



(RESEARCH ARTICLE)



Understanding illegal dumping in Ontario: Drivers, barriers, and policy recommendations

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GSC Advanced Research and Reviews, 2024, 20(03), 212–225

Publication history: Received on 11 August 2024; revised on 21 September 2024; accepted on 23 September 2024

Article DOI: <https://doi.org/10.30574/gscarr.2024.20.3.0347>

Abstract

Illegal dumping, the unauthorized disposal of waste in public spaces, poses significant environmental, social, and economic challenges, particularly in Ontario, Canada. This study investigates the drivers behind illegal dumping, with a focus on rural and urban communities in Ontario. Using a mixed-methods approach, including household surveys and interviews, we examine self-reported instances of dumping, attitudes towards waste management, and perceived barriers to legal waste disposal. The results reveal that inadequate waste collection infrastructure, particularly in rural areas, and high disposal costs are primary motivators for illegal dumping. Additionally, a lack of awareness regarding proper disposal methods exacerbates the issue. While most respondents recognize the immorality of illegal dumping, rural participants show less guilt and are more likely to engage in the behavior. The study provides actionable insights for policymakers, including the need for improved waste infrastructure, targeted educational campaigns, and increased enforcement efforts. By addressing these key factors, Ontario can mitigate the environmental and public health risks posed by illegal dumping, while fostering a culture of responsible waste disposal.

Keywords: Illegal dumping; Waste management; Ontario; Community attitudes; Environmental policy; Rural waste disposal; Enforcement

1. Introduction

Illegal dumping, also known as fly tipping or wild dumping, refers to the improper disposal of waste in unauthorized public spaces instead of proper waste facilities. It involves deliberately discarding hazardous household waste, construction debris, old furniture, appliances, vehicle parts, tires, and various other waste products in public parks, empty lots, roadsides, or other land areas not intended for waste disposal (Matos & Ostir, 2012) (Note: Illegal dumping in this context does not include litter of single use printed paper and packaging)

This unlawful dumping of refuse has the potential to create significant public health hazards when not disposed of through proper channels. Illegal dump sites become breeding grounds for rats, mosquitos, and other disease vectors (Mills et al., 2014). Dumping near waterways also causes severe pollution impacts, degrading local water quality and harming aquatic ecosystems (Slagor, 2017).

In addition to environmental and health risks, illegal dumping negatively impacts communities in economic and aesthetic terms. Site cleanup and remediation in response to illegal dumping can be very costly to municipalities, lowering available funds for other services. Property values also decline in affected areas, as illegal dumping can breed community blight (Bleck et al., 2019). The presence of waste and litter psychologically demoralizes residents who take pride in their neighborhoods.

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While illegal dumping occurs globally, it remains an understudied issue with significant research gaps on motivations, costs, and solutions. Dumping behaviors can vary across cultures and locales, and discouraging this activity requires evidence-based policies informed by data on the complex interplay of access, norms, deterrence, and behaviors unique to each community. More scholarship is needed to guide tailored solutions minimizing health, environment, economic, and social harms. Tackling illegal dumping thus emerges as a topic necessitating interdisciplinary research.

While there is a significant body of research that has examined illegal dumping internationally, few studies have focused on the drivers and impacts specific to Ontario, Canada. Furthermore, there is limited comparative research assessing the efficacy of various policy and technology solutions for deterring illegal dumping. This points to key knowledge gaps around the situational factors, attitudes, norms, and motivations that may encourage illegal dumping, and the tailoring of anti-dumping strategies to local contexts.

The aim of this study is to characterize the illegal dumping issues facing Ontario, Canada, while also identifying practical solutions for policy makers and residents. To do so, a survey was developed to gauge household attitudes towards illegal dumping, with a specific examination of:

- Self-reported instances of illegal dumping
- Observed instances of illegal dumping within communities
- Attitudes toward illegal dumping
- Access and infrastructure barriers
- Attitudes towards enforcement

Household surveys and interviews provide unique insights into dumping motivations, barriers to proper disposal, risk perceptions, and local attitudes. These findings can be used to inform potential anti-dumping measures such as enhanced municipal solid waste services, expanded disposal options, education campaigns, and increased enforcement.

A unique aspect of this study is a comparison of household illegal dumping habits in both urban and rural communities, exploring potential differences in self-reported behavior based on locality.

This research will help deepen understanding of an understudied local issue, while providing actionable recommendations to policymakers on deterrence options. Curbing illegal dumping will in turn mitigate risks to health and environment while preventing ecological degradation and community blight. The study aims to bridge gaps between research, policy, and practice for evidence-based solutions tailored to the needs of Ontario, Canada.

2. Literature Review

2.1. Barriers to Legally Disposing of Waste

Most past studies have noted that a lack of adequate and accessible waste collection infrastructure is the primary determinant of illegal dumping. In areas with mature waste management systems and readily accessible collection points (waste depots, transfer stations, etc.), significantly lower rates of illegal dumping are reported. Most research has found a direct inverse relationship between the density of waste collection sites and incidents of illegal dumping — illegal dumping increases as the density of waste collection sites decreases (Lakhan, 2014).

This is fairly consistent with observations made about waste behavior in general, as convenience is one of the most significant predictors of behavior. While people generally are supportive of activities such as recycling, reuse, etc., they are not willing to incur a significant cost (measured in terms of effort or resources) to engage in the behavior (Lee, 2017). Inconsistent provision of waste management services was found to indirectly incent illegal dumping among urban households, as they become accustomed to baseline level of service and collection frequency (Palermo, 2020). Unlike rural households, the behavioral precedent of taking waste to a depot or transfer station is not something that normally is expected of urban households. As a result, the perceived inconvenience of doing so for a waste stream that is not serviced by municipal collection programs is enough to encourage illegal dumping (Palermo, 2020).

In a comprehensive meta-analysis of the factors contributing to illegal dumping conducted by Ichinose et al. (2015), it was observed that increasing the number of designated waste collection points had the most measurable impact on decreasing the frequency of illegal dumping. Their findings are supported by the vast majority of studies on illegal dumping, which have found that illegal dumping cannot be addressed adequately until there is sufficient collection infrastructure in place. Generally speaking, even when attitudes toward the desired behavior (in this case, disposing of waste at approved collection points) are positive, any impediments to carrying out the behavior (lack of access, lack of

opportunity, lack of awareness, cost of disposal, etc.) can act as a deterrent. Awareness regarding where waste should go and what programs are available to households also has been noted as a key cause of illegal dumping.

A lack of awareness regarding where to correctly dispose of waste has been noted in several studies and often is cited as one of the primary barriers to having waste collected through the appropriate (and legal) channels (Jutta, 2016). With that being said, the efficacy of behavioral intervention, promotion, education and even punitive measures to discourage illegal dumping diminishes if adequate infrastructure is not in place.

In addition to the physical barriers to participation due to a lack of collection infrastructure, waste disposal fees also have been identified as a primary driver of illegal dumping. Numerous studies have observed a direct relationship between increased disposal rates and incidents of illegal dumping in a community (Ichinose & Yamamoto, 2011). Disposal fees act as a disincentive for properly disposing of waste, which in turn, encourages illegal dumping as a means to avoid an economic penalty for disposal. Communities that implement unit pricing on waste disposal (also known as pay as you throw (PAYT) or variable-rate pricing) also have been observed as having higher rates of illegal dumping. While PAYT programs are effective in diverting waste from landfills, they indirectly encourage illegal dumping, as the increase in the cost of disposal can be sufficient to encourage illegal dumping as a means to avoid disposal costs (Hamilton et al., 2013).

2.2. Site-Specific Characteristics That Contribute to Illegal Dumping

Findings from the broader literature have shown that the geospatial characteristics of an area can contribute to illegal dumping. Site-specific and situation-specific characteristics also can promote/discourage the occurrence of illegal dumping. Geospatial characteristics include access to roads, adequate lighting, population densities, mixed land use, foot/vehicle traffic and site visibility.

These characteristics all have been identified as potentially important drivers when attempting to understand illegal dumping. In many ways, illegal dumping has been characterized as a “crime of opportunity.” Despite most research finding that households overwhelmingly are opposed to illegal dumping and view the behavior as abhorrent, illegal dumping is quite common and very often is a function of how easy it is for a person to engage in the activity — and get away with it. As an example, researchers have found that areas with mixed land use (where residential and commercial land use coexist – e.g., homes, apartments, retail shops and industrial sites) may provide more opportunity for illegal dumping if there are unoccupied areas or areas that lack traffic and lighting. Mixed-use land also increases nonresidents’ familiarity with and easy access to places offering the opportunity to dump items.

Many studies have emphasized that geospatial features, such as the position of road networks (Matos et al., 2012), proximity to roads (Tasaki et al., 2007) and distance to residential areas (Jordá-Borrell et al., 2014), play important roles in predicting illegal dumping sites or landfills. Illegal dumping in public spaces is more common in areas that are easy to access but have low visibility, for example, rural areas with road access and low population density. Locality in particular has been seen to play a significant role in affecting both the instances of and willingness to dump material illegally.

2.3. Communal Maintenance of a Public Space/Area

A particularly interesting observation is that the willingness to illegally dump waste also is a function of whether a public space is being maintained and whether that space is perceived to be a communal space.

As noted by Brunton-Smith et al., the aesthetics or cleanliness of a site is inversely related to rates of illegal dumping — the cleaner or better maintained an area, the less likely people are to illegally dump waste (2014). By contrast, if an area is perceived to be poorly maintained (litter, overflowing waste bins, other illegal dumping), people will be more inclined to dump waste. The characteristics of a site send signals to people about the collective lack of control and concern about the space, and the values and intentions of others who share the space. In simpler terms, people will rationalize and justify the behavior — “If other people don’t care, why should I?” This effect is exacerbated in instances where enforcement is perceived as low.

It should be noted that both the willingness to illegally dump and observed instances of illegal dumping decrease significantly in areas that are perceived to be communal spaces/amenities. As an example, public parks often are thought to be one of the types of sites most likely to attract illegal dumping — however, when members of the community utilize such a space and feel a collective responsibility for its maintenance, illegal dumping is discouraged. The concept of “ownership” has been observed to have a significant influence on waste disposal behavior, particularly with respect to adherence to rules and regulations. In multi-residential buildings where residents own their units (vs.

renting) or belong to a cooperative, participation in source separation initiatives is significantly higher, while contamination rates of the organics/recycling stream are lower, when compared with rental units. This also may explain, in part, why some people choose to illegally dump material outside of their communities. Not only is there a reduced risk of being recognized, but people also are able to avoid harming areas they may use and perceive to be part of their neighborhood.

3. Methodology

Three geographical regions were targeted to complete a combination of structured surveys and open-ended survey statements pertaining to respondents' attitudes toward illegal dumping, self-reported measures of illegal dumping, assessments surrounding the efficacy and consistency of enforcement, and perceived infrastructural availability.

These communities were chosen on the basis of representing large urban, suburban and rural communities, as a means to achieve a representative approximation for the province as a whole. Of note, previous research on the topic has identified locality as being a significant predictor/modifier of illegal dumping findings.

Geographic regions are defined by population density, geographic location and collection type (curbside collection vs. depot systems). These groups include:

- Large urban
- Urban regional/suburban
- Rural/northern

These groups were selected on the basis that they adequately represent the geographic/demographic differences in the province.

Questionnaires were pre-tested and refined prior to conducting the official. The pre-test allowed for wording refinements and changes to the ordering of the questions. The finalized survey was conducted over a six-week period beginning in the second week of May 2021 and running through June 2021. Teams of two enumerators and one site supervisor were sent to each municipality for a period of four days each, spending six hours at each survey site.

Questionnaire "booths" were set up in spaces with high foot traffic (namely malls, arenas and public commons areas). Enumerators were asked to approach members of the public, explain who they were and the purpose of the study, and requested approximately 10–15 minutes of the participant's time to complete the survey. A \$5 Tim Hortons café and bake shop gift card was used to incent participation.

Survey responses were recorded by hand and by tape recorder by the enumerator, and later electronically archived and analyzed using Provalis Word Stat, Microsoft Excel and Microsoft Word. Word Stat was used to code, summarize and categorize interview responses. Microsoft Excel and Microsoft Word were used to record Likert scale values and record frequency counts and percentage distribution of responses.

Respondents were asked to answer questions using a combination of Likert scales, dichotomous selection (yes or no) and open-ended statements. Respondents were read questions and asked to mark their responses on the survey with the assistance of the enumerator. Upon completion of the written survey, respondents were asked a series of open ended questions related to illegal dumping.

While concerns surrounding the COVID-19 pandemic resulted in fewer interactions between enumerators and potential survey participants, the total number of samples obtained (612) is statistically significant and representative of the broader population of Ontario (at the 95% confidence interval).

A mix of convenience and quota sampling was employed to ensure that survey participants reflect the relative proportions of Ontario's population.

Distribution of samples were as follows: (Note: Municipal classification is in accordance with RPRA guidelines.)

- 310 samples taken from large urban municipalities
- 161 samples taken from medium urban/suburban municipalities
- 141 samples taken from rural municipalities

4. Results and discussion

This section presents findings from a survey conducted to assess the prevalence, motivations, attitudes, and deterrents related to illegal dumping of waste in communities across Ontario, Canada. The study gathered data from over 600 residents of urban, suburban, and rural municipalities through a questionnaire containing both quantitative questions and open-ended prompts.

The results and analysis of the survey have been organized into five sections:

- Self-reported instances of illegal dumping
- Observed instances of illegal dumping within communities
- Attitudes toward illegal dumping
- Access and infrastructure barriers
- Attitudes towards enforcement

Please note that Tables 1 through 4 are selected excerpts from the survey results – for a full list of questions and results, please refer to Appendix A

4.1. Self-reported illegal dumping frequency results

Table 1 Self Reported Illegal Dumping

Question	Yes (%)	No (%)
Have you participated in illegal dumping in the past 12 months? (Urban)	28	72
Have you participated in illegal dumping in the past 12 months? (Suburban)	52	48
Have you participated in illegal dumping in the past 12 months? (Rural)	72	28
Have you participated in illegal dumping in the past 12 months? (Single Family)	37	63
Have you participated in illegal dumping in the past 12 months? (Multi Family)	45	55

The survey found high rates of admitted illegal dumping across all municipality types, with 64% of total respondents acknowledging they had engaged in illegal disposal of waste in the past year. This indicates that illegal dumping is a widespread issue affecting communities across the province of Ontario.

Of note, self-reported dumping was most prevalent among rural respondents, with 72% admitting to the practice in the past 12 months. This compares to 52% of suburban and just 28% of urban respondents reporting illegal dumping. The substantially higher rate in rural versus urban areas suggests that population density and access to waste infrastructure may drive dumping behaviors. These results align with findings from other studies that illegal dumping tends to be more common in rural localities with fewer official waste collection services (Lakhan, 2015).

The relatively low urban self-reported dumping rate of 28% should be interpreted with caution, as it still represents over a quarter of city-dwelling respondents that admit to participating in illegal dumping. While improved disposal access and social norms may discourage the practice in urban environments, illegal dumping remains a problem even where waste management systems are more robust.

The survey also found a moderately higher rate of dumping among those in multi-family versus single-family residences (45% vs 37%). This indicates a correlation between illegal dumping and dense, non-owned housing like apartments. One potential factor is that apartment buildings often lack adequate facilities and services for bulky waste disposal compared to single-family homes (Hoornweg et al., 2013).

Self-reported data reveals an interesting attitudinal difference between urban and rural dwellers when it comes to illegal dumping. While rural residents dumped more often, they also expressed significantly less guilt about doing so

compared to urban respondents. Just 24% of rural respondents felt guilty about illegally dumping versus 80% of urban dwellers. This suggests illegal dumping may be viewed as more socially acceptable behavior in rural communities.

These findings suggest that illegal dumping of waste is a common practice across Ontario municipalities, driven by gaps in disposal access and infrastructure as well as socio-cultural attitudes toward environmental compliance.

4.2. Observed instances of illegal dumping within communities

In addition to self-reported dumping rates, the survey also collected data on witnessed illegal disposal of waste by others in the community. Across all respondents, 91% had observed neighbors or community members engaging in illegal dumping in the past 12 months (shown in figure 1). This shows that not only is dumping commonly self-disclosed, it is also widely witnessed and visible in Ontario municipalities.

The highest witnessed dumping rates were reported in rural (97%) and suburban (94%) areas compared to 87% of urban households. While still a clear majority, the lower urban rate aligns with the self-reported dumping figures in suggesting these practices are less pervasive in cities versus less populated regions.

According to the broken windows theory, visible signs of pollution, dumping, and disorder can create an environment that encourages further violations by signaling that misconduct is tolerated (Keizer et al., 2008). The high witnessed dumping rates, especially in rural communities, indicates illegal waste disposal has become an accepted norm in many regions. When residents frequently encounter illegally dumped waste in their neighborhoods, they are more likely to view the practice as normal and permissible.

However, the theory also states that addressing signs of disorder and visibly restoring community standards can help deter future infractions. Thus high-visibility enforcement and cleanup efforts in illegal dumping hotspots may be able to shift social norms over time by clearly communicating what behaviors are unacceptable. However, changing deeply embedded attitudes and perceptions around illegal dumping will likely require engagement between local governments, community groups, and residents.

4.3. Attitudes toward illegal dumping

Table 2 Attitudes towards illegal dumping

Category	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
<i>Illegal dumping is wrong</i>					
Urban	31	55	7	4	3
Suburban	26	57	10	6	1
Rural	28	44	18	8	2
<i>People who illegally dump should face a fine</i>					
Urban	14	37	21	13	15
Suburban	16	26	23	19	16
Rural	9	18	29	24	20
<i>I would be discouraged from illegal dumping if faced with a fine or penalty</i>					
Urban	23	37	16	11	13
Suburban	21	33	19	17	10
Rural	28	27	24	13	8

<i>I would feel guilty for illegally dumping waste</i>					
Urban	37	44	8	6	5
Suburban	26	36	14	9	15
Rural	7	19	31	17	26

As shown in table 2 above, 88% of total respondents agreed that illegal dumping is morally wrong. However, there were significant gaps between urban and rural dwellers when assessing the environmental impacts of illegal dumping. Just 29% of rural respondents believed illegal dumping is bad for the environment, compared to 49% of urban participants.

Respondents reported feeling frustration when faced with barriers to illegal dumping, often rationalizing the act by saying that they felt forced into dumping waste. Both self-reported measures of guilt/remorse and perceived personal responsibility for illegal dumping were observed to be lower among respondents who felt there was a lack of adequate collection infrastructure. Rural residents in particular felt that their communities were being neglected and that an inordinate share of resources were spent focusing on the needs of urban communities. (This is a situation that is exacerbated by the fact that most rural areas do not receive curbside waste/recycling service.) This latter finding is of particular interest, as it speaks to how relative access to waste management services can affect illegal dumping — the perceived inequity and fairness in the provision of waste collection among rural residents is used to rationalize dumping behavior.

When asked if illegal dumpers should face fines, 55% of total respondents agreed. However, these rates varied significantly by location, with 69% support in cities versus only 36% in rural municipalities. 44% of respondents said they personally would be discouraged from illegal dumping if faced with penalties. This shows fines could be an effective deterrent, but the lower support for penalties in rural communities indicates negative attitudes that could hinder enforcement. Successful anti-dumping strategies will require shifting social norms as well as infrastructure improvements.

In summary, while most view dumping as wrong, rural-urban value differences exist both in the perceived severity of environmental impacts and support for punitive enforcement measures. Nuanced education and engagement campaigns tailored to community perceptions will be key to addressing illegal waste disposal across these differing contexts.

4.4. Access and infrastructure barriers

Table 3 Perceived access barriers

Category	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
<i>I know where to take my waste that is not collected as part of my city's recycling or garbage service</i>					
Urban	17	21	14	31	17
Suburban	11	28	17	34	10
Rural	7	14	25	41	13
<i>It is easy to safely dispose of waste that is not collected as part of my city's recycling or garbage service</i>					
Urban	22	17	31	19	11
Suburban	14	20	33	24	12
Rural	15	14	27	34	10

<i>The city's waste depot and/or transfer station is easy to get to</i>					
Urban	18	24	20	25	13
Suburban	19	20	17	33	11
Rural	9	14	25	39	13
<i>There are an adequate number of drop off/collection points for waste in my city</i>					
Urban	19	21	27	19	14
Suburban	15	19	34	15	17
Rural	5	7	30	20	38

The survey results indicate that lack of convenient access to waste disposal infrastructure and services is a primary driver of illegal dumping. Rural respondents cited insufficient collection infrastructure as the main reason for illegal dumping, with 70% of households lacking curbside pickup and 63% having no municipal bulky item collection. Without affordable options to properly dispose of these hard-to-manage items, rural residents appear far more likely to dump them illegally. The insufficient rural disposal infrastructure reported in the survey aligns with prior research identifying access gaps as a key predictor of dumping. Studies consistently find higher dumping rates in areas with lower facility density and waste collection coverage (Lakhan, 2014; Ichinose et al., 2015). Rural regions often lack funding and population density needed to support robust municipal waste programs. Even small distance increases to disposal sites have been shown to reduce household participation (Owens et al., 2000). While urban and suburban respondents were more likely than rural ones to have municipal waste services, they also noted gaps in waste collection programs for bulky items like furniture and appliances.

The higher rural dumping admittance also reflects findings on convenience motivations. When legal waste disposal requires high effort or costs, non-compliance increases (Abbott et al., 2011). Rural self-hauling of bulky items to distant depots appears to contribute to illegal dumping behavior. Urban residents that are used to home pickup service may expect municipal collection of these goods, though many cities lack needed programs and infrastructure.

Overall, only 34% of all respondents reported that they knew where to take non-recyclable or non-standard waste items. This highlights a major education gap, as people are more likely to dump illegally when they do not know how to properly dispose of materials (Jutta et al., 2016). Rural residents showed the lowest awareness, with just 14% of respondents knowing where to bring hard-to-dispose waste materials. The information gaps reported reinforce studies showing awareness of proper disposal options reduces dumping (Jutta et al., 2016). Even urban residents familiar with standard waste programs remain unsure of how to discard bulky and hazardous items legally. This finding highlights that community outreach is vital in ensuring that households know what can and cannot be disposed of, and through which municipal channels.

Financial barriers were also a factor, with 74% of urban and 61% of suburban respondents indicating they pay fees when visiting waste depots. Paying for disposal disincentivizes legal management channels, and may indirectly incent illegal dumping behavior. Rural respondents were less impacted by fees, with only 56% paying at depots, likely because many lack access altogether.

In summary, major infrastructure and information barriers exist across all municipality types, but are acutely problematic for rural areas. Residents who lack home pickup, have no affordable disposal options for bulky goods, or simply do not know where to bring waste are significantly more likely to discard materials illegally. Extending consistent waste collection and education services, especially to rural communities, should be a priority for reducing illegal dumping.

4.5. Enforcement

Table 4 Enforcement

Category	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
<i>My city enforces bylaws that punish people for illegal dumping</i>					
Urban	7	14	36	24	19
Suburban	8	10	29	30	23
Rural	2	9	30	20	39
<i>My city imposes a fine or penalty for illegal dumping</i>	Yes (%)	No (%)	Don't Know (%)		
Urban	44	27	29		
Suburban	35	29	36		
Rural	17	20	63		

The survey sought to gauge perceptions around enforcement of anti-dumping regulations. Only 21% of total respondents believed their municipality does enough to prevent illegal waste disposal. Many were uncertain whether dumping fines even exist where they live, particularly rural residents. Additionally, most participants felt that any existing anti-dumping laws or bylaws were ineffective due to lack of enforcement. As previous studies have shown, deterrence depends not just on strong policies, but on the perceived likelihood these regulations will be enforced (Fullerton & Kinnaman, 1996). If potential dumpers view enforcement as lax or unlikely, they will be more prone to offend regardless of written prohibitions.

This aligns with the high rates of self-reported and witnessed illegal dumping found in the survey. When residents frequently encounter dumped waste in their neighborhoods with no apparent consequences, they come to see the behavior as de facto legally permissible. The results suggest insufficient enforcement resources, uneven regulation across municipalities, and perceived unlikelihood of penalties are undermining Ontario's ability to combat illegal dumping.

Deterrence theory indicates enhancing the visibility of enforcement activities, even beyond actual intervention levels, can begin shifting social norms and improving compliance (Rogers & Green, 2005). Ontario municipalities should prioritize high-profile dumping patrols and crackdowns, coupled with public education on penalties, in order to clearly communicate violations will reliably be met with consequences.

Recommendations

- Data Collection and Reporting

The development of effective policy is fundamentally premised on the availability of “good data,” which provides insights into the size, scale and scope of the problem. With specific reference to illegal dumping, it is critical that there be province/regionwide data collection and reporting requirements that track instances/frequency of illegal dumping, the types and quantities of material being illegally dumped, and areas where material is being dumped.

For the sake of consistency, a central agency/organization should, if possible, be responsible for collecting and serving as a steward of this data statewide, requiring that relevant stakeholders (municipalities, waste collectors, etc.) submit information at regularly scheduled intervals (monthly, quarterly, etc.). This information is required to track instances of illegal dumping over time and to identify hot spots where immediate action is needed, and should be used to set actionable targets, including evaluating the efficacy of programmatic and policy changes over time. In the absence of this data, it is not only difficult to understand what strategies may or may not be working, it also compromises a region's ability to effectively allocate resources to ensure optimal outcomes. In short, a comprehensive data collection strategy is a prerequisite to preventing illegal dumping and should not be seen as optional.

- Availability, Access and Infrastructure

The survey clearly found that lack of convenient and affordable disposal options was a primary driver of illegal dumping across all types of communities. Due to the perceived inconvenience or cost of disposing of waste, households are more inclined to participate in illegal dumping. This behavior is exacerbated in communities with low levels of enforcement or a perceived lack of interest on the part of the community to encourage proper disposal.

It is critical that communities offer a minimum level of service with respect to waste management collection and extend that service to include the collection of durable waste. As observed in the survey, municipalities that did not offer a formal program for mattress/white good/furniture collection experienced higher rates of illegal dumping. Survey participants rationalized their illegal dumping by saying they did not have any other options, as the municipality neither collected the materials being dumped nor communicated where those materials could go.

Generally speaking, curbside collection yields the highest rates of household participation with respect to the diversion of all waste streams. It is seen as the most convenient option and also is the most familiar method to residents who live in urban areas. In communities with curbside collection of residential organics, printed paper and packaging, there is an expectation that all waste should be serviced via curbside pickup. However, the costs of curbside waste collection, particularly for durable goods, is prohibitive for many municipalities. The cost effectiveness of curbside collection is premised on having a critical mass of material being collected within a certain geographic boundary and at scheduled intervals (weekly, biweekly, etc.). Given the nature by which durable goods are disposed, curbside collection may not be an affordable option for many communities. A potential option is to offer curbside pickup on special days when residents are instructed to set out durable waste for pickup (e.g., monthly or seasonal collections, etc.).

Local authorities also need to consider how easy it is to access proper disposal locations. For example, if the nearest waste and recycling center is a significant distance away and in an area with low rates of car ownership, then there is a higher likelihood that people will illegally dump. In such scenarios, local authorities need to be responsive and think about initiatives, such as local amnesties on specified dates, or setting up temporary collections for bulk waste in municipal car parks or parking garbage collection vehicles at convenient spots on weekends to act as mobile waste collection sites. Increasing access to and utilization of free collection services, increasing the number of free bulky collections and providing access to temporary waste collection points during periods of high waste generation are demonstrably effective strategies to encourage community buy-in and cultivate awareness regarding the waste disposal options available to the public.

Designated drop-off sites (waste depots, transfer stations, material recycling facilities, participating retailers, etc.) should be used to either complement curbside waste collection in urban communities or serve as the primary form of collection in communities where curbside collection is not possible for financial or infrastructural reasons. Local governments need to ensure that there are sufficient designated drop-off/collection points relative to the distribution of households.

For context, Recycle BC, the stewardship program responsible for managing British Columbia's residential recycling program, requires that all communities with more than 1,000 residents be provided access to either curbside or transfer station collection, which translates into more than 97% of households being able to participate in residential recycling programs. Accessibility standards and service coverage areas will depend on site-specific and situation-specific factors of a community, including available infrastructural and staffing resources.

- Promotional, Educational and Awareness Initiatives

One of the challenges identified in the illegal dumping survey conducted by York University is that most communities do not take a coordinated approach when developing promotional and educational initiatives to encourage proper disposal and discourage illegal dumping. This, in part, is explained by the differences in waste management services and programming that exist across communities — some municipalities offer residential curbside collection of bulky and white goods, while others do not. Some municipalities offer curbside collection to both single-family and multifamily residences, while others rely exclusively on depot-based drop-off systems. Regional differences in the services offered and the expectations of households with respect to waste disposal make it difficult to develop a harmonized approach to promotion and education.

While there is rarely a one-size-fits-all approach to promotion and education, it is important that communities provide clear and consistent messaging with respect to illegal dumping, highlighting the “who, what, when, where, why and how?” of a program.

- Households should understand “why” illegal dumping is a critical issue, including the problems it causes with respect to health, the environment, quality of life and community aesthetics.
- A promotional and educational campaign also should clearly communicate “where” waste should be taken, including designated drop-off sites and collection points that are available in a community.
- Households should clearly understand “what” items are permissible for disposal as part of a residential waste program. This needs to be as prescriptive as possible, as not all waste (including durable waste such as white goods and mattresses) is accepted, depending on the collection point (i.e., a refrigerator must be taken to a hazardous waste depot, while electronics can be taken to a participating retailer for e-cycling).
- A promotional and educational campaign also should clearly specify “when” households should dispose of waste (particularly durable waste), communicating hours of operation for designated drop-off sites, collection schedules for curbside pickup, and dates of special waste amnesty days and community cleanup events where households can dispose of bulky waste at no cost with a municipality or partner group.

Cultivating awareness regarding where waste materials should be disposed and what programs are offered also is considered a key component of garnering community support. Communications should focus on promoting the desired behavior, aim to reduce the burden on the resident to decipher the program (where waste goes), and occur at a time and place relevant to the disposal behavior. This last point is particularly important because communications that occur in a time and place proximal to the behavior are more likely to have an impact.

Legislators and policymakers need to consider that illegal dumping is an activity based on a series of decision points that follow a line of least resistance — from the point of waste generation (when the item no longer has any value to a household) all the way through to the moment at which the illegal dumping occurs.

Therefore, the chain of decisions that leads to illegal dumping also represents multiple opportunities for behavioral intervention, diverting the decision-making chain onto a path that results in the legal disposal of waste through appropriate collection channels.

- Stakeholder Collaboration

Based on experiences from other jurisdictions, as well as insights provided by industry experts, it is clear that promoting effective collaboration and forging partnerships among multiple stakeholders is required in order to effectively address illegal dumping.

Given the size and scale of the problem, no one entity can “go it alone” and attempt to tackle illegal dumping. As noted, a harmonized approach across multiple jurisdictions and agencies is likely to be the most effective approach, particularly with respect to data collection/management and effective promotion and education. The challenge, however, is how to bring a diverse group of stakeholders together, particularly when they may have competing interests.

In light of these challenges, it is recommended that consideration be given to forming specialized partnerships to address illegal dumping. These would involve all relevant stakeholders, including local and regional government, law enforcement and regulatory agencies, service providers, and community representatives, working collaboratively to address illegal dumping from both a policy and operational perspective. To be effective, such groups would need to be facilitated by dedicated management professionals, with the costs shared between affected stakeholders.

Such partnerships should review what existing resources are being spent on illegal dumping and what cost savings and efficiencies could be achieved by pooling budgetary resources. Such cost/resource sharing reduces the burden on individual stakeholders, allowing a coordinated approach to addressing issues surrounding illegal dumping. Pooled resource sharing also can reduce budgetary commitments over time, as efficiencies and costs savings are realized.

All operational responses to illegal dumping should be channeled through whichever organization is deemed to be nearest to the main centers of population — likely municipalities or other local governments. These organizations should be collectively responsible for financing all cleanup operations, with stakeholder budgets redirected to support local governments’ effort to combat illegal dumping. Thus, by pooling budgetary resources, local governments would be better equipped to address and remediate illegal dumping by increasing the number of free collections available to all households, funding more temporary collection points, sponsoring promotional and educational campaigns, etc.

In order to overcome some of the administrative challenges associated with stakeholder collaboration and partnerships (a likely inevitability given the number of actors involved and the sectors that they represent), it is strongly

recommended that a framework be developed that sets out commonly agreed upon principles, roles, responsibilities and desired outcomes. This framework also would specify benchmarks regarding the frequency of illegal dumping, service coverage, cost of remediation/cleanup, and appropriate penalties and enforcement. If appropriate, formal bylaws and legislation could be used to codify the guiding principles of stakeholders in a given jurisdiction .

- Enforcement

Historically, enforcement measures regarding illegal dumping have been defined poorly, with limited harmonization across jurisdictions. This particularly is true for the illegal dumping of nonhazardous durable waste, which oftentimes is understood poorly by both law enforcement and policymakers. As noted by Haseman (2020), this was (and to a degree, remains) one of the foremost challenges associated with illegal dumping — insufficient knowledge regarding how to identify illegal dumping, what appropriate enforcement measures should be and how it should be prosecuted. Given this, one of the first steps to improving illegal dumping laws and enforcement is to provide the necessary training to law enforcement and local government staff so that effective deterrents can be developed and implemented. Members of the justice system need be trained to fully understand the consequences of illegal dumping to ensure that judgments are sufficient to act as deterrents, while also encouraging further positive enforcement activity.

5. Conclusion

This study is intended to provide insights into the factors that contribute to illegal dumping and offer potential preventive strategies to discourage illegal dumping of durable waste. While there are a multitude of drivers that contribute to illegal dumping, the primary issue can be distilled to a lack of access to appropriate disposal methods. Households overwhelmingly recognize that illegal dumping is an abhorrent activity that poses both environmental and economic harm and should be avoided when possible. However, a lack of perceived behavioral control (measured in terms of accessibility and convenience) is ultimately what results in illegal dumping, highlighting the importance of providing communities with readily accessible waste collection points (through curbside collection, designated drop-off points or a combination of measures). The most effective strategy for dealing with illegal dumping is to make legal disposal of waste at approved collection points as convenient as possible.

While providing infrastructural access is a prerequisite to discouraging illegal dumping, it also is important that there is clear and consistent messaging regarding the “who, what, when, where, why and how” of disposing of waste — households need to know where they can go and what materials they can take, as well as the importance of avoiding illegal dumping because of its economic, environmental and health risks. Harmonization across jurisdictions is critical in promoting desired behavior, as differences in levels of service, access and operations among neighboring communities can result in confusion for households. This report found that the confusion and uncertainty resulting from a lack of harmonization also contributes to illegal dumping, as households report receiving mixed messaging, that in turn leads to illegal dumping.

One of the key takeaways from this report is that addressing the drivers of illegal dumping (lack of access, lack of awareness, etc.) requires a concerted and coordinated effort of multiple stakeholders from a range of sectors. It is not sufficient for any one actor to “go it alone” when addressing illegal dumping, as it requires the resources, expertise and input of multiple actors that represent state and local governments, manufacturers of durable goods, waste management operators and the community. It is important that the roles and responsibilities of involved stakeholders are defined clearly, with consensus regarding the most effective and economically practical ways to address illegal dumping and prevent it from occurring in the first place.

Discouraging illegal dumping also can be achieved through behavioral intervention strategies that emphasize punitive measures for noncompliance. Results of a survey that accompanied this study showed there was an inverse relationship between illegal dumping and enforcement. In communities that were more likely to enforce ticketing/fining individuals for illegal dumping, there was a reduced willingness to partake in illegal dumping. In short, enforcement has to be both credible and severe enough to actually deter an individual from illegal dumping. Where possible though, punishment should be seen as a line of last resort — the emphasis of policy ideally should

be placed on preventing illegal dumping. Furthermore, while punishment may achieve the desired behavioral outcome, it is of greater value to educate households about the impacts of illegal dumping and create a shared sense of stewardship in maintaining the cleanliness and safety of public spaces.

Illegal dumping is an incredibly complex issue that is driven by a multitude of factors. In turn, the solutions to addressing illegal dumping also must be nuanced and multifaceted – it is a shared problem that affects multiple stakeholders and only can be meaningfully addressed when a collaborative and inclusive approach is utilized.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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