Evaluating Accessibility of Food Resources in the Miami Valley

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1. Introduction

The Foodbank Inc., in Dayton, OH, partners with over 100 aid agencies and operates direct service mobile food pantries to meet the needs of those who are food insecure in Montgomery, Preble, and Greene counties. The available operating times and locations of each agency differ, resulting in overlapping schedules as well as gaps in service. The goal of this research is to increase food accessibility. This involves understanding how far clients are willing to travel and which agencies they prefer. The Foodbank's PantryTrak database is used to analyze the zip codes of an agency's clients to better understand how clients are currently utilizing food resources. The three counties are divided into several subsections, and the locations of agencies within the counties are shown in Figure 1 below.

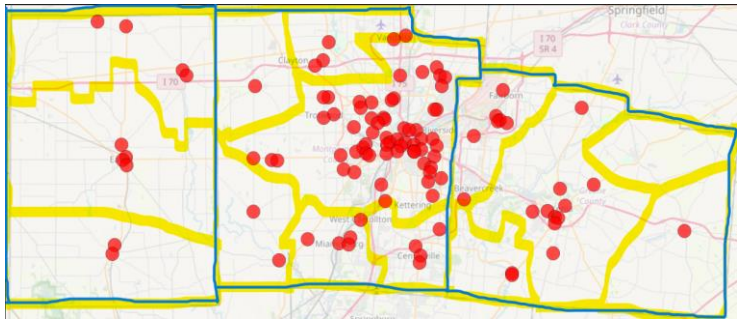


Figure 1: Locations of Agencies and Breakdown of Counties

2. Example of Agencies Serving a County

Different agencies address the needs of different populations from differing locations. The schedules of these agencies sometimes occupy the same time slot and do not cover other time slots. In those cases, people need to travel further to different agencies to obtain food. Thus, it is important to understand how the schedules of all the agencies match up. A future state schedule could be made where all time windows from M-Sat are covered by the local agencies preventing longer travels for people. The chart below shows the scheduling times of the agencies that clients in Northern Preble County visited in the last 6 months. The blue columns show service gaps while the red columns show overlap

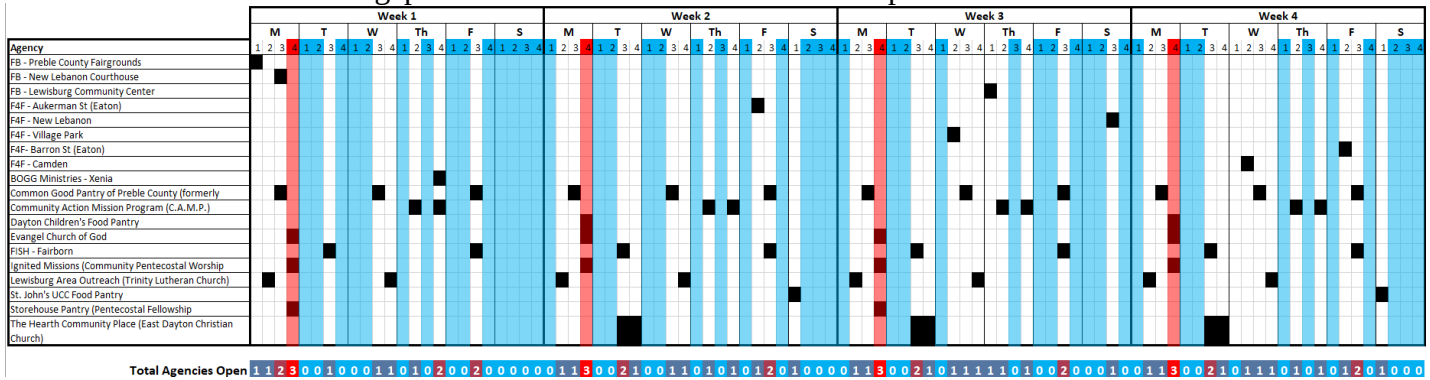


Figure 2: Agency Schedules of Preble Northern

3. Example of Distance Calculation for a County

			ZipCode		45070	45311	45330
			City		WEST ELKTON	CAMDEN	GRATIS
			State		OH	OH	OH
			County		Preble	Preble	Preble
			Longitude		-84.5599013	-84.6442513	-84.5284636
			Latitude		39.5881477	39.6373973	39.6486131
Agency	Latitude	Longitude					
1	39.736803	-84.627393			10.89	6.93	8.06
2	39.742927	-84.395359					9.63
11	39.844483	-84.532059			17.79	15.52	13.55
24	39.746264	-84.629625			11.55	7.57	
25	39.745281	-84.423771			13.06	13.91	
26	39.908322	-84.674288			22.97	18.81	
27	39.761287	-84.636573			12.65	8.58	
28	39.629921	-84.651388			5.67	0.64	
34	39.673666	-83.936061				37.80	
42	39.818115	-84.311862					
43	39.743046	-84.634876			11.43	7.32	8.65
44	39.680491	-84.425009				12.05	
45	39.779271	-84.163213				27.41	
57	39.768894	-84.137371					22.41
64	39.79031	-84.029116				34.40	
72	39.648166	-84.338044					10.14
74	39.850817	-84.538349				15.80	
92	39.622895	-84.382805			9.74	13.96	
97	39.640948	-84.647001			5.91	0.29	6.34
98	39.747823	-84.134456				28.19	22.06

Figure 3: Distance Calculations of Preble Northern

Each county subsection undergoes distance analysis. The distance of each agency from the centroid of the zip code served in the county subsection is calculated. The goal is for most people in a county subsection to have close access to an agency. The equation for distance calculation is as follows:

$$\cos^{-1}(\sin(Lat_1) \times \sin(Lat_2) + \cos(Lat_1) \times \cos(Lat_2) \times \cos(lon2 - lon1)) * Earth\ Radius$$

4. Next Steps

The next step is analyzing the schedules of agencies serving a particular zip code to determine where there is overlap and where there is no time windows of service. After that, we will work with the Foodbank to optimize their mobile pantry schedules so that we reduce overlap and reduce time windows with no service. This shall improve food accessibility.

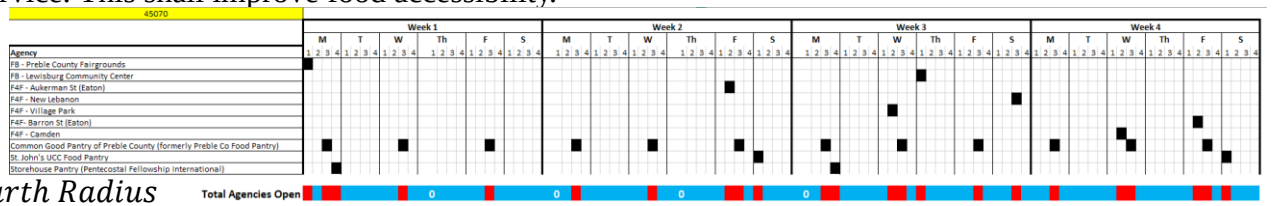


Figure 4: A preliminary schedule of the current state for zip code 45070