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# Curbside recycling as a public service: Evidence from Tipton, Iowa

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**Curbside recycling as a public service: Evidence from Tipton, Iowa**

by

**Miranda Lyn Wehde**

A thesis submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

Major: Political Science (Public Policy)

Program of Study Committee:  
Yu Wang, Major Professor  
David Keiser  
Mack Shelley

Iowa State University

Ames, Iowa

2017

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## DEDICATION

To Mrs. Robin Hoffman who gave me a copy of E: The Environmental Magazine when I was in 7<sup>th</sup> grade, an act that serves as my personal evidence of what Robert Kennedy called ‘ripples of hope’. Days after reading the magazine, when John Kerry had a campaign event at the middle school and met with the students I infamously was the only student to ask a political question, asking something along the lines of what he would do about cleaning our waterways – though not as eloquently stated. Now, thirteen and a half years later I am just as passionate about the environment and politics, thus the topic of my thesis. Thank you for igniting a fire that has never died and for helping shape the way I see the world.

## TABLE OF CONTENTS

|   | Page |
|---|------|
| LIST OF FIGURES .....   | iv   |
| LIST OF TABLES .....  | vi   |
| ACKNOWLEDGMENTS .....   | vii  |
| ABSTRACT .....  | viii |
| CHAPTER 1 INTRODUCTION .....  | 1    |
| A Short History of Waste management and Recycling in the United States .....      | 2    |
| Finding Value in Municipal Recycling Programs .....                               | 7    |
| CHAPTER 2 LITERATURE REVIEW .....   | 9    |
| The Social Traps of Environmental Decision-making .....                           | 9    |
| Municipal Recycling Literature Review .....                                       | 12   |
| Adding to the Study of Municipal Recycling .....                                  | 19   |
| CHAPTER 3 SURVEY METHODOLOGY, DESIGN AND DESCRIPTIVE STATISTICS .....             | 20   |
| Survey Design and Methodology .....   | 20   |
| Descriptive Statistics .....  | 23   |
| Survey Conclusions .....  | 29   |
| CHAPTER 4 WILLINGNESS TO PAY MODELS .....   | 30   |
| Determining Willingness to Pay .....  | 30   |
| Public Service Model .....  | 33   |
| Income and Education Model .....  | 34   |
| Income and Education with Public Service Model .....                              | 35   |
| Modeling Conclusions .....  | 36   |
| CHAPTER 5 CONCLUSION .....  | 37   |
| REFERENCES .....  | 39   |
| APPENDIX A WILLINGNESS TO PAY FOR CURBSIDE RECYCLING IN TIPTON, IOWA SURVEY ..... | 43   |
| APPENDIX B IRB APPROVAL FORMS .....   | 54   |

## LIST OF FIGURES

|  | Page |
|--|------|
| Figure 1 U.S. Scrap and Waste Plastics Exported to China 1996-2016 .....           | 5    |
| Figure 2 U.S. Scrap and Waste Aluminum Exported to China 1996-2016 .....           | 5    |
| Figure 3 U.S. Scrap and Waste Paper Exported to China 1996-2016 .....              | 5    |
| Figure 4 Clemons and Schimmelbusch (2007) Short-Term Prisoner's Dilemma ....       | 11   |
| Figure 5 Clemons and Schimmelbusch (2007) Long-Term Prisoner's Dilemma ...         | 11   |
| Figure 6 Washing Recyclable Containers .....                                       | 26   |
| Figure 7 Placing Garbage in the Recycling .....                                    | 27   |
| Figure 8 Placing Items in the Garbage or Recycling .....                           | 28   |
| Figure 9 Support for Recycling as a Public Service .....                           | 30   |
| Figure 10 Survival Probabilities of Willingness to Pay for Curbside Recycling .... | 31   |

|           |   |    |
|-----------|---|----|
| Figure 11 | Maximum Willingness to Pay for Curbside Recycling Service - Un-weighted ..... | 32 |
| Figure 12 | Maximum Willingness to Pay for Curbside Recycling Service - Weighted.....     | 32 |
| Figure 13 | Public Service and WTP Boxplot -- Weighted.....                               | 34 |

## LIST OF TABLES

|   | Page |
|---|------|
| Table 1 Sample Demographics vs. American Community Survey Estimates ..... | 24   |
| Table 2 Recyclable Item List.....   | 29   |
| Table 3 Public Service GLM Model.....                                     | 33   |
| Table 4 Income and Education GLM Model.....                               | 35   |
| Table 5 Income, Education and Public Service GLM Model.....               | 36   |

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## ABSTRACT

As more communities across the United States contemplate the increasing cost of municipal recycling programs, this work suggests curbside recycling programs become a public service for which residents pay a monthly fee. Using a convenience survey of residents of Tipton, Iowa this research evaluates residents' recycling behaviors and attitudes and provides estimates of maximum willingness to pay per month for curbside recycling service. Two methods were used to determine willingness to pay for curbside recycling, a single-bound dichotomous choice referendum and an open-ended stated preference question, which provided three estimates of maximum willingness to pay per month for curbside recycling service. This work adds to the literature by evaluating recycling through a lens of a public service and establishes a current estimate of WTP for curbside recycling in a rural Iowa community directly affected by the increased cost of recycling.

## CHAPTER 1. INTRODUCTION

Waste and the nuisance it places on society is not something new. Every civilization has had to find a way to dispose of unwanted materials; in fact, many archeological discoveries are “waste sites”. Prior to the industrial revolution, society did not produce much in the form of household waste and with the exception of some metal products and ash, all household waste produced was biodegradable. Historically, cities like London, Paris and New York were considered filthy because household waste was simply thrown out windows into the street. Pedestrians would often use the street out of fear of what may fall upon their heads while walking on the sidewalk. What was not thrown out of sight was usually burned by individuals or in large municipal incinerators that would emit smoke, contributing to the smog found in industrial cities.

Municipalities have been recycling in the United States since the late 19<sup>th</sup> century with the practice becoming widespread during the environmental movement of the 1970’s. Yet today many public officials and residents are questioning if the practice should continue. What was once a profit generating ‘side business’ for municipalities has grown to become a costly service. As crude oil prices continue to decline and China’s ‘Green Fence’ dampens the international demand for recycled plastics, how can municipal recycling programs continue?

In this work I hope to add to the literature of recycling and municipal solid waste in the United States. Particularly, I hope to add to the foundations laid by McBride (2012) who posed in *Recycling Reconsidered* that business alone could not be “trusted with solutions to ecological

problems” (8). This belief has only been heightened with the implementation of China’s ‘Green Fence’ and decreasing oil prices, more than ever the future of recycling requires the involvement of government regulation to ensure its continued use.

### **A Short History of Waste Management and Recycling in the United States**

New York City was the first municipality in the nation to adopt policies to deal with the waste choking its streets. In 1881 the city founded the Department of Street Cleaning, which would eventually become the Department of Sanitation. Originally, 75% of the waste that was collected by the department was dumped into the Atlantic Ocean, as was standard practice at the time, but this changed in the 1890’s when George Waring became commissioner of the department. Waring revolutionized how the city handled waste. One of the most important changes made by Waring was to separate household waste into three groups: food waste, garbage, and ash. The food waste that was collected would be turned into fertilizer and soap products while much of the garbage was sold as recycled materials (NYC Department of Sanitation). At this time not only did the city sell recyclable materials found in waste, but so did individuals. In the opening pages of her autobiographical work *A Tree Grows in Brooklyn* author Betty Smith describes the scene at the turn of the 20<sup>th</sup> century children going through the garbage of apartment buildings to find metal, paper, rubber and rags that could be sold for a small amount to the local “junkie”.

The first official “true” sanitary landfill in the United States was opened in Fresno, California in 1937. While the Fresno Sanitary Landfill was not the first attempt to make a sanitary landfill, Davenport, Iowa made one in the 1910’s, the practices crafted in Fresno were eventually adopted throughout the country (Melosi, 2000). Soon after the opening of the Fresno

Sanitary Landfill when World War II erupted and the United States began widespread recycling efforts. While recycling was done prior to World War II, the practice of selling scrap metal and rags was generally frowned upon and viewed as an act of desperation from the poor (Alexander and Reno, 2012). Though recycling did not remain widespread when the war came to a close, the wartime efforts served as an image makeover for recycling.

Post World War II, the United States economy became dependent on consumerism, leading to increased levels of household waste and increased need for landfills. These early sanitary landfills were unregulated and were discovered to leech toxic chemicals into the groundwater. In 1965 the federal government passed the Solid Waste Disposal Act (SWDA), which placed the first regulations on landfills. Then in 1976 Congress passed the Resource Conservation and Recovery Act (RCRA), placing the regulation of hazardous and non-hazardous wastes under the purview of the newly created Environmental Protection Agency. One of the most important implications of the RCRA was that it placed the responsibility of the waste on the party that created the waste, not the waste disposal facility. Both the RCRA and SWDA were amended in 1984, which included the Hazardous and Solid Waste Amendments to the SWDA. The RCRA was amended its final time in 1991 and the SWDA received its last amendment the following year (Kline, 2011).

Though many environmental policies rely on economic incentives, these types of incentives are not present in recycling and waste management legislation (Lawrence and Weber, 2014). The SWDA and RCRA rely on fines in order to ensure laws are followed by waste facilities, but the last time a landfill faced a significant fine was in 2006 when the city of Oahu and its landfill operator Waste Management Hawaii were fined \$2.8 million for violations. The only economic incentives to encourage recycling have been created by states that place

refundable taxes on beverage containers. The tax ranges from five cents in Iowa to ten cents in Michigan, which has a 97% redemption rate. Not only do these taxes affect consumers, but it also affects redemption centers that include grocery stores or businesses that reuse or recycle containers (Rabe, 2013). It could even be argued that these taxes affect the producers of the beverages, as consumers may be less inclined to purchase a product that comes with an additional tax. In 2012 beverage giant Coca-Cola paid lobbyists to oppose “programs that discriminate against specific foods and beverages” (Thomas, 2012).

Despite the arguments that environmental regulation will spur innovation to create new clean processes, many of the externalities from waste and recycling were transferred overseas as a result of the SWDA and RCRA. In a 1991 memo, Chief Economist of the World Bank, Lawrence Summers, noted that “... the economic logic of dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that” (Alexander and Reno, 2012). The World Bank thus encouraged nations of the Global North to dump their waste in the poorest countries of the world. Not only do companies that produce toxic waste remove the increased liability placed on them by the RCRA, but recycling business benefit for lower labor cost and environmental regulation.

Encouraged by the World Bank, the United States began exporting ‘recycled’ materials to China in large quantities. In 1996 the United States exported approximately \$2 million of waste and scrap plastics to China. This number grew to over \$500 million in 2011 (U.S. Department of Commerce). As more recycling was imported to China, concern began to grow. Along with environmental concerns, policymakers became concerned for worker health and safety in small recycling enterprises.

**US Scrap and Waste Plastic Exports to China**

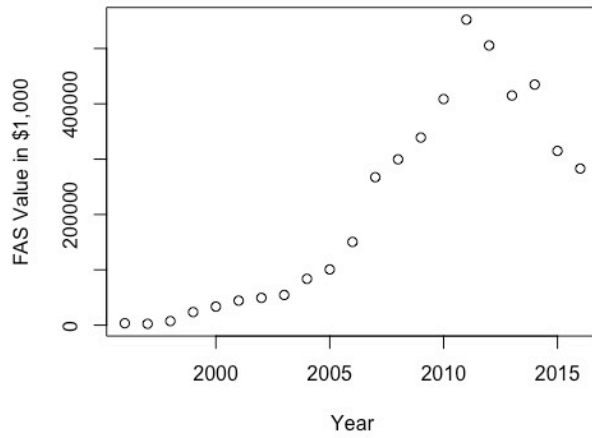


Figure 1. U.S. Scrap and Waste Plastics Exported to China from 1996-2016

**US Scrap and Waste Aluminum Exports to China**

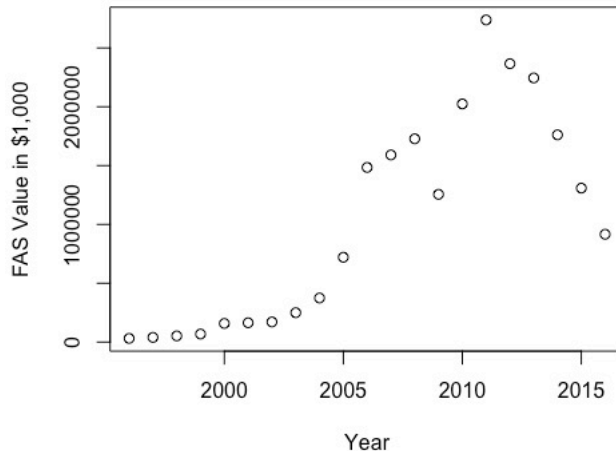


Figure 2. U.S. Scrap and Waste Aluminum Exported to China from 1996-2016

**US Scrap and Waste Paper Exports to China**

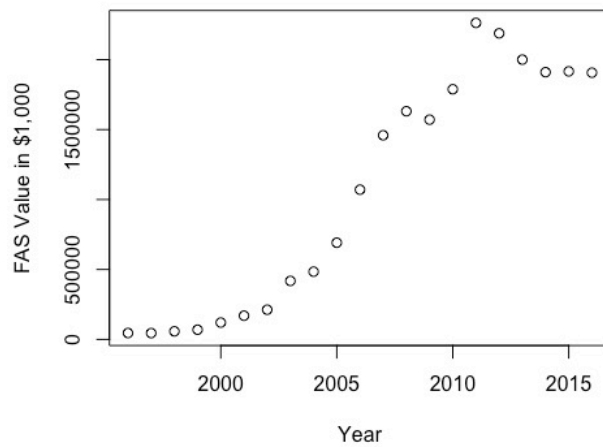


Figure 3. U.S. Scrap and Waste Aluminum Exported to China from 1996-2016

The quality of much of the plastic exported by the United States was so low it could not be reused and the Chinese were stuck with trash. The materials Americas thought they were recycling were not being recycled at all. Instead the materials were labeled as recycling and exported to China to end up in a Chinese landfill. In her work *Recycling Reconsidered*, McBride (2012) highlights that the recycling firms are solid waste firms that simply found a way to derive profits from disposal, this can be seen in the way recycling was being treated during this era.

Out of concern for the environment, Chinese President Xi Jinping, who has been quoted stating those damaging the environment “should be held accountable for a lifetime,” began an enforcement effort nicknamed the ‘Green Fence’ in 2013. The ‘Green Fence’ has led to an increase in customs inspections of imported plastics, tightened contamination standards, removal of export licenses and rejection of shipments that are then charged port demurrage fees until containers are sent back to the United States. According to industry, the Green Fence has not affected high-value recyclables (nonferrous metals) or commercially generated materials, while mixed plastics, e-plastics, film and other low-value plastics have been hit hard, but export data telling a different story. According to the U.S. Department of Commerce and the U.S. International Trade Commission, the exports of scrap and waste aluminum – a high value recyclable – is just as much affected as plastic and paper, with exports also in decline (see Figures 1-3).

The once profitable recycling industry is struggling to survive in a Green Fence Era. Prior to 2013 the recycling industry employed about 101 million people who generated \$27 billion in annual payroll and if that wasn’t staggering enough the industry grossed a total \$246 billion in annual revenues (MacBride, 2012). Unfortunately, this is no longer the case and many recycling

companies have been ‘forced’ to transfer the increased costs of recycling to customers, i.e. municipalities. For the first time since the 1970’s public managers are beginning to wonder if recycling is worth the increased costs.

### **Finding Value in Municipal Recycling Programs**

Headlines across the country raise questions if communities should continue costly recycling programs. It is estimated that more than 2,000 municipalities across the country are now paying to dispose of recyclables rather than getting paid for them as was common pre-Green Fence (Hauslohner and Olivo, 2015). We cannot be quick to blame rising costs solely on recycling firms and the Green Fence, because municipalities also played a role in the demise of their own recycling programs.

Many municipalities adopted “single stream” systems where all recyclables were comingled, meaning recycling firms would have more cost in sorting the materials. A 2014 survey by the National Waste and Recycling Association found 20% of Americans will place an item into a recycling bin if they are not completely sure it is recyclable and that 9% of Americans admit that have put trash in a recycling bin when the trash bin was full. This type of “garbage contamination” can become a serious problem for municipalities trying to make a profit off of recycling. In 2014 the District of Columbia increased the size of recycling bins from 32-gallons to 48-gallons and the amount of garbage contamination was a factor in the 50% drop in profits in 2014.

Additionally, by mixing materials municipalities were decreasing the value of the recycled goods. For instance, a paper product would lose value if it were mixed with a dirty, unwashed tuna can. The tuna would contaminate the paper and the can could mash it all up. In



this way the single-stream system works against cities attempting to generate a profit from recycling. It is this same type of contamination that Jinping is hoping to keep out of China with the Green Fence.

It did not take long for municipalities to begin feeling the repercussions of the Green Fence and their own mistakes. Alexandria, Virginia went from generating \$150,000 profit in 2013 to running a deficit in 2014 and in the same timespan Arlington, Virginia saw its recycling profits drop 98%.

Municipalities across the U.S. are at a unique position to make changes to their recycling policy. This research proposes one such change that municipalities could make to their recycling programs; instead of hoping recycling programs pay for themselves municipalities should make recycling a public service, much like a park services, garbage service or street cleaning. The following research works to answer the following questions in response to this policy solution:

1. Do individuals consider recycling programs a public service?
2. How much are individuals willing to pay per month for a curbside recycling program?

## CHAPTER 2. LITERATURE REVIEW

### **The Social Traps of Environmental Decision-making**

The literature describes environmental actors and their decisions in the light of social traps. These traps are similar to animal traps, which entice victims with bait that then leads to death. In environmental social traps, actors are enticed with immediate rewards and are blind to the destruction that follows. Two specific traps can be related to recycling in the United States: the prisoner's dilemma, race to the bottom and pollution exportation.

### **Race to the bottom recycling policy and pollution exportation**

Race to the bottom and pollution exportation are the popular concepts that states will loosen environmental standards in exchange for increased economic opportunities and pollution exportation is when businesses transfer pollution to areas where the environmental standards make pollution cheaper (Rabe, 2013; Konisky, 2007; Konisky and Woods, 2010; Potiski, 2001). Business have long been known to search for locations that have the most lax environmental standards, in his 1933 dissenting opinion of *Liggett Co. v. Lee*, Justice Louis Brandis noted,

Companies were early formed to provide charters for corporations in states where the cost is lowest and the laws least restrictive. The states joined in advertising their wares. The Race was not of diligence but of laxity.

Recycling firms unloading non-reusable plastics in China can be easily viewed as a form of pollution exportation. The forces that led to the implementation of the Green Fence are the same forces discussed by Brandis in his opinion. The laxity of Chinese standards resulted in U.S.

recycling and waste firms to offload recycling materials that could not be reused, a practice that was encouraged by the World Bank. As the void left by China has yet to be filled, U.S. recycling firms are only now paying the pollution cost that they had been exporting to China.

The Not in My Backyard (NIMB) Movement explored by Bullard (2000) and Swire (1996) is an additional example of pollution exportation manifesting in recycling. In refusing the expansion or creation of a landfill in their own neighborhood, protestors were off loading the cost of their own waste onto other members of society. Traditionally, wealth and waste are positively correlated, but the wealthy NIMB protestors do not bare the burden of their excessive waste.

### **Prisoner's Dilemma and Municipal Recycling**

Another social trap discussed in the literature of environmental policy is that of the prisoner's dilemma. While this trap is similar to the tragedy of the commons it differs in that environmental actors in this approach consider the actions of others when making their decisions, where did previously did not. Clemons and Schimmelbusch (2007) show how the prisoner's dilemma is used as a bargaining tool in international negotiations on climate change. There is one important different between the traditional view of the prisoner's dilemma and the environmental version; in the traditional perspective there is only one time frame, while the environmental prisoner's dilemma has two timeframes. Depending on the timeframe environmental actors are considering the payouts change drastically. Clemons and Schimmelbusch (2007) provide useful graphic to show how the dilemmas change based on the timeframe:

|                       |                | Short Time Frame                             |                                    |
|-----------------------|----------------|--|------------------------------------|
|                       |                | Your Policy                                  |                                    |
|                       |                | Go Green                                     | Don't Go Green                     |
| Your Partner's Policy | Go Green       | You: -\$35 Billion<br>Partner: -\$12 Billion | You: \$0<br>Partner: -\$12 Billion |
|                       | Don't Go Green | You: -\$35 Billion<br>Partner: \$0           | You: \$0<br>Partner: \$0           |

Figure 4. Clemons and Schimmelbusch (2007) Short-Term Prisoner’s Dilemma

|                       |                | Longer Time Frame                            |  |
|-----------------------|----------------|--|--|
|                       |                | Your Policy                                  |  |
|                       |                | Go Green                                     | Don't Go Green                               |
| Your Partner's Policy | Go Green       | You: \$0<br>Partner: \$0                     | You: -\$X Trillion<br>Partner: -\$X Trillion |
|                       | Don't Go Green | You: -\$X Trillion<br>Partner: -\$X Trillion | You: -\$X Trillion<br>Partner: -\$X Trillion |

Figure 5. Clemons and Schimmelbusch (2007) Long-Term Prisoner’s Dilemma

Municipalities currently find themselves in a prisoner’s dilemma. In the short-term it makes financial sense to save money and cut recycling programs, but when the long-term costs of more waste are taken into consideration keeping the recycling programs is the best decision. Recycling has many benefits that go unnoticed by municipalities and the public at large. According to the EPA (2016) municipal recycling in 2014 saved over 1.1 quadrillion BTU of energy – the equivalent of powering 25 million homes for an entire year. Kinnaman (2015) estimates the amount of waste Americans dispose of in landfills is actually more than two times what the EPA estimates. The EPA (2016) estimated 136 million tons of material were landfilled, if Kinnaman (2015) was correct that would mean over 272 million tons of material was landfilled in the United States in 2014. As a society we cannot continue at this rate, but we will if public managers only look at the problem as a short-term issue.

## Recycling Literature Review

The current problem facing municipal recycling in the United States is multifaceted. This section reviews the prominent literature in general recycling and sustainability in America, willingness to pay for recycling, and the Chinese green fence.

### Recycling in the United States

One of the most prominent and current works evaluating recycling in the United States is Samantha MacBride's 2012 work *Recycling Reconsidered*, which provides a comprehensive sociological and political overview of recycling in the United States. In her conclusion MacBride (2012) makes five major recommendations for U.S. solid-waste policy: 1) a stronger federal role in waste management, 2) paper and metal should be the only things collected in curbside recycling, 3) cities should compost, 4) cultivation of community-based enterprises that provide jobs relevant to reuse and remanufacture, and 5) relegate notions of personal commitment and responsibility. While MacBride (2012) provides one of the most comprehensive overviews of recycling in the United States, the work is from a pre-Green Fence world and therefore some of the work and recommendations no longer apply to the United States recycling industry. One recommendation that is still applicable is MacBride's (2012) fifth recommendation that individuals need to take personal responsibility for the materials economy. Individuals paying for recycling, like other public services would be an individual approach that changes the

Paul Connett's (2013) *The Zero Waste Solution* takes a much different approach than MacBride. In this work Connett and his contributors have a much broader approach than MacBride and look at all waste in the United States, not just recycling, and central to their argument is the suggestion that the United States should shift to a system where there are no

landfills and no incinerators, instead all the waste created by Americans should be recycled, reused, or composted. The historic approaches to waste management are outlined as burn it, bury it or cart it out to sea and dump it, with Connett and his contributors arguing how these options are not viable. There is particular interest in dispelling the idea that incinerators are a positive alternative to landfills and should instead be avoided at all costs. Overall the work provides numerous suggestions to encourage recycling, but many of the ideas are not realistic. For instance, contributor Lombardi (2013) suggests the government require every home and business separate discards into recyclables, compost and residuals and have the public take ownership of all discards – claiming neither of these actions have a cost “just courage,” but this is clearly not the case as many municipalities contemplate the cost of recycling programs. When the United States is at a 35% recycle rate and an estimated 10% of Americans throw trash in the recycling, the proposal for Americans to sort waste into clean organics, marketable recyclables and reusable objects is lofty.

### **Recycling in cities**

The 1990s played a critical role in the expansion of recycling in the United States as highlighted by the work of Folz (2000). This is most evident in the recycling rate, which Folz (2000) notes went from 9 percent in 1989 to an astounding 28 percent in 1996. To truly place this achievement into context it should be noted from 1996 to 2014 the recycling rate only increased 7 percent (EPA, 2016). Folz (2000) attributes much of the success of recycling in the 1990’s to the favorable cost of recycling compared to the cost of solid waste disposal, something that has since changed. Folz (2000) argues that recycling coordinators and city administrators

should not be afraid of full-cost accounting of recycling programs because they will almost always be lower than traditional solid waste collection and if they are not simple changes to increase participation and diversion could once again make it favorable.

Kinnaman and Fullerton (2000) added to this literature when they explored ways local policy could reduce solid waste and increase recycling rates. In their argument Kinnaman and Fullerton (2000) noted many individuals mistakenly believe that more garbage is free. Many communities at the time did not charge extra fees for larger garbage bins or extra items leading residents to believe any extra garbage was free, despite the marginal cost increasing with every unit of garbage. Using a mixture of data from the EPA and the International City Managers Association, Kinnaman and Fullerton (2000) created a regression that estimated a \$1 user fee for garbage could result in a decrease of 412 pounds of garbage per person per year and an increase of recycling of 30 pounds per person per year. Kinnaman and Fullerton (2000) explain this confounding difference between garbage and recycling as reduction at the source, composting, burning or dumping. Kinnaman (2006) fueled the concerns of illegal dumping of waste and the high costs associated with the administration of a curbside tax. If recycling fees were introduced to municipalities, similar byproducts of could be a result.

Mueller (2013) had similar findings to Folz (2000) in his evaluation of the effectiveness of recycling policy options. In his analysis of 223 recycling programs in Ontario during 2005-2010 he found the convenience of systems that accept a wide array of materials and have frequent collection to more important in increasing recycling rates than strategies that penalize waste like bag limits or pay programs. Mueller's (2013) finding on garbage fees is contradictory to Kinnaman and Fullerton's (2000) earlier findings, indicating a shift in the motivations that influence an individual to recycle.

The idea that recycling is more cost effective than garbage shifted when Bohm et al. (2010) found marginal and average costs of recycling systems exceeded those of waste collection and disposal systems. Bohm et al. (2010) found that small communities producing less than 13,200 tons of material will be unable to achieve minimum average costs. These small communities typically have lower individual incomes and education levels which Bohm et al. (2010) found to be important factors that contribute to recycling rates – as education and income increase so too does recycling rates.

Higher recycling rates, is not necessarily optimal as Kinnaman et al. (2014) discovered. Kinnaman et al. (2014) added to the literature of the cost of recycling by looking beyond municipal costs and focusing their attention on social costs of waste and recycling. This was a significant deviation from prior works and resulted in evidence that average social costs of recycling are minimized when the recycling rate is lower than those mandated and observed in Japan. Specifically, Kinnaman et al. (2014) suggest a recycling rate of 10 percent average social costs of waste management. The finding resulted in publication in mainstream news attention, including an opinion piece featured by Newsweek where Kinnaman (2015) recommends a recycling rate of 10 percent which is composed of metals – particularly aluminum – and cardboard with a recycling rate of 0 for plastics and glass.

### **Willingness to pay for recycling**

There is a strong literature of willingness to pay for recycling studies in the United States with researchers using several contingent valuation methods including stated preference, randomized referendum, payment card, and the ordered-interval.



Aadland and Caplan (2000) completed one of the first studies of willingness to pay for curbside recycling. In their study the authors determined the WTP for the city of Ogden, Utah discovering the average resident was willing to pay **\$2.05** per month for a recycling program.

Instead of using a randomized referendum, where by respondents are presented a random bid and asked if they are willing to pay, respondents were presented a series of intervals and asked to select which most closely reflected their maximum willingness to pay. An additional goal of Aadland and Caplan (2000) was to determine what factors influenced WTP, in this study they discovered education and income to be important factors influencing predicted WTP.

Aliri (2002) completed a study of WTP for curbside recycling in the city of Missoula, Montana finding respondents would be willing to pay an estimated **\$10.13** per month for a program. In his survey Aliri (2002) used cheap talk and a single-bound dichotomous choice referendum to determine WTP; respondents were provided one of the following bids at random: \$1, \$3, \$5, \$8, \$10, \$12, \$15, \$20.

In 2002 Dr. Arthur Caplan and Dr. David Aadland of Utah State University compiled a comprehensive dataset of 40 cities in the Western United States about curbside recycling programs. The dataset is based on a survey of 4354 interviews that asked respondents about household recycling practice and willingness to pay for curbside recycling programs. Prior to asking contingent valuation questions respondents were presented a cheap-talk statement reminding them that they are valuing a hypothetical program. In this study a double-bounded dichotomous choice (DBDC) referendum model was used to estimate WTP for curbside recycling, where researchers presented participants with an opening bid of  $\tau$  and based on the response to the opening bid participants were asked a follow-up bid of  $2\tau$  or  $0.5\tau$  depending

on the response to the initial bid. This survey and consequential dataset has resulted in several published articles that explore attitudes toward recycling and willingness to pay for curbside recycling in specific municipalities and states.

Utilizing this dataset Aadland and Caplan (2003) used a double-bounded dichotomous-choice (DBDC) referendum model to estimate WTP for curbside recycling. In this model Unlike many DBDC models Aadland and Caplan (2003) added an additional question for participants that responded 'no' to every bid, asking if they would be willing to use curbside recycling if it were free of charge. This question added a fifth valuation region measuring if individuals would need to be paid to recycle. This fifth valuation region is unique and not something commonly used in contingent valuation studies. Using this additional bound Aadland and Caplan (2003) find the mean WTP for curbside recycling in Utah to be approximately **\$7.00** per month. Another unique feature of this study was the efforts to detect and mitigate hypothetical bias finding evidence that individuals tend to overstate with maximum WTP for a hypothetical curbside recycling program relative to an actual program.

Kamesar and Nadler (2004) also used the dataset compiled by Aadland and Caplan but were not concerned with estimating WTP, rather they sought to see how Eugene, Oregon's WTP for curbside recycling compared to other cities in the United States. Additionally, Kamesar and Nadler (2004) worked to uncover what factors influenced the WTP for curbside recycling in Eugene. They discovered citizens of Eugene were willing to pay on average \$0.93 more than other cities for curbside recycling services. While Kamesar and Nadler (2004) found those with higher educations would pay more for recycling and that women would pay more than men – something Aadland and Caplan (2003) also discovered – the only demographic variable that had a significant influence on WTP was income. As an individual's income increased, the WTP also

increased. Least surprising of Kamesar and Nadler's (2004) finding was that individuals who belonged to environmental organizations or saw recycling as an ethical obligation were willing to pay significantly more for curbside recycling, \$2.00 and \$3.40 respectively.

Blaine et al. (2005) added to the work focusing on consumer willingness to pay with their study, which evaluated the WTP for recycling in Lake County, OH. In addition to establishing WTP, Blaine et al. (2005) worked to determine whether type of contingent valuation method influenced WTP. Specifically researchers evaluated whether there was a difference in the estimated WTP between the payment card method and referendum methods of contingent valuation. In the study the payment card method – open-ended stated preference – presented respondents with several values from \$0-\$3.00 and asked respondents to select the maximum amount they would be willing to pay, while the referendum method worked as a single-bounded dichotomous choice where respondents were presented a random bid between \$1.00-\$3.00. Blaine et al. (2005) found that the WTP for the payment card procedure was lower than the referendum, **\$1.59** compared to **\$2.24**. The reason for this difference is presumably because respondents could easily select the lower amounts. The WTP for recycling in Lake County, OH is the lowest of the literature, but Blaine et al. (2005) presented the respondents with low bids that might not accurately measure how much more than \$3.00 individuals would be willing to pay.

What is important to note, is that these studies predominately take place in the western region of the United States and are over a decade old. The valuation of recycling could be different in other regions of the country and could have changed drastically in the years since the studies were conducted.

### **Adding to the Study of Municipal Recycling**

The approach recommended by Folz (2000) is similar to the approach that is still used by communities seventeen years later, but it is no longer appropriate in the post-Green Fence Era. In the 1990s increasing recycling rates was critical to lowering the cost of the programs, but today increasing recycling rates can be problematic having the opposite effect than planned.

Communities like the District of Columbia have worked to increase recycling participation, which according to Folz (2000) should help to decrease the cost of their program, but instead this change cost the city more. As efforts were made to create a convenient single-stream recycling program in D.C. officials began to see increased rates of waste entering the recycling stream (Hauslohner and Olivo, 2015). This is not just a problem in the D.C., in a recent survey the National Recycling Association and PEW research found ten percent of Americans purposely place waste in the recycling if their waste container is full. There is a desperate need for solutions to the current “crisis” in recycling.

The literature has established that recycling is not economically optimal, but it remains one of the best ways to manage waste compared to the alternatives of dumping and burning (Kinnaman et al., 2014; Connett, 2013). There is no work that views recycling as a public service, only a handful of works evaluating WTP for curbside recycling and fewer looking at the recycling attitudes and behaviors. This work adds to the literature by evaluating recycling through a lens of a public service and establishes a current estimate of WTP for curbside recycling in a rural Iowa community directly affected by the increased cost of recycling after the implementation of the Chinese Green Fence. Not only can this work advance the academic literature, but it can influence the solid waste management decision making in similar communities.

## CHAPTER 3. SURVEY METHODOLOGY AND PRELIMINARY ANALYSIS

Using the work of Aadland and Capland (2000; 2003; 2006) and Aliri (2002) as a reference, an online survey was formulated using Qualtrics and distributed to a convenience sample. A description of the survey methodology along with preliminary statistical analysis follows.

### **Survey Design and Methodology**

A link to an online survey was distributed via social media positing on Facebook, Instagram, and Twitter and through email to a convenience sample of residents from Tipton, Iowa with the survey was available from February 6, 2017 to February 20, 2017. During this period 111 individuals participated in the survey with 107 completing the entire survey. Tipton residents were selected for two reasons: 1) convenience and 2) the City of Tipton has been directly affected by the increased cost of recycling. The recycling firm Republic Recycling of Cedar Rapids, Iowa utilized by the city of Tipton increased the tipping fee for recyclables resulting in an estimated increased cost of \$20,000 - \$30,000 a year for the recycling program and council members openly contemplating discontinuing the city's recycling service (Tipton City Council, 2016). Therefore the valuation of curbside recycling provided by residents could be more honest and realistic, given the "crisis" in their own community.

Arrow et al. (1993) warn against using non-face-to-face methods of contingent valuation, because individuals are more likely to overstate their maximum willingness to pay in an impersonal survey compared to a personal, face-to-face interaction, but an online survey was thought to be the best option. The fact that residents are actually facing a recycling "crisis" was

thought to provide them with greater context to provide an accurate maximum willingness to pay and recent research by Casler et al. (2013) found that social media and email recruited participants can provide high quality data that was previously assumed to require in-person testing.

The first section of the survey presented to respondents with questions about their current waste and recycling behaviors. In his work, *Environmental Communications*, Cox (2013) notes repeatedly how vital framing is to forming environmental attitudes and behaviors and that these frames can remind individuals of liberal political ideology. It was for this reason and that Aliri (2002) established a connection between environmental ethics and higher levels of WTP for curbside recycling that efforts were made to ensure any questions that could create a pro-environment frame were placed after the WTP section. These questions were used to establish if respondents actually use the current curbside recycling program in Tipton and created a frame of recycling and the public service of garbage service prior to being asked questions about paying for a hypothetical curbside recycling program.

Respondents to contingent valuation questionnaires often overestimate how much they would be willing to pay, therefore a screen that contained the following “cheap talk” statement preceded the second section of the survey, which contained the questions referring to WTP (see Arrow et. al 1993; Aadland and Capland, 2003). In addition to the cheap talk, respondents were reminded of current cost of garbage service in Tipton in an effort to establish budgetary context as recommended by SHADAC (2001). The “cheap talk” statement used in the survey follows:

At this point you are going to be asked about your household's willingness to pay for curbside recycling service. Recent market changes have resulted in increased costs associated with municipal curbside recycling programs, with some communities left to decide if they want to continue their curbside recycling programs.

In this **HYPOTHETICAL** situation you would need to pay to continue your curbside recycling service, if you choose not to pay you would no longer have curbside recycling service. The curbside program would be the exact same as what is already offered in your community, it would accept the same materials as are already accepted and exclude the same materials, like glass.

As you read the following curbside recycling fees, please keep in mind some of the current monthly municipal fees you pay and imagine your household is **ACTUALLY** paying the curbside recycling fees in addition to what you already pay.

Garbage Service:  
35-gallon - \$18.25/month  
64-gallon - \$22.25/month  
Extra Items - \$15/item

Following the cheap talk, respondents were presented two questions to determine WTP. The first was a question formatted as a dichotomous-choice referendum; respondents were randomly presented a bid and were asked “yes” or “no” if they would be willing to pay for curbside recycling program in addition to their current garbage fees (Freeman et al., 2014). The following were the possible bids that could have been presented to respondents: \$2, \$7, \$12, \$17, \$22, \$27, \$32, \$37, \$42, and \$47. This type of question has been utilized by many researchers evaluating willingness to pay for curbside recycling as it is recommended by most researchers specializing in contingent valuation methods (Aadland and Caplan, 2000, 2003; Aliri, 2002; Blaire et al., 2006; Green, 2003; and Freeman et al., 2014).

After the random ‘bid’ respondents were asked to state what amount between \$0 and \$50 they would be willing to pay per month for curbside recycling. This type of question is not typically used because the willingness to pay guidelines produced by Arrow et al. (1993) assume these type of open-ended questions produce maximum willingness to pay values that are higher than what individuals are willing to pay. Blaire et al. (2006) contradict Arrow et al. (1993),

finding the maximum willingness to pay for curbside recycling elicited from their open-ended “payment card” was lower than the maximum willingness to pay from the “referendum” dichotomous choice.

The third section contained questions that referred to the recycling knowledge and attitudes toward curbside recycling programs. These questions diverted significantly from prior work on willingness to pay for curbside recycling, which did not evaluate the respondents’ knowledge of recycling or their attitudes toward programs being considered a public service. These questions are important in understanding if other suggestions for creating more efficiency in municipal recycling are plausible, like MacBride’s (2012) assertion that municipalities should collect more high value materials like textiles.

Then the fourth and final section of the survey provided demographic information about the respondents. Information collected in this section included age, education, employment, income and household size and with the exception of household size all of these variables were measured as categorical variables.

## **Descriptive Statistics**

### **Survey sample vs. general population**

During the two week period 111 individuals participated in the online survey with 107 completing the entire survey; four respondents provided consent to take the survey, verified they were residents of Tipton, but failed to respond to any of the other questions. The following section provides a summary of the descriptive data and provides comparisons to the U.S. Census Bureau’s 2011-2015 American Community Survey 5-Year Estimates (ACS).



Table 1. Sample Demographics vs. American Community Survey Estimates

| Variable Name                     | Sample % | ACS % |
|-----------------------------------|----------|-------|
| <b>Gender</b>                     |          |       |
| • Male                            | 42%      | 47.5% |
| • Female                          | 55%      | 52.5% |
| <b>Age</b>                        |          |       |
| • 18-24                           | 5.6%     | 7.8%  |
| • 25-34                           | 17.8%    | 14.1% |
| • 35-44                           | 15.9%    | 11.1% |
| • 45-54                           | 22.4%    | 9.6%  |
| • 55-64                           | 19.6%    | 13.4% |
| • 65+                             | 14.9%    | 20.8% |
| <b>Household Income</b>           |          |       |
| • < \$25,000                      | 3.8%     | 10.7% |
| • \$25,000-\$34,999               | 5.6%     | 5.7%  |
| • \$25,000-\$49,999               | 19.6%    | 11%   |
| • \$50,000-\$74,999               | 21.5%    | 42.3% |
| • \$75,000-\$99,999               | 19.6%    | 17.8% |
| • \$100,000-\$149,999             | 14%      | 10.4% |
| • \$150,000+                      | 0.9%     | 2.2%  |
| <b>Education</b>                  |          |       |
| • Some High School, no diploma    | 0.9%     | 4.7%  |
| • High School Graduate            | 26.1%    | 46%   |
| • Some College, no degree         | 9.3%     | 19.2% |
| • Associate's Degree              | 15.8%    | 8.2%  |
| • Bachelor's Degree               | 31.8%    | 13.2% |
| • Graduate or Professional Degree | 12.1%    | 4.4%  |

Gender and age demographics are similar to the ACS estimates with no differences that should be cause for concern. Education and income do vary from the ACS estimates, both skewing towards those who make more money and are more educated.

The education levels of the sample are higher than the general population of Tipton, as estimated by the ACS. Previous research indicates that those with higher levels of education are more willing to pay for recycling programs (Aadland and Caplan, 2000 and 2003). Furthermore, there are some groups with too few respondents, only one person responded as having ‘some high school’. These problems with the education variable will be addressed in the following chapter.

Although there are fewer low-income individuals represented in the survey the general distribution is similar to the actual income distribution as established by the ACS. Both the survey and ACS peak with the \$50,000-\$74,999 so there is a similar distribution of incomes between the sample and the ACS estimates. Additionally, it can be assumed that many of the low-income residents would reside in apartments where they do not receive waste service from the city.<sup>1</sup>

### **Recycling knowledge and attitudes**

Although work has been done to understand the knowledge and attitudes of individuals towards recycling, this has never been combined with willingness to pay. MacBride (2012) indicates in her work, that the failure of individuals to properly recycle is a major factor that has led to the high cost of recycling. The following section evaluates the descriptive statistics from the recycling knowledge and attitudes section of the survey.

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<sup>1</sup> According to the 2010 U.S. Census 739 individuals lived in renter-occupied homes and according to the ACS estimates 309 individuals had low-incomes of less than \$25,000.

One of the problems leading up to the implementation of the “Green Fence” was the failure of U.S. recycling firms to provide clean plastics to China. Instead, many of the plastics were unclean and consequently contaminated so they could not be recycled by Chinese firms. Therefore it has been suggested by recycling managers that more diligence on behalf of individuals to wash their plastics could reduce some of the cost to U.S. recycling firms that are forced to go through costly processes to clean plastics (Hauslohner and Olivo, 2015).

According to the respondents of the survey approximately 71% of individuals washed containers before placing them in the recycling, which could be an indication that cleanliness is not an issue for recycling in Tipton.

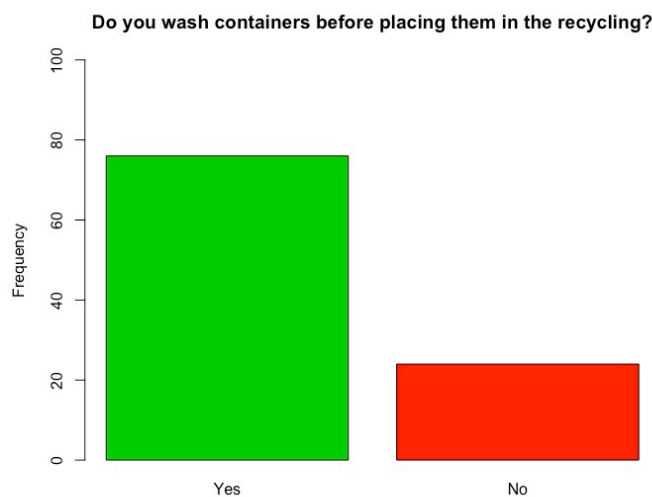


Figure 6. Washing Recyclable Containers

Another contributing factor leading to the increased cost of recycling is that more trash is being placed in the recycling. This requires more staff to sort through the collected “recycling” and remove products that are non-recyclable which contributes to increased overhead costs which is then passed on to municipalities. Communities have noted when they switch from a multi-stream recycling service to single-stream curbside recycling that the recycling rate has increase, but non-recyclables increased as well (Hauslohner and Olivo, 2015). Not only is the

trash issue something individuals might do on purpose (National Waste and Recycling Association, 2014), but it could also be an error on behalf of individuals who mistakenly think certain items are recyclable when they are not.

According to the National Waste and Recycling Association (2014) approximately 10% of Americans will throw items in the recycling if the trash is full, despite knowing the item is non-recyclable. According to the respondents of the survey this is a similar problem in Tipton where ~7% of the respondents admitted to placing garbage in the recycling.

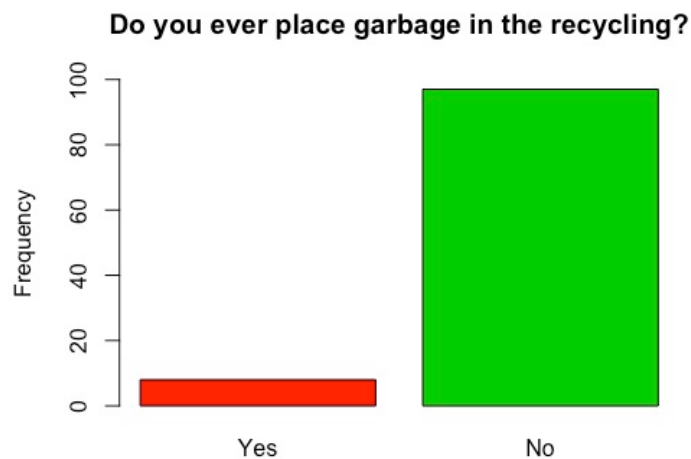


Figure 7. Placing Garbage in the Recycling

It has been suggested that many individuals will optimistically place items in the recycling when they are unsure of its recyclability (MacBride, 2012). This is particularly problematic with wax-coated cardboard used for liquid (i.e. orange juice, milk, soup broth...), many individuals consider the product cardboard, ignoring the wax coating. When unsure if an item is recyclable many waste/recycling managers prefer individuals to place the item in the garbage, not the recycling. A majority of the respondents also take this approach with 79% of the respondents stating if they are unsure if an item is recyclable it should be placed in the recycling. This finding is problematic and unsettling for small communities. While Tipton's waste could be

“cleaner” than other communities using the same recycling firm Tipton does not have the leverage to demand lower tipping fees, instead they are forced to offset the higher costs of the “dirty” recycling streams.

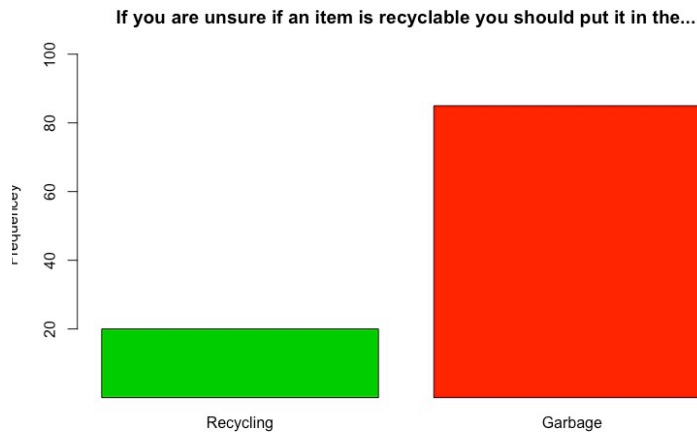


Figure 8. Placing Items in the Garbage or Recycling

While a majority of individuals might not be placing items that are non-recyclable in the recycling it is also possible that they believe an item is recyclable, when it is not – like the wax-coating cartons. When given a list of items and asked to determine which are recyclable and which are not recyclable. Approximately 48% of respondents listed pizza boxes as recyclable, when they are not. Grease from the pizza contaminates the cardboard and it is not recyclable. Similarly 43% of individuals listed paper towels as recyclable, when they are never recyclable. Wet paper is always difficult to recycle because the water ruins the integrity of the fiber, but with paper towels in particular the paper fibers used are incredibly fine and nearly impossible to reuse before or after the paper towel has been used. The most surprising of the non-recyclable items listed was that of Styrofoam, which was listed as recyclable by 27% of the respondents.

In addition to respondents mistaken beliefs that non-recyclable items were recyclable, there were a number of items that were believed to be non-recyclable when they are in fact

recyclable. Only 59% of respondents were aware plastic grocery sacks were recyclable and a mere 27% knew textiles could be recycled. Neither of these items are typically allowed in municipal curbside recycling programs, instead both are usually collected at specific locations like grocery stores or clothing donation centers, which could be a contributing factor to the misunderstanding. MacBride (2012) suggests programs should switch to collect more high value items, collecting textiles instead of plastics, but an expansion would not be successful without extensive education efforts given the number of individuals who do not appear to know these items are recyclable.

Table 2. Recyclable Item List

| <b>Which of the following items can be recycled?</b> |                                       |                            |                                       |
|--|---------------------------------------|----------------------------|---------------------------------------|
| <b>Item</b>  | <b>Responded item can be recycled</b> | <b>Item</b>                | <b>Responded item can be recycled</b> |
| A flyer printed on white paper                       | 94.74%                                | Colored construction paper | 69.74%                                |
| A newspaper  | 96.84%                                | Textiles – i.e. clothing   | 27.37%                                |
| A plastic water bottle                               | 98.95%                                | Food waste                 | 14.74%                                |
| A can of soda  | 75.79%                                | An aluminum can            | 96.84%                                |
| A glass jelly jar                                    | 64.21%                                | A plastic grocery sack     | 58.95%                                |
| A pizza box  | 48.42%                                | Paper towels               | 43.16%                                |
| A cardboard box                                      | 100.00%                               | A Styrofoam cup            | 27.37%                                |

### **Survey Conclusions**

These preliminary findings indicate that the best way for recycling to continue is for it to be considered a public service. Most part residents are aware of the items that can be recycled and they are placing items with questionable recyclability in the trash and washing recyclables prior to placing them in their recycling, indicating the efficiency, which reduces cost, is not likely to increase in residents. Therefore the only option left to continue recycling programs in the United States is for residents to pay for the service the same way they pay for their waste/garbage service.

## CHAPTER 4. MODELING WILILNGNESS TO PAY FOR CURBSIDE RECYCLING

Respondents were also asked if recycling should be considered a public service like garbage service, street cleaning and water. An overwhelming 87% of respondents thought that recycling should be considered a public service. But in terms of priority, recycling was usually considered one of the bottom three services along with street cleaning and parks.

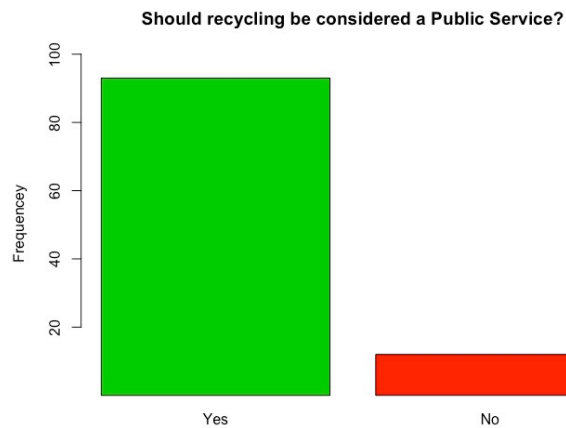


Figure 9. Support for Recycling as a Public Service

### **Determining Willingness to Pay**

Two methods were used to determine willingness to pay for curbside recycling, a single-bound dichotomous choice referendum and an open-ended stated preference question – the payment card method (Blair et al., 2005). Because education was skewed to have more highly educated respondents and it is known to influence maximum willingness to pay for curbside recycling, the data was weighted to more accurately reflect the population of Tipton and consequently five responses were removed from the dataset. The four respondents that did not

list their education level and the individual with “Some High School” were removed from the dataset. The individuals who did not list education could not be accurately weighted and weighting the one person with “Some High School” would be considered extrapolation.

The Kristrom (1990) method was used to obtain WTP estimates for the referendum method. This method of estimating maximum likelihood can produce a higher estimate of WTP than other methods, like Turnbull (1976), but it is presumed to be more realistic (Blair et al., 2005). The Kristrom mean is defined as:

$$\text{Krsitrom mean} = LBM + (1/2)p_0(1 - \pi_0) + \sum_{i=1}^K 1/2 |(p_i - p_{i-1}) + 1/2\pi_k(p^* - p_k)|$$

Where LBM is the lower bound mean,  $\pi_i$  are percentages who support a given amount  $p_i$ , whose initial bid is  $p_0$ ,  $k$  is the number of bids offered after the initial bid  $p_0$ , and  $p^*$  is the estimate bid price where  $\pi$  falls to zero. Since respondents were only presented one bid the equation to determine WTP for this study is:

$$LBM + \sum_{i=1}^K 1/2 |(p_i - p_{i-1}) + 1/2\pi_k(p^* - p_k)|$$

Using Kristrom function available in the DCchoice package in R, the mean WTP was **\$15.34** using the Kaplan-Meier method to estimate the survival function.

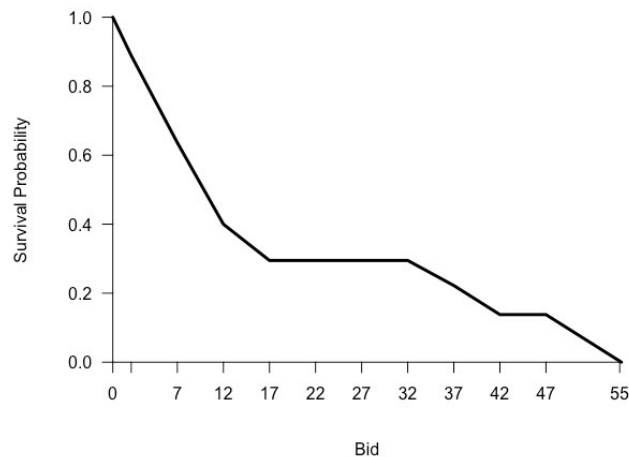


Figure 10. Survival Probabilities of Willingness to Pay for Curbside Recycling



Similar to Blaire et al. (2005), this ‘referendum’ mean was slightly greater than the mean un-weighted willingness to pay determined by the open-ended stated preference question, which was **\$14.27**. As discussed earlier, the education level of the respondents did not match the education levels of the general population of Tipton as estimated by the American Communities Survey. After weighting the data to match the general population’s education level, the mean maximum willingness to pay per month for curbside recycling was reduced to **\$12.29**, much lower than either the referendum mean or the mean un-weighted stated preference maximum willingness to pay. All of the willingness to pay analysis forward will use the mean weighted stated preference data, as this predicted mean is the lowest.

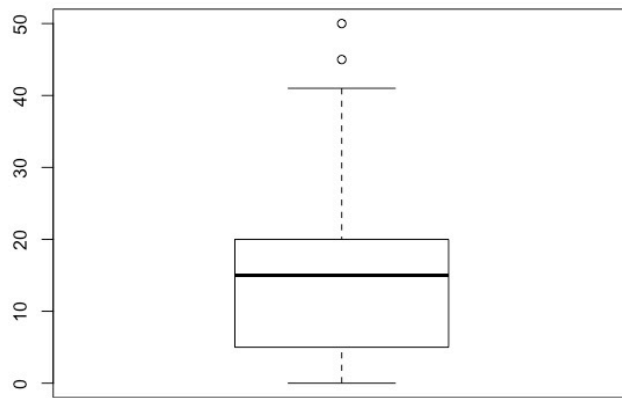


Figure 11. Maximum Willingness to Pay for Curbside Recycling Service Un-weighted

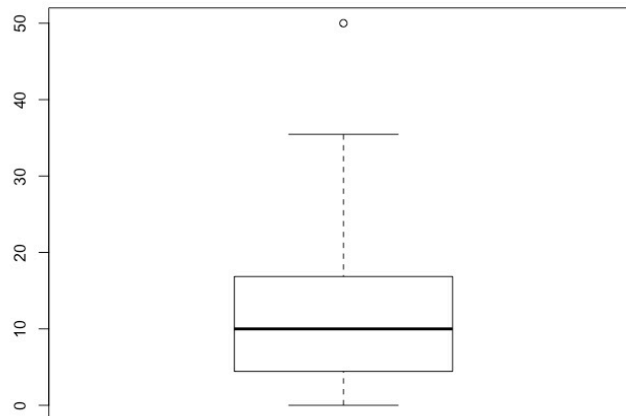


Figure 12. Maximum Willingness to Pay for Curbside Recycling Service Weighted

### Public Service Model

The goal of this research is to determine if people are willing to view recycling as a public service similar to waste or water service. As noted earlier in the chapter most respondents thought recycling should be considered a public service. Is there a difference between the individuals that responded recycling should be considered a public service and individuals who felt recycling should not be considered a public service?

$$H_0: \beta_{\text{Public Service - No}} = \beta_{\text{Public Service - Yes}}$$

$$H_a: \beta_{\text{Public Service - No}} \neq \beta_{\text{Public Service - Yes}}$$

Using the weighted survey data and creating a generalized linear model, there is evidence that the predicted maximum willingness to pay is different based on whether an individual felt recycling should be considered a public service or if recycling should not be considered a public service. According to this model individuals who think recycling should be considered a public service are predicted to be willing to pay almost **\$3.50** more per month for curbside recycling than those who do not think recycling should be considered a public service.

Table 3. Public Service GLM Model

| <b>Coefficients</b>  | <b>Estimate</b> | <b>Std. Error</b> | <b>t-value</b> | <b>p-value</b> |
|----------------------|-----------------|-------------------|----------------|----------------|
| Intercept            | 1.000           | 2.846e-15         | 3.514e+14      | <2e16***       |
| Public Service – No  | 8.382           | 2.588             | 3.239          | 0.00163**      |
| Public Service – Yes | 11.86           | 1.259             | 9.42           | 2.02e-15***    |

Significance Codes: <0.01\*\*\*; <0.05\*\*; <0.10\*

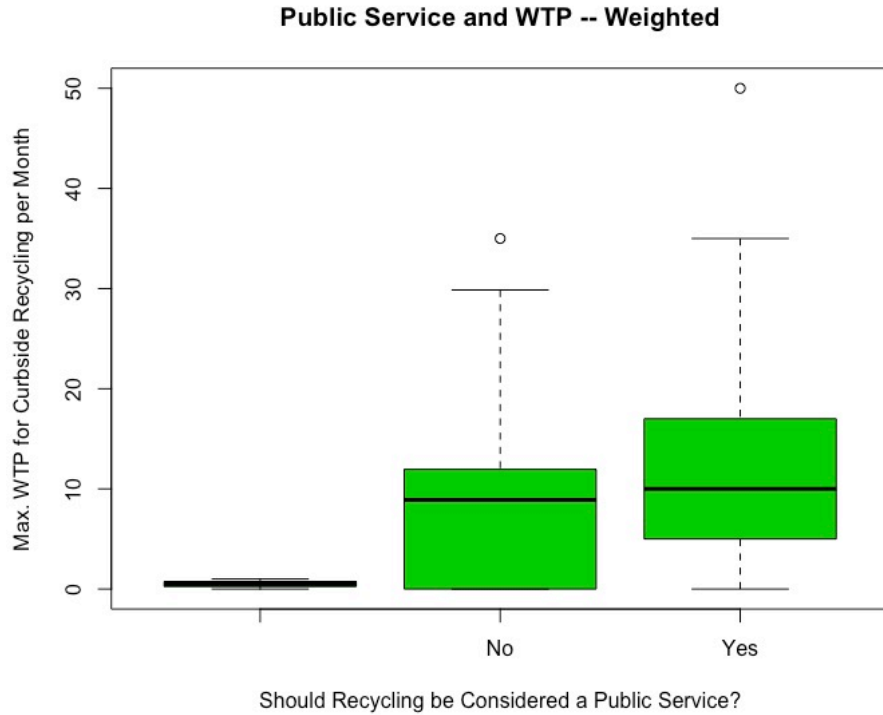


Figure 13. Public Service and WTP Boxplot -- Weighted

### Income and Education Model

Previous research has indicated that education and income significant predictors of predicted maximum willingness to pay per month for curbside recycling service. In this study are these factors also significant?

$$H_0: \beta_{\text{High School Graduate}} = \beta_{\text{Some College}} = \beta_{\text{Associates degree}} = \beta_{\text{Bachelors degree}} = \beta_{\text{Graduate or Professional Degree}}$$

$$H_a: \text{At least one } \beta \text{ is not equal}$$

$$H_0: \beta_{\text{Less than } \$25,000} = \beta_{\$25,000 \text{ to } \$34,999} = \beta_{\$35,000 \text{ to } \$49,999} = \beta_{\$50,000 \text{ to } \$74,999} = \beta_{\$75,000 \text{ to } \$99,999} = \beta_{\$100,000 \text{ to } 149,999} = \beta_{\$150,000+}$$

$$H_a: \text{At least one } \beta \text{ is not equal}$$

Using the weighted survey data those that had a low levels of education and low income had the lowest predicted maximum willingness to pay for month for curbside recycling service. Additionally, there is evidence that these two factors are significant in predicting WTP in this study much like they were in earlier studies.

Table 4. Income and Education GLM Model

| <b>Coefficients</b>             | <b>Estimate</b> | <b>Std. Error</b> | <b>t-value</b> | <b>p-value</b> |
|---------------------------------|-----------------|-------------------|----------------|----------------|
| Intercept                       | 4.686           | 3.179             | 1.474          | 0.14401        |
| Some College                    | -3.557          | 3.002             | -1.185         | 0.23910        |
| Associates Degree               | 8.861           | 3.335             | 2.657          | 0.00931***     |
| Bachelors Degree                | 2.212           | 2.492             | 0.888          | 0.37709        |
| Graduate or Professional Degree | 2.090           | 4.129             | 0.506          | 0.61403        |
| \$25,000 to \$34,999            | 6.298           | 3.341             | 1.885          | 0.06256*       |
| \$35,000 to \$49,999            | 6.194           | 3.107             | 1.994          | 0.04915**      |
| \$50,000 to \$74,999            | 10.000          | 3.423             | 2.921          | 0.00440***     |
| \$75,000 to \$99,999            | 10.314          | 2.976             | 3.465          | 0.00081***     |
| \$100,000 to \$149,999          | 10.092          | 3.387             | 2.980          | 0.00370***     |
| Income - Prefer not to answer   | 0.293           | 3.148             | 0.093          | 0.92606        |

Significance Codes: <0.01\*\*\*; <0.05\*\*; <0.10\*

### **Income, Education and Public Service Model**

Combining the Public Service Model with the Income and Education Model there is once again evidence that all three factors are significant in predicting the maximum willingness to pay for curbside per month for curbside recycling. Of these factors, Public Service is one of the most significant factors in predicting WTP. In this model individuals who thought recycling should be considered a public service had a predicted maximum willingness to pay per month for curbside recycling service more than **\$5.00** more than those who did not think recycling should be considered a public service holding all other variables constant.

Table 5. Income, Education and Public Service GLM Model

| <b>Coefficients</b>             | <b>Estimate</b> | <b>Std. Error</b> | <b>t-value</b> | <b>p-value</b> |
|---------------------------------|-----------------|-------------------|----------------|----------------|
| Intercept                       | -5.5808         | 3.0371            | -1.838         | 0.069461*      |
| Some College                    | -4.9356         | 3.1183            | -1.583         | 0.117016       |
| Associates Degree               | 8.4392          | 3.3105            | 2.549          | 0.012508**     |
| Bachelors Degree                | 1.7234          | 2.4433            | 0.705          | 0.482440       |
| Graduate or Professional Degree | 1.2240          | 4.1258            | 0.297          | 0.767416       |
| \$25,000 to \$34,999            | 5.5386          | 3.3044            | 1.676          | 0.097222*      |
| \$35,000 to \$49,999            | 6.5808          | 3.0371            | 2.167          | 0.032918**     |
| \$50,000 to \$74,999            | 10.1389         | 3.4157            | 2.968          | 0.003846***    |
| \$75,000 to \$99,999            | 10.9142         | 2.8173            | 3.874          | 0.000204***    |
| \$100,000 to \$149,999          | 10.0270         | 3.3419            | 3.000          | 0.003497***    |
| Income - Prefer not to answer   | 0.1817          | 3.2682            | 0.056          | 0.955799       |
| Public Service – No             | 5.7992          | 3.6762            | 1.577          | 0.118230       |
| Public Service – Yes            | 11.2821         | 3.1347            | 3.599          | 0.000525***    |

Significance Codes: <0.01\*\*\*; <0.05\*\*; <0.10\*

### **Modeling Conclusions**

There is strong evidence that public service influences predicted maximum willingness to pay per month for curbside recycling service. The models that included public service as a factor indicate that it is a significant factor and its significance is more prominent than income and education, which were identified in previous research. In addition, the importance of public service explains why the predicted WTP of \$12.29 is higher than previous studies. The first questions in the survey asking about the current recycling and garbage service created a public service frame that directly preceded the willingness to pay section and the ‘cheap-talk’ section furthered this by referencing the public service of garbage service and quoting the exact cost of the service per month. This public service frame therefore could have resulted in individuals choosing higher values than they would have otherwise stated, like in previous WTP surveys.

## CHAPTER 6. CONCLUSION

Municipal recycling in the United States is at a crisis. Not only have we failed to see innovation on behalf of recycling firms in response to the Green Fence, but President Trump's proposed 20% budget cut to the Environmental Protection Agency's recycling and waste reduction efforts could soon place an additional blow to a floundering industry. (Earley, 2013; Flower, 2016; Staub, 2017). Loss of federal funds is not a new problem for waste and recycling managers, ten years ago this problem was identified as a primary reason Blaine et al. (2006) conducted their willingness to pay for curbside recycling study in Lake County, Ohio. Still, the combination of these two issues could have a devastating blow on municipal recycling programs. Solutions like 'pay as you throw,' which incentivize recycling and create increased revenues, can make the programs more costly to municipalities rather than covering the increased cost of recycling because of the negative relationship between recycling rate and quality of recyclables (Seldman, 2016; Hauslohner and Olivo, 2015). Previous solutions to handle the cost of recycling do not work and it is becoming ever clear that municipal recycling needs to be viewed in a new light. This work suggests that this perspective should be that of a public service no different than water or sewer service rather than a free program offered by your community.

This study establishes that a majority of residents of Tipton, Iowa support recycling being considered a public service and the predicted maximum willingness to pay per month for municipal recycling is \$12.29. Most importantly there is strong evidence that whether or not an individual considers recycling a public service significantly influences the predicted maximum willingness to pay per month for curbside recycling, something previous research on willingness to pay for curbside recycling did not evaluate. If Tipton were to propose a fee for recycling in

order to cover the increasing cost of the program it would most likely be supported if the proposed fee was \$12.29 it would almost cover the estimated \$20,000 increased cost of the recycling program (Tipton City Council, 2016). Additionally, there is evidence that if such a fee were established, if it were presented to residents as a public service, like water or sewer, provided by the city government residents would be supportive of the change.

These findings add to the literature by showing individuals largely support curbside recycling becomes a standard public service provided by municipal governments and provides evidence that whether an individual views curbside recycling as a public service is a significant predictor in willingness to pay for curbside recycling. Future research on recycling in municipalities should make an effort to continue evaluating the relationship between recycling programs and other public services. Given the homogenous nature of rural Iowa it would be beneficial to have this study repeated in a more populous community that has more diverse residents in order to further establish the relationship between support of curbside recycling as a public service and increased maximum willingness to pay for curbside recycling.

The President Trump's war on the Environmental Protection Agency does not indicate any federal policy will be established in order to handle the problems created by the Green Fence, therefore the responsibility of dealing with America's waste lays with those closest to it, municipal governments. In addition to adding to the academic literature, the work of this research is can help inform public managers as they deal with the increasing problems of municipal waste and recycling.

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## APPENDIX A. SURVEY: WILLINGNESS TO PAY FOR MUNICIPAL RECYCLING SERVICES IN TIPTON, IOWA

The following are the questions presented to respondents on the Qualtrics survey.

### Page 1: Informed Consent to Participate

**Title of Study:** Willingness to Pay for Municipal Recycling Services in Tipton, Iowa

**Investigators:** Miranda Wehde, Principal Investigator; Dr. Yu Wang, Faculty Supervisor

This page describes a research project, it has information to help you decide whether or not you wish to participate.

#### Introduction

The aim of this study is to examine attitudes toward recycling and the willingness to pay for curbside recycling services in the community of Tipton, Iowa.

**This study is NOT being conducted by the City of Tipton.**

You should not participate in this study if you do not live within the city limits of Tipton, Iowa or you are under the age of 18.

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#### Description of Procedures

If you agree to participate, you will be asked to fill out a short survey about your willingness to pay for curbside recycling and your attitudes toward recycling followed by a few demographic questions. The survey should take no longer than 15 minutes to complete.

There are no risks associated with the participation in this study. Participants will not incur any costs by participating in this study and will not be compensated. It is hoped that the information gained in this study will benefit society by contributing to the better understanding of attitudes and knowledge of recycling and willingness to pay for curbside recycling services which can be used to create more effective municipal recycling policy .

Survey participants will not be identified and will remain anonymous; no identifying information will be collected (i.e. names or addresses).

## Page 1: Informed Consent to Participate Continued

### Participant Rights

Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. During the interview, you may skip any questions that you do not wish to answer.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, [IRB@iastate.edu](mailto:IRB@iastate.edu), or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

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### Questions

You are encouraged to ask questions at any time during this study. For further information *about the study*, contact Miranda Wehde ([mwehde@iastate.edu](mailto:mwehde@iastate.edu)).

### Consent and Authorization

By selecting 'Agree' you are indicating you are over the age of 18 and that you voluntarily agree to participate in this study.

## Page 2: Residence

Are you a resident of Tipton, Iowa?

### Page 3: Current Recycling Behaviors

Does your household receive curbside trash and recycling services provided by the City of Tipton or another private business?

What size of garbage bin does your household currently use?

Does your household utilize the curbside recycling service?

Are you currently satisfied with the recycling services provided in Tipton, Iowa?



## Page 4: Cheap - Talk

At this point you are going to be asked about your household's willingness to pay for curbside recycling service. Recent market changes have resulted in increased costs associated with municipal curbside recycling programs, with some communities left to decide if they want to continue their curbside recycling programs.

In this **HYPOTHETICAL** situation you would need to pay to continue your curbside recycling service, if you choose not to pay you would no longer have curbside recycling service. The curbside program would be the exact same as what is already offered in your community, it would accept the same materials as are already accepted and exclude the same materials, like glass.

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As you read the following curbside recycling fees, please keep in mind some of the current monthly municipal fees you pay and imagine your household is **ACTUALLY** paying the curbside recycling fees in addition to what you already pay.

Garbage Service:

35-gallon - \$18.25/month

64-gallon - \$22.25/month

Extra Items - \$15/item



## Page 5: SBDC – one of the possible options

Would you be willing to pay \$2.00 per month for curbside recycling in addition to your current monthly garbage fee?

Yes

No



**Page 6: Stated Preference Maximum Willingness to Pay**

What is the MOST you would be willing to pay per month for curbside recycling?

Amount in Dollars (\$)  
0      5      10      15      20      25      30      35      40      45      50

Click to write Choice 1

>>

**Page 7: Confidence**

On a scale from 0 to 100 percent, how certain are you of the answer to the previous questions with 0 meaning completely uncertain and 100 percent meaning completely certain?

0      10      20      30      40      50      60      70      80      90      100

Confidence in Response

>>



## Page 8: Recycling as a Public Service

Which would most encourage your household to recycle?

Ethical duty to help the environment

Saving money -- For example returning beverage containers for the deposit

Other

Municipalities provide many public services to residents; a few examples would be water, sewer, garbage and street cleaning services. Do you think recycling should be considered a public service that is provided by municipal government?

Yes

No

Below are some public services provided by municipalities, please list them in order of importance, 1 being most important and 7 being least important.

Water

Storm Water Runoff

Recycling Service

Street Cleaning

Parks

Sewer

Garbage Service



**Page 9: Recycling Knowledge**

Which of the following items can be recycled? Please select all items that can be recycled regardless if they are accepted by your curbside recycling program.

Paper towels

A styrofoam cup

A plastic grocery sack

A cardboard box

An aluminum can

Textiles -- i.e. Clothing

A can of soda

A pizza box

A plastic water bottle

Colored construction paper

Food Waste

A newspaper

A flyer printed on white paper

A glass jelly jar

**Page 9: Recycling Knowledge Continued**

Do you wash containers before placing them in the recycling?

Do you ever place garbage in the recycling?

Please fill in the blank.

If you are unsure if an item is recyclable you should put it in the \_\_\_\_\_.



**Page 10: Demographics**

What is your gender?

 Male Female Prefer not to answer

What is your age?

 18-24 25-34 35-44 45-54 55-64 65+ Prefer not to answer

What is your ethnicity?

 White or Caucasian Hispanic or Latino Black or African American Native Alaskan or American Indian Asian/Pacific Islander Prefer not to answer Click to write Choice 7

**Page 10: Demographics Continued**

What is the highest degree or level of school you have complete?

Some high school, no diploma

High school graduate, diploma or the equivalent (for example: GED)

Some college credit, no degree

Trade/technical/vocational training

Associates degree

Bachelor's degree

Master's degree

Professional degree

Doctorate degree

Prefer not to answer

What is your current employment status?

Employed for wages

Self-employed

Out of work and looking for work

Out of work but not currently looking for work

Homemaker

Student

Military

Retired

Unable to work

Prefer not to answer

**Page 10: Demographics Continued**

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How many other adults over the age of 18 currently live in your home?

How many children under the age of 18 currently live in your home?

**Page 11: Thank You**

We thank you for your time spent taking this survey.  
Your response has been recorded.

## APPENDIX B. IRB APPROVAL FORM

IOWA STATE UNIVERSITY  
OF SCIENCE AND TECHNOLOGY

Institutional Review Board  
Office for Responsible Research  
Vice President for Research  
2420 Lincoln Way, Suite 202  
Ames, Iowa 50014  
515 294-4566

**Date:** 12/22/2016  
**To:** Miranda Wehde  
506C Ross Hall  
**CC:** Dr. Yu Wang  
545 Ross  
**From:** Office for Responsible Research  
**Title:** Willingness to Pay for Municipal Recycling Services in Tipton, Iowa  
**IRB ID:** 16-601  
**Study Review Date:** 12/22/2016

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

**Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form.** A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.