Analyzing Accessibility of SNAP-accepting Grocery Stores in Allegheny County

Managing Analytics Projects
Final Project Report

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Executive Summary

Inequitable access to basic necessities, like food, formulates a key issue of the modern socio-economic landscape. As of 2022, about 24 million households reported having issues related to food insecurity in America [1]. The Supplemental Nutrition Assistance Program (SNAP) plays a crucial role in addressing food insecurity and promoting more equitable access to basic needs. Our project aims to assess the accessibility of SNAP benefits for communities in Alleghany County that are most eligible for it. Thus, improving equity in access to the program.

We propose three key policy recommendations to ensure equitable access to SNAP benefits. Firstly, to segment based on priority levels, where highly SNAP-eligible populations with longer walk times are considered the highest priority and are catered to the policy intervention first. Within this high-priority group, the top three census tracts that require immediate focus are tracts 1610, 1306, and 5623, based on their long walk times (i.e. 10-15 minutes) and high SNAP eligibility. Finally, due to limited access to personal transportation within these areas, we believe analyzing bus routes and car ownership rates would be a key next step in allowing for an in-depth deployment of the program.

Background & Problem Framing

Food insecurity is having no or limited access to healthy foods needed for dietary needs and it is a critical social equity issue. In Allegheny County, 131,440 people were food insecure in 2020 [2]. The Supplemental Nutrition Assistance Program (SNAP) provides food assistance to low-income Americans to ensure they can meet basic food needs. Eligible people can apply for the program and receive their benefits using electronic benefit transfer (EBT) cards at grocery stores and other convenience stores. In 2020, 159,279 Allegheny County residents received SNAP benefits [3]. Fortunately, the SNAP program addresses the affordability aspect of food insecurity. However, accessibility, by way of travel time, is part of food insecurity that remains a challenge. This matters because SNAP recipients, by nature of being low-income, may have limited access to transportation and therefore would need to be able to quickly travel to grocery stores. Therefore, if travel times to SNAP-accepting grocery stores are too time-consuming, portions of SNAP recipients will be limited in their ability to take full advantage of their benefits.

This project aims to investigate ways SNAP-eligible populations can optimally access their benefits. After briefly exploring the availability of SNAP-accepting grocery stores, we noticed that while most Allegheny County grocery stores accept EBT, not all of these stores are equally accessible by travel time, especially walk time.

Hypothesis: Identifying areas with higher SNAP-eligible populations and higher average walk times to SNAP stores will help the SNAP Policy Division within the Pennsylvania Department of Human Services to better advocate for more resources for these communities.

Decision to be improved: Determining which Allegheny County communities (census tracts) are in need of more support because of transportation barriers to accessing SNAP-accepting grocery stores.

Decisionmaker: SNAP Policy Division within the Pennsylvania Department of Human Services (DHS).

Value of Improved Decision: more equitable benefit of the SNAP program for the 150,000 plus recipients in Allegheny County, especially those most disadvantaged.

Data Sources

Our project required gathering data from a variety of sources as shown in Table 1. First, we acquired data from the US Department of Agriculture (USDA) on the locations of all retailers who accept SNAP benefits (EBT cards) in Allegheny County. We also retrieved data from the Western Pennsylvania Regional Data Center (WPRDC) on the locations of all supermarkets and convenience stores in Allegheny County. Through these two datasets, we were able to filter through the data to find the grocery stores that were not listed as accepting SNAP customers. Finally, we wanted to understand the demographics of people living in Allegheny County so we utilized data from the US Census on the number of households receiving SNAP benefits and the number of individuals living at or below the poverty line.

Table 1: Data Sources

Dataset	**Source**
SNAP Retailer Location Data	USDA Food and Nutrition Services
Allegheny County Supermarkets & Convenience Stores Location Data	Western Pennsylvania Regional Data Center (WPRDC)
Number of households receiving SNAP benefits in Allegheny County	US Census table S2201
Number of individuals living at or below 185 of the poverty line in Allegheny County	US Census table S1701

While the data was sufficient for our analysis and testing our hypothesis, we did run into some potential concerns with the data. First, the data on supermarkets and convenience stores in Allegheny County is dated since it comes from 2016. It is likely that stores have closed or moved, which might make the data unreliable. One way to solve this problem is to find a different source for the data. For example, one could use a Google application programming interface to get location data of grocery stores in Allegheny County, but this option is more complex and time-intensive. Another challenge that we encountered was filtering through the data to find the stores that do not accept EBT. The filtering was challenging and time-consuming, and it eventually required external research to check the results. Despite these limitations and tradeoffs, we were still able to find important results.

Methodology

To conduct our analyses and test our hypothesis, we planned on using three different methods. First, we implemented exploratory data analysis (EDA) to better understand our data and the situation in Allegheny County. Through EDA, we visualized where stores that did not accept EBT are located and how close EBT-accepting stores were to populations with high concentrations of SNAP recipients. Overall, the EDA created visual snapshots of the relationship between these SNAP-eligible populations

and stores where they can use their EBT cards. The visualizations are not only useful for understanding the situation but for communicating the results to key stakeholders.

Second, we implemented a network analysis to determine walk times and drive times to grocery stores that accept EBT cards. The network analysis enables us to discover which areas lack access to grocery stores that accept EBT cards. To determine which areas we should concentrate on, we used data from the US Census that has a high number of residents that are eligible for SNAP. Due to the limited number of credits that students are given in ArcGIS, we narrowed the areas of concentration to census tracts with the highest number of eligible residents. From there, we were able to conduct a network analysis for drive time and walk time. We used times of 0 to 2, 2 to 3, 3 to 5, 5 to 10, and 10 to 15 minutes.

Finally, we initially planned on using clustering (specifically k-means) to uncover patterns in the data to see if there are common characteristics across grocery stores. K-means clustering would identify patterns and trends in the data and potentially provide insight into a large number of stores in Allegheny County based on whether or not they accept EBT cards. The clusters could show if there are common characteristics across stores that do not accept EBT cards, such as whether they are supermarket chains or local stores. The clustering findings could also identify areas that have low EBT card-accepting stores that we can recommend to DHS for better outreach.

Project Version One

To better understand which populations are SNAP eligible and their access to EBT-accepting stores, we performed preliminary data analysis and visualization utilizing the Western Pennsylvania Regional Data Center (WPRDC) dataset on Allegheny County Supermarkets & Convenience Stores, and the US Census Data for the number of households receiving SNAP benefits in Allegheny County. This preliminary EDA helped us identify two key themes; areas of high SNAP eligibility based on income levels and stores accepting or not accepting EBT.

The following figure identifies stores accepting EBT, as represented by the red dots, and stores not accepting EBT, as represented by the black dots. A simple cross-check between the two datasets revealed that there were about 116 out of a total of 133 stores that did not accept EBT. This was a concerning finding, especially as a majority of the non-EBT accepting stores can be seen to be concentrated in areas of high SNAP-eligible populations based on income levels. This can be seen in the figure as the darker regions represent higher SNAP eligibility based on income levels and vice versa.

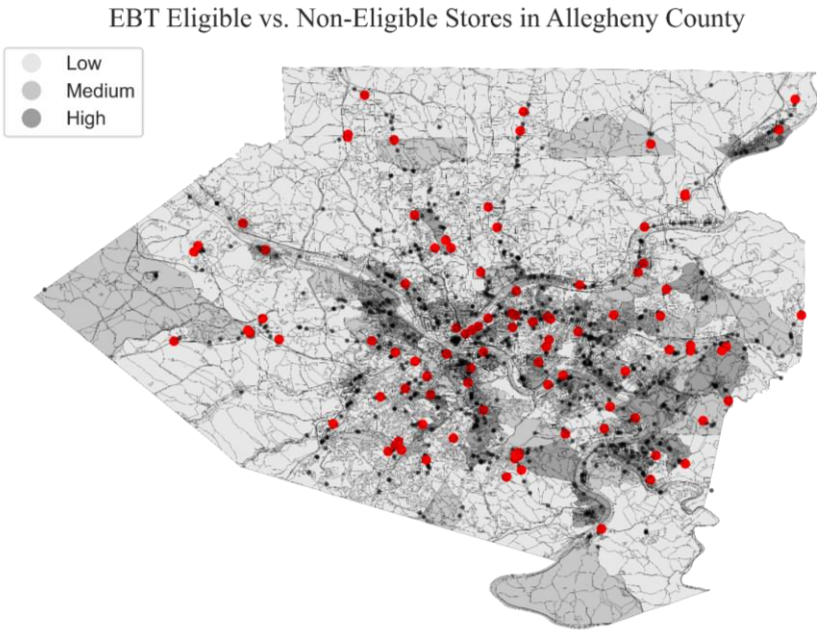

Figure 1: EBT Eligible vs Non-Eligible Stores in Alleghany County

However, further data analysis identified certain data limitations and discrepancies within the datasets utilized for the first visualization which led to inaccurate analysis and results. Re-aligning our approach, we improved our model and analysis through further research and by creating a more refined visualization. As we focus on the location of grocery stores concerning SNAP-eligible populations, an overlay of a choropleth map and a dot map was utilized.

The following figure represents this overlaid approach. Through the choropleth, we can identify areas of high SNAP eligibility, as represented by the transition of color from yellow to red. The darker (ie red) regions represent census tracts with higher densities of SNAP-eligible populations, while the lighter (ie yellow) regions represent census tracts with lower densities of SNAP-eligible populations. The census tracts are later utilized to perform network analysis. The dot map helps us identify stores that do not accept EBT cards. As we see, quite several stores not accepting EBT cards are found in regions with high SNAP-eligible populations. Therefore, through this analysis and visualization, we allow the identification of specific areas and stores for a targeted policy intervention for the introduction of SNAP benefits.

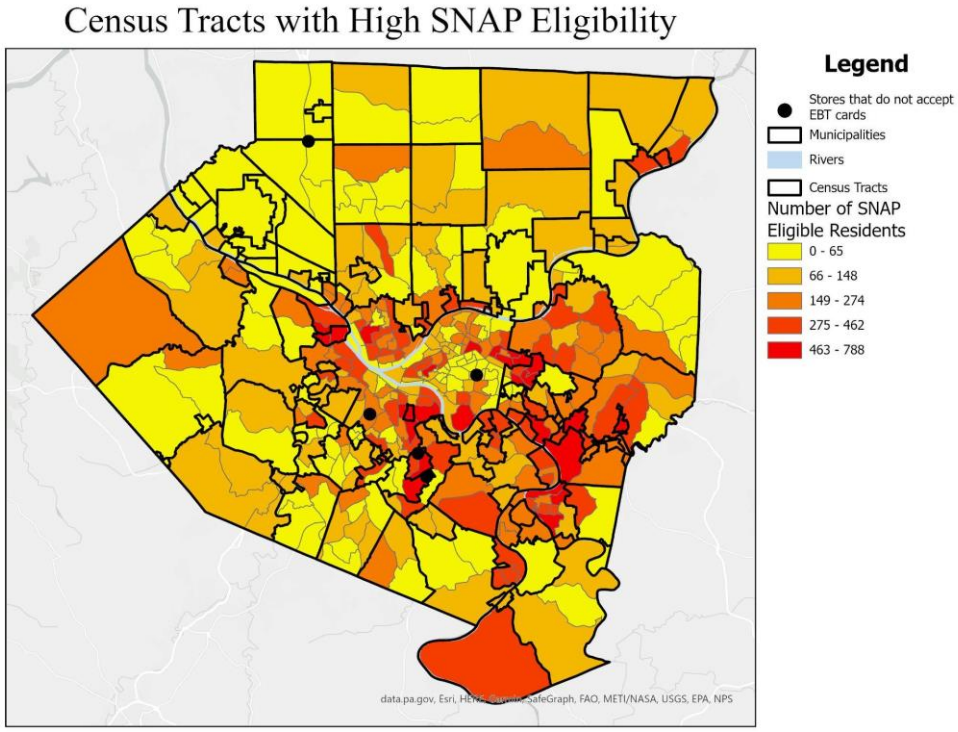

Figure 2: Census Tracts with High SNAP Eligibility

To perform the drive time analysis, we used the US Census Data for the Number of households receiving SNAP benefits in Allegheny County, SNAP Retailer Location Data, and Allegheny County Supermarkets & Convenience Stores Location Data. The number of households receiving SNAP benefits in Allegheny County, allowed us to narrow down on areas with high eligibility that would benefit best from increased outreach or resources. The SNAP Retailer Location Data allowed us to determine the location of stores that accept EBT cards. The Allegheny County Supermarkets & Convenience Stores Location Data allowed us to determine if there are stores in regions that have high eligibility and do not accept EBT cards. Once all the data was geocoded and added to the map we were able to conduct a network analysis for drive time. We found that many grocery stores do accept EBT cards within each radius. We also concluded if people also have cars driving further for a little longer would not have a big impact on the number of grocery stores people can access.

There are assumptions and limitations to our network analysis. First, all the data is at a census tract level, which is not the most granular since census tracts cover a few different neighborhoods. For the network analysis, we utilized the center of a census tract to measure drive times. Areas within the census tract could be closer to EBT-accepting stores, while others are closer to the center. These location differences mean that walk times could differ slightly within a census tract. Additionally, all drive times are averages. Depending on traffic, weather, or time of day, it could take longer to get to an EBT-accepting store.

Table A1 shows the raw numbers of how many EBT-accepting stores are within each radius of census tracts that have a high SNAP-eligible population.

Figure-3 shows the network analysis of stores within each time radius.

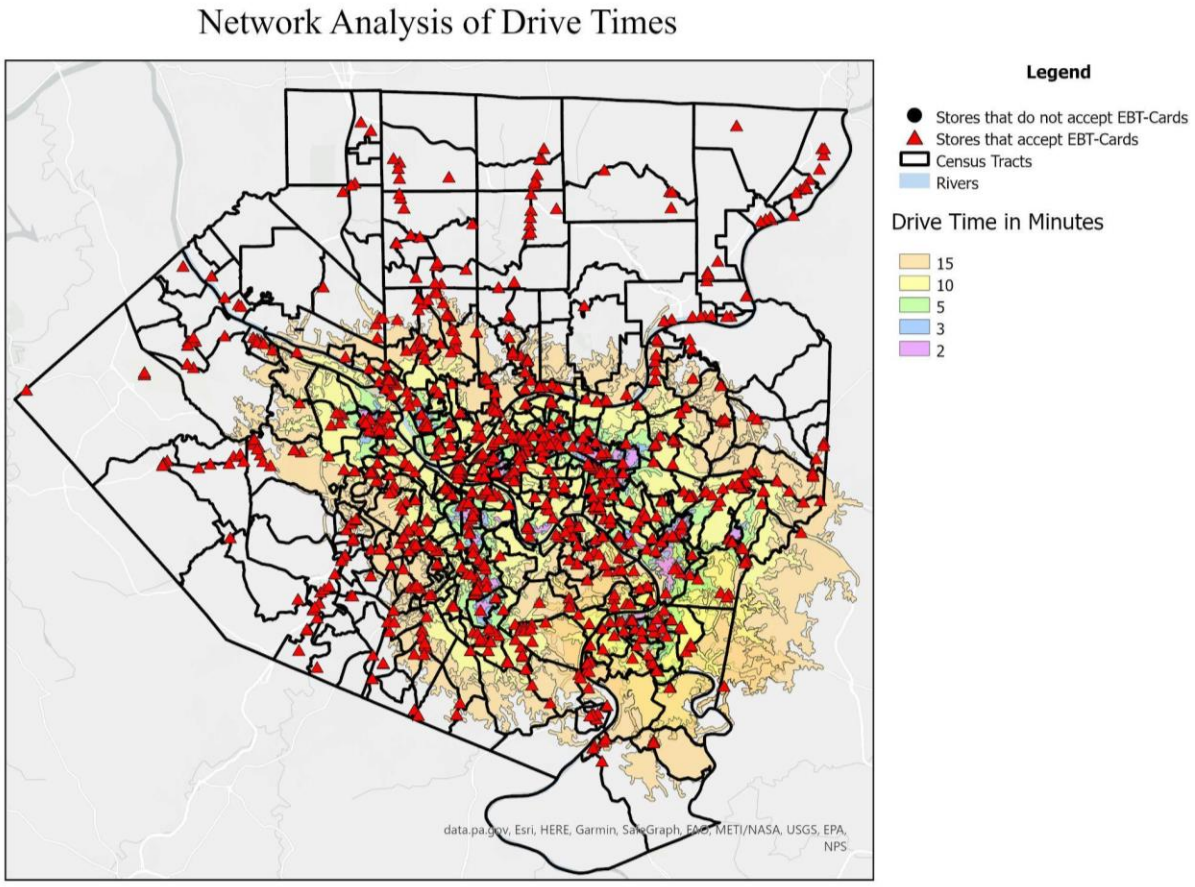

Figure 3: Network Analysis of Drive Times

Feedback & Modifications

After receiving valuable feedback on version one, we learned that we did not have sufficient and appropriate data needed to conduct a k-means clustering. Additionally, we were asked to elaborate on what resource allocation recommendations we were planning on supplying the SNAP policy division within the DHS. Finally, we were asked to adequately evaluate the process of convincing stores to accept EBT cards.

In response, we assessed our data and determined we did not have sufficient additional attributes on the stores to do a meaningful k-means clustering. Therefore, we decided not to move forward with the analysis method. Next, we changed our problem statement from identifying stores that did not accept EBT to making EBT-accepting stores more accessible by way of travel time. Further after assessing results from the network analysis in version one, the second version of this project will focus on walk time. This is because the network analysis indicated that most drive times were practical. Moreover, focusing on walk times is more appropriate given that SNAP recipients, by nature of being low-income,

may not have consistent access to motor vehicles. Therefore, version two of the project will be adding walk times to the network analysis. Lastly, to offer more actionable recommendations, we decided to provide a decision-making matrix to help stakeholders prioritize census tracts most disadvantaged in terms of walkability to SNAP-accepting grocery stores.

Project Version Two

Network Analysis

In version two, we wanted to further develop our analysis. We broke the process into two stages. The first stage was determining which methods we wanted to use and the second stage was executing the analysis. The first milestone was when we agreed to look at walk times to EBT-accepting stores. We considered how most people who qualify for SNAP benefits are under the 185-poverty line, so they may not own a car. In this version, we had all of the stores and census tracts of interest already geocoded and chosen so it was very simple to construct the walk time analysis. Similar limitations and assumptions carry over from our first network analysis. All walk times are average walking pace, so some people may be slower or quicker than the walking time. Also, the weather can definitely affect how quickly people can walk to a grocery store. From the walk time network analysis, we were able to determine which areas lack access to grocery stores that accept EBT cards and would benefit from increased resources. In terms of where stakeholders should start we narrowed it down to three census tracts. Census tracts 1610, 1306, and 5623 have very few if any grocery stores within the 15-minute walk radius.

Table A2 shows the raw numbers of how many EBT-accepting stores are within each radius of the highly eligible census tracts. From this, we can see that there are not many stores for people to walk to. Figure-4 shows the network analysis of stores within each time radius.

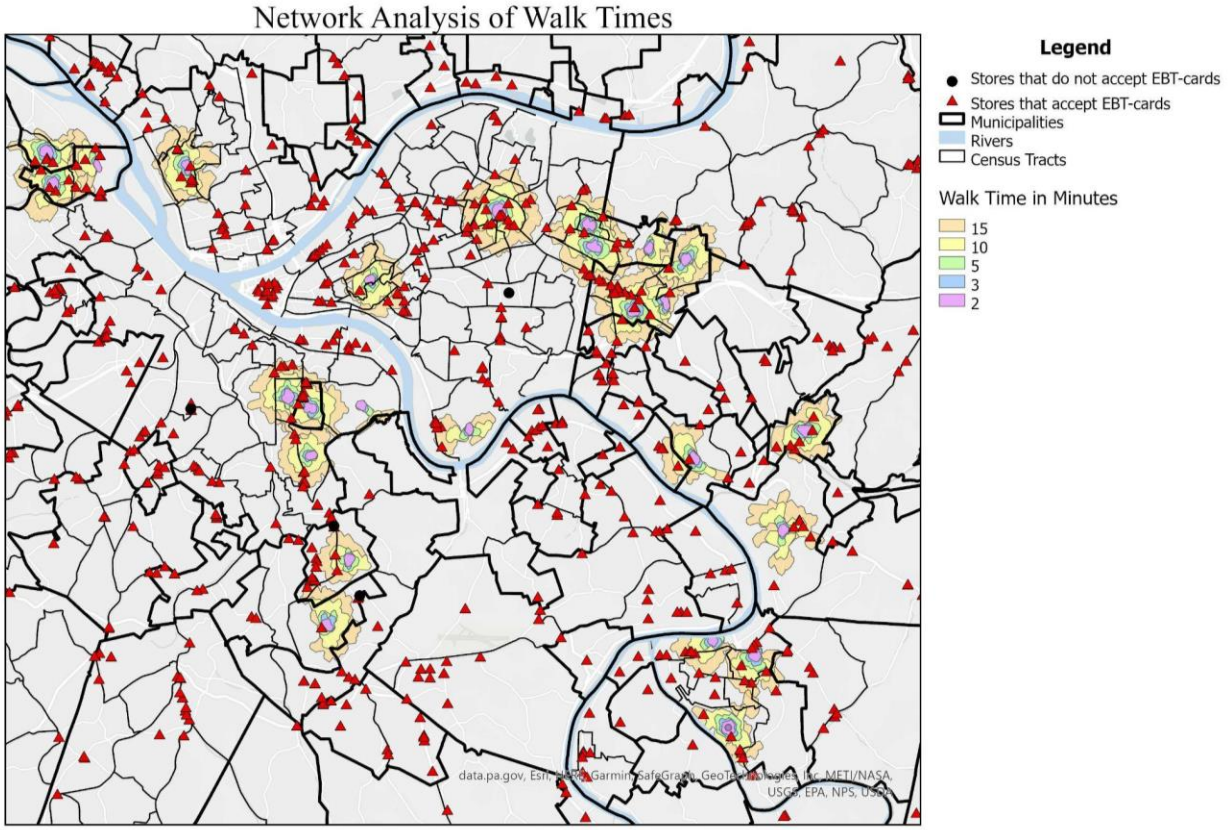

Figure 4: Network Analysis of Walk Times

Deliverables

1) A map presenting the walk time to the nearest stores that accept EBT cards. The map presents the network analysis for census tracts that we have identified as high priority based on SNAP-eligible population and walk times to the nearest store.
2) A segmentation matrix representing high, medium, and low-priority census tracts categorized by high SNAP eligibility and walk times to the nearest EBT-accepting store.
3) List of top three census tracts that we have categorized as a high priority. These include census tracts 1610, 1306, and 5623. Among all the high-priority census tracts, these three have the least number of EBT-accepting stores in a 10 to 15-minute radius and the high number of SNAP-eligible populations.

Resources

There are some data and technical requirements that stakeholders will need to implement our analysis in the future or a different context. These include the following:

1) Data on SNAP-eligible population and grocery stores in Allegheny County
2) Up-to-date data on Pittsburgh Regional Transit bus routes
3) Python for data processing and exploratory data analysis

4) ArcGIS for network analysis
5) GIS specialist
6) Data Analysts

Potential Risks, Assumptions, and Critical Success Factors

The latest data on grocery stores used for this analysis is from 2016. There might be some stores that have closed or changed locations since then and this needs to be accounted for in the analysis. A critical success factor for this project is accurate information on stores and SNAP-eligible populations to get more precise results.

Communicating Progress to Stakeholders

To keep open communication with the DHS SNAP Policy Division, we devised a communication plan to provide updates on the project. We plan on scheduling bi-weekly meetings that have two main goals for every meeting. First, we will provide updates to the DHS group on our progress, sharing any key findings from our work over the past two weeks. Second, we will discuss the challenges that we are facing and how we plan to address them. These bi-weekly meetings serve as ideal check-in times for discussing findings from the EDA, version one, and version two portions of the project. These meetings will allow our team to receive feedback so that we can adjust our project as needed.

Results & Recommendations

Given the results from the EDA and network analysis, we have three primary recommendations for the DHS SNAP Policy Division. Our first recommendation is to segment the area into four categories depending on the SNAP-eligible population and walk times. The highest priority group comprises census tracts with high numbers of SNAP recipients and census tracts with long walk times to EBT-accepting grocery stores. The medium-high priority group consists of census tracts with lower numbers of SNAP recipients but high walk times whereas medium-low priority groups are the reverse (short walk time and high number of SNAP recipients). Low priority contains census tracts with short walk times and low numbers of SNAP recipients. This segmentation approach can allow DHS to prioritize investing resources into the higher-priority groups. Moreover, DHS can reallocate resources from low-priority areas (where resources are in lower demand) to higher-priority areas.

Table 2: SNAP Accessibility Priority Levels

	Longer walk time to grocery store	**Shorter walk time to the grocery store**
a High number of SNAP recipients	High priority	Medium-low priority
Low number of SNAP recipients	Medium-high priority	Low priority

Within the high priority group, we identified three census tracts with long walk times to grocery stores (10 - 15 minutes) as well as a high snap-eligible population. These census tracts, which were discovered

to be a high priority by the network analysis, include census tracts 1610, 1306, and 5623 in the neighborhoods Arlington and St. Clair, East Hills, and Hazelwood and Homestead respectively. They all have large numbers of individuals who use SNAP benefits with East Hills having the largest count at 788. Although Arlington and St. Clair neighborhoods have a lower count of 481, the walk time is significantly higher than all other census tracts. Additionally, the 481 count is still much higher than census tracts that would be in the other priority groups. Finally, to provide further illustration of why these three tracts are important, their income per capita numbers are tremendously low. While Allegheny County's income per capita as a whole is around $42,000, these tracts range from $17,613 to $28,241.[1]

Table 3: Census Tracts Requiring the Most Attention

	Recommendation One	Recommendation Two	Recommendation Three
Census Tract	**1610**	**1306**	**5623**
Neighborhood	Arlington/St Clair	East Hills	Hazelwood/Homestead
Number of Snap Recipients	481	788	526
Average Walk Time	15 + mins	10 mins	10 mins
Percent Below Poverty Line	26%	45.9%	41.8%
Income Per Capita	$28,241	$17,613	$23,737

In addition to the walk-time network analysis, an additional next step in this analysis is to look at transportation, particularly bus routes and car ownership rates. We believe this component is important because we hypothesize that access to personal transportation (personal cars) is lower in these areas. First, we will test this hypothesis by looking at car ownership rates across the higher-priority census tracts. If our findings support this assumption, then we will further assess transportation concerns by analyzing Pittsburgh Port Authority bus routes in census tracts above low priority. The proximity of bus stops to grocery stores can provide further insight. The analysis can also investigate the average waiting time at these bus stops to get a more holistic view of the accessibility constraint. A few other key metrics in this analysis include looking at which bus routes service each census tract, how many bus stops are in each tract, how many EBT-accepting stores are along the bus routes, and average wait times for buses.

Conclusion

Our initial hypothesis suggested that there may not be enough EBT-accepting stores to support areas with high SNAP-eligible populations. Therefore we intended to identify more grocery stores to start accepting SNAP. A closer look at the data demonstrated that the hypothesis was not supported. This finding forced the team to shift the analysis to another important component of food accessibility:

[1] Information retrieved from censusreporter.org

focusing on the highest SNAP-eligible populations in census tracts with low walkability to EBT-accepting stores. We implemented a network analysis to quantify the accessibility constraint using drive time and walk time. Ultimately, we narrowed our findings to three main census tracts that require immediate attention due to their high concentration of SNAP-eligible populations and low walkability to grocery stores. Our report provides recommendations for the next steps on this important issue, including segmenting areas by SNAP population and walk times to determine priority levels and analyzing bus routes in high-priority census tracts to ensure they allow for transportation to grocery stores. Overall, this project aims to move forward the conversation on increasing equitable food accessibility across low-income populations in Allegheny County.

Appendix

Table A1

Census Tract	Number of SNAP Eligible	Neighborhood	15 drive time	10 drive time	5 drive time	3 drive time	2 drive time
1306	788	East Hills	93	46	9	0	0
4644	731	McKees Rocks	78	45	4	1	0
5041	697	McKeesport	130	65	14	2	6
5094	650	Turtle Creek	98	63	8	1	5
4626	649	McKees Rocks	80	48	11	2	5
4810	639	Mt. Oliver	172	54	9	4	7
2716	624	Marshall Shadeland	164	67	7	0	8
4782	606	Brentwood	93	38	20	1	1
5647	601	Wilkinsburg	159	63	18	7	4
1307	591	Homewood North	107	63	7	5	3
5614	581	Wilkinsburg	112	70	15	2	1
1115	577	East Liberty	115	61	14	7	12
4773	575	Whitehall	79	51	17	5	1
1308	568	Homewood	112	65	18	8	4
5512	550	McKeesport	77	57	9	9	2
2902	530	Mt. Oliver	122	47	9	4	0
4639	527	McKees Rocks	89	38	11	3	4
5220	527	Pitcairn	54	36	5	5	0
5623	526	Hazelwood/Homestead	132	25	7	2	0

5519	524	McKeesport	79	55	14	3	4
510	507	Terrace Village	160	75	7	0	1
3001	489	Knoxville	176	87	6	9	7
5615	483	Wilkinsburg	114	64	16	4	1
5130	482	North Braddock	107	53	6	2	1
1610	481	Arlington/Saint Clair	142	68	1	0	0
5524	469	Eden Park	63	32	11	5	6

Table A2

Census Tract	Number of SNAP Eligible	Neighborhood	15 walk time	10 walk time	5 walk time	3 walk time	2 walk time
1306	788	East Hills	1	0	0	0	0
4644	731	McKees Rocks	3	1	0	0	0
5041	697	McKeesport	0	4	1	0	0
5094	650	Turtle Creek	1	3	1	1	0
4626	649	McKees Rocks	3	2	1	1	1
4810	639	Mt. Oliver	3	5	4	0	0
2716	624	Marshall Shadeland	0	3	4	0	1
4782	606	Brentwood	0	2	0	0	0
5647	601	Wilkinsburg	5	7	2	0	1
1307	591	Homewood North	5	2	0	1	0
5614	581	Wilkinsburg	0	1	0	0	0
1115	577	East Liberty	6	6	5	0	4
4773	575	Whitehall	1	0	0	1	0
1308	568	Homewood	6	4	0	0	0
5512	550	McKeesport	2	3	0	0	0

2902	530	Mt. Oliver	6	2	0	0	0
4639	527	McKees Rocks	5	4	0	0	2
5220	527	Pitcairn	4	1	0	0	0
5623	526	Hazelwood/Homestead	2	0	0	0	0
5519	524	McKeesport	2	3	0	0	0
510	507	Terrace Village	3	1	0	0	0
3001	489	Knoxville	7	7	2	0	0
5615	483	Wilkinsburg	4	2	0	0	0
5130	482	North Braddock	2	1	0	1	0
1610	481	Arlington/Saint Clair	0	0	0	0	0
5524	469	Eden Park	1	0	1	0	0

References

[1] Center for American Progress. "The United States Can End Hunger and Food Insecurity for Millions of People." https://www.americanprogress.org/article/the-united-states-can-end-hunger-and-food-insecurity-for-millions-of-people/

[2] *Overall (all ages) hunger & poverty in Allegheny County, Pennsylvania: Map the meal gap*. Overall (all ages) Hunger & Poverty in the United States. (n.d.). Retrieved May 3, 2023, from https://map.feedingamerica.org/county/2020/overall/pennsylvania/county/allegheny

[3] *SNAP benefits recipients in Allegheny County, PA*. FRED. (2022, December 21). Retrieved May 3, 2023, from https://fred.stlouisfed.org/series/CBR42003PAA647NCEN