Going Green – With Envy or Education?

1. **Executive Summary**
2. **Introduction**

We are living in a world where life expectancy of humans has increased steadily over the years at 1.09% per year and currently is around 7.6 billion. Addition of every single human being to the planet adds significant waste over his or her lifetime and in New York alone, an entire Empire Sate building can be filled with just one day of trash collection. With the steady increase in population and the prevalence of certain societal factors like increase in wealth leading to more buying, development of new packaging and technical products that are not biodegradable and life style changes over reliance of fast food consumption all leading to more and more waste being created in the world.

By 2100[[1]](#footnote-1), the increasing global urban population will be producing three times as much waste at it does today. If the world keeps up with the current urbanization and population growth rate, the global waste generation is estimated to rise to 2.2 billion tones by 2025[[2]](#footnote-2). All this waste being produced has been having a grave and negative impact on the environment.

* Generation of harmful chemicals and green house gases from landfill sites.
* Effects of deforestation to habitat destruction and global warming.
* Larger amounts of energy required to build new products from raw materials

1. **Why Recycling**

According to United States Environmental Protecting Agency (EPA), “*Recycle is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products*”. According to 2016 Recycling Information Report[[3]](#footnote-3), it was estimated that in 2007, activities related to recycling in US contributed to 757,000 jobs (.52% of all jobs in US economy), $36.6 billion in wages (.62% of total wages paid) and $6.7 billion in tax revenue (.90 % of total tax revenue). Along with the economy benefits of recycling its positive impact on the natural environment is even far greater including

* Waste reduction that is being sent to landfills.
* Conservation of natural resources like wood, water and minerals.
* Pollution reduction by reducing the need for the creation of new raw materials.
* Savings in energy consumption by reusing existing products to building new products.

1. **Social Comparison Theory**

Annually, Americans generate 258 M tons of municipal solid waste (MSW)[[4]](#footnote-4) and 35% of MSW is recycled while 13% is combusted for energy production. Compare to other part of the world, Germany ranks #1 on the list of countries with the highest recycling rate with 65% of its waste being recycled.

Our research is predicated on evaluating social comparison[[5]](#footnote-5) theory to drive positive change for the environment. Social comparison theory is predicated on the belief that there is an intrinsic drive with in each individual to gain accurate self-evaluations.

1. **Experiment Design**

The field experiment in this study examine whether the type of communication (flyer) will increase recycling behavior. The communication including about the benefits

of recycling to the environment, what can be recycled and how to do it. It also includes social

comparison - how their recycling habits compare to their neighbors. The treatment group will get a flyer of this information while the control group receives no additional information.

**Target Population**

For this project, we chose single family houses as our subjects. If the recycling rate is already high, it would be difficult to detect treatment effect, or the treatment will not have any effect. Thus, we need to choose neighborhoods with relatively low recycling rates. After initial evaluation of four different neighborhoods or states the team members live, we decided to conduct the experiment in one county– Montgomery County in Rockville, MD.

Currently the recycling rate in Montgomery County is 61%[[6]](#footnote-6) (waste diversion rate = recycled material weight divided by (trash + recycle) weight). We pick two routes which have 154 and 331 houses respectively. However, we didn’t include all these houses in our random assignment but only those who didn’t use recycle bin during the period when we collect the pre-treatment data. Then we randomly assign these subjects (186 households) into treatment group and control group.

**Outcome Measures**

Ideally, we want to measure recycling rate using the same definition as the dept. of environmental protection (DEP) Division of Solid Waste Services of the county. But it’s difficult for us to collect data of the amount of recycling materials (by weight). Instead, we measure participation rate: 1/0 indicator for whether a household made materials available for

recycle pick-up on the day of collection each week

**Covariates**

The variable we control is whether the households use recycle bin before the treatment. If they use, we will not include them in our further analysis and experiment as we cannot increase their participation rate any more.

Further, we didn’t collect data (both pre-treatment and post treatment) during spring break or the week with snow storm.

**Experiment Duration**

The recycling garbage is collected weekly. We collected data for one week prior to the launch of the experiment, then sent out the flyer and measured one week after the flyer was

delivered.

**Treatment Details**

The flyer includes benefits of recycling to the environment, and how you can recycle in Montgomery county through pictures on the front page. It has social comparison data on the back, encouraging the treated neighborhood to recycle more to achieve the average recycling rate of the county and meet the county’s goal. Please see the flyer [here](https://github.com/CynthiaHu/w241experiment/blob/master/flyer/Mailed/IMG_20180321_165607.jpg).

As recycling rules vary by county or state, we used the information from the county’s website[[7]](#footnote-7) and integrate all the information into the flyer with one style.

We define that household is treated if the household gets the flyer and read it. To increase the compliance rate, we use postcard instead of putting the flyer inside an envelope. It’s easier for people to see the information. To monitor whether and when the treatment group get the postcard, we also add one of our team member who lives in the same county in the mailing list.

**Randomization engineering**

Since neighbors may talk to each other (and observe each others’ actions) - it is possible that

there might be some spill-over if we assign houses in a neighborhood to different

treatment conditions. Therefore, we conducted random assignment at street level - an entire street gets the same treatment condition. There are 25 streets in our sample, and we randomly assigned 13 of them to treatment group which has 102 households.

After collecting pre-treatment data for all 485 households in the 2 routes we picked, we filtered out households already participating in recycling program. Then we have 186 households left for random assignment. We import the list of 186 households into R, set seed and randomized at street level.

d <- read.csv("Recycling\_Subjects.csv", header = T)

# clustering randomization at street level

set.seed(1234)

cluster.id <- unique(d$Street)

treat.street.ids <- factor(sample(cluster.id,13))

d$Assigned <- d$Street %in% treat.street.ids

describe(d$Assigned)

# save the assignment to csv file

write.csv(d, "Recycling\_Assigned.csv")

**Power Calculation**

1. **Results**
2. **Challenge and Limitations**

1. http://www.worldbank.org/en/news/feature/2013/10/30/global-waste-on-pace-to-triple [↑](#footnote-ref-1)
2. http://www.globalwastemanagementconference.com/ [↑](#footnote-ref-2)
3. https://www.epa.gov/sites/production/files/2017-05/documents/final\_2016\_rei\_report.pdf [↑](#footnote-ref-3)
4. https://www.infrastructurereportcard.org/cat-item/solid-waste/ [↑](#footnote-ref-4)
5. https://www.psychologytoday.com/us/basics/social-comparison-theory [↑](#footnote-ref-5)
6. https://www.montgomerycountymd.gov/sws/programs/recycling-rate.html [↑](#footnote-ref-6)
7. https://www.montgomerycountymd.gov/sws/ [↑](#footnote-ref-7)