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Comparison of recycling outcomes in three types of recycling collection units

Ashley Andrews [a,1], Mary Gregoire [b,*], Heather Rasmussen [c,2], Gretchen Witowich [d,2]

[a] Akron Children's Hospital, 1 Perkins Square, Akron, OH 44308, USA
[b] Rush University Medical Center, Food and Nutrition Services, 1700 W. Van Buren St., Triangle Office Building, Ste. 425, Chicago, IL 60612, USA
[c] Rush University, 1700 W. Van Buren St., Triangle Office Building, Ste. 425, Chicago, IL 60612, USA
[d] Rush University Medical Center, 1700 W. Van Buren St., Triangle Office Building, Ste. 425, Chicago, IL 60612, USA

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ABSTRACT

Commercial institutions have many factors to consider when implementing an effective recycling program. This study examined the effectiveness of three different types of recycling bins on recycling accuracy by determining the percent weight of recyclable material placed in the recycling bins, comparing the percent weight of recyclable material by type of container used, and examining whether a change in signage increased recycling accuracy. Data were collected over 6 weeks totaling 30 days from 3 different recycling bin types at a Midwest University medical center. Five bin locations for each bin type were used. Bags from these bins were collected, sorted into recyclable and non-recyclable material, and weighed. The percent recyclable material was calculated using these weights. Common contaminates found in the bins were napkins and paper towels, plastic food wrapping, plastic bags, and coffee cups. The results showed a significant difference in percent recyclable material between bin types and bin locations. Bin type 2 was found to have one bin location to be statistically different ($p = 0.048$), which may have been due to lack of a trash bin next to the recycling bin in that location. Bin type 3 had significantly lower percent recyclable material ($p < 0.001$), which may have been due to lack of a trash bin next to the recycling bin and increased contamination due to the combination of commingled and paper into one bag. There was no significant change in percent recyclable material in recycling bins post signage change. These results suggest a signage change may not be an effective way, when used alone, to increase recycling compliance and accuracy. This study showed two or three-compartment bins located next to a trash bin may be the best bin type for recycling accuracy.

1. Introduction

According to the Environmental Protection Agency (2010), the amount of municipal solid waste (MSW) produced by the United States has been continuously rising since 1960. In 2010, the United States produced 250 million tons of waste, equaling 4.4 lb of solid waste per day per person. The majority of the waste generated comes from residential areas, but 35–45% of waste generated comes from commercial institutions. The EPA cited environmental concerns in solid waste management (SWM) because of lack of landfill space to deposit the MSW and the harmful effects landfills have on the environment. The benefits of recycling on the environment are numerous; recycling has been shown to contribute to cleaner air, water and land (EPA, 2010).

With further knowledge about the harmful effects of landfills, and the growing concern of lack of landfill space, there has been an increased demand for commercial institutions to incorporate waste reduction and recycling programs (Ward and Richards, 1991). A recycling program is only successful if it can initiate individual participation. This has brought attention to the predictors and influencers of recycling behavior. These factors have been separated into two different categories: personal and situational factors.

Prior research has focused on how individual's attitudes, beliefs and values, or personal factors, affected their recycling behavior (Chen et al., 2010a, 2010b; De Young, 1986; Huang et al., 2011; Nyamwange, 1996; Sia et al., 1985; Vining and Ebreo, 1990; Williams, 1991). Individuals with greater knowledge of recycling and other environmental factors, greater perceived skill, and who are older, have higher income and are from the northeastern and western areas of the United States are more likely to participate in a recycling program. Individuals who perceived greater ease of use of a recycling station had increased recycling participation; this may be a result of a combination of personal and situational factors (Vencatasawmy et al., 2000).

* Corresponding author. Tel.: +1 312 942 5297; fax: +1 312 942 5203.
E-mail addresses: Ashley.andrews2@gmail.com (A. Andrews), mary_gregoire@rush.edu (M. Gregoire), heather_rasmussen@rush.edu (H. Rasmussen), Gretchen_witowich@rush.edu (G. Witowich).
[1] Tel.: +1 330 543 1000.
[2] Tel.: +1 312 942 5926.

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Situational factors are able to be manipulated and therefore are useful for organizations when implementing a recycling program. Institutions can use these factors to help increase recycling participation. Situational factors reported most often were rewards, prompts, block leaders, informational brochures, proximity or location of bins, and physical structure of the bins (Austin et al., 1993; Brothers et al., 1994; Cole, 2007; Duffy and Vargas, 2009; Geller et al., 1975; Hopper and Nielson, 1991; Ludwig et al., 1998; Schultz et al., 1995). Research has shown distance of recycling stations to have an impact on recycling participation in urban and rural areas, with an increase in participation with a decrease in distance (Vencatasawmy et al., 2000). The effect of these external cues is important for institutions when developing a recycling program.

Rush University Medical Center (Rush) expanded its recycling program in 2007, and a "Green Team" was established to champion and implement sustainable practices. Rush provides containers for recycling for plastics, aluminum, glass, and paper. Items that can be recycled at Rush include #1, 2, 3, 4, 5 and 7 plastics, aluminum and tin cans, foil, glass, colored and white paper, newspaper, and magazines. Currently, Rush utilizes three different types of recycling receptacles, which vary in look, size, shape, and signage. Rush diverted 950,000 tons from the landfill in 2010. Anecdotal comments from Environmental Services (EVS) staff suggested varying recycling compliance and accuracy across the campus, but no empirical data existed to guide the purchase of future bins.

Previous research has shown that external cues have an impact on recycling compliance (Austin et al., 1993; Brothers et al., 1994; Cole, 2007; Duffy and Vargas, 2009; Geller et al., 1975; Hopper and Nielson, 1991; Ludwig et al., 1998; Schultz et al., 1995), but minimal research has studied the effect of different types of bins, or the impact of prompt manipulation on recycling compliance.

The purpose of this study was to examine the effectiveness of three different types of recycling bins on recycling accuracy by determining the percent weight of recyclable material placed in recycling bins, comparing the percent of recyclable material based on the type of container used, and to examine whether a change in signage increased the percent weight of recyclable material placed in recycling bins.

2. Materials and methods

2.1. Description of facility

This study took place at Rush, in Chicago, IL, a combined university and academic medical center setting. Rush had more than 8000 employees and 1800 students during the study (2010–2011). The campus, located in a two square block area, included office, professional practice, hospital, and academic buildings. Individuals who might place items in a recycling bin on the campus property included medical staff, skilled professionals, unskilled support staff, faculty and students affiliated with the academic medical center, and members of the general public who were on the campus for physician office visits and/or visiting hospitalized patients. All buildings were available for public access.

Rush's Green Team is a committee of Rush employees from various areas of the medical center who volunteer to be on the committee. The Green Team's goals are to create a culture supportive of reducing, reusing and recycling.

2.2. Description of recycling containers

Two recycling waste streams were collected at Rush, commingled items (glass, plastic, aluminum and tin) and mixed paper (colored paper, white paper, newspaper, and magazines). Recycling bins were placed in hallways and lobbies in buildings around campus. All bins were available for use by medical center employees, faculty, students and the general public. Three types of bins were used on the Rush campus: bin type 1 was a large, grey, three-compartment recycling kiosk made by Midpoint International. These bins were segmented into three receptacles, one for commingled, one for mixed paper, and one for garbage. Bin type 1 was found in public areas in the academic, research, physician office and hospital buildings. Bin type 2 was individual, colored bins made by Rubbermaid. A green bin with a specialized lid with a circular hole for disposal of bottles and cans was used for commingled items and a blue bin with a specialized lid with a narrow slit for disposal of paper items. The presence of a trash bin next to bin type 2 varied by location. Bin type 2 was found in public areas in the academic buildings. Bin type 3 was a round grey bin specifically for recyclable materials with slots for commingled and paper that fed into one liner made by Glaro (see Fig. 1). Bin type 3 was found by elevators in the hospital and physician office buildings. Trash bins were not located next to bin type 3. Five bins from each bin type were chosen for sampling from various buildings across campus for geographical diversity.

2.3. Data collection

Data were collected in two phases, baseline and post–new signage implementation. Bags were pulled from each type of recycling bin on five consecutive weekdays, Monday through Friday between the hours of 5 and 8 AM. When bags were pulled the liners were replaced. Pulled bags were labeled with bin type and location and transported to the sorting area. Environmental Services (EVSs), the waste management team at Rush, was notified not to pull the bags on the days data were being collected.

A table with data sorting bins, a bucket, and a scale were used. Each empty sorting bin was weighed each day to give a base weight prior to the sorting process. Contents of each pulled bag were sorted into two groups: recyclable and non-recyclable items, and placed into the respective sorting bin. Items with liquids present were emptied into a liquid waste collection bucket, as the

Fig. 1. Three bin types used at Rush University Medical Center, bin type 1, bin type 2, and bin type 3, respectively.