Diabetes in Dallas County

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INTRODUCTION

Type two diabetes diagnoses in the United States have continued to increase especially among states with high incidences of obesity. Examples of southern states with high prevalence of obesity are Texas, Kentucky, Louisiana, South Carolina and Tennessee with a rate of 31%. Mississippi has the highest rate of obesity with 34% of their population categorized as obese or morbidly obese. Northern state populations are beginning to show increased rates of obesity with 30.9% in Michigan and 30.4% in Oklahoma and Missouri [1]. Diabetes has become the seventh leading cause of death and affects 25.8 million people in the United States [2]. The cost of diabetes to patients are the reduction of quality of life and suffering complications which include heart disease, stroke, high blood pressure, blindness, kidney disease, nervous system disease (neuropathy), and amputation [3]. In 2010, the United States fiscal cost of diabetes waas $116 billion for direct medical costs and $58 billion for indirect costs, such as disability, work loss and premature mortality [4]. Contributing factors to diabetes prevalence are obesity, lack of physical activity, family history and environmental resources, such as fresh fruits and vegetables; healthcare access; and neighborhood parks/recreation center availability.

In Dallas County, diabetes affects 11.4% of the population, which is 1.8 percentage points higher than the state average of 9.6% and 3 percentage points higher than the national average of 8.4% [5]. Dallas County is urban with a population of 2.4 million people in about 880 square miles with 2,692 people per square mile. The median income is $46,044. The population is 53.5% white, 22.3% black and 38.3% of Hispanic Origin. Therefore, the total number people in Dallas County with diabetes are 273,600 and of those 25,992 are of Hispanic origin. The study focuses on the environmental factors that could influence the control of diabetes in Dallas County.

METHODOLOGY

The DFWHC Foundation ("Foundation") has a claims data warehouse, managed by the Information, Quality and Safety Center (IQSC), that receives claims data from 77 North Texas hospitals. The claim records are available from 2001 for inpatients and 2006 for outpatients. Fields include a patient's demographic data; payor type; up to 25 diagnosis codes; 25 procedure codes; severity of disease; total charges and charges for individual services and is risk adjusted. The Foundation developed the regional enterprise master patient index (REMPI) which allows the tracking of any patient over time, hospital, and payor. The REMPI has an algorithm that accurately matches 99% of all patients. To date, there are 23 million patient encounters and over 7.3 million uniquely identified patients in the warehouse. Currently, 80% of new patient encounters are already patients in the claims data warehouse. In order to better understand the demographical and environmental possible influences on diabetic patients, the diabetes project applied the data received from the Foundation warehouse and geographically mapped the results. Blinded patient data from the IQSC was mapped using the residential zip codes for each patient in Dallas County [6]. Using Census data, and other data sources, [2,7,8] maps were developed to depict the environmental influences of those diabetic patients.

Permission to utilize warehouse information was obtained from the hospitals through the North Texas Healthcare Quality and Information Center (NTHIQC). No patient level data was used for this research, other than aggregate zip code data. Using a business intelligence tool, aggregated data was pulled for any person receiving a primary diagnosis of diabetes and inpatients/outpatients that had any comorbidity of diabetes. ArcGIS, a geographical mapping system, was then used to spatially join those primary diabetes diagnoses frequencies with their

corresponding zip codes. Frequencies were also mapped for those patients with a comorbidity of diabetes but with another primary diagnoses.

RESULTS

Dallas County's top five primary diagnoses in 2010 were pneumonia, septicemia, other rehabilitation, urinary tract infection, and acute kidney failure. Of those top five primary diagnoses, those patients with an underlying condition of diabetes were 29% for pneumonia, 39% for septicemia, 31% for other rehabilitation, 34% of urinary tract infection and 45% of acute kidney failure (See Table 1). Dallas County's top seven diagnoses for emergency room department (ER) patients were acute URI unspecified, otitis media, abdominal pain, chest pain unspecified, urinary tract infection, headache and other chest pain. In those top seven diagnoses, 20%-45% had an underlying condition of diabetes. Specifically, the percentage of the patient ER population in these primary diagnoses who had diabetes listed as a comorbidity is 11% with urinary tract infection, 0% Otitis media, 10% abdominal pain, 46% with chest pain and 9% of those with headaches (See Table 1).

Table 1: Diabetes Frequency within the Top Conditions for Inpatients and Outpatients for the Dallas County Area

Top Five Diagnosis **INPATIENTS 2010 Dallas**	Number of Patients	Number of patients with Diabetes	% with Diabetes
Pneumonia	4,359	1,279	29%
Septicemia	3,142	1,217	39%
Other Rehabilitation	2,816	872	31%
Urinary Tract Infection	2,447	822	34%
Acute Kidney Failure Unspecified	2,355	1,068	45%
Top Seven Diagnosis **ER VISITS 2010 Dallas**			% with Diabetes
Acute URI Unspecified	23,979	392	2%
Otitis Media	18,576	84	0%
Abdominal Pain	14,677	1,516	10%
Unspecified Chest Pain	14,511	3,010	21%

Urinary Tract Infection	14,302	1,254	9%
Headache	13,531	1,228	9%
Other Chest Pain	13,217	2,980	25%

Data was pulled to review the percentage of other diagnoses that had a comorbidity of diabetes. The results are reported for the number of patients with other diagnoses that had a minimum of 11% of that population with diabetes. In Appendix 1, the results are reported by hospital service line, number of patients with a specific diagnoses and the number of patients reporting a comorbidity of diagnoses. Each color in Appendix 1 under Product Line represents each hospital service line and colors are continued in Table 2. The cutoff for this table was at 10% for those who had diabetes as a diagnosis. Some of the diagnoses with a high percentage of diabetes as a comorbidity are heart failure at 59%, acute/chronic respiratory failure at 51%, chronic obstructive asthma and *e.coli septicemia* at 41%.

The statistics in Appendix 1 were summarized by product line for Table 2. The product lines with the most admissions in 2010 for Dallas County are cardiology, pulmonary and medicine. Of those in the top three, cardiology and neurology have largest percentage of diabetic patients at 42% and 41% respectively. Cardiology, Pulmonary and Medicine product lines compose the highest percentage of patients in Dallas County in 2010.

Table 2: Comparisons between Hospital Product Lines

Product Line	Number of Patients	Percentage of Total	Patients with Diabetes	% with Diabetes
Behavioral	2032	4%	259	12%
General Surgery	764	1%	259	34%
Oncology	1458	3%	254	17%
Orthopedics	3259	6%	871	27%
Gastroenterology	3488	6%	831	25%

Product Line	Number of Patients	Percentage of Total	Patients with Diabetes	% with Diabetes
Neurology	4461	8%	1627	41%
Medicine	12406	22%	4123	32%
Pulmonary	12978	23%	4278	34%
Cardiology	14033	25%	6000	42%
Diabetes	1977	3%	1946	98%
Totals	56856	100%	20448	36%

In 2010, 35% of the top 5 inpatient diagnoses in Dallas County had diabetes as an underlying condition; the top is pneumonia (see Table 3). The data was analyzed to determine the top four zip codes in Dallas County with the highest percentage of the top five diagnoses. These zip codes were 75227, 75217, 75150, and 75149. Table 3 describes the comparison between those zip codes and Dallas County as a whole. Zip code 75227 had the highest incidence of pneumonia (33%) compared with Dallas County (29.3%); septicemia was (47.9%) compared with Dallas County (38.7%); acute kidney failure (57.4%) compared with Dallas County (45.4%). Other rehabilitation diagnosis was highest in 75217 (50.8%) compared with Dallas County (30.9%) and of urinary tract infection (42.6%) compared with Dallas County (33.6%).

Table 3: Top Five Diagnoses with Diabetes as an Underlying Condition

	Diagnosis	Dallas County	75227	75217	75150	75149
1	Pneumonia	29.3%	33.0%	24.0%	22.5%	31.2%
2	Septicemia	38.7%	33.3%	47.9%	34.4%	25.0%
	OTH	30.9%	43.1%	50.8%	32.4%	39.3%

3	Rehabilitation					
4	Urinary Tract Infection	33.6%	40.9%	42.6%	41.9%	33.9%
5	Acute Kidney Failure	45.4%	57.4%	55.9%	42.1%	38.5%

The demographics of those four counties was pulled from Census data to determine if the zip codes identified had any demographics that might explain some of the frequency of diagnoses with diabetes as an underlying factor. The median age, gender, race and ethnicity is shown in Table 4.

Table 4: Zip Code Demographics

Zip Code	Median Age	Male	Female	White	African American	Hispanic	Asian	Other
75217	27 years	50.4%	49.6%	34.6%	34.8%	46.4%	.3%	30.3%
75227	28.1 years	48.5%	51.5%	35.6%	37.1%	43.1%	1.4%	25.8%
75149	31.2 years	48.1%	51.9%	71.2%	15.2%	16.8%	3.0%	10.6%
75150	32.7 years	48.2%	51.8%	76.9%	10.4%	16.1%	4.0%	8.7%

The four zip codes that were identified for the highest frequency of diabetic patients were mapped using Arc GIS software in order to overlay environmental factors that could influence the health of those patients. The results revealed that the incidence of diabetes was not correlated with a higher population (see Map 1 and Map 2 in Appendix 2). The zip code with the highest number of diabetic patients was 75227. From the Appendix 3 maps, it is shown that supermarkets are not within a mile walking distance or a five minute driving distance and fast food restaurants are prolific. Convenience stores were the most prevalent (See Appendix 3.Map

1). Hospitals are not found within walking distance of the zip codes with the most prevalent incidence of diabetes and clinics are in clusters and not evenly spread throughout the high prevalent zip codes (See Appendix 4).The zip codes with the highest prevalence of diabetes had high unemployment and low income (See Maps 1 and 2 in the Appendix 5). Recreational locations and parks were mapped for the Dallas County zip codes (See Appendix 6.Map 1). The map revealed that there were few parks within a mile walking distance and only one recreation center near zip code 75227.

Overall, the zip codes with the highest prevalence of diabetes had a very low income < $35,000 and an unemployment rate of between 6.3 and 9.8, few supermarkets, few hospitals and clustered medical clinics. However, there were many convenience stores and fast food restaurants.

DISCUSSION

There is quite a divergence in population characteristics of the four zip codes researched as discussed previously. With such a significant difference in demographics, it suggests that community resources may be a factor for diabetes prevalence. Using the Arc GIS mapping software, it allowed the data to be spatially analyzed providing a picture of the resources available to the residents of these zip codes. The limited availability of these resources can greatly influence the health behaviors of those living in the community.

Medically, only two hospital systems are in the geographic area and one is mental health hospital, demonstrating a paucity of 24 hour health care access for the residents of these zip codes. Brown, Vargas, Ang and Pebley (Brown, et al., 2008) suggest that the socioeconomic environment and the traveling distance to supermarkets are associated with higher rates of obesity in that area. Appendix 3.Maps 3 and 4 illustrate the food desert of these zip codes. Zip

code 75227 does not have a supermarket available to its population, only convenience stores.

Since nutritious foods and a healthy diet are key behaviors for control of diabetes, living in a

food desert with many fast food restaurants is detrimental for these patients' health. Even with a

chain grocery store, there is no guarantee that fresh, healthy options are offered. In lower income

areas, markets often have a smaller, more limited selection of healthy fruits, vegetables and milk

products (Brown et al., 2008). Physical activity is also important in the behavior of diabetes.

Although there are some recreation centers and local parks in the area, most have limited hour

availability making it difficult for residents to fully utilize these facilities. Using parks require

good weather, and Dallas is known for the high number of days over 100° in the summer and

fall. The remaining days with good weather are limited in Texas.

Diabetes is often a comorbidity of other chronic illnesses and their symptoms. According

to the CDC (CDC, 2011a) diabetes is the main cause of kidney failure. Within the top five

inpatient diagnoses in Dallas County, the fifth is acute kidney failure with more than 46% of

patients having a comorbidity of diabetes with an average of 49% among the four other zip

codes. Pneumonia is the top diagnosis in Dallas County, and diabetes is a major co-morbidity of

that disease. Although the outpatient data revealed a lower percentile of diabetes, the diagnosis

of chest pain and abdominal pain relate to chronic conditions (like CHF) in which diabetes is

also a high co-morbidity. The data brings to light that even though diabetes is not a priority

diagnosis that it is a prominent condition related to several of the top diagnoses in Dallas County.

Cardiology and Neurology hospital product lines have the highest percentage of diabetes

as a comorbidity. These product lines include heart attack and stroke which are risk factors for

those with diabetes. Respiratory conditions also had a high percentage of diabetic patients.

CONCLUSIONS

Diabetes is a complicated disease that has risk factors for cardiology and neurology incidents with uncontrolled diabetes. In order improve the control the glucose levels of diabetic patients, fresh fruits and vegetables should be eaten and regular exercise should be included. Many diabetic patients in Dallas County do not have access to fresh fruits and vegetables due to the lack of supermarkets within either a one mile walking distance or five mile driving distance. Recreational facilities are very rare in low income areas with the highest prevalence of diabetes. The lack of clinics spread throughout the county is also a problem as they are clustered together with large distances between these clusters.

It may assist diabetic patients in Dallas County to place more supermarkets with fresh foods in those four zip codes, add low cost recreational sites and more clinics. Community groups may be able to assist by working together to improve the environmental factors for diabetic patients of Dallas County.

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APPENDICIES

Appendix 1: Top Diagnoses and Percentage of those with Diabetes in Dallas County by Product Line

Product Line	Diagnosis 2010 Dallas	Number of Patients	Patients with Diabetes	% with Diabetes
Diabetes	DIABETES W/MANIFEST OTH	754	745	99%
Diabetes	DIABETES KETOACID TYPE II UNCONT	449	442	98%
Diabetes	DIABETES KETOACID TYPE I UNCONT	774	759	98%
Cardiology	ACUTE/CH DIASTOLIC HEART FAILUR	1004	589	59%
Medicine	RENAL HYPERT UNSPEC/FAILURE	1004	589	57%
Cardiology	ACUTE/CH SYS/DIAST HEART FAILURE	461	234	51%
Pulmonary	ACUTE/CHRONIC RESP FAILURE	606	307	51%
Cardiology	ATHEROSCLER NATIVE COR ART	1849	931	50%
Cardiology	CONGESTIVE HEART FAILURE UNSPEC	1578	751	48%

Product Line	Diagnosis 2010 Dallas	Number of Patients	Patients with Diabetes	% with Diabetes
Cardiology	ACUTE/CH SYSTOLIC HEART FAILURE	1520	728	48%
Cardiology	SUBENDO INFRC INIT EPISODE	1843	840	46%
Pulmonary	CHRONIC OBSTRUCT ASTHMA W/EXAC	963	408	42%
Medicine	E.COLI SEPTICEMIA	560	227	41%
Neurology	CEREBRAL ARTERY OCC W/INFARCT	1900	788	41%
Cardiology	OTH CHEST PAIN	1581	636	40%
Pulmonary	RESPIRATORY FAILURE	1400	556	40%
Medicine	CELLULITIS/ABSCESS TRUNK	436	176	40%
Cardiology	UNSPEC CHEST PAIN	589	230	39%
Neurology	CEREBRAL EMBOLISM W/INFARCT	518	196	38%
Pulmonary	OBSTRUCT CHRONIC BRONCHITIS W/EXAC	2100	748	36%
Cardiology	CAROTID ARTERY OCCLUS NO INFARCT	567	200	35%
Medicine	CELLULITIS/ABSCESS LEG	1566	543	35%

Product Line	Diagnosis 2010 Dallas	Number of Patients	Patients with Diabetes	% with Diabetes
Neurology	INTRACEREBRAL HEMORRHAGE	452	159	35%
Pulmonary	CHRONIC BRONCH W/ACUTE BRONCHITIS	503	173	34%
Medicine	URIN TRACT INFECTION UNSPEC	2447	822	34%
Neurology	TRANS CEREB ISCHEMIA UNSPEC	587	197	34%
Neurology	TRANS CEREB ISCHEMIA UNSPEC	587	197	34%
Gastroenterology	GASTROINTEST HEMORRHAGE UNSPEC	523	178	34%
General Surgery	MORBID OBESITY	764	259	34%
Medicine	OTH REHABILITATION	2816	872	31%
Medicine	C DIFFICILE ENTERITIS	491	152	31%
Cardiology	SYNCOPE & COLLAPSE	784	237	30%
Pulmonary	PNEUMONIA ORGANISM UNSPEC	4359	1279	29%

Product Line	Diagnosis 2010 Dallas	Number of Patients	Patients with Diabetes	% with Diabetes
Pulmonary	FOOD/VOMIT PNEUMONITIS	775	225	29%
Gastroenterology	NONINFECT GASTROENTERIT OTH	696	201	29%
Cardiology	HYPERTENSION UNSPEC	474	133	28%
Cardiology	ATRIAL FIBRILLATION	1783	491	28%
Medicine	OTH POSTOP INFECTION	854	243	28%
Orthopedics	LOCALIZED OSTEOARTH UNSPEC LEG	1321	366	28%
Pulmonary	ASTHMA UNSPEC W/EXACERBAT	936	252	27%
Medicine	HYPOSMOLALITY	510	137	27%
Pulmonary	AC VNUS EMB&THRMB DP VES PRX LW EXT	449	118	26%
Orthopedics	LUMBAR DISC DISPLACEMENT	493	129	26%
Orthopedics	INTERTROCHANTERIC FX CLOSED	597	156	26%
Orthopedics	LOCALIZED PRIMARY OSTEOARTH LEG	848	220	26%
Medicine	CELLULITIS/ABSCESS ARM	424	104	25%

Product Line	Diagnosis 2010 Dallas	Number of Patients	Patients with Diabetes	% with Diabetes
Pulmonary	PUL EMBOLI/INFARCT OTH	887	212	24%
Neurology	OTH CONVULSIONS	417	90	22%
Gastroenterology	INTESTINAL OBSTRUCT UNSPEC	692	154	22%
Medicine	EPILEPSY UNSPEC OTH INTRACT	515	105	20%
Medicine	DEHYDRATION	783	153	20%
Gastroenterology	INTESTINAL ADHES W/OBSTR	463	94	20%
Gastroenterology	DIVERTICULITIS COLON	1114	204	0.18
Oncology	ENCOUNTER ANTINEOPLASTIC CHEMO	1458	254	17%
Behavioral	SCHIZOAFFECTIVE UNSPEC	1016	141	14%
Behavioral	PARANOID SCHIZOPHRENIA UNSPEC	441	53	12%
Behavioral	PSYCHOSIS UNSPEC	575	65	11%

Appendix 2.Map 1: Dallas County Population by Code and Diabetes Incidence
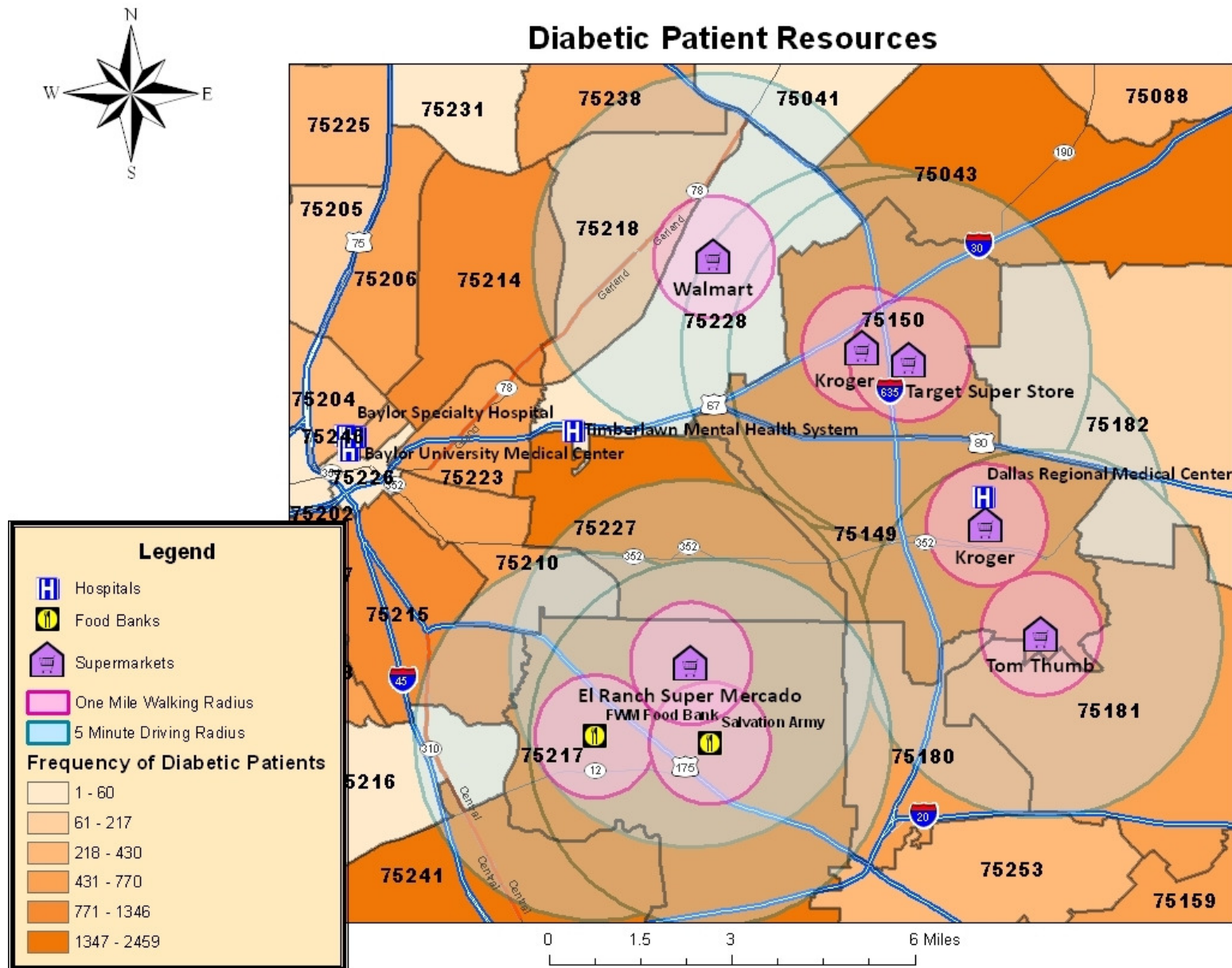

Diabetes Patients by Zip Code
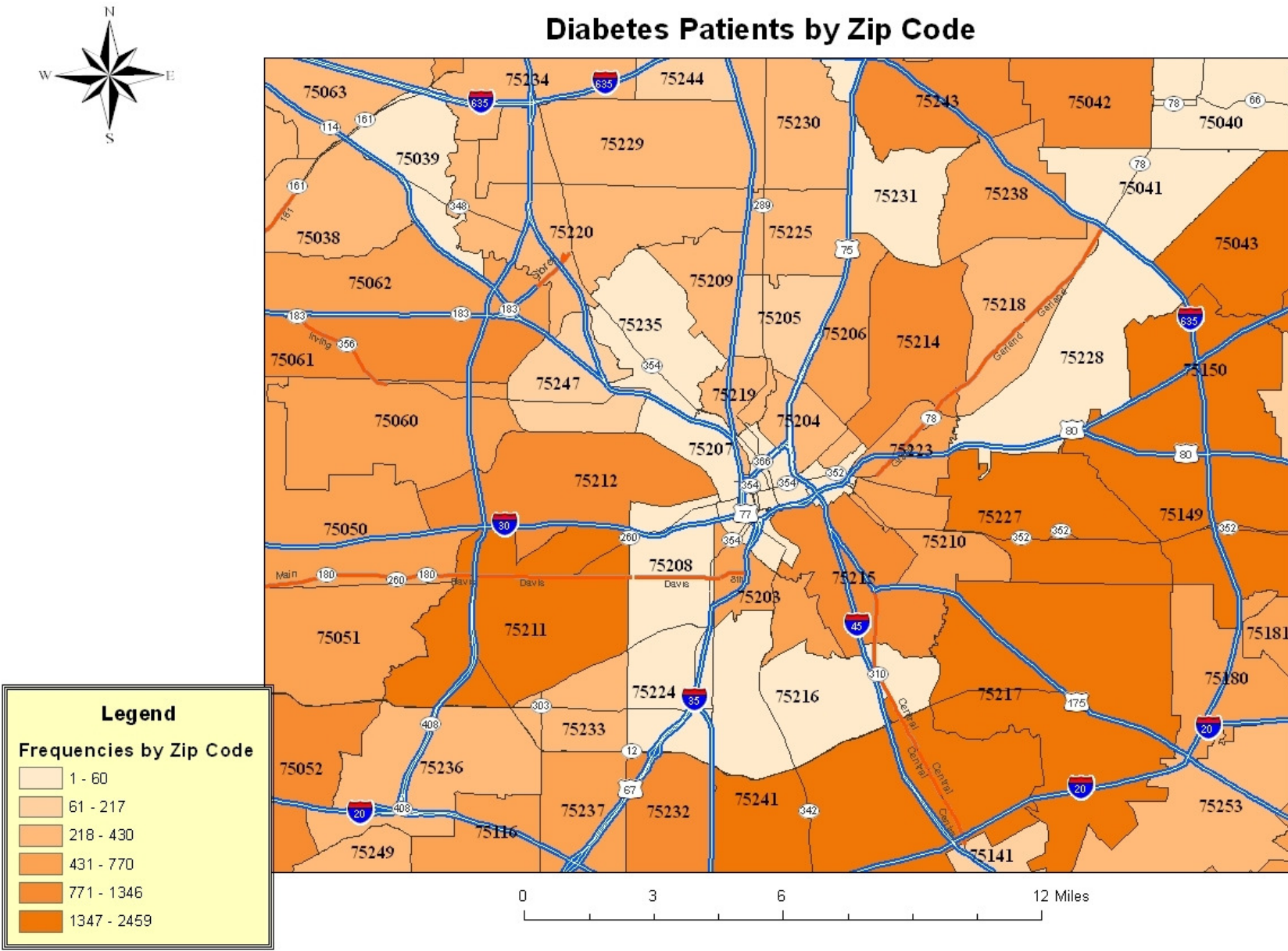
Appendix 2.Map 2: Diabetes Frequency by Zip Code
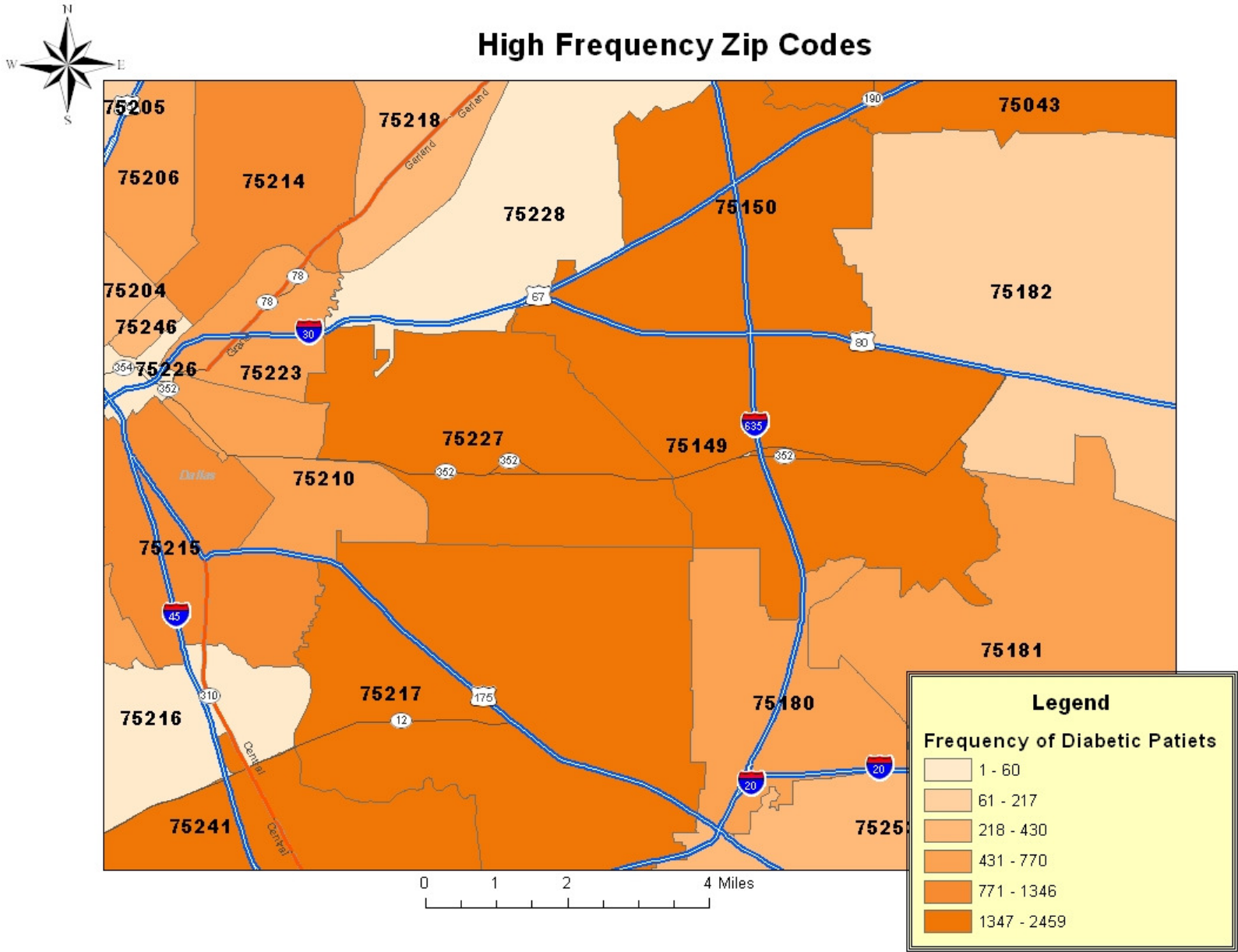
Appendix 3.Map 1: Available Food for Purchase
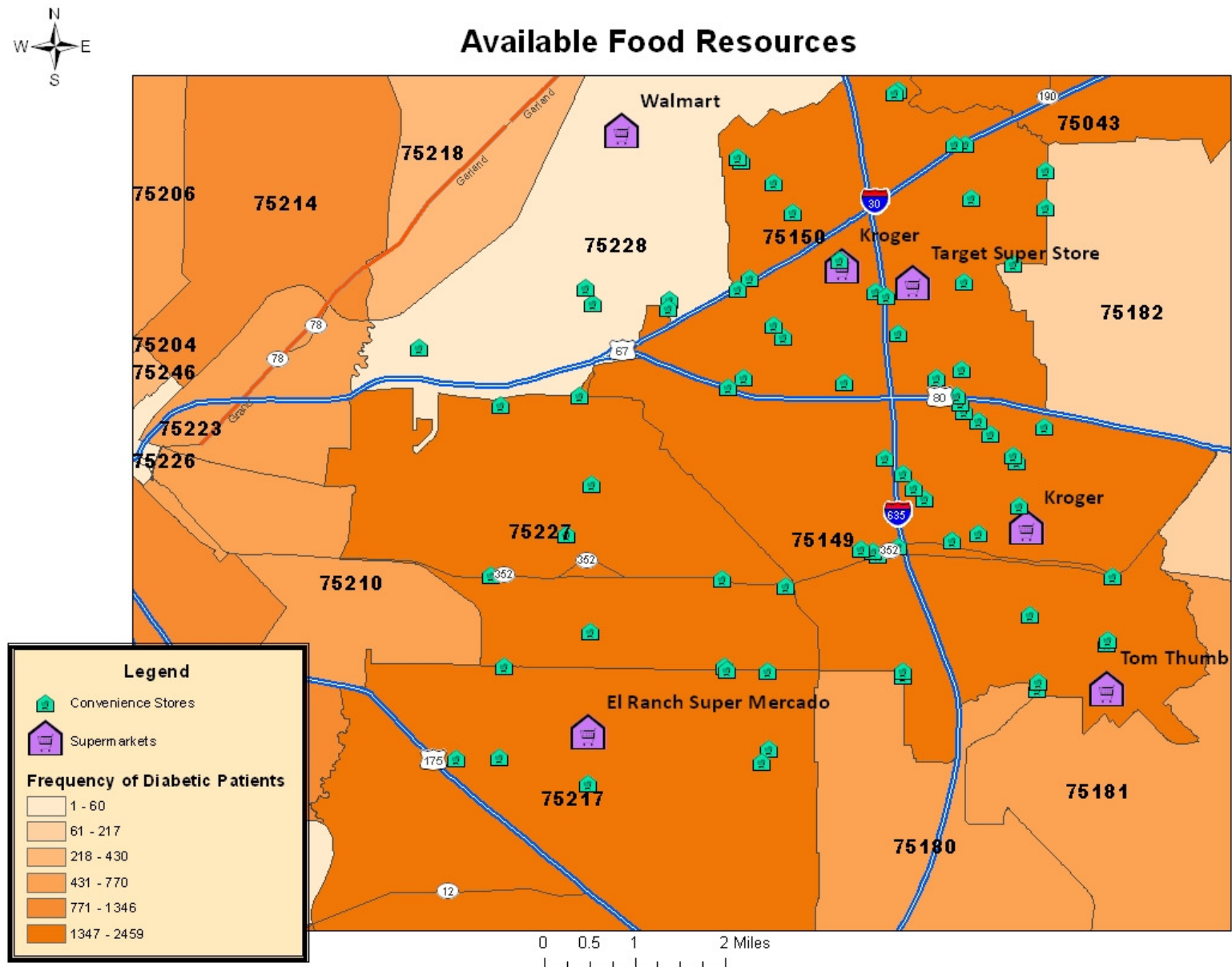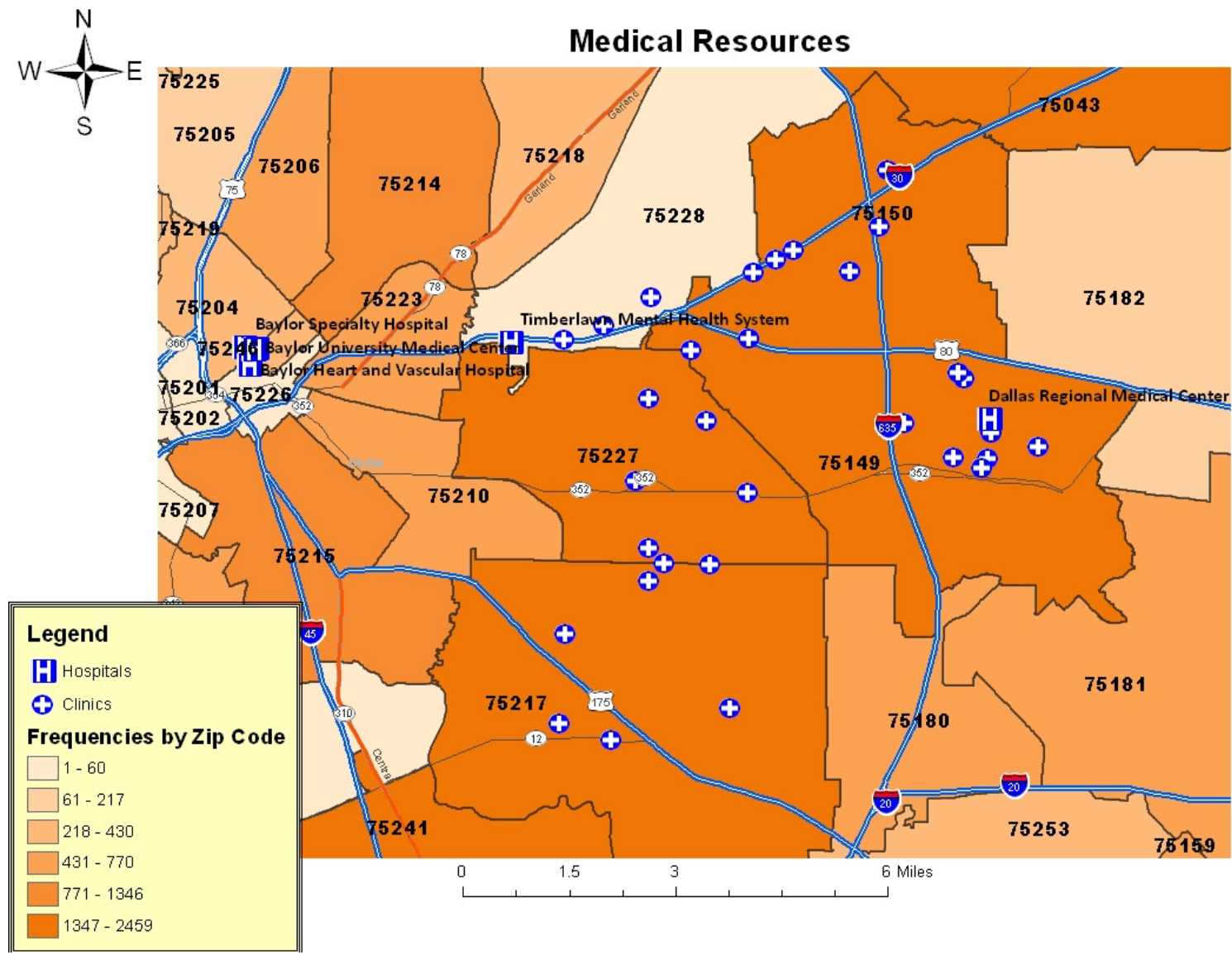
Appendix 3, Map 2 Diabetic Patient Resources

Diabetic Patient Resources

Legend
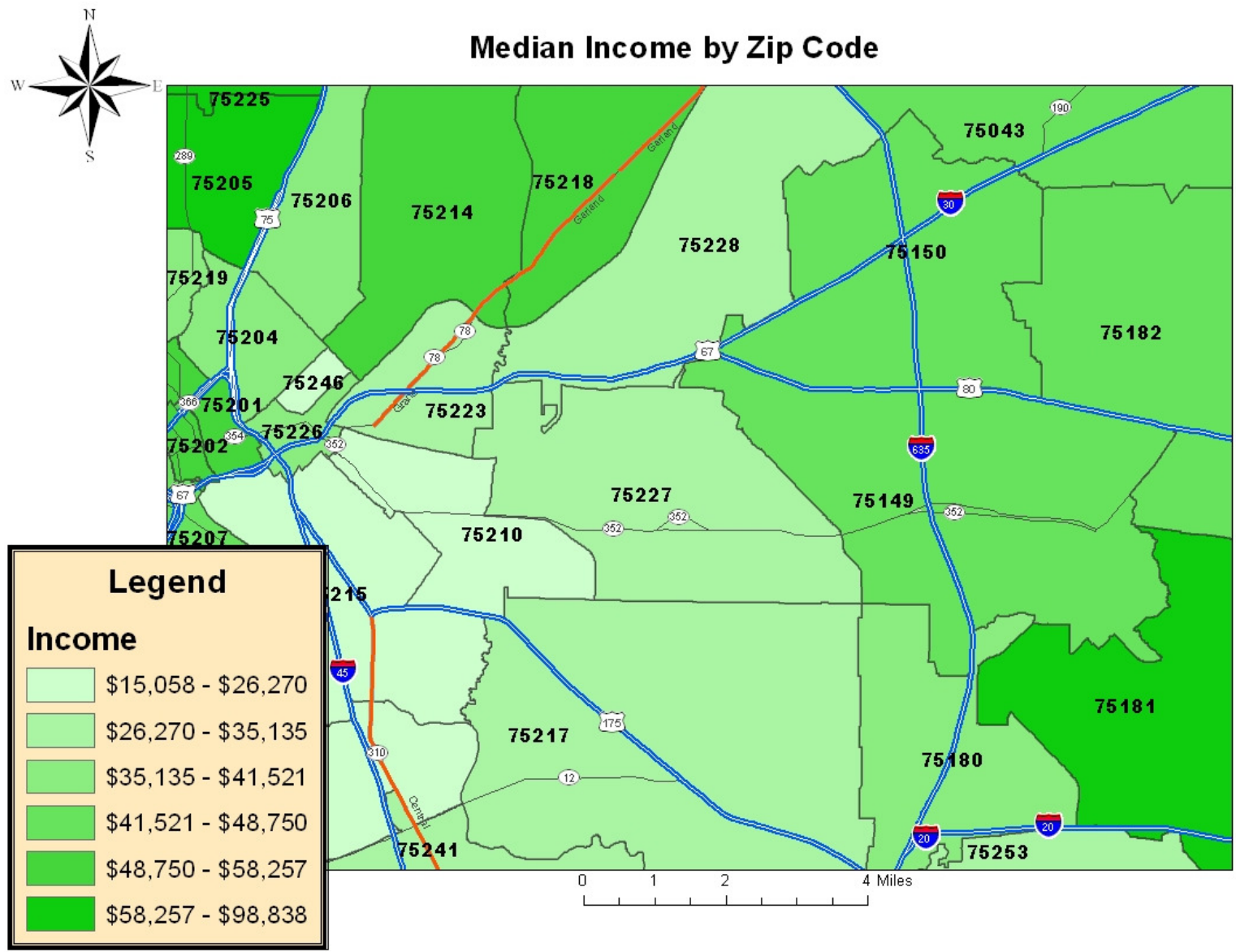
- H Hospitals
- Food Banks
- Supermarkets
- One Mile Walking Radius
- 5 Minute Driving Radius

Frequency of Diabetic Patients

- 1 - 60
- 61 - 217
- 218 - 430
- 431 - 770
- 771 - 1346
- 1347 - 2459

Appendix 3: Map 3 Fast Food Availability

Fast Food Availability

Legend

Fast Food Restaurants

Frequency of Diabetic Patients
- 1 - 60
- 61 - 217
- 218 - 430
- 431 - 770
- 771 - 1346
- 1347 - 2459
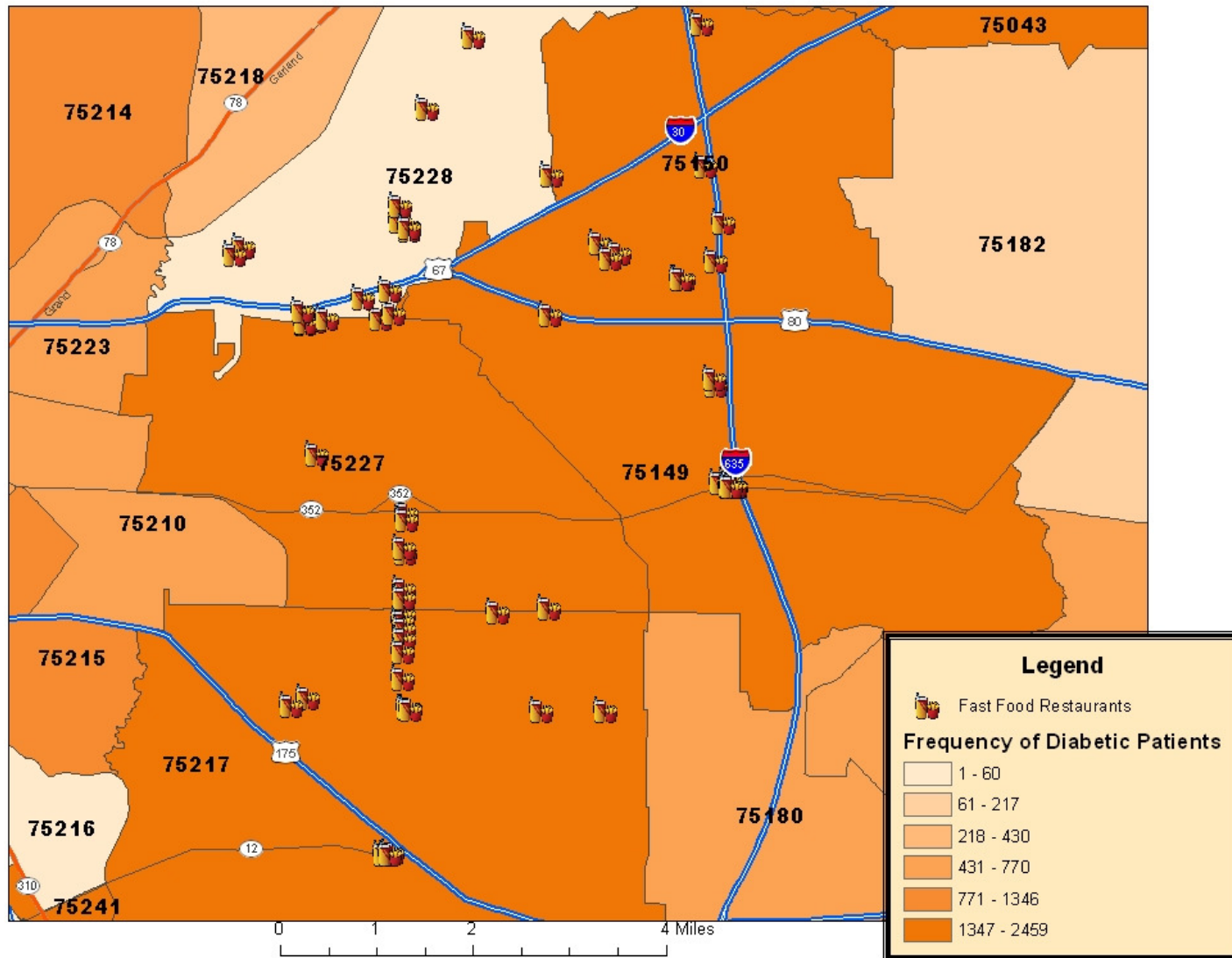
Appendix 4: Map 1 Medical Resources

Appendix 5: Map 1: Median Income

Appendix 5 Map 2: Unemployment

Unemployment Rate by Zip Code
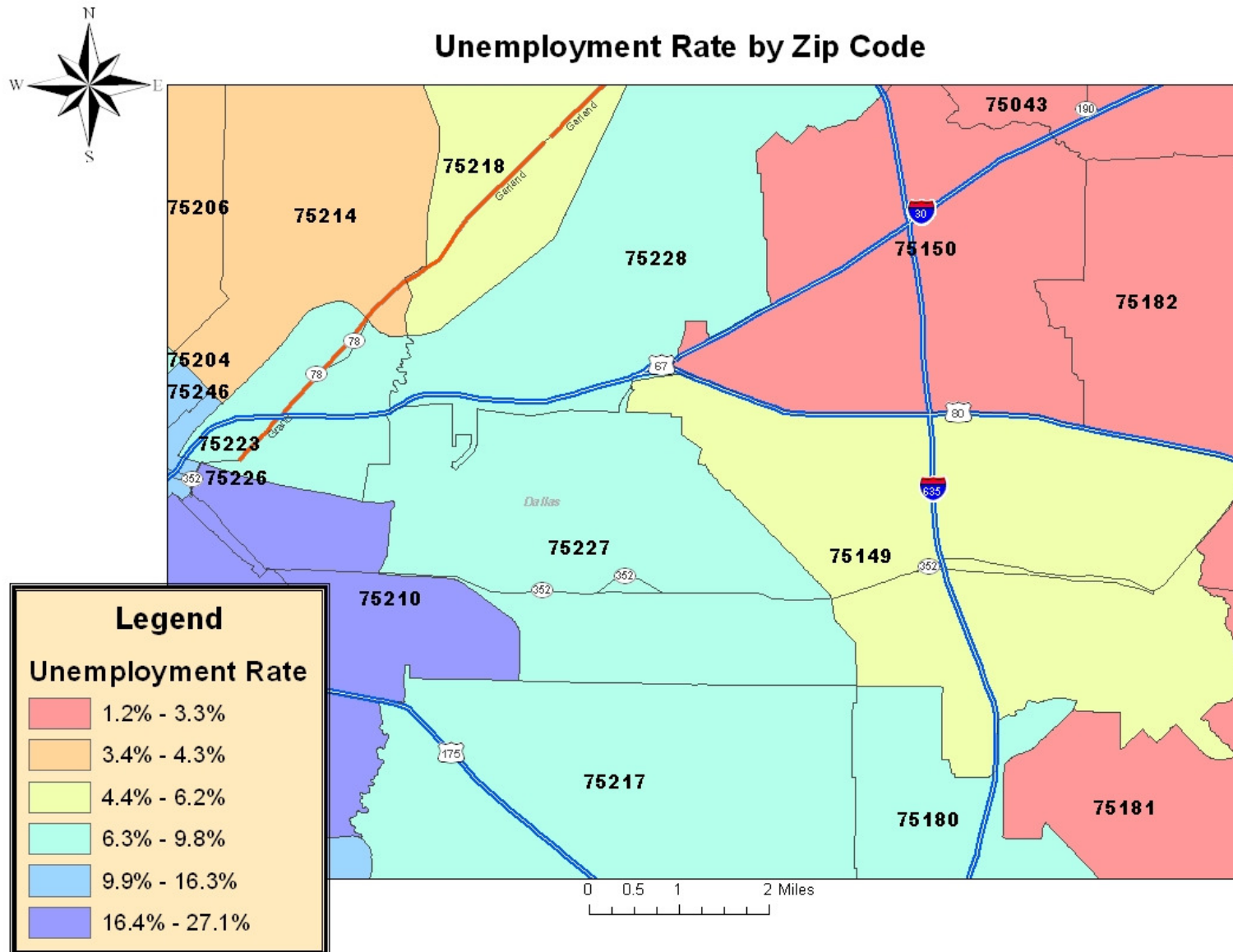
Appendix 6: Map : Recreation Availability

Local Parks and Recreational Centers