site_i + \beta_5 \theta_{i,t} + \varepsilon_{i,t}$$

where $Y_{i,t}$ is the dependent variable at site $i$ in time $t$; "Intervention" represents whether or not site $i$ had received the intervention in time $t$; "Implementation" is a dummy variable for the week we first observed the intervention; "week" and "site" are temporal and geographic fixed effects; $\theta_{i,t}$ is a vector of other data collection fixed effect controls, and $\varepsilon$ is the error term.

All models include site and week fixed effects. Standard errors were clustered by development. We also include models with RA fixed effects, day of week fixed effects, and data collection hour fixed effects. Our primary specification includes all data collection fixed effects (Gerber & Green, 2012) given the wide variation in trash counts based on the time, day, and individual collecting data.

## Results

Baseline data patterns were similar between treatment and control developments and observation sites, confirming that randomization was effective and ensuring balance across groups. In general, counts of trash and litter are highly correlated with each other; sites that have high amounts of trash also tend to have high amounts of litter.

**Table 1**
**Baseline Characteristics**

| | Treatment | Control | *p* |
|---|---|---|---|
| Number of NYCHA developments | 27 | 26 | |
| Mean buildings per development | 6.5 | 4.7 | .22 |
| | (5.0) | (5.8) | |
| Mean apartments per development | 633.2 | 526.2 | .50 |
| | (605.9) | (530.3) | |
| Mean population per development | 1,391.0 | 1,198.6 | .61 |
| | (1,440.1) | (1,278.5) | |
| Number of observation sites | 43 | 36 | |
| Distribution of sites by borough | | | .07 |
| Manhattan | 23 | 13 | |
| Brooklyn | 7 | 14 | |
| Bronx | 13 | 9 | |
| Mean population per site | 873.6 | 865.6 | .96 |
| | (115.6) | (97.2) | |
| Baseline mean trash bags per site | 43.3 | 46.4 | .30 |
| | (1.8) | (2.4) | |
| Baseline mean litter per site | 160.8 | 156.9 | .70 |
| | (7.5) | (7.0) | |

Notes: Standard Deviations appear in the parentheses below the means.

We find that the average number of household trash bags decreased by 25% ($p < .05$) in treatment sites, after the intervention (Table 2). On average, research assistants observed 43 bags of trash at sites which had not received the intervention, and 31 bags of trash at sites which had received the intervention. The average amount of litter observed also decreased by 16% ($p < .05$) in treatment sites (Table 3). On average, research assistants observed 136 pieces of litter at sites that had not received the intervention, and 102 at sites which had. These effects are robust and consistent across all models. Our primary specification, Column 5 of Tables 2 and 3, which includes all data collection fixed effects, is typically somewhat smaller than our results with no or fewer controls. We do not see any changes in trash or litter in the "Implementation Week" dummy.

Given this evidence of short-term impact, we also tested for potential variation of the treatment effect over time by introducing an interaction term between the intervention variable and a counter of the number of weeks since the intervention was installed on a site (Appendix C). However, this interaction was not significant in any model, suggesting that at least over this period (M = 5.5 weeks per site) the effects of the intervention did not substantially increase or decrease over time.

This intervention had the strongest unadjusted effects ($p < .05$) compared to control on sites in the third quartile of baseline distributions for trash and litter, but was least successful on sites in the fourth quartile (Figures 1 and 2); developments that were dirtier than average, but not the dirtiest, were the most impacted.

**Table 2**
**Intervention Effect on Trash Bags Observed (N = 1,641 site observations)**

| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
|---|---|---|---|---|---|
| Treatment | -0.44*** | -0.25* | -0.37*** | -0.42*** | -0.25* |
| | (0.12) | (0.11) | (0.11) | (0.12) | (0.10) |
| Implementation Week | -0.04 | 0.00 | 0.05 | -0.02 | 0.00 |
| | (0.21) | (0.19) | (0.21) | (0.22) | (0.20) |
| Site fixed effects | X | X | X | X | X |
| Week fixed effects | X | X | X | X | X |
| RA fixed effects | | X | | | X |
| Day of week fixed effects | | | X | | X |
| Hour fixed effects | | | | X | X |
| Pseudo R2 | 0.04 | 0.08 | 0.05 | 0.05 | 0.08 |

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test). Standard Errors appear in the parentheses below the coefficients. RA=Research assistant

**Table 3**
**Intervention Effect on Pieces of Litter Observed (N = 1,641 Site Observations)**

| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
|---|---|---|---|---|---|
| Treatment | -0.27** | -0.15** | -0.22* | -0.25** | -0.16* |
| | (0.10) | (0.06) | (0.11) | (0.10) | (0.06) |
| Implementation Week | -0.23 | -0.01 | -0.18 | -0.15 | -0.01 |
| | (0.13) | (0.11) | (0.13) | (0.13) | (0.11) |
| Site fixed effects | X | X | X | X | X |
| Week fixed effects | X | X | X | X | X |
| RA fixed effects | | X | | | X |
| Day of week fixed effects | | | X | | X |
| Hour fixed effects | | | | X | X |
| Pseudo R2 | 0.04 | 0.09 | 0.05 | 0.05 | 0.10 |

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test). Standard Errors appear in the parentheses below the coefficients. RA=Research assistant

**Figure 1**
**Bags of Household Trash Observed After Treatment, by Quartile of Baseline Trash**

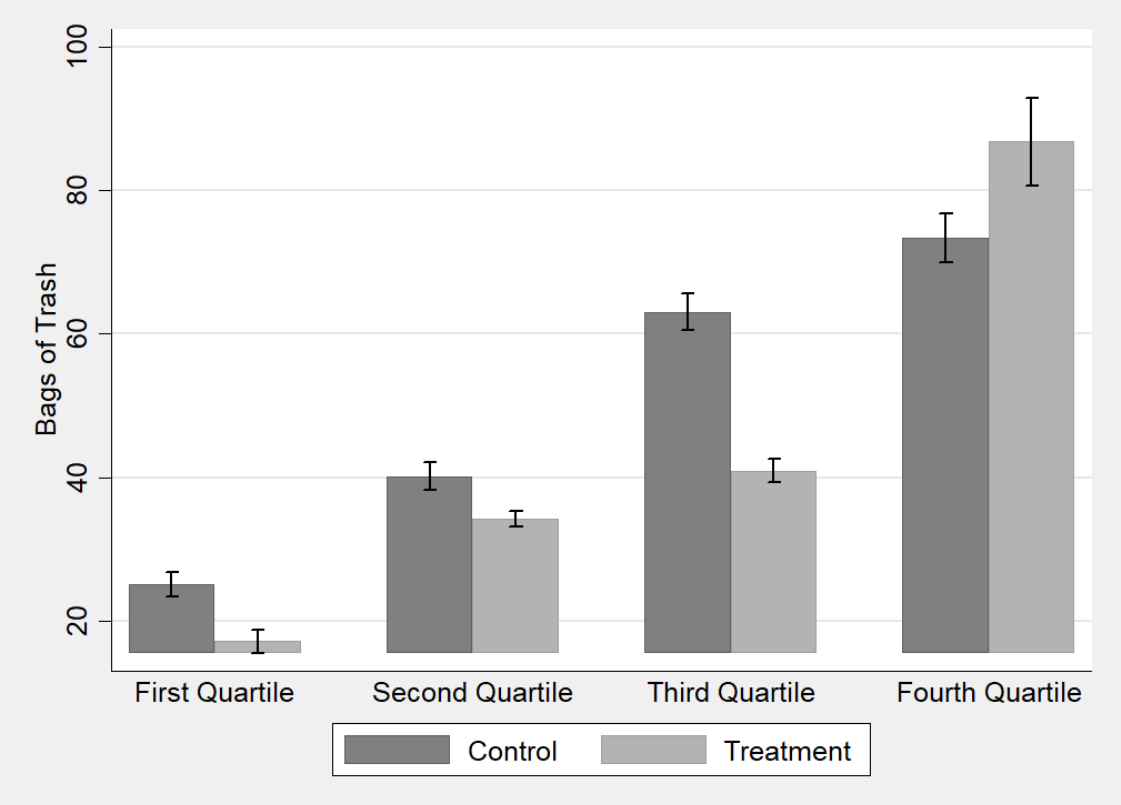
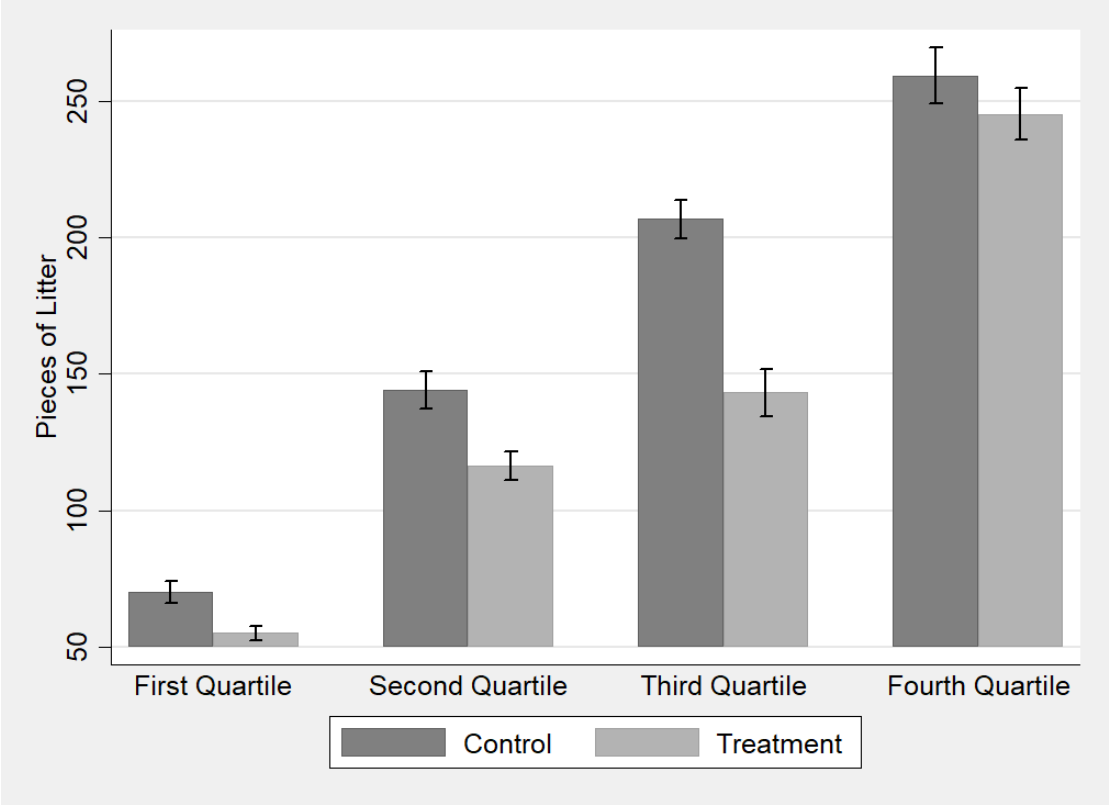


**Figure 2:**
**Pieces of Litter Observed After Treatment, by Quartile of Baseline Litter**




## Discussion and Conclusion

In summary, we find that providing easier access to trash disposal infrastructure, complemented by community-oriented and instructional communications, significantly reduced the amount of trash visible on NYCHA grounds. Our focus on the co-produced service of trash disposal through the lens of administrative burden provides empirical evidence for the importance of reducing compliance and learning costs to public housing residents.

Rather than reflecting any inherent behavioral tendencies of NYCHA residents, our results suggest that quality of life issues such as littering may be impacted by administrative burden and a lack of available channels for the prosocial behaviors NYCHA residents prefer to engage in. When public housing residents face an undue burden to dispose of their trash, misguided administrative policy essentially serves as a form of "sludge" (Thaler, 2018). In this way, this field experiment and its formative work served as a "Sludge Audit" for NYCHA, as advocated by Sunstein (Sunstein, 2020), to identify the burdens on residents and to demonstrate that a simple redesign of choice architecture can create real behavioral change. Previously, residents did not have a clear option for proper disposal of medium sized household trash; new structures and resources to reduce the compliance burden on residents, accompanied with guidance to reduce learning costs, subsequently reduced problem behavior.

While we verified intervention roll-out at individual site level based on fidelity checks by RAs (e.g. any tilt truck or poster seen on site), we did not systematically measure adherence to the spirit of the intervention (e.g. did all buildings of the development have tilt trucks, trashcans, and a variety of posters in sight?). Although we

observed a significant impact of our intervention across treated sites on average, anecdotally we are aware of a high degree of variability in implementation intensity, reflecting the reality of working with many different property managers and staff across many NYCHA developments. Since we do not differentiate between these degrees of implementation in our evaluation, this variability is likely to suppress the average intervention effect across treatment sites, which may have been stronger if the implementation process had been more strongly measured or controlled. We also cannot evaluate what other factors or characteristics about development sites may have contributed to the intervention being only partially delivered; however, given that we randomly assigned sites to receive the intervention, these underlying characteristics are likely to be similar between treatment and control groups. Similarly, we cannot make conclusions about what aspects of the intervention package to reduce administrative burden – infrastructure changes and communications materials – had the biggest impact on outcomes. Additional qualitative follow-up with residents after roll-out of the intervention may have helped provide further insight into the results observed.

Although the intervention was only installed for up to 10 weeks on treatment sites, we did not find that additional weeks of exposure were associated with a significantly greater, or smaller, reduction in trash and litter observed. While the variability in implementation time across sites makes it difficult to conclude about the sustainability of this intervention, this does suggest a potential lasting effect of changes to the physical environment on behavior, a "pure green nudge" towards the prosocial behavior (Carlsson, Gravert, Johansson-Stenman, & Kurz, 2020) rather than a prompt for short-term adoption due to the interventions being new and salient (Allcott & Rogers, 2014). Emotional triggers may be at more at risk of fading over time without accompanying structural change; for example, persuasive prompts alone have not been found to create lasting changes in recycling behavior (Dupré & Meineri, 2016; Timlett & Williams, 2008). On the other hand, the lack of positive interaction effects may indicate that the significant reductions in trash and litter observed by this study were not sufficiently noticeable by residents to generate amplification effects; that is, they did not reach the tipping point in which a cleaner environment itself can create additional social pressure for compliance.

The finding that the intervention was most effective on sites that were in the third quartile of "dirtiness" at baseline supports the conclusion that basic resource provision may be sufficient to have impact on sites with significant trash problems. Yet the intervention as designed is not the only way to reduce the burden of trash disposal for residents; more tailored, robust infrastructure upgrades may be required to show impact on sites with varied baseline levels. The intervention package studied here was ultimately a compromise due to challenges in implementing a more substantial infrastructure change – enlarging the openings of trash chutes within NYCHA buildings, which would allow residents to conveniently dispose of larger items such as the common 13-gallon trash bags used by many households. Our RAs also anecdotally observed that site-level differences (size, demographics, social norms) can make some sites more challenging to visibly impact; however, we are not able to make conclusions about those differences through this evaluation. While a more fundamental infrastructure change may have stronger overall impact, catering to the specific needs of residents and being responsive to environmental norms may also help close the gap for impact between sites. Further efforts to involve the community in the placement, rollout, and promotion of future infrastructure changes are warranted.

## Notes

1. https://www1.nyc.gov/site/doh/health/health-topics/rats-working-in-your-community.page

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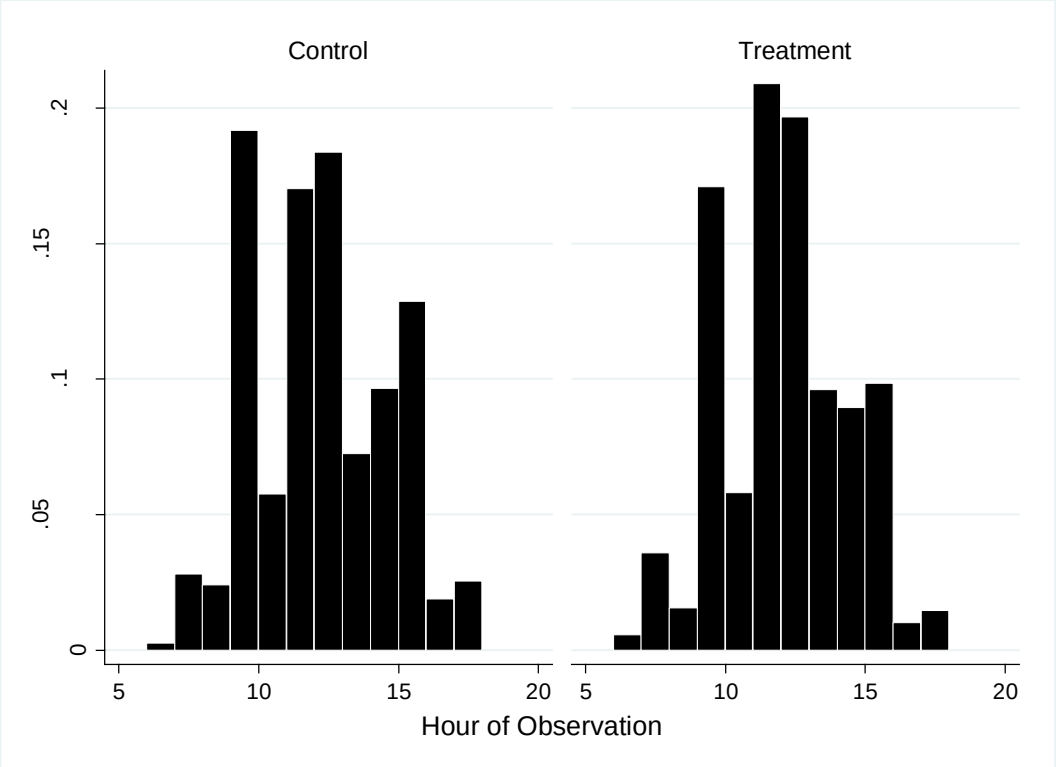
# Appendix

## Appendix A: Examples of Signage



**Appendix B. Distribution of Time of Day of Site Observation by Treatment Group**



## Appendix C. Time Interaction Effects

### Table 2A. Effect of Intervention on Trash Bags Observed

| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
|---|---|---|---|---|---|
| Treatment | -0.49** | -0.16 | -0.38* | -0.44* | -0.15 |
| | (0.18) | (0.16) | (0.18) | (0.19) | (0.16) |
| Implementation Week | -0.04 | 0.00 | 0.05 | -0.03 | 0.01 |
| | (0.22) | (0.19) | (0.21) | (0.22) | (0.20) |
| Week of Treatment | 0.02 | -0.03 | 0.00 | 0.01 | -0.03 |
| | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| Site fixed effects | X | X | X | X | X |
| Week fixed effects | X | X | X | X | X |
| RA fixed effects | | X | | | X |
| Day of week fixed effects | | | X | | X |
| Hour fixed effects | | | | X | X |
| Pseudo R2 | 0.04 | 0.08 | 0.05 | 0.05 | 0.08 |

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test). Standard Errors appear in the parentheses below the coefficients. RA=Research assistant

**Table 3A. Effect of Intervention on Litter Observed**

| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
|---|---|---|---|---|---|
| Treatment | -0.44** | -0.14 | -0.35* | -0.38* | -0.14 |
| | (0.18) | (0.10) | (0.19) | (0.16) | (0.11) |
| Implementation Week | -0.24 | -0.01 | -0.19 | -0.16 | -0.01 |
| | (0.13) | (0.11) | (0.13) | (0.13) | (0.11) |
| Week of Treatment | 0.05 | 0.00 | 0.04 | 0.04 | 0.00 |
| | (0.04) | (0.02) | (0.04) | (0.04) | (0.02) |
| Site fixed effects | X | X | X | X | X |
| Week fixed effects | X | X | X | X | X |
| RA fixed effects | | X | | | X |
| Day of week fixed effects | | | X | | X |
| Hour fixed effects | | | | X | X |
| Pseudo R2 | 0.04 | 0.09 | 0.05 | 0.05 | 0.10 |

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test). Standard Errors appear in the parentheses below the coefficients. RA=Research assistant