The Effect Being In A Group Has On Putting Shopping Carts Away

I. Introduction

Have you ever gone shopping and seen carts rolling around freely? Have you seen them hitting into cars, taking up full parking spots, or causing kids to get hurt? One would expect that the simple action of putting a cart away into the right place would not be difficult to follow, but from my own experiences and the experiences of friends and family members, it does not appear to be true.

There is a long list of what loose shopping carts can cause, but the most prominent ones are the damages they cause for cars, and the more serious issue, the injuries they can inflict on children. First, even a shopping cart brushing the side of your car can cause a scratch, but "if a metal part of your car was actually pushed into the cart, then it has been damaged beyond repair and will need to be replaced".

The financial damage a shopping cart can cause is enough to be frustrated by people who are not putting their carts away, but the second issue is even worse. According to the American Academy of Pediatrics, "about 23,000 U.S. children are treated in emergency rooms for shopping cart-related injuries each year". Granted, not all of these injuries are caused by shopping carts that have not been put away, but many of them are due to shopping carts being left out. Putting carts away "will keep children away from the moving parts of the cart and also prevent someone from using it as a playground".

In short, these are problems all stemming from a person's decision to not follow a simple rule; putting their shopping carts away. The importance of this issue is undeniable, leading me to want to figure out what might cause people to leave their carts out instead of putting them away.

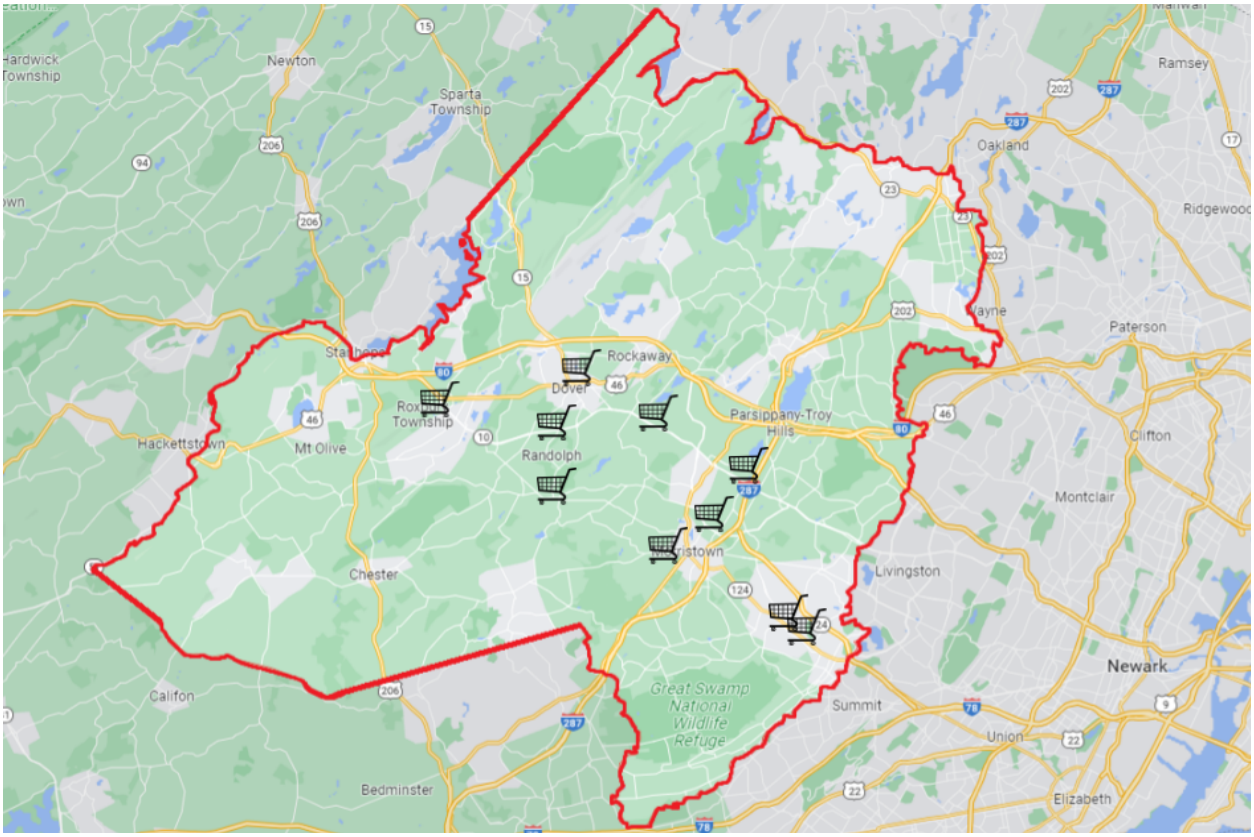
II. Statistical Question: For people shopping in Morris County, NJ in clear weather, is the proportion of shoppers alone that put their cart away different from the proportion of shoppers in groups of two or more that put their cart away?

Hypotheses	Definitions
H_0: $p_g - p_i = 0$	p_g: the true proportion of shopping carts put away by a group shopping in Morris County, NJ in clear weather
H_a: $p_g - p_i \neq 0$	p_i: the true proportion of shopping carts put away by an individual shopping in Morris County, NJ in clear weather

III. Data Collection Procedure

This is an observational study, in which I collected data by going to various supermarkets and taking note of who was putting shopping carts away and whether they were in a group or were alone. In order to have as unbiased results as possible, I had to randomly select the supermarket and time, and I had to limit some factors such as weather.

I randomly selected the supermarket and date to get a more representative sample and prevent sample bias. Going to a Walmart on a Monday morning will have different shoppers than a Shoprite has on a Saturday in the evening. I began the process of random selection by selecting the supermarkets. I selected the supermarkets I would go to via a simple random sample, in which I randomly selected ten supermarkets out of all supermarkets in Morris County, NJ. These are the locations that I randomly selected;



690 Millbrook Ave, Randolph, NJ, 437 US-46 East, Rockaway Township, NJ, 3056 NJ-10 W, Denville, NJ, 222 Main St, Madison, NJ, 133 Main St, Madison, NJ, 110 Washington St, Morristown, NJ, 146 Center Grove Rd, Randolph, NJ, 34 Sylvan Way, Parsippany-Troy Hills, NJ, 461 NJ-10, Ledgewood, NJ, and 178 E Hanover Ave, Morristown, NJ.

Next I randomly selected the dates I would be going to the supermarkets. However, the dates I chose were heavily impacted by weather. After researching weather's effects on a person's personality, I found out that "[i]n comfortably warm weather, we are more likely to go outside, where we encounter other people and engage in a wider range of activities. But in cold or very hot weather, we tend to stay indoors, where our social interactions and activities are more limited". This impacts this study because if the weather is too hot or cold, people will want to get inside as soon as possible, meaning they have a higher chance of leaving their cart somewhere more convenient, like in the middle of the parking lot, so they can get back into the comfort of their vehicle/shelter. So, with this knowledge, I decided to only go out to the selected supermarkets in temperatures from 33 to 84 degrees fahrenheit. I chose these temperatures

because in a YouGov study, these temperatures were the average temperatures deemed too hot and too cold in the Northeast. This limited my ability to choose an exact day to go to a supermarket, because if I had chosen a day in advance and it turns out that day was under or above a limit, I would not be able to go because it would contradict my data on weather. Thus, I decided to pair days of the week and supermarkets instead of exact dates. To do this, I first randomly selected ten numbers, with replacement, of a sample of seven to represent the days I would go. Then, I randomly selected a supermarket, without replacement, and paired it to a day of the week corresponding to the order they were randomly selected. Once I finished this, I knew when and where I would be going to collect my data.

Now that I knew where to go and when, all I had to do was wait for the days to come. The process I went through was first waiting for a day, for example Tuesday, and then after I made sure that that day met the weather requirements I would drive to whichever supermarkets I had to go that day, for example Shoprite. At the supermarkets, I observed shoppers and noted down who put their carts away and if they were a group or not. I did not observe the shoppers for a set amount of time nor did I randomize the time of day in which I observed them. I defined individual shoppers as those that were completely alone, and I defined groups of shoppers as those that had two or more people. Even if an individual or group had two or more shopping carts, I would write put away if the majority of carts were put away and not put away if the majority of carts were not put away.

Data Display

Raw Data:

Madison, Whole Foods	Cart Put Away	Not Put Away
Group	5	2
Individual	13	10
Extra Notes	*9:00 - 10:40*	*Not many groups*

Denville, Trader Joe's	Cart Put Away	Not Put Away
Group	6	1
Individual	11	1
Extra Notes	*4:00-4:30*	

Madison, Stop & Shop	Cart Put Away	Not Put Away
Group	10	0
Individual	16	8
Extra Notes	4:00 - 5:00	

Morristown, Whole Foods	Cart Put Away	Not Put Away
Group	3	0
Individual	7	4
Extra Notes	*3:00 - 4:00*	

Randolph, Acme	Cart Put Away	Not Put Away
Group	2	0
Individual	17	1
Extra Notes	*3:00-3:45*	

Randolph, Weis Markets	Cart Put Away	Not Put Away
Group	0	0
Individual	7	5
Extra Notes	*4:00 - 5:00*	

Parsippany-Troy Hills, Wegmans	Cart Put Away	Not Put Away
Group	6	3
Individual	16	0
Extra Notes	*2:40-3:30*	*Holiday*

Ledgewood, Walmart	Cart Put Away	Not Put Away
Group	4	0
Individual	13	3
Extra Notes	*3:00-4:00*	

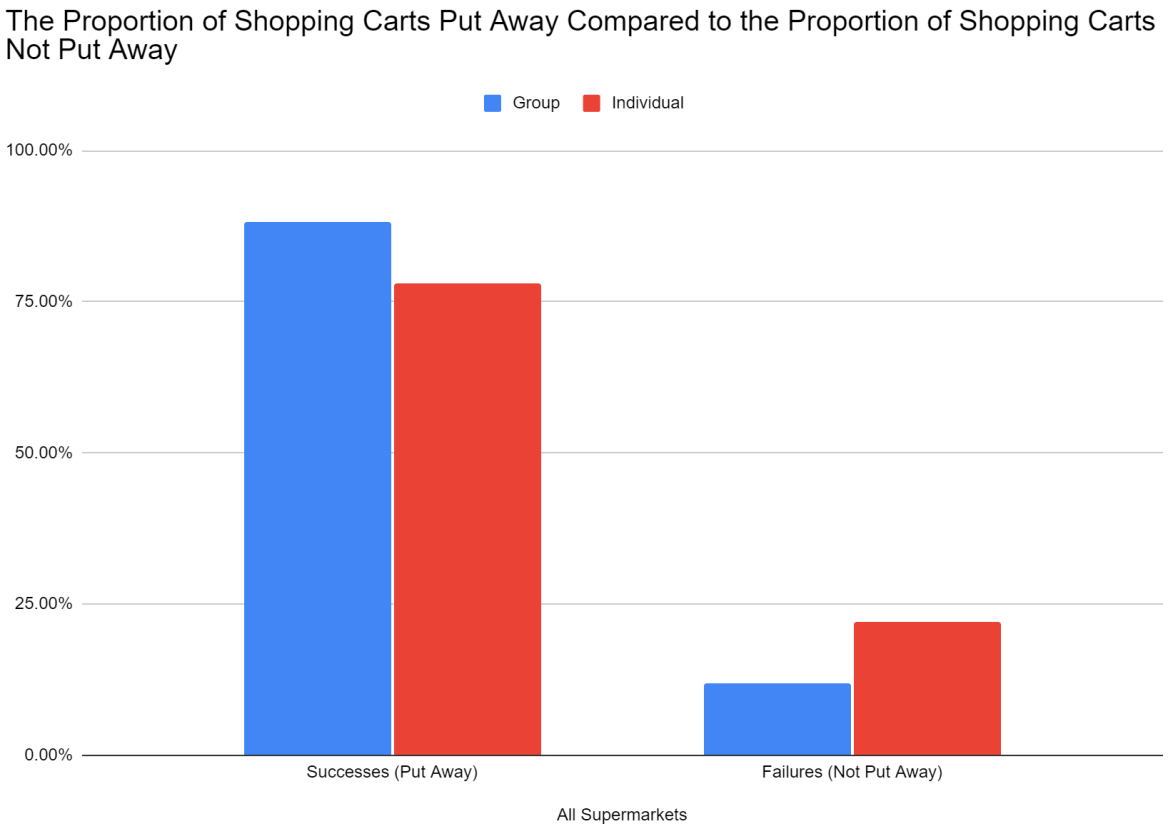
Morristown, Shoprite	Cart Put Away	Not Put Away
Group	3	0
Individual	7	1
Extra Notes	*3:30-4:30*	*Holiday*

Rockaway, Shoprite	Cart Put Away	Not Put Away
Group	6	0
Individual	14	1
Extra Notes	*4:00-5:00*	

Summary Table:

All Supermarkets	Successes (Put Away)	Failures (Not Put Away)	Total	Proportion of Successes
Group	45	6	51	0.88
Individual	121	34	155	0.78
Total	166	40	206	0.81

Graphs:



IV. Data Analysis

The table above shows that in this observational study groups put their carts away in a greater proportion (0.88) than individuals do (0.78), and that groups did not put away their carts in a smaller proportion (0.12) than individuals did (0.22).

Conditions

1. **Random:** The random condition was met by us randomly selecting the supermarkets and days we would go to them.
2. **Normal:** The large counts condition was met by gathering 5 successes, shopping carts being put away, and 5 failures, carts not being put away, for both groups and individuals.
3. **Independent:** The independent check is met because the total number of group and individual shoppers we observed is assumed to be less than 10% of the total population of group and individual shoppers shopping in Morris County, NJ in clear weather.

$$\hat{pc} = \frac{45+121}{51+155} = \frac{166}{206} = 0.81$$

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\hat{pc}(1-\hat{pc})}{n_1} + \frac{\hat{pc}(1-\hat{pc})}{n_2}}} = \frac{(0.88 - 0.78) - 0}{\sqrt{\frac{0.81(0.19)}{51} + \frac{0.81(0.19)}{155}}} = 1.579$$

$\alpha = 0.05$

p-val = 0.056

V. Conclusion

Because the p value, 0.056, is greater than the significance level of 0.05, we fail to reject the null hypothesis, meaning we do not have sufficient evidence to conclude that the true proportion of shopping carts put away by a group shopping in Morris County in clear weather is

different compared to the true proportion of shopping carts put away by an individual shopping in Morris County in clear weather.

VI. Reflection

Throughout the processes of randomly selecting, collecting data, running tests, and writing the paper, this project went quite well. In hindsight however, there are a few changes I would have liked to have made before I began the study at all. First off, I would have liked to have gathered larger samples of people. Because the data collection process was so tedious, an accumulation of the time needed to drive out to a supermarket, find a parking spot, and stay alert, it was very difficult to be patient and collect as much data for the best sample possible. Because the process was so time consuming, I also feel as if I may have missed too many shoppers because of natural constraints; I cannot see everyone at all times coming in and out of a supermarket and where they put their cart away, it is just impossible, at least the way I carried out the observational study. A really simple fix to both of these problems could be having more than one person looking around at shoppers. If five people at once were observing, it could be guaranteed that no shoppers were missed. These are the only things in my eyes that could be changed in this study.

While collecting data, I observed one thing that I thought could possibly be interesting. I noted that on holidays there may be a chance the supermarkets are more crowded. For example, Thanksgiving, or times near Thanksgiving, could mean more crowded supermarkets because of the need for Thanksgiving dishes. My data presented no evidence that this did truly have an effect on the crowds, but it is logical to say that there might be a difference between the crowds at a supermarket not on a holiday compared to a day on a holiday.

After finishing the study, there was also an interesting note I made; there is the possibility of a shopper shopping at the supermarket being observed twice. While the chances may be very slim, it is still very possible, and if it were to happen then the study would have had some form of replacement. However, because the supermarkets are not being sampled with replacement, I decided to go with the 10% rule to be conservative.

VII. Works Cited

Works Cited

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VIII. Help Received

Throughout writing this, I received help such as teaching statistical topics, support, and proofreading from my statistics teacher, Alex Lerner, and I received proofreading from the AP teacher at my high school, Ms. Meredith Kempson.