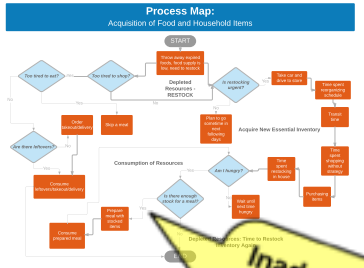
Storyboard: Reducing Weekly Spending and Excess Time

Process owner and team: Jon Kaplan

Purpose: Decrease weekly spending and excess time spent acquiring food and household items

DEFINE

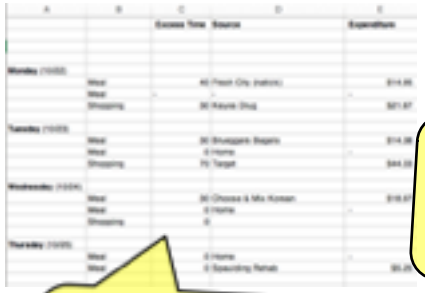
Goal:
At least ***$100*** saved in money spent a week along with ***2 hours*** saved in excess time in acquiring/consuming food and getting household items



SQL of 1.4

Impact:
- More time for other activities and more money saved

MEASURE



Output (y): daily/weekly spending and excess time

Input (X's): food and household items, source of meal, day of week

Type of Data: dollar amounts, ~~minutes~~ (continuous)

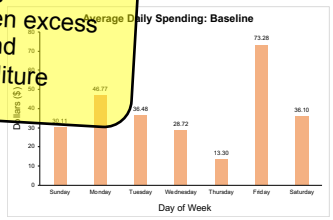
Collection: manual input spreadsheet

Sorted:
Categories (meals, snacks, shopping, excess time, thrown out food)

ANALYZE

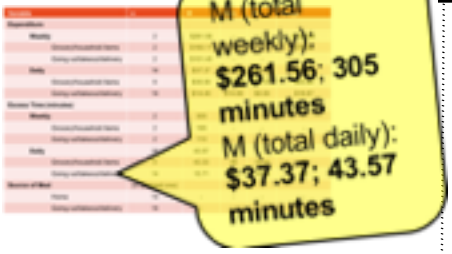
Correlation:
r = 0.79 and a **p<0.001**

Strong link between excess time and expenditure



Monday and **Friday** most problematic

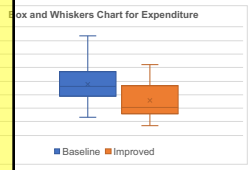
Inadequate planning; inefficient use of time; excess spending

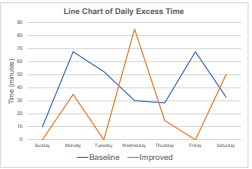


M (total weekly): **$261.56; 305 minutes**
M (total daily): **$37.37; 43.57 minutes**

IMPROVE

- Plan for **more** efficient shopping
- **Reduce** unnecessary time expenditure
- **Increase** home sourced meals





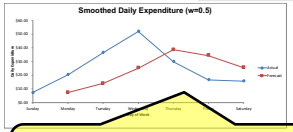
Lower excess time and spending; **more** home sourced meals

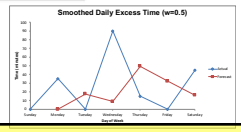
SQL of 1.5

Correlation: r = 0.60, p = 0.150
X^2 (1) = 3.52, p = 0.06
Paired t-test; t(6)=1.17, p = 0.285

Process Improved

CONTROL





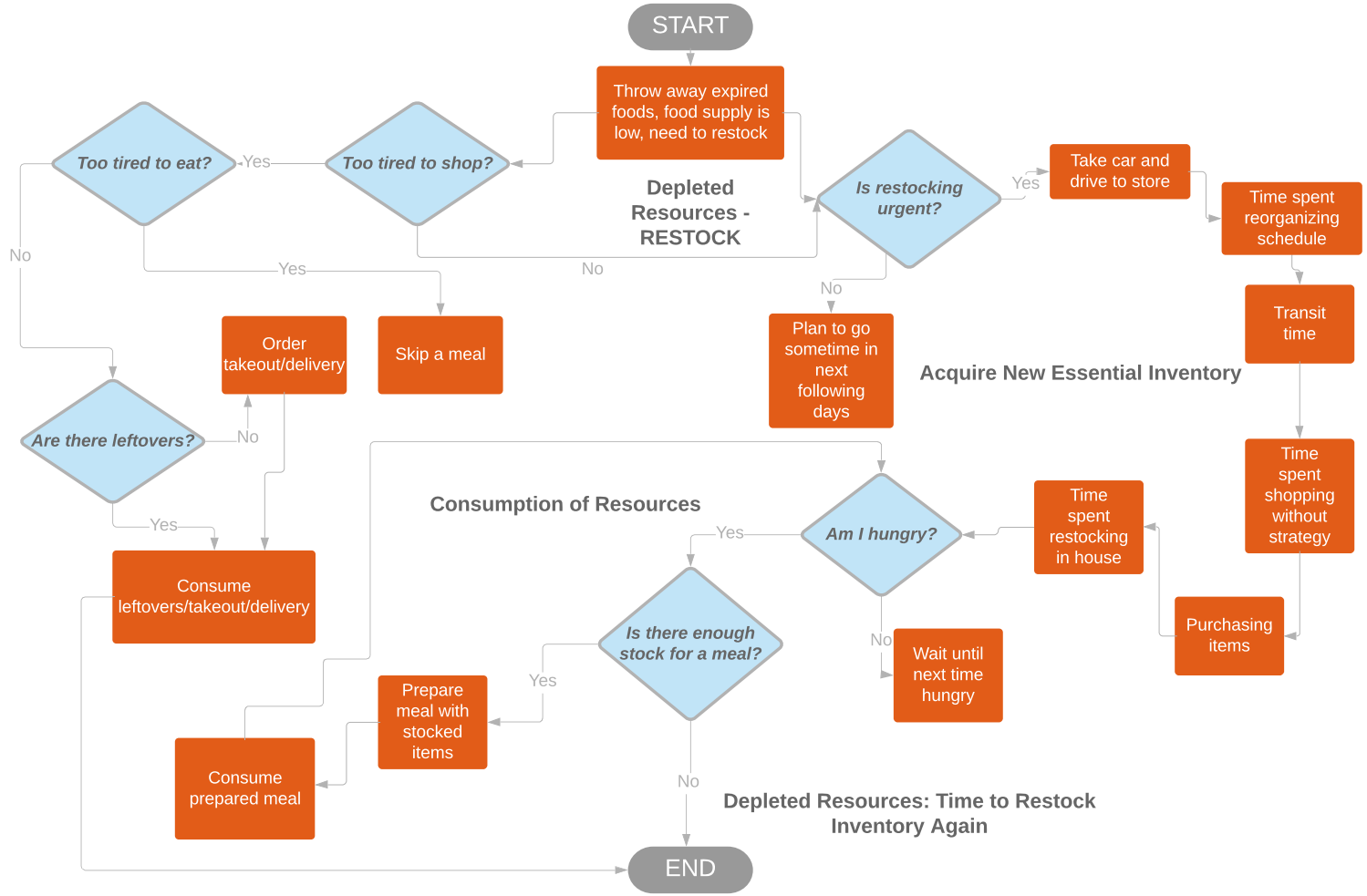
Minimize time spent grocery shopping; **continue prioritizing** home sourced meals

Summary: Weekly monetary goal was not met, but substantial improvements were made; goal for reduction in weekly excess time was met

DEFINE:

Process Map:

Acquisition of Food and Household Items



Data Measurement Plan

Performance Measure	Data Source and Location	How Will Data Be Collected	Who Will Collect Data	When Will Data Be Collected	Target Sample Size
Baseline spending	•Jon's baseline spreadsheet	•Manual data collection	•Jon	10/18 - 11/1	14 days
Baseline excess time spent	•Jon's baseline spreadsheet	•Manual data collection	•Jon	10/18 - 11/1	14 days
Baseline category of expenditure	•Jon's baseline spreadsheet	•Manual data collection	•Jon	10/18 - 11/1	14 days
Baseline location of meals consumed	•Jon's baseline spreadsheet	•Manual data collection	•Jon	10/18 - 11/1	14 days
Improvement spending	•Jon's improvement spreadsheet	•Manual data collection	•Jon	12/2 – 12/9	7 days
Improvement excess time spent	•Jon's improvement spreadsheet	•Manual data collection	•Jon	12/2 – 12/9	7 days
Improvement category of expenditure	•Jon's improvement spreadsheet	•Manual data collection	•Jon	12/2 – 12/9	7 days
Improvement location of meals consumed	•Jon's improvement spreadsheet	•Manual data collection	•Jon	12/2 – 12/9	7 days

DEFINE:
Operational Definitions

Type of data: dollar amounts, time in minutes = continuous data

Output (y) = daily/weekly spending and daily/weekly excess time

Input (x) = food and household items, source of meal, day of week

Food spending = money spent on acquiring food through takeout/delivery/groceries

- Exclusions: planned social events (family and friends)
  - *Note: Typical number of meals per day is 2

Time expenditure (excess) = time spent beyond a 30 minute period for acquiring food and household items as well as acquiring, preparing, and consuming meals

Success measure: At least ***$100*** saved in money spent a week along with ***2 hours*** saved in excess time in acquiring/consuming food and getting household items

MEASURE:
Data set and Inputs / Sample Size

Variables measured by day: category of expenditure, location of meals consumed, excess time, expenditure, food thrown out

		Excess Time	Location	Expenditure	Food Thrown Out	Notes
Monday (10/22)						
	Meal	40	Fresh City	$14.95	Threw out old berry smoothie	Kung pao with chicken and udon noodles, berry smoothie
	Meal	-	-	-	-	Skipped dinner, fell asleep because tired
	Shopping	30	Keyes Drug	$21.87	-	Lotrimin Ultra skin cream and giant mouthwash
Tuesday (10/23)						
	Meal	30	Brueggers Bagels	$14.38	Threw out chocolate chip cookie	Chicken bagel sandwich, chocolate chip cookie, chips
	Meal	0	Home	-	-	Leftovers: pumpkin ravioli and rest of chipotle chicken burrito
	Shopping	70	Target	$44.33	-	Eclipse gum, Tostitos, Mio energy (2x), la croix, applegate chicken, salad, captain crunch halloween cereal, lactaid milk
Wednesday (10/24)						
	Meal	30	Choose & Mix Korean	$18.97		Bibimap with sweet potato noodles, chicken. Dumplings
	Meal	0	Home	-	-	Made my own chicken parm sandwich, ate rest of lunch leftovers
	Shopping	0			Threw out old full salad in fridge	
Thursday (10/25)						
	Meal	0	Home	-	-	Lunch at home: made avocado toast and takeout chicken Alfredo
	Meal	0	Spaulding Rehab	$5.25	-	Dinner: slice of pizza, Mountain Dew energy drink, peanut butter crackers

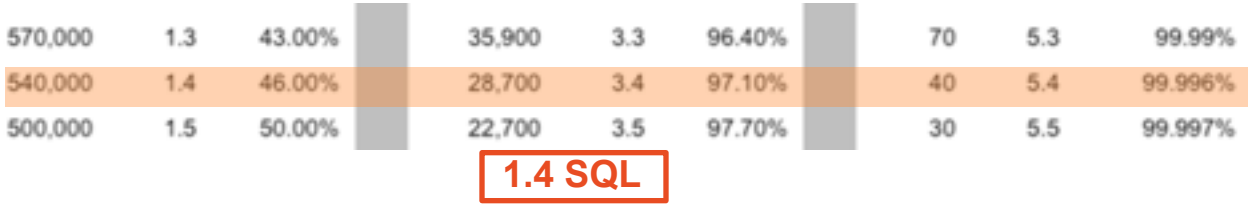
Sample Size:

- For my sample size I wanted to be 95% confident
- Using the estimated population standard deviation of 35, I applied a margin of error of 20 to calculate the estimated **sample size of 7**
- The risk of collecting a smaller sample size is sampling bias and also running into more Type I errors; you are less likely to get a true estimation of the population

MEASURE:
SQL & Measurement Error

Sigma Quality Level (SQL) = I calculated a baseline SQL in which I could later compare to see if my process improved after changes in the process:

- **D** = 3 (irresponsible spending with delivery/takeout, throwing away expired food, excess time occurrence)
- **U** = 28 (28 opportunities to eat, found by 14 days sample size * 2 meals a day)
- **D x U** = 84 (total defect opportunities 28*3)
- **A** = 47 (6 times food thrown out, 23 times irresponsible spending, 18 occurrences where excess time spent)
- **DPO** = 47/84 = .5529
- **DPMO** = 552,290 (.5529 *1,000,000)



570,000	1.3	43.00%	35,900	3.3	96.40%	70	5.3	99.99%
540,000	1.4	46.00%	28,700	3.4	97.10%	40	5.4	99.996%
500,000	1.5	50.00%	22,700	3.5	97.70%	30	5.5	99.997%

1.4 SQL

Measurement Error:

- There could be measurement error in accurate time measuring since most of it was estimation
- There was also difficulty in ascertaining grocery expenditure when there were multiple beneficiaries to the shopping occurrences (one shopping session had items for visiting girlfriend)
- The starting points for available food and household items were different for baseline and improved. As a result, it's possible that the available household items could have been different for baseline and improved phases and therefore impacted measured variables
- To minimize measurement error with excess time, one thing I would do is have a pre-baseline phase where I would accurately measure the average times for meals and grocery shopping (instead of the blanket 30 minute period for everything)

ANALYZE:
Baseline Measurement Expenses

Variable	n	M	Mdn	SD	Range
Expenditure					
Weekly	2	$261.56	-	-	$108.66
Grocery/household items	2	$160.11	-	-	$76.32
Going out/takeout/delivery	2	$101.45	-	-	
Daily	14	$37.37	$27.90	$33.79	$134.55
Grocery/household items	9	$35.58	$27.00	$21.57	$63.84
Going out/takeout/delivery	14	$14.49	$14.89	$5.59	$18.67
Excess Time (minutes)					
Weekly	2	305	-	-	-
Grocery/household items	2	195	-	-	-
Going out/takeout/delivery	2	110	-	-	-
Daily	14	43.57			
Grocery/household items	9	43.33	45	14.14	40
Going out/takeout/delivery	14	15.71	17.5	14.66	40
Source of Meal	27 (skipped one)				
Home	13	-	-	-	-
Going out/takeout/delivery	14	-	-	-	-

What does this data tell us?

- We can also see that there is more excess time associated with grocery/household item shopping compared to going out (**43.33 versus 15.71 excess minutes**)
- I noticed that I ate out more than 50% of the time for my source of meal which seems to be problematic since it has the tendency to accumulate over time

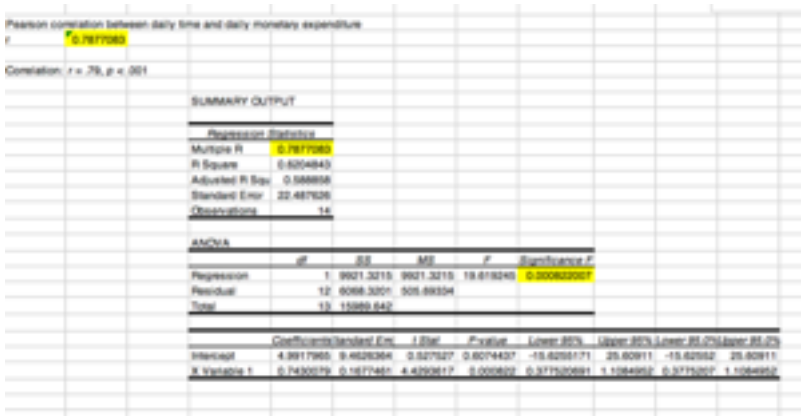
ANALYZE:
Bar Chart / Correlation

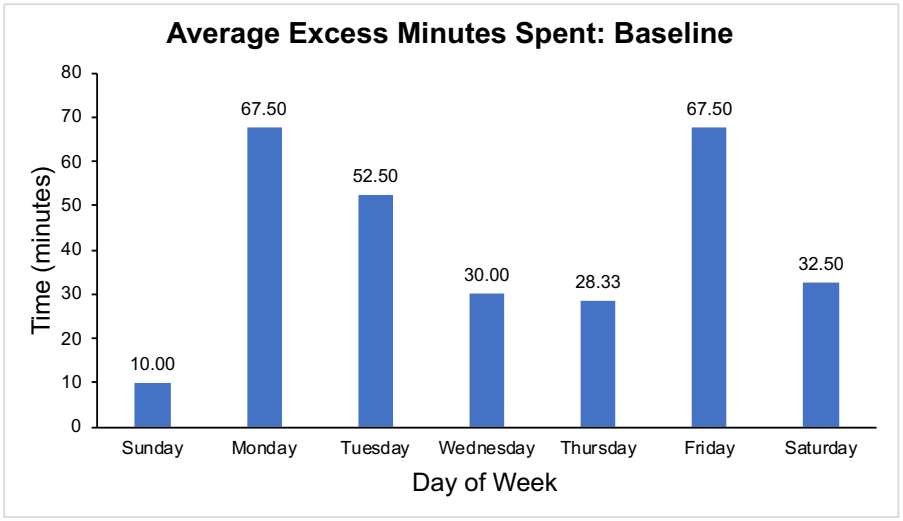
Trend:

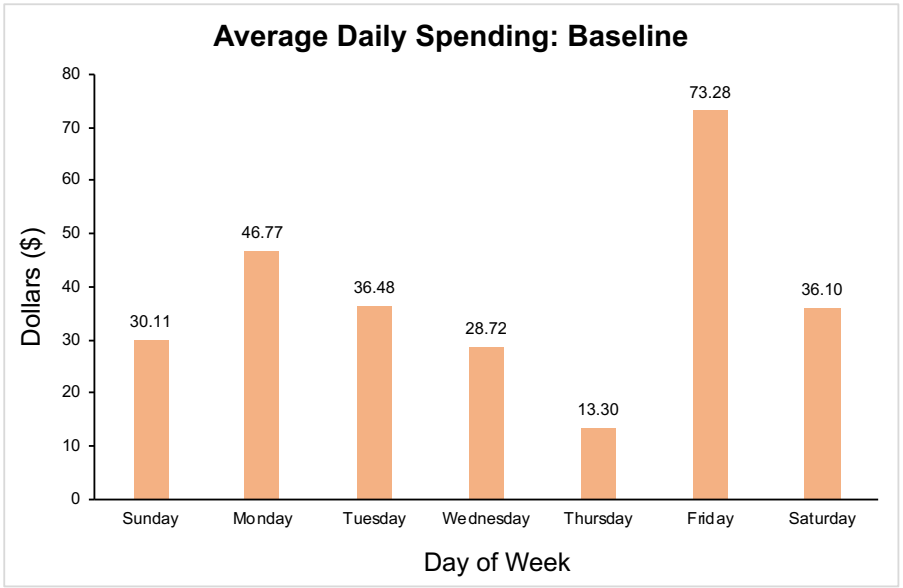
- Every few days shop until supplies run out, then shop again
- I tend to shop for next 2-3 days instead of whole week
- Spikes most noticeable on Monday and Friday

Correlation:

- Since both bar charts looked similar, I decided to run a Pearson correlation between daily excess time and daily money spent to see if there was an association between the two variables
- I got **r = 0.79** and a **p<0.001**, indicating a strong relationship between the two; therefore, the more excess time I spent, I had a tendency to spend more money as well







IMPROVE:
Pilot Process

Problematic Areas:

- There seems to be a strong link between excess time and monetary expenditure
- The peak excess time and monetary expenditure on Monday and Friday
- Too many unnecessary shopping excursions
- 14/14 days in baseline included takeout
- Highest average excess time per day was spent grocery/household items shopping
- Highest average daily expenditure was also spent on grocery/household items shopping

Plan/Proposed Solution:

- Time frame: one week, 7 days of data
- *Shop less times a week, ideally one day a week for groceries and household items* (**chose Wednesday** since typically cheapest and most fresh day (source)
- *Buy more pre-prepared meals at grocery store*
- *Be more conscious on the days when problems were identified*, especially **Monday** and **Friday**
- *Consume less takeout/delivery*
- For measurement purposes, *I decided to eat more at home*, and therefore estimated the cost for each meal at home and deducted that cost from the main grocery haul that the items came from

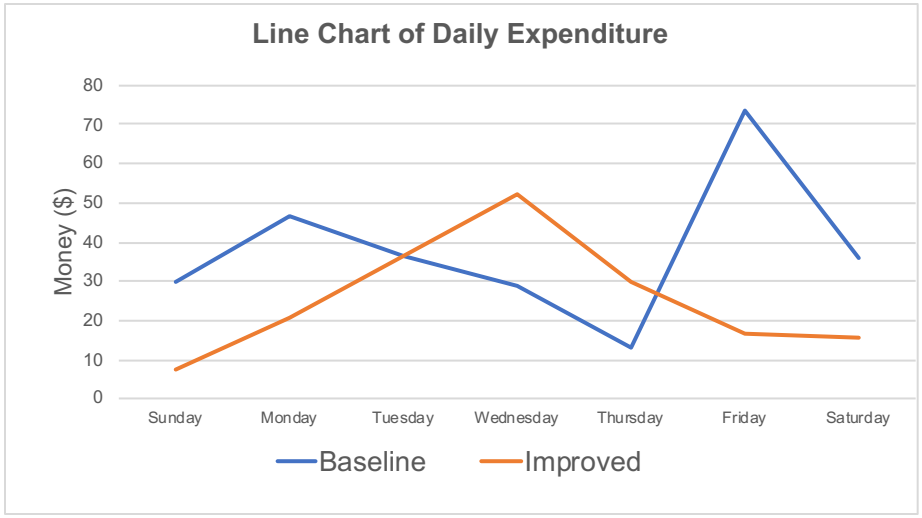
IMPROVE:
Variability and Spikes

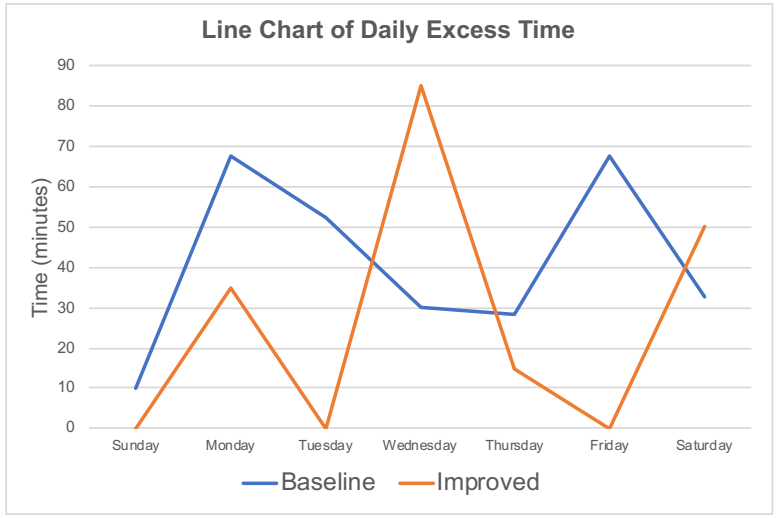
Expenditure:

- We can see that the big spikes on Monday and Friday in baseline are reduced in improved line, as the only spike is Wednesday which was the designated grocery day
- Peak on Wednesday is still not excessive relative to some of baseline peaks

Time:

- Even though the peak excess time on Wednesday in improved line is bigger than anything in baseline, we can see that this reduces overall excess time for whole week
- Outside of Wednesday, there is a tendency for excess time to be lower than baseline excess time for each day of the week





IMPROVE:
Improvement Results

Variable	n	M	Mdn	SD	Range
Expenditure					
Weekly	1	$178.82*	-	-	-
Grocery/household items	1	$116.25*	-	-	-
Going out/takeout/delivery	1	$62.57*	-	-	-
Daily	7	$25.55	$8.77	$11.43	$46.12
Grocery/household items	2	$58.13	$30.02	$23.31	$32.97
Going out/takeout/delivery	3	$20.86	$19.38	$4.61	$8.85
Excess Time (minutes)					
Weekly	1	185*	-	-	-
Grocery/household items	1	100*	-	-	-
Going out/takeout/delivery	1	35*	-	-	-
Preparing meal at home	1	50*	-	-	-
Daily	7	26.43	15	32.37	85
Grocery/household items	2	50	50	49.50	70
Going out/takeout/delivery	3	11.67	0	20.21	35
Preparing meal at home	1	50*	-	-	-
Source of Meal	14				
Home	11	-	-	-	-
Going out/takeout/delivery	3	-	-	-	-

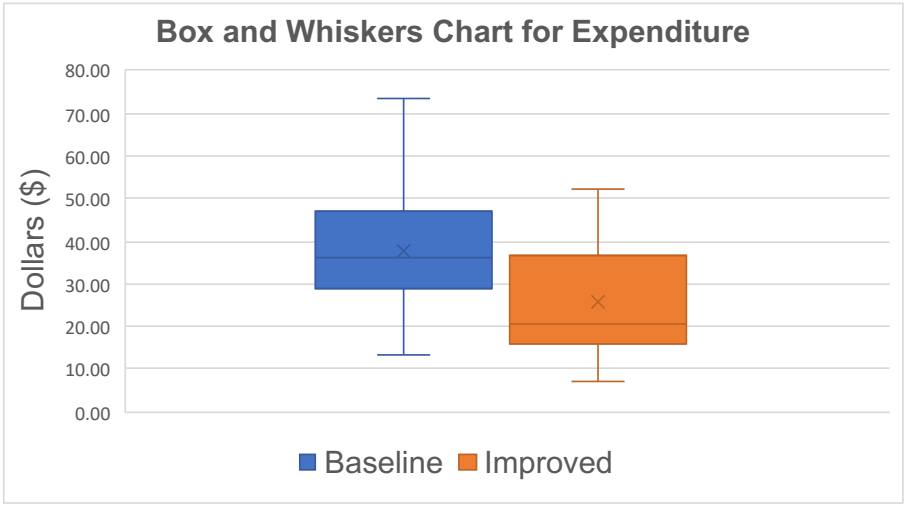
*Note: These values are not technically means because only based on one value

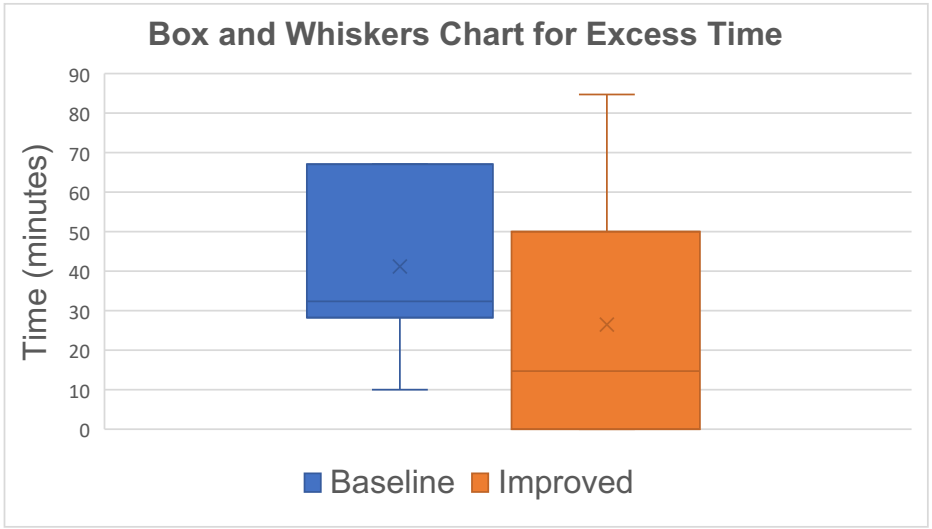
What does this data tell us?

- My weekly expenditure dropped to $178.82, just short of my $100 reduction goal which was $161.20
- My weekly excess time dropped to 185 minutes, down from 310 minutes
- As planned, the majority of my meals came from my home source

IMPROVE:
Visual Comparison of Daily Averages

- I decided to use a Box and Whiskers plot to have a better visual understanding of the mean of daily expenditure and excess time for baseline compared to improved
- My daily time expenditure dropped by 17.14 minutes
- My daily expenditure dropped from $37.37 to $25.55





IMPROVE:
New SQL & Hypothesis Test

Improvement SQL Level = Once improvement week finished, I calculated a new SQL level with the improvement week data:

- **D** = 3 (irresponsible spending with delivery/takeout, throwing away expired food, excess time occurrence)
- **U** = 14 (14 opportunities to eat, found by 7 days sample size * 2 meals a day)
- **D x U** = 42 (total defect opportunities 14*3)
- **A** = 21 (1 time food thrown out, 15 times where irresponsible spending, 5 occurrences where excess time spent)
- **DPO** = 21/42 = 0.5
- **DPMO** = 500,000 (.5 *1,000,000)

540,000	1.4	46.00%	28,700	3.4	97.10%	40	5.4	99.996%
500,000	1.5	50.00%	22,700	3.5	97.70%	30	5.5	99.997%
460,000	1.6	54.00%	17,800	3.6	98.20%	20	5.6	99.998%

1.5 SQL

SQL improved! SQL level improved from 1.4 baseline to 1.5 in improvement

Hypothesis Test

- I used a two-tailed t-test to identify differences between daily expenditure in baseline compared to improved phase
- I performed this test to help make inferences about the efficacy of the improved phase if it had to be implemented for a prolonged period of time

t-Test: Paired Two Sample for Means - average daily expenditure from baseline to improved

	Baseline	Improved
Mean	37.82285714	25.54571429
Variance	347.6254238	228.8574952
Observations	7	7
Pearson Correlation	-0.335874198	
Hypothesized Mean Diffe	0	
df	6	
t Stat	1.173666565	
P(T<=t) one-tail	0.142501616	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.285003233	
t Critical two-tail	2.446911851	

Alternate:

There is a difference in average daily expenditure between baseline and improved

Null:

There is no difference in average daily expenditure between baseline and improved

Conclusion:

- It was not statistically significant (**p=0.285**) indicating the null hypothesis is to be retained

IMPROVE:
Correlation of Baseline vs Improved

- I decided to calculate a new correlation with the improvement data and got **r = 0.60** and **p = 0.15**
- This 0.60 correlation was a clear drop from the baseline correlation of 0.79, which means excess time and excess money spent don't correspond as much after improving the process
- Improvement process has helped lower association and indicates a moving away from the trend that was found in the baseline

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.604929797
R Square	0.365940059
Adjusted R Square	0.239128071
Standard Error	13.19587981
Observations	7

r = .60, p = .15

ANOVA

	df	SS	MS	F	ignificance F
Regression	1	502.4887517	502.4887517	2.88569	0.150122
Residual	5	870.6562197	174.1312439		
Total	6	1373.144971			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	18.30030449	6.562599855	2.788575396	0.03851	1.430605	35.17	1.430605	35.17
X Variable 1	0.274150641	0.161385475	1.698731816	0.150122	-0.140704	0.689005	-0.140704	0.689005

IMPROVE:
Chi-Square Test

I conducted a Chi-Square Test of Independence to obtain a more nuanced understanding of the source of my lower weekly expenditure:

- My question was - ***do I have a tendency to eat more at home in improvement phase vs baseline?***
- To do this, I compared whether I ate more meals prepared at home at baseline vs improvement phase:

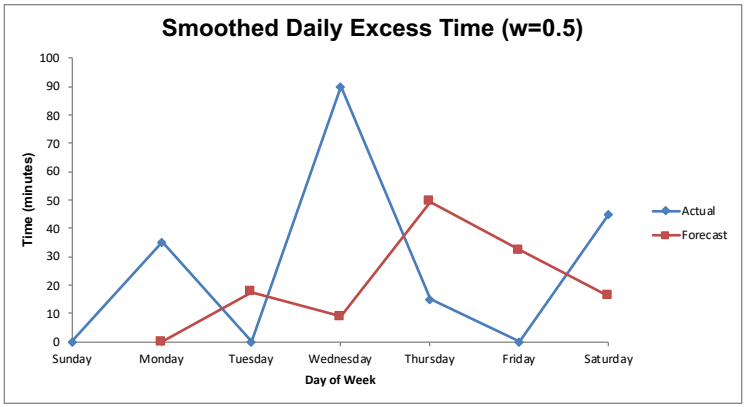
		Phase		
		Baseline	**Improved**	totals
Meal Consumption Location	**Home**	13	11	24
	Takeout	14	3	17
	totals	27	14	41
		f(Observed)	**F(Expected)**	**(f-F)2 / F**
	Home (B)	13	15.80487805	0.49777928
	Home (I)	11	8.195121951	0.9600029
	Takeout (B)	14	11.19512195	0.70274722
	Takeout (I)	3	5.804878049	1.35529822
			test statistic =	3.51582763
		Degrees of freedom = 1		
	Formula =	CHI.SQ.RT	p value =	0.06078529
Home B	0.48148148			
Home I	0.78571429			

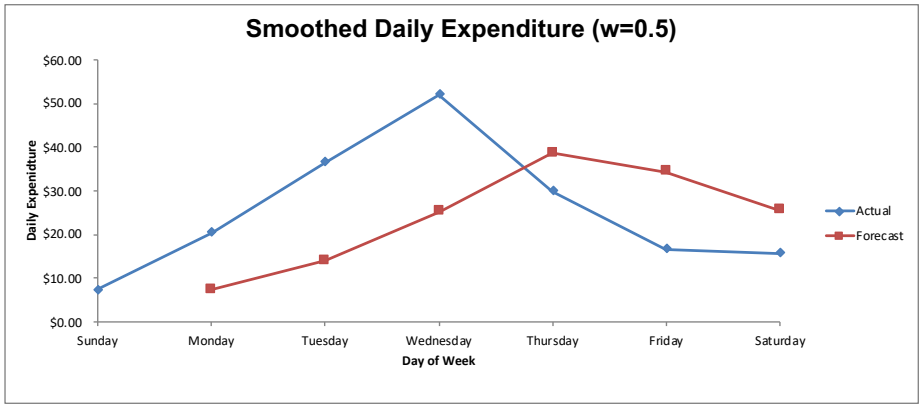
Results:

- The test did not reach statistical significance (**0.06 < 0.05**)
- However, there was an *increased tendency* for me to eat a higher proportion of meals at home during improvement compared to baseline (**79%** vs **48%** home source meals)

CONTROL:
Summary

- For my control phase, I decided to a use smoothed time series plot for excess time and daily expenditure
- These charts will help me anticipate daily future spending and excess time, and will identify reasonable ranges for daily spending/excess time that are consistent with trends identified during the improved phase





Future:

- One of the bigger trends I discovered was that if I can minimize my excess time expenditure, I can lower my spending patterns. I can use the findings of this project to carefully monitor excess time expenditure to minimize its future on spending.
- The gains identified during the improve phase are associated with an increase in home source meals. These gains can maintained over time by prioritizing home sourced meals.
- To further improve upon the gains identified in this project, I would identify specifications for excess time expenditure based on the type of event/activity rather than applying a universal quantity of 30 minutes chosen for this project.
- Although improvements were identified during this project, further reductions in expenditure might be achieved by focusing more narrowly on excess expenditure (unnecessary)