



# Information sharing and curbside recycling: A pilot study to evaluate the value of door-to-door distribution of informational literature



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## ARTICLE INFO

### Article history:

Received 23 January 2015

Received in revised form 21 August 2015

Accepted 25 August 2015

Available online 28 September 2015

### Keywords:

Curbside recycling

Recycling behavior

Recycling bin

Information campaigns

Waste reduction

## ABSTRACT

Residential curbside recycling has been shown to be an effective tool for communities to manage the challenges associated with increasing levels of material solid waste and landfill expansion. As community leaders make improvements to these programs their success can be dependent upon their ability to effectively communicate these improvements to residents so that action can be taken. One such improvement, the addition of recycling carts that can contain higher volumes of recyclable materials, was recently established within the city of Fairfield, Ohio. Information about the resident action required to obtain these new recycling carts was communicated by literature provided at the city website and in monthly utility bills. This study showed that a simple door-to-door delivery of the same literature resulted in a significantly faster adoption rate than these other means of communication. Within four weeks, 50% of households already recycling had converted to the larger volume recycling carts after receiving door-to-door delivery of literature, while only 5% of recyclers had converted to the larger carts in the control neighborhood which relied exclusively on city sources for program information. The door-to-door literature delivery did not increase the percentage of households that were recycling on a weekly basis. This study shows strong acceptance by community residents for the availability of different sizes of recycling containers. It also shows that a simple door-to-door delivery of literature could be done at low cost and should be effective for communicating improvements to curbside recycling programs and other community initiatives where resident action is desired.

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## 1. Introduction

In 2012, each person in the US generated an average of 4.4 pounds of material solid waste (MSW) every day resulting in 251 tons of total waste being produced within the US for that year (EPA, 2014). 135 million tons of this waste went to landfills with the remaining waste going to recycling, composting, and energy generation. Almost 35% of the MSW was recycled, which is a meaningful improvement in residential recycling when compared to the 26% MSW recycling level seen in 1995, though the rate of recycling growth has slowed the past five years (EPA, 2014). It has been estimated, however, that 60% of MSW going to landfills can be recycled (RumpkeRecycling, 2012b). As the average landfill size continues to increase due to the accumulation of non-recycled MSW (EPA, 2014), proposals to expand or create new landfills can often face

strong resident opposition. As a result, community leaders have worked to increase the usage of other disposal strategies, such as community recycling, to minimize the demand for future landfill space.

### 1.1. The advent of curbside recycling

Curbside recycling has been a significant advance within the past 25 years that has resulted in increased levels of household recycling. Curbside recycling expanded rapidly in the US between 1989 and 1992, going from 600 community programs to 4000 (Oskamp et al., 1998) and continued to expand in following years with 7689 community programs reported in 2004 (Simmons et al., 2006). Initially residents needed to sort their recyclables into different containers depending upon the material, but the development of commingled curbside recycling, which does not require residents to sort by material type, added more convenience and increased curbside recycling participation rates (Oskamp et al., 1996). The convenience provided by these curbside recycling programs has been a key driver for its expansion

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and success with residents (Folz, 1999; Jenkins et al., 2003; Sidique et al., 2010; Wagner, 2013; Saphores and Nixon, 2014) with over 82 million people in the US now having access to curbside recycling (Simmons et al., 2006). While residents having pro-environmental attitudes can be important for recycling, recycling behavior is shaped by convenience, such as the distance traveled to access recycling facilities, storage space within one's own house, and the amount of time involved in recycling, all of which favor curbside recycling (Barr and Gilg, 2005). This has also come during a time period in which recycling technology has improved such that the costs associated with curbside recycling are similar to regular garbage collection and disposal (Folz, 1999), and residents have shown a willingness to incur small additional expenses by their local governments to provide curbside recycling (Blaine et al., 2005).

A number of different approaches have been used by community leaders in their attempt to affect recycling attitudes and promote curbside recycling behavior amongst residents. Some communities have made recycling mandatory, in which "pay as you throw" user fees are added for excess garbage (Reschovsky and Stone, 1994; Folz and Giles, 2002; Kipperberg, 2006) or deposits paid, and returned, for recyclable materials at drop-off centers (Viscusi et al., 2015). The outcomes from such mandatory programs appear to be effective in some situations with researchers showing benefits for garbage user fees and mandatory curbside recycling requirements (Everett and Peirce, 1993; Kinnaman and Fullerton, 2000; Sidique et al., 2010; Saphores and Nixon, 2014; Starr and Nicolson, 2015), but other researchers have seen no benefit (Noehammer and Byer, 1997; Jenkins et al., 2003). Regardless of a potential benefit, imposing higher fees associated with personal conservation can be unpopular and a risk for community leaders, and has led to elected officials being removed from office (Hall, 2000). As such, voluntary curbside recycling programs are preferred and, when well designed, can achieve recycling participation levels comparable to that of mandatory programs (Noehammer and Byer, 1997). Approaches to improve such voluntary recycling behavior have included offering economic rewards for recycling (Timlett and Williams, 2008; Noehammer and Byer, 1997), obtaining verbal commitments for recycling (Bryce et al., 1997), or providing feedback on how the individual or community are performing and meeting recycling goals (Schultz, 1999; Timlett and Williams, 2008). Indeed, one of the more obvious signs of feedback are the unique colors and shapes of recycling bins, which by their presence on the day of recycling provide feedback on the community norm to recycle (Everett and Peirce, 1993; Barr et al., 2001). While the success of these various approaches to motivate residents to recycle appears mixed, and no single approach may be best for any community, all studies share the critical nature of providing information to residents about the specific steps that they can take to recycle.

Most local governments provide recycling containers to residents at no additional cost (Lane and Wagner, 2013) which adds to the convenience of recycling and has been shown to be a key factor in increasing recycling participation rates (Guagnano et al., 1995; Platt et al., 1991), especially for voluntary curbside recycling programs (Noehammer and Byer, 1997). While larger collection bins have been shown to increase the amount of recyclable material collected (Williams and Kelly, 2003; Woodard et al., 2005), no single recycling bin size appears to be ideal with many residents preferring to have a choice of different sizes depending upon their waste habits and home storage space. If a recycling bin is full, many residents will simply throw their excess recyclables away with their garbage (Lane and Wagner, 2013), while large recycling bins may require too much storage space which is a top reason given by residents to not be involved in recycling efforts (McDonald and Oates, 2003).

## 1.2. Curbside recycling campaigns and information sharing

Recycling rate increases have been shown to be positively correlated to information campaigns (Nixon and Saphores, 2009; Del Cimmuto et al., 2014). Providing specific knowledge about the local program has been seen as the key predictor for recycling behavior (Gamba and Oskamp, 1994; Hopper and Nielsen, 1991; Seacat and Northrup, 2010) and the key barrier to be overcome by the community to increase recycling behavior (Nixon and Saphores, 2009; Read, 1999). While people may be aware that recycling programs exist, those that lack information typically do not seek it out (Borgstede and Andersson, 2010). Recyclers and non-recyclers are both aware of the environmental issues related to recycling and have similar attitudes toward the environment (Gamba and Oskamp, 1994; Oskamp et al., 1998; Del Cimmuto et al., 2014), so providing additional education in the areas of environmental value and benefits for recycling are seen as having little benefit. Providing information that is viewed as abstract, such as the big picture issues associated with waste management and its importance to the environment, was shown to have little effect on one's recycling behavior, while providing local knowledge on how to recycle had a significant effect (Barr, 2003).

There are many means that can be used to communicate information about recycling programs some of which include direct mail, television, radio, newspapers, magazines, school or community presentations, word of mouth, and the Internet. Nixon and Saphores (2009) conclude that face-to-face communication with friends, or in schools, or at work, is the most effective means to convince non-recyclers to begin recycling. They, as well as Borgstede and Andersson (2010), further state that leaflets or environmental newsletters are the most effective print forms for encouraging recycling. Positive peer pressure (Gamba and Oskamp, 1994) and activation of social norms (Dai et al., 2015) through communications with friends and neighbors has also been shown to be of value, with the highest impact coming from those living in the specific neighborhood (Hopper and Nielsen, 1991). In delivering literature, it is important to get the attention of the recipient as many do not read leaflets dropped at their house considering them junk mail (Read, 1999; Borgstede and Andersson, 2010).

It has been difficult to assess the influence of different means of information sharing to positively affect curbside recycling participation rates as most information has been shared as part of a broader campaign, with multiple activities and sources of communication, and few direct studies have been done to evaluate the individual means of sharing information (Nixon and Saphores, 2009; Timlett and Williams, 2008). When a new recycling initiative starts, overall participation tends to increase so it can be difficult to determine if any increase in participation is due to greater overall publicity or a simple change in the communication process (Lane and Wagner, 2013). Keller (1991) demonstrated that recycling rates increased from 34% to 52% during a three week time period when door-to-door information sharing was combined with weekly feedback on the progress of the community and with an incentive provided for recycling. A door-to-door roadshow was used with other efforts to increase recycling levels, and while benefits were seen for the overall program, it was not possible for city leaders to evaluate the specific contribution of the roadshow in the overall program success (Read, 1999) and determine whether the significant expenses associated with the roadshow were worthwhile. In a study where approximately 40% of households participated in weekly curbside recycling, Boy Scouts were used to communicate door-to-door recycling messages and a 15% weekly increase in recycling was seen by those residents who were not previously recycling (Burn and Oskamp, 1986). In this effort, the scouts had been trained during three sessions, including role playing, to not only share the details of the local program but also to persuade

the resident to begin recycling. A study with canvassers trained to promote positive attitudes about recycling and address recycling barriers, showed a small initial benefit for door-to-door messaging, but the benefit was lost versus the control group within three months (Cotterill et al., 2009). Another study (Timlett and Williams, 2008) showed that the use of trained individuals to engage “with residents about the reasons they were not participating regularly or effectively, any problems experienced and try to resolve or persuade them into taking part” (p. 627) was not effective at increasing the number of recycling bins set out by residents. The authors suggested this lack of a change in participation might be the result of the mature nature of curbside recycling in the neighborhood with over 60% of residents already participating at the start of the study. This high level of recycling maturity might have also been relevant for the study by Cotterill et al. (2009) as starting recycling participation rates were 47.7% and 54.0% for the test and control groups, respectively.

### 1.3. Purpose of this study

The city of Fairfield, Ohio, is located in southwest Ohio, twenty miles north of Cincinnati, and had a 2012 population of 42,647 (Onboard Informatics, 2012). The city encompasses twenty one square miles and has a median home value of \$146,259, which is 13% higher than the overall median home value in Ohio. The city offers commingled curbside recycling with no additional fees associated with the recycling and recycling bins. Residents place their recycling bin at the curbside at the same time as they place their garbage cans curbside, and the garbage (destined for landfill) and recyclables (destined for recycling) are collected by different trucks. This system has resulted in approximately 15% of household material waste generated being recycled (D. Butsch, personal communication, October 10, 2012).

In the fall of 2012, the city began a program to upgrade resident’s recycling bins from eighteen gallons (Fig. 1) to sixty-five gallon carts (Fig. 2) at no additional cost to the resident. The resident could keep, and continue to use their eighteen gallon bin for recycling, but as a choice could request a sixty-five gallon cart for their weekly recycling. Once requested by phone or email, the new cart would be delivered to their house within one week. The city communicated information about this new recycling initiative at the city’s website and by a flyer included in the resident’s monthly utility bill (Fig. 3). These communication approaches are attractive to the city as negligible costs are incurred by placing the information onto an existing website or placing the literature into mailings that were already being sent to residents.

This project studied whether door-to-door distribution of the flyer describing the new initiative would increase the rate at which



Fig. 1. Eighteen gallon recycling bin used by the city of Fairfield.



Fig. 2. New sixty-five gallon recycling cart being offered by the city of Fairfield.

the new initiative was adopted by residents. The process for distribution was intentionally kept simple so that no special training would be required for delivery. This would make such delivery suitable for community volunteers (i.e., scouts, school, civic, and environmental groups), avoiding the higher costs and training often associated with door-to-door campaigns (Read, 1999; Bernstad et al., 2013), but more readily assures that the relevant information is received by the residents. Other questions studied were whether providing information about how to recycle would boost recycling participation rates in a neighborhood that had below average levels of recycling; how well the residents accepted the use of the new sixty-five gallon carts; and, whether the publicity associated with this new initiative would boost overall recycling participation rates.

## 2. Materials and methods

### 2.1. Neighborhood selection

Three neighborhoods in the city of Fairfield were selected for study based on their recycling habits from an earlier screening study (Willman, 2012). To briefly describe this screening study, houses in different neighborhoods were evaluated for the presence of recycling bins at curbside when garbage cans were also visibly seen curbside for the house. If neither recycling bins nor garbage cans were seen at the time of the survey, the house was not counted in the study as it was assumed the homeowner had not yet placed their garbage and recyclables out for the evening. It was assumed, however, that if the homeowner had placed their garbage can curbside for waste collection destined for landfill, then they would have also made the decision whether to place a recycling bin curbside for collection of recyclables. A percent recycling value for each neighborhood was determined by dividing the number of households with recycling bins by the number of households with garbage cans then converting this value to a percentage. An overall recycling rate of 58.7% was seen within the city, though this participation rate varied within city neighborhoods ranging from 36.7% to 94.6%. For this study, two neighborhoods were selected as test neighborhoods, with “Test-A” having 104 homes and showing a percent recycling



## Larger recycling carts now available!

The City of Fairfield is teaming up with Rumpke to help residents recycle more material each week.

Residents, who currently receive curbside recycling, can now upgrade to a Rumpke 65-gallon recycling cart at **no additional cost**.

**Recycling cart perks:**

- Carts can hold nearly four times more material than the current bins
- Carts feature wheels to make getting your recyclables to the curb easy
- Carts have a sturdy lid to keep recyclables in and animals out



**Three easy ways to request a recycling cart upgrade:**

1. Call (513) 867-5300.
2. Email [recycle@fairfieldoh.gov](mailto:recycle@fairfieldoh.gov).
3. Go online to [www.fairfieldoh.gov](http://www.fairfieldoh.gov) to fill out the recycling cart request form.

Carts will be delivered to residents this Fall.

**Remember to recycle:**

<p><b>Paper</b></p> <ul style="list-style-type: none"> <li>• Office paper</li> <li>• Newspapers &amp; inserts</li> <li>• Magazines &amp; catalogs</li> <li>• Junk mail</li> <li>• Envelopes</li> <li>• Phone books</li> <li>• Paper grocery bags</li> <li>• Cereal &amp; snack boxes</li> <li>• Cardboard</li> <li>• Clean pizza boxes (free of food &amp; grease)</li> </ul>	<p><b>Plastic Bottles &amp; Jugs</b></p> <ul style="list-style-type: none"> <li>• Plastic bottles &amp; jugs (lids accepted if replaced on empty, flattened bottles)</li> </ul>	<p><b>Glass Bottles &amp; Jars</b></p> <ul style="list-style-type: none"> <li>• Glass bottles &amp; jars (any color, lids removed)</li> </ul>	<p><b>Metal Cans</b></p> <ul style="list-style-type: none"> <li>• Aerosol cans (with lids &amp; tips removed)</li> <li>• aluminum cans</li> <li>• metal cans &amp; lids</li> <li>• tin and bi-metal cans</li> </ul>
			

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Fig. 3. Literature describing new sixty-five gallon recycling cart upgrade initiative (RumpkeRecycling, 2012a).

value of 50.0%, and “Test-B” having 83 homes and showing a percent recycling value of 36.7%. A control neighborhood was selected having 73 homes and a recycling percentage of 58.9%, which was similar to the overall city average percent recycling value of 58.7%.

### 2.2. Establishing baseline recycling bin levels

Baseline data was taken for three weeks by counting the number and size of recycling bins (eighteen gallon or sixty-five gallon) between 8 a.m. and 9 a.m. the day of recycling collection. This was an ideal time to count the recycling bins and carts for these neighborhoods as it was after their usual garbage collection, typically between 6 a.m. and 7 a.m., but before their usual recycling bin collection, typically between 9 a.m. to 10 a.m. It is assumed that when residents take out their garbage for collection, they also take out their recycling bins. At all times during this study, counting was done before recyclables were collected as materials were still observed within the recycling bins and carts during the count.

### 2.3. Door-to-door information delivery

On Saturday and Sunday, October 20 and 21, 2012, door-to-door visits were made to both test neighborhoods. A leaflet was given to the residents (Fig. 3) which is the same as shared on the Fairfield city webpage and inserted into the monthly utility bill. If the resident was present verbal information was provided, in addition to the literature, sharing the details of the new city program in which sixty-five gallon recycling carts can be ordered at no cost, that eighteen gallon bins were still accepted and available at the Fairfield Municipal Building, describing what items could be recycled, and providing any additional recycling information as requested by the residents. No actions were taken in an attempt to convince the resident of the value of recycling, only specific information on how to participate in the city program was shared. If the resident was not present, the literature was inserted in their door, as the first choice, or with their mailbox. No attempts were made to return at a later date for face-to-face discussions. No door-to-door visits were done within the control neighborhood, but all neighborhoods continued

**Table 1**  
Summary of door-to-door contacts during October 20 and 21, 2012.

Test group	Homes where residents were present		Homes where residents were absent		Homes with no contact (no solicitation signage)		Total number of homes in neighborhood
	Number	Percentage	Number	Percentage	Number	Percentage	
Test – A	51	49%	49	47%	4	4%	104
Test – B	40	48%	39	47%	4	5%	83

to receive information about the program in their monthly utility bills and the information could also be viewed at the city webpage.

#### 2.4. Recycling bin counting after the door-to-door information delivery

The presence and size of recycling bins and carts were counted after the literature was distributed for the next four weeks in the test and control neighborhoods in the same manner as described in Section 2.2.

#### 2.5. Calculations

Calculations were done to determine the weekly recycling participation rates, the adoption and use of the new sixty-five gallon recycling carts, the potential increase (or decrease) in recycling volume achieved by the new initiative, and whether these changes were significant versus the start of the project and versus the control neighborhood.

*Recycling Participation* was defined as the total number of recycling bins counted each week within each of the neighborhoods. The calculation could be further refined by dividing the participation by the number of houses in the specific neighborhood, but this is not necessary since a goal of this study was to determine whether participation increases (or decreases) after door-to-door literature distribution. Simple counting of the total number of households with bins and carts present during the test was sufficient to determine if a participation rate change within a neighborhood had occurred.

*Percent Adoption* of sixty-five gallon carts was defined as the number of sixty-five gallon carts that were observed in use during the day of recycling divided by the number of total recycling bins and carts seen in the specific neighborhood:

$$\text{Percent Adoption} = \left( \frac{\text{number of 65 gallon recycling carts observed}}{\text{total number of recycling bins} + \text{recycling carts observed}} \right) \times 100$$

An increase in the percent adoption value would indicate that more residents who recycle in their neighborhoods have converted to the use of the sixty-five gallon cart.

*Recycling Potential* was a calculation for the volume of recyclables that are possible from a neighborhood if all of the recycling bins and carts observed were completely filled:

#### Recycling Potential

$$= 18 \times (\text{total number of 18 gallon bins observed}) + 65 \times (\text{total number of 65 gallon carts observed}).$$

**Table 2**  
Number of sixty-five gallon carts observed on the day of recycling.

	Week 1	Week 2	Week 3		Week 4	Week 5	Week 6	Week 7
Test – A	2	2	2	Door-to-door distribution of literature	4	7	18	24
Test – B	0	0	1		3	3	14	16
Control	0	0	0		0	1	2	2

Recycling potentials can be compared at the start and end of the project to provide an estimate of the recycling increase possible by the initiative.

The Fischer Exact Probability Test (NIST/SEMATECH, 2013) was used to determine if the differences seen during the course of the study were significant at  $p < 0.05$ . This statistical analysis method is preferred for studies which have base sizes less than 1000 and when results are a simple “presence” or “absence” of a feature such as the presence or absence of recycling bins. To determine if significant advantages were seen for the distribution of literature in the adoption and use of the sixty-five gallon carts, the neighborhood data for each week following literature distribution was compared to the data for that specific neighborhood from the first three weeks before literature distribution occurred. These comparisons were then analyzed by the Fischer Exact Probability Test analysis tool shared by Lowry (2014). The results for each test neighborhood were also compared on a weekly basis to the control neighborhood and analyzed by the Fischer Exact Probability Test. This statistical test was also used to determine if the literature distribution led to an overall change in household participation by comparing the total number of recycling bins the first three weeks within each neighborhood, before literature distribution, with the weekly recycling participation numbers for each specific neighborhood during the following four weeks.

### 3. Results

#### 3.1. Contacts made during door-to-door literature distribution

Literature was distributed to the residents of the “Test – A” group on October 20, 2012, and to the “Test – B” group on October 21, 2012. Table 1 shows that both of these groups had similar contact profiles with almost half of the residents having discussions along with the handing out of literature, nearly half were not present and literature was left in a prominent location in or near their front door, and a small number were not contacted as “no solicitation” signage was present. Houses that were obviously unoccupied were not included in the count. The percentage data shared represents the number of homes in that column divided by the total number of occupied homes in that neighborhood.

Of the ninety-one households with which the program was discussed, fourteen (15%) volunteered that they had heard about the sixty-five gallon recycling container initiative. Two households in the “Test – A” group were using larger recycling carts, with these carts purchased by the homeowners at an earlier date and not a result of the new city initiative. These two households were included in the count used to create Table 2.

**Table 3**  
Total number of recycling bins observed on the day of recycling (eighteen gallon + sixty-five gallon).

	Week 1	Week 2	Week 3		Week 4	Week 5	Week 6	Week 7
Test – A	52	52	49	Door-to-door distribution of literature	47	46	56	50
Test – B	29	32	33		34	23	31	31
Control	39	40	43		44	42	47	39

3.2. Recycling bin counts before and after literature distribution

Tables 2 and 3 show the observations for size and quantity of recycling bins and carts counted during the baseline establishment period (weeks 1–3) and during the four weeks following the door-to-door distribution of literature. Given the distinctive size and colors for the recycling bins and carts, and the quiet nature of the streets selected, a slow drive through the neighborhoods made counting easy. The weather was fair most weeks during the observation period, though in weeks 1 and 5 a heavy rainfall occurred the night before or day of the collection. Both of these dates had the lowest number of recycling bins, which may be a result of the bad weather and a reluctance to take out recycling bins, especially since the eighteen gallon recycling bins have no cover to protect their contents from the wind and weather. This study was conducted in October and early November, before the Thanksgiving holiday, so it is not expected that an unusual number of vacations occurred during this time period that could have affected the recycling observations.

Dividing the data in Table 2 (sixty-five gallon carts only) by the data in Table 3 (the total number of recycling bins and carts observed) generates the *Percent Adoption* value for the use of the new recycling carts. This data shows that the increase in sixty-five gallon cart adoption happened quickly after the door-to-door distribution of literature (Fig. 4). Since it takes approximately one week for the recycling vendor to deliver the new recycling carts after they have been contacted, it is likely that this contact occurred soon after the literature distribution with 50% of those already recycling in the two neighborhoods converting and using the new sixty-five gallon carts within one month. Only 5% of the control group, or two residents, who received the information about the sixty-five gallon initiative exclusively through city sources had converted to the larger carts during this same time period.

When considering only the number of households participating in weekly recycling, Table 4 shows that the average number of households recycling in the test neighborhoods during the four weeks after the information sharing had a slight decrease in participation when compared to the average result for the three weeks before the information was shared. By contrast, the control neighborhood showed a slight increase in household participation in the last four weeks of the study.

**Table 4**  
Average number of recycling bins before and after distribution of literature.

	Before literature distribution	After literature distribution	Difference
Test – A	51.0	49.8	–1.2
Test – B	31.3	29.8	–1.5
Control	40.1	43.0	+2.9

3.3. Statistical analysis

Using the Fischer Exact Probability Test (NIST/SEMATECH, 2013) several of the questions posed at the start of the study were analyzed to determine if significant differences ( $p < 0.05$ ) were seen as a result of the literature distribution. The results of Table 5 show that an advantage was seen for literature distribution in adoption of the new sixty-five gallon carts for the two test neighborhoods when compared to the use of the larger carts at the start of the test and also when compared to the adoption of the new carts by the control neighborhood. No evidence is seen, however, that the distribution of literature increased the total number of households participating in curbside recycling.

3.4. Impact of literature distribution on neighborhood recycling levels

The results for the last week of this study can be compared to the average of the first three weeks of the study, before door-to-door literature distribution was conducted, to determine the change in *Recycling Potential* for the neighborhoods studied. This doubling of the *Recycling Potential* for both of the test neighborhoods studied shows the increase possible for recyclable collection volumes by the sixty-five gallon cart adoption rates that were seen in these neighborhoods (Fig. 5).

Follow-up audits were conducted in the control neighborhood to determine whether and, if so, at what time the *Percent Adoption* for the use of sixty-five gallon recycling carts in the control neighborhood approached that achieved in the two test neighborhoods. The result shows a gradual increase in *Percent Adoption* of the sixty-five gallon cart in the control neighborhood, taking approximately

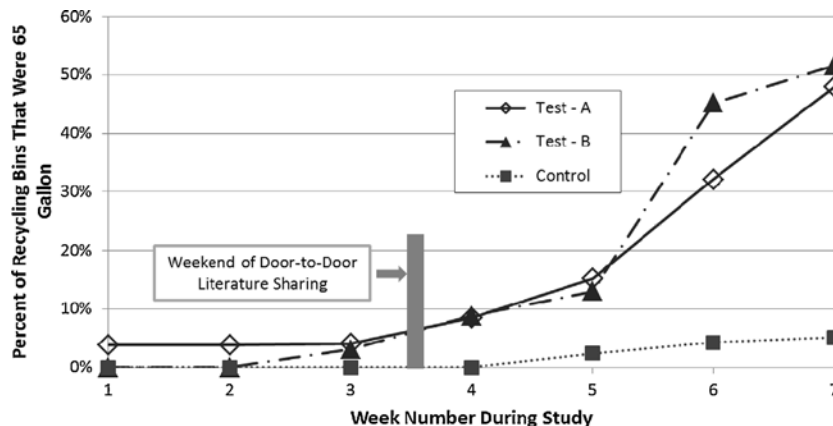


Fig. 4. Percentage of recyclers in each neighborhood that had converted to the sixty-five gallon cart.

**Table 5**  
Statistical results for questions asked during the curbside recycling study.

Question	Was statistical significance seen ( $p < 0.05$ )?	Number of 65 gallon carts observed for test versus control
Does the “Test – A” neighborhood show an increase in the presence of sixty-five gallon carts after literature distribution? ( <i>Control shown is week 3 data</i> )	Yes, at weeks: Six Seven	18 versus 2 24 versus 2
Does the “Test – B” neighborhood show an increase in the presence of sixty-five gallon carts after literature distribution? ( <i>Control shown is week 3 data</i> )	Yes, at weeks: Six Seven	14 versus 1 16 versus 1
Does the Control neighborhood show an increase in the presence of sixty-five gallon carts during the test?	No	
Does the “Test – A” neighborhood show an advantage for the presence of sixty-five gallon carts versus the Control neighborhood?	Yes, at weeks: Six Seven	18 versus 2 24 versus 2
Does the “Test – B” neighborhood show an advantage for the presence of sixty-five gallon carts versus the Control neighborhood?	Yes, at weeks: Six Seven	14 versus 2 16 versus 2
Does the “Test – A” neighborhood show a change in neighborhood participation rate after literature distribution?	No	
Does the “Test – B” neighborhood show a change in neighborhood participation rate after literature distribution?	No	
Does the Control neighborhood show a change in neighborhood participation rate after literature distribution?	No	

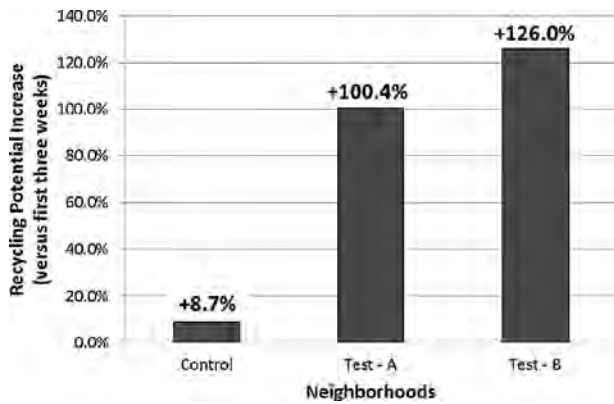


Fig. 5. Increase in Recycling Potential seen at the completion of the study.

one year to approach the adoption rate attained in the first four weeks for the test neighborhoods (Fig. 6).

**4. Discussion**

The purpose of this study was to evaluate the effect that simple door-to-door delivery of specific information about how to participate in a curbside recycling improvement would have on influencing the recycling behavior of residents in a community that had practiced curbside recycling for several years. This study was in contrast to recent studies where training was significant and the

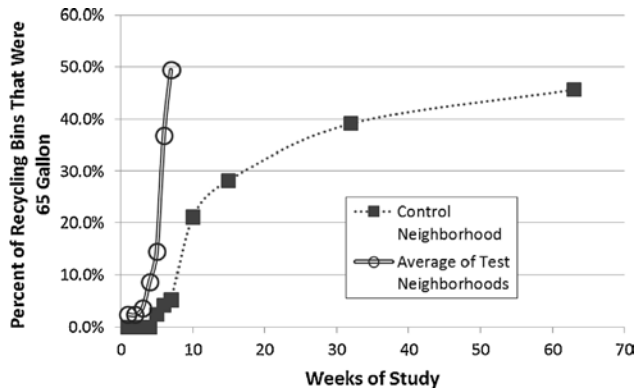


Fig. 6. Adoption rate for the sixty-five gallon recycling cart in the control neighborhood.

costs associated with door-to-door delivery were high such that the overall benefit of the door-to-door approach was in question (Read, 1999; Timlett and Williams, 2008). The article by Read (1999) showed an overall increase in recycling volumes when door-to-door canvassing was used as part of a broader program to increase recycling, but community leaders were reluctant to acknowledge the individual contribution made by the canvassers to the overall program success. The study by Timlett and Williams (2008) showed that a door-to-door campaign led to an increase in the ordering of new recycling bins, but it did not lead to an increase in resident recycling participation which was the goal of the program. This led the authors to speculate that door-to-door campaigns might be best for more limited programs with specific aims and goals.

The specific aim in the study of this paper was to increase the awareness, ordering, and usage of larger sixty-five gallon carts in the test neighborhoods by active delivery of literature containing information about this program. This was in comparison to the more passive communication routes that the city was using by including the informational literature in monthly utility bills and presenting the same information at the city Internet website. The results of this study demonstrate that the adoption of the new recycling carts occurred very rapidly, within three to four weeks, when this more active form of literature distribution was used. This rapid adoption of the new recycling carts was significant versus the control neighborhood and especially meaningful given the many months it took the control neighborhood to approach the adoption rate achieved in one month within the test neighborhoods. This improvement is consistent with the assertion by Nixon and Saphores (2009) that targeted information campaigns can lead to overall recycling increases. This more active distribution of literature also overcomes the issues cited by Borgstede and Andersson (2010) in that people typically do not take the initiative to seek out information about local recycling, and that personal delivery of the literature minimizes the chances of it immediately being discarded as junk mail.

The information provided within the literature given to residents and the actions of the person delivering the literature were both important elements of this study. The literature distributed gave specific instructions on how to participate in the local recycling program (Gamba and Oskamp, 1994; Hopper and Nielsen, 1991; Seacat and Northrup, 2010) and was identical to the flyer which was sent to residents with their monthly utility bill and available at the city website. In distributing the information, no actions were taken by the person delivering the literature to provide reasons for recycling, to address recycling barriers, or make return visits to provide the information, all of which were key



features of other door-to-door programs (Burn and Oskamp, 1986; Cotterill et al., 2009; Timlett and Williams, 2008). The lack of training sessions required for personnel and the time that was not needed to revisit households missed during the literature distribution should greatly reduce the personnel costs related to door-to-door delivery and make it possible for a wide variety of community groups or volunteers. It is uncertain if the residents viewed the person delivering the literature as a member of their immediate neighborhood who played the role of “block leader” which has been shown to be an effective means to increase recycling involvement (Hopper and Nielsen, 1991; Cotterill et al., 2008; Dai et al., 2015). As neighborhood residents began to use the newer recycling carts it is also possible that their visibility encouraged others in the neighborhood to order and use these new carts (Barr et al., 2001; Everett and Peirce, 1993), though the rapid rate at which the carts were observed in the test neighborhoods indicate that if this was an effect, then it also happened very quickly.

Door-to-door distribution did not obviously increase the level of recycling participation as determined by the numbers of residents participating in weekly pick-up in either of the two test neighborhoods that were studied. It was an initial belief of this study that recycling participation might increase since providing specific knowledge about the mechanics of local programs is seen as a key predictor for increasing recycling levels (Gamba and Oskamp, 1994; Hopper and Nielsen, 1991; Seacat and Northrup, 2010) and the publicity surrounding new recycling initiatives often raise overall participation rates (Lane and Wagner, 2013). While a lack of a significant increase for curbside recycling participation has been attributed to neighborhoods that had high levels of recycling participation at the start of a program (Timlett and Williams, 2008) the “Test – B” neighborhood started at a low participation rate in this study, a 38% average for the first three weeks, and its participation rate at the end of the study was slightly lower. Measuring the total number of households with recycling bins and carts out for collection each week may not be an accurate measure of resident participation, however, since it is possible that those residents who adopted the new sixty-five gallon carts would wait until the carts are full before taking them to the curb. As such, these households of recyclers might be under-represented in a weekly count. While this might have affected the participation rate calculations, and it would be best to study each house individually to judge any changes in recycling habits, it seems safe to conclude that any participation rate changes caused by the door-to-door information delivery is not likely to be large. It is possible that the literature distributed was missing key elements that would encourage non-recyclers to begin recycling. Missing in the literature distributed was information specifically focused on creating a more positive attitude toward recycling (Meneses, 2006) or demonstrating that recycling is embraced by the majority of the community (Vicente and Reis, 2008). The “Test – A” and “Test – B” neighborhoods in this study border each other so key demographics, such as median household income, home value, and percent renter occupied, are the same for both neighborhoods (Onboard Informatics, 2012). As such, it is interesting that they both had different recycling participation rates, those being 50.3% and 36.7%, respectively, during the course of this seven week study. It is likely that there are other, unknown, issues to be addressed in encouraging recycling from these neighborhoods which could be best understood by surveys and interviews (McDonald and Oates, 2003).

The acceptance and use of the larger sixty-five gallon carts appeared very strong amongst residents who were already taking action toward curbside recycling. Within four weeks of the door-to-door campaign 50% of those recycling were using these new, larger containers. This resulted in a doubling of the recycling

potential for both test neighborhoods, which could lead to a significant increase in the amount of recycled materials. Two years following the introduction of the sixty-five gallon carts to Fairfield residents, almost 40% of households have adopted these carts (D. Butsch, personal communication, May 13, 2015). During those two years the quantity of recycled materials has increased by 13% when compared to the previous two years, while the overall MSW quantity has increased by only 2%. The contribution made by the adoption of the sixty-five gallon carts to this increase in recycled material is unknown, as it is also possible that the residents have embraced recycling to a higher degree than in previous years, but there is value in encouraging those who are recycling to do more (Thomas and Sharp, 2013), which could be provided by the opportunity to use larger carts. The extent of this recycling improvement and contribution by the larger carts could be the focus of future studies, but it is apparent that many of the community residents have accepted the use of the sixty-five gallon carts.

It is noteworthy that half of those recycling in these test neighborhoods, and one year later in the control neighborhood, continued to use the eighteen gallon bin as opposed to adopting the new larger carts. The city plans to offer both recycling container options to its residents, the eighteen gallon bin and the sixty-five gallon cart. In a UK study (McDonald and Oates, 2003), 1401 recycling carts were offered at no cost to residents, then a survey was done with those people who did not request the carts. The top two reasons given for not participating in this program were people claiming to not having enough recyclables to make it worthwhile or not having enough space for the recycling cart. As such, keeping these two recycling container options, the eighteen gallon bin and sixty-five gallon cart, should be important for the overall success of the Fairfield curbside recycling program.

The study results also show that simple door-to-door distribution of literature can be an effective tool that not only provides useful information to residents about community activities but also can result in action being taken by these residents. In 2013, the average American spent 20.4 h per week on the Internet (Cole, 2013) so placing important information on websites has been popular, but this information can be difficult to find and the Internet browsing that takes place may not be effective at converting residents to take personal action. Only 18% of people say that knowledge gained online for a social issue has affected their offline behavior (Cole, 2013). Within this study, even though information had been provided by the city on the Internet and in monthly mailings, only 15% of residents during the door-to-door activity volunteered that they were aware of the initiative, yet none of these residents had taken action yet to secure the new recycling carts. Campaigns that provide information from multiple sources are most effective at raising awareness and changing behavior (Nixon and Saphores, 2009) and door-to-door literature distribution can play an important role in these campaigns. Such door-to-door distribution does not require extensive training of those handing out the literature, or revisits to homes to assure that personal contacts are made, but it does serve to get the literature into the hands of residents for consideration. While this study shows that adoption rates can be increased by a door-to-door information campaign on curbside recycling, it would also be expected that other city wide programs, such as energy and water conservation programs or awareness and utilization of local parks, could also benefit from a similar door-to-door approach.

## 5. Conclusions

Door-to-door distribution of literature significantly increased the adoption rate of a new city curbside recycling initiative, enabling residents to upgrade from eighteen gallon recycling bins to sixty-five gallon recycling carts, when compared to the more



passive communication routes of literature inclusion in utility bills and the presence of the information at the city website. Within four weeks the two test neighborhoods that had received the door-to-door literature distribution had converted to 50% of those recycling using the new larger bins. This is a significant increase when compared to the control neighborhood increase to 5% use of the larger recycling carts, this control neighborhood only receiving information from city sources. The study shows the ready acceptance by residents for the larger recycling carts, but also that it is important for multiple recycling bin and cart sizes to be available as half of the residents in the test neighborhoods continued exclusive use of the smaller bin size. The number of houses participating in weekly curbside recycling did not increase, though weekly counting for the presence of recycling bins and carts as a means for determining participation rates may not be an appropriate measure for recycling participation as residents converting to the larger bins may take more weeks to fill them and, therefore, place them on the curbside less frequently. No special training was required for individuals handing out the door-to-door literature, so this should be a cost effective approach for communities or volunteer groups to share information about new community programs for which resident action is desired.

## Acknowledgments

The author would like to thank David Butsch, Public Works Director for the city of Fairfield, for helpful discussions and to his staff for providing literature for the door-to-door distribution.

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