Environmental Disparities Present a Challenge for Diabetes Prevention and Management Efforts in Dallas County

Theresa Mendoza, Dallas-Fort Worth Hospital Council Research Foundation
Sushma Sharma, Dallas-Fort Worth Hospital Council Research Foundation
Pamela Doughty, Dallas-Fort Worth Hospital Council Research Foundation
Crystee Cooper-Walton, Dallas-Fort Worth Hospital Council Research Foundation
Carol Young, Dallas-Fort Worth Hospital Council Research Foundation
Larry Tubb, Cook Children Health Care System
Kristin Jenkins, Dallas-Fort Worth Hospital Council Research Foundation
Community Health Collaborative of North Texas (CHC)

ABSTRACT

The State of Texas is home to nearly 2 million men, women and children with diabetes, over half a million of which reside in the Dallas-Fort Worth (DFW) region. Recognizing the rising need to identify the disparities in implementing the diabetes prevention and management efforts and adopting the healthy lifestyle in high diabetes prevalence areas in Dallas County, we explored the potential of Geographic Information System (GIS) methodology to analyze the data at zip code level from Dallas-Fort Worth Hospital Council (DFWHC) Research Foundation's data registry. The objectives of this research were to identify the zip codes with the highest prevalence of diabetes in Dallas County and to analyze the disparities that may relate to the higher diabetes prevalence. The process revealed the zip codes with the highest prevalence of diabetes and the disparities possibly influencing the higher prevalence. The results showed that the zip codes with the highest prevalence of diabetes had very few fresh food and supermarkets, food banks, parks, sidewalks and hospitals and clustered medical clinics, indicating that addressing these disparities may be a promising strategy for decreasing the prevalence of diabetes in these diabetes clusters in Dallas County. The strength of this research is DFWHC research Foundation's comprehensive data registry which allowed us to analyze the patient data up to the zip code level to identify the high diabetes prevalence areas. Our results have significance in the realm of public health and health care. With the identification of the contributing disparities in the high diabetes prevalence in Dallas County, public health efforts and resources can be more efficiently targeted and focused for prevention and management. Also in the future, we support improvements in health care data-sharing in order to improve coordinate care between different health care providers to prevent diabetes at an early stage and provide coordinated care at treatment and management stage.

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School of Community Health Sciences
University of Nevada, Las Vegas
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INTRODUCTION
Diabetes has become the seventh leading cause of death in the U.S. and affects 25.8 million people in the United States [Centers for Disease Control (CDC) 2011]. Unfortunately, the State of Texas has received more than its share of the diabetes epidemic. While our national average is 8.3%, a disproportionate 9.7% of Texans have diabetes. The State of Texas is home to nearly 2 million men, women and children with diabetes, over half a million of whom reside in the Dallas-Fort Worth area also known as the DFW region. In Dallas County, diabetes affects 11.4% of the population, which is 3% higher than the national average [Texas Department of State Health Services (TDSHS) 2011]. Some experts project the total number of diabetes cases in Texas will increase to nearly 3 million by 2040 [Texas Diabetes Council (TDC) 2011]. Others believe these estimates to be far too conservative, suggesting that as early as in 2025, Texan diabetics will number 4 million, by which time the Dallas-Fort Worth area may be home to well over a million people with diabetes (Rowley 2011).

The economic cost of diabetes to the state is estimated to be in excess of $12 billion each year. On average, people with diabetes have medical expenditures more than double that of people without the disease [Bureau of Labor Statistics (BLS) 2011]. Annually, there are more than 200,000 hospital admissions attributed to diabetes in Texas, the cost of which exceeds $3.5 billion (TDC 2011). In addition to the direct economic burden, diabetes is often a co-morbidity to other chronic illnesses, such as heart disease, kidney disease, neuropathy, retinopathy, pneumonia and several other metabolic complications (Diabetes Care 2003). In 2010 alone, 35% of the top five Inpatient diagnoses in Dallas County had diabetes as an underlying condition, the top being acute kidney failure and septicemia. In the outpatient data, 9% of the top five diagnoses had diabetes as an underlying condition (DFWHC Research Foundation, 2011).

Obesity is one of the leading causes for diabetes. The prevalence of obesity is continuously on the rise in Texas with 37% overweight and 29% obese adults (CDC 2011). Despite the nationwide, statewide and local public health efforts to promote healthy eating and active living in communities, the prevalence of obesity and diabetes is on the rise in Dallas County. Besides obesity, other contributing factors for increased prevalence of diabetes are lack of physical activity, family history, racial and ethnic differences, low socioeconomic status and insufficient environmental resources, i.e. food deserts, less healthcare access and unavailability of safe neighborhood parks/recreation centers/sidewalks (Hill et al. 2013).

In the past few years, several researchers have reported large disparities between population groups including race and ethnicity (Miech et al. 2009; Kirk et al. 2008; Peek et al. 2007; Nwasuruba et al. 2009), socioeconomic status (Anderson and Armstead 1995; McLaren 2007; Kupelian et al. 2008; Kington and Smith 1997), environmental factors (Latetia et al. 2006; La Veist et al. 2008; Carol et al. 1994; Charreire et al. 2010), and also continuous changes in the associated patterns of diabetes prevalence. In the State of Texas, researchers have reported ethnic, cultural and socioeconomic disparities related to diabetes, obesity and cardiovascular disease in various counties (Chaturvedi KM 2003; Kauffman 2012; Siordia et al. 2012; Fisher-Hoch et al. 2010; Nwasuruba et al. 2009, Metghalchi et al. 2008).
Use of a Geographic Information System (GIS) mapping and analysis tool has been very effective in health related research to identify the disparities and to critically examine the issues, strengths, and challenges inherent to current community and public health approaches. Medical geography uses the concepts and techniques of geography to investigate health-related issues (Nykiforuk and Flaman 2011; Geraghty et al. 2010; Siordia et al. 2012; Green et al. 2003; Babey et al. 2008; Charreire et al. 2010). Zip code areas were used to define small areas in the current study because they are the smallest commonly-used geographic units that are also identified in most health data sources. In Texas, previous researchers have reported the unavailability of zip code level analysis within the dataset as a limitation in health research (Kauffman 2012). Dallas-Fort Worth Hospital Council Research Foundation (DFWHC Research Foundation) has a comprehensive patient data registry, which has the capability to investigate the disparities in high disease prevalence areas in North Texas at zip code levels.

According to the US census bureau, Texas has the highest number of uninsured people (24.6%) in the United States (United States Census Bureau, 2012). The US census bureau also suggests that in Dallas County, 33.1% of residents are uninsured. Dallas is the largest city in the North Texas region with its unique characteristics, rapidly increasing population and changing demographics (DFW International 2010). The population of Dallas and neighboring areas (also known as DFW region) has grown in size, especially over the last few decades. The report published by Dallas-Fort Worth (DFW) International in 2010 highlighted the diversification of the population in Dallas area from a primarily white population to a more mixed population including Whites, Latino, African American and Asian residents. This report also suggested that approximately 26.10% of residents in the Dallas area were new Americans (foreign-born population). Over one million new Americans moved to this area during the past 10 years. In addition, 43.20% of the population does not speak English as their primary language. Due to these unique characteristics and diversifications of the population in the Dallas area, it is important to investigate the prevalence of diseases and associated disparities in order to implement the appropriate strategies. To our knowledge, no such attempts have been made to investigate the disparities related to high diabetes prevalence in Dallas County.

Therefore, recognizing the rising need to identify the disparities associated with the high diabetes prevalence in Dallas County, we explored the potential of GIS methodology to analyze the data at the zip code level from DFWHC Research Foundation’s registry. The objectives of this research were:

1. To identify the zip codes with the highest prevalence of diabetes in Dallas County based on DFWHC Research Foundation’s data registry.
2. To use GIS technology to spatially map the information related to environmental factors (community resources) with diabetes prevalence in corresponding zip codes.
3. To evaluate the results to identify the disparities that may relate to the higher prevalence of diabetes in selected zip codes in Dallas County.

METHODS

The Dallas-Fort Worth Hospital Council Research Foundation (DFWHC Research Foundation) securely houses and manages the combined data warehouse created in 1999 by North Texas hospital systems and holds information for over 9.5 million regional patients and their more than 35 million hospital encounters. This warehouse collects claims data from 95% of the hospitals in North Texas. The claims records reveals patients’ demographic data, payer type,
up to 25 diagnosis codes and surgical/testing procedure codes, charges, The Current Procedural Terminology (CPT) codes, severity of disease as well as other information. With the Regional Enterprise Master Patient Index (REMPI), the DFWHC Research Foundation assigns a unique ID to each patient, allowing the foundation researchers to track any patient over time by hospital and by payer. For race and ethnicity, our dataset uses the standard classification used by Texas Health Care Information Collection (THCIC: https://www.dshs.state.tx.us/thcic/) and U.S. Census Bureau (2011). This classification categorizes race as black/white or Caucasian / Asian or Pacific Islander/ American Indian/Eskimo/Aleut/others and ethnicity as Hispanic or Latino/ Not Hispanic or Latino.

To find the information and numbers of diabetic patients in Dallas County, we extracted the inpatients, out patients and emergency department (ED) visits data for all patients with a primary and secondary diagnosis of diabetes and sorted by Dallas County as well as for Dallas County zip codes.

Arc GIS mapping system (ArcInfo version 10.0, ESRI, Redlands, CA), was then used to spatially join these numbers with their corresponding zip codes. This process revealed the zip codes with the prevalence of diabetes. For this research we selected four zip codes based on the highest diabetes prevalence. Data from the U.S. Census Bureau (2011) U.S. Department of Agriculture (2012) U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors. This information was spatially mapped with high diabetes prevalence zip codes to identify the disparities in these selected high diabetes zip codes.

Our North Texas Health Information and Quality Committee (NTHIQC) determine the research quality, the patient/hospital confidentiality as well as HIPAA (Health Insurance Portability and Accountability Act 1996), PHI (Protected Health Information) and FISMA (Federal Information Security Management Act of 2002) compliance of all the research projects conducted as well as supported by DFWHC Research Foundation. This research project was approved by the NTHIQ committee.

North Texas Community Health Collaborative (CHC) is a collaborative group comprised of professionals from different local organizations with wide range of expertise in public health, health care, data analysis, health disparities, strategic planning, and advocacy etc. Based on community health needs assessments and local organizations’ suggestions, community member organizations came together to develop this collaborative. DFWHC Research Foundation is a member, and serves to facilitate the collaborative’s efforts with communities in North Texas. This collaborative is governed and managed by its members only. This collaborative is working towards developing replicable models for understanding health and disease determinants/disparities, and supporting mechanisms for promoting healthier life style for individuals, families, neighborhoods, and communities.

RESULTS

The Data from DFWHC Research Foundation’s data registry were extracted at the zip code level. The four overall zip codes with high diabetes prevalence (75227, 75217, 75150, and 75149) revealed a median age of 29.8 years and practically a 50/50 split in gender distribution. Women had higher prevalence of diabetes (63% to 56%) as compared to men in all selected zip codes. Zip codes 75149 and 75150 had more than 70% Caucasian/whites and not Hispanic
population whereas 75227 and 75217 had mixed raced populations including Caucasians/whites, blacks and others and 43% to 46% residents with Hispanic or Latino ethnicity (Table 1).

**Table 1: Demographics of High Diabetes Prevalence Zip Codes in 2010**

<table>
<thead>
<tr>
<th></th>
<th>75217</th>
<th>75227</th>
<th>75149</th>
<th>75150</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>80,324</td>
<td>55,029</td>
<td>56,065</td>
<td>58,730</td>
</tr>
<tr>
<td><strong>Diabetes Prevalence</strong></td>
<td>10.8%</td>
<td>11.6%</td>
<td>9.5%</td>
<td>10.4%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Median Age</strong></td>
<td>27 Years</td>
<td>28 Years</td>
<td>31 Years</td>
<td>33 Years</td>
</tr>
<tr>
<td><strong>Median Age w/ Diabetes</strong></td>
<td>58 Years</td>
<td>58 Years</td>
<td>60 Years</td>
<td>63 Years</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>50.4%</td>
<td>48.5%</td>
<td>48.1%</td>
<td>48.2%</td>
</tr>
<tr>
<td><strong>Males w/ Diabetes</strong></td>
<td>36.6%</td>
<td>43.7%</td>
<td>43.0%</td>
<td>43.1%</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>49.6%</td>
<td>51.5%</td>
<td>51.9%</td>
<td>51.8%</td>
</tr>
<tr>
<td><strong>Female w/ Diabetes</strong></td>
<td>63.4%</td>
<td>56.3%</td>
<td>57.0%</td>
<td>59.9%</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>White/Caucasian</strong></td>
<td>34.6%</td>
<td>35.6%</td>
<td>71.2%</td>
<td>76.9%</td>
</tr>
<tr>
<td><strong>White/Caucasian w/ Diabetes</strong></td>
<td>21.8%</td>
<td>22.5%</td>
<td>60.3%</td>
<td>60.7%</td>
</tr>
<tr>
<td><strong>Black/African American</strong></td>
<td>34.8%</td>
<td>37.1%</td>
<td>15.2%</td>
<td>10.4%</td>
</tr>
<tr>
<td><strong>Black/African American w/Diabetes</strong></td>
<td>39.9%</td>
<td>48.0%</td>
<td>17.4%</td>
<td>14.0%</td>
</tr>
<tr>
<td><strong>Asian</strong></td>
<td>0.3%</td>
<td>1.4%</td>
<td>3.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>Asian w/ Diabetes</strong></td>
<td>0.2%</td>
<td>0.9%</td>
<td>3.2%</td>
<td>2.1%</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>30.3%</td>
<td>25.8%</td>
<td>10.6%</td>
<td>8.7%</td>
</tr>
<tr>
<td><strong>Other w/ Diabetes</strong></td>
<td>2.7%</td>
<td>2.1%</td>
<td>2.6%</td>
<td>4.3%</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hispanic or Latino</strong></td>
<td>46.4%</td>
<td>43.1%</td>
<td>16.8%</td>
<td>16.1%</td>
</tr>
<tr>
<td><strong>Hispanic or Latino w/ Diabetes</strong></td>
<td>35.1%</td>
<td>26.2%</td>
<td>16.3%</td>
<td>18.6%</td>
</tr>
<tr>
<td><strong>Unemployment Rate</strong></td>
<td>7.02%</td>
<td>6.80%</td>
<td>7%</td>
<td>6.56%</td>
</tr>
</tbody>
</table>

Table 2 shows the top five Inpatient diagnoses with diabetes as an underlying condition based on DFWHC Research Foundation’s clinical data registry. Acute kidney failure (45%) and septicemia (39%) were the most common causes for hospitalization in these diabetic patients in Dallas County. Acute kidney failure was also the most common cause for hospitalization in diabetic patients from these selected zip codes, ranging from 39% to 57%.

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In addition to the above, our data also showed that patients with diabetes had relatively higher mortality rates as compared to non-diabetic patients with septicemia (21% vs 23% w/diabetes) and acute kidney failure (3% vs 3.5% w/diabetes). Mortality with septicemia was much higher (23%) in inpatients with diabetes as compared to other four diagnoses. Our emergency department data showed that about 25% chest pain and 10% abdominal pain patients who visited emergency rooms were diabetic.

Table 2: Percent of Total In-patients with Diabetes in Five Selected Diagnoses in 2010

<table>
<thead>
<tr>
<th>Diabetes related Complications¹</th>
<th>Dallas County²</th>
<th>75227</th>
<th>75217</th>
<th>75150</th>
<th>75149</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Kidney Failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45.4%</td>
<td>57.4%</td>
<td>55.9%</td>
<td>42.1%</td>
<td>38.5%</td>
</tr>
<tr>
<td>Septicemia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38.7%</td>
<td>33.3%</td>
<td>47.9%</td>
<td>34.4%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>33.6%</td>
<td>40.9%</td>
<td>42.6%</td>
<td>41.9%</td>
<td>33.9%</td>
</tr>
<tr>
<td>Other Rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30.9%</td>
<td>43.1%</td>
<td>50.8%</td>
<td>32.4%</td>
<td>39.3%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.3%</td>
<td>33.0%</td>
<td>24.0%</td>
<td>22.5%</td>
<td>31.2%</td>
</tr>
</tbody>
</table>

¹ Based on DFWHC Research Foundation’s data these were the top five inpatient diagnosis (Diabetes related complications) with diabetes as an underlying condition. The data represent the percent of total inpatients in five selected diagnoses that had diabetes as an underlying condition.

² The data for Dallas County represent the percent of inpatients with diabetes in five selected diagnoses at the county level.

The results revealed that the prevalence of diabetes was not in proportion to the total population density (people/square mile) in these selected zip codes (Table 1). The zip code with the highest number of diabetic patients was 75227.

Map1: Diabetes Prevalence by Zip Code¹
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1 Based on DFWHC Research Foundation’s 2010 data
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Map 2: High Diabetes Prevalence Zip Codes in Dallas County

Based on DFWHC Research Foundation’s 2010 data

Only three hospital systems reside or were adjacent to these zip codes and clinics were in clusters and not evenly spread throughout these zip codes (Map3). Recreational locations and parks were also mapped for the Dallas County zip codes (Map 4). The map revealed that there were a small number of parks within a mile walking distance and there was only one recreation center near zip code 75227. Unemployment and median income levels were unevenly distributed suggesting that a low economic status was not always a determining factor to high prevalence of diabetes (Map 5). Supermarket availability was slim, yet convenience stores and fast food restaurants were plentiful in these areas (Map 6 & 7). Apart from this, hospitals were not found within walking distance or a five minute driving distance in these zip codes (Maps 8).

In addition, Map 8 clearly shows that in zip code 75227 supermarkets and food banks were not within a mile walking distance or a five minute driving distance of residents, while fast food restaurants were prolific. Convenience stores were the most prevalent retail businesses.
Map 3: Available Medical Resources in High Diabetes Prevalence Zip Codes in Dallas County

Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.

1 Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Map 4: Local Parks and Recreational Centers in High Diabetes Prevalence Zip Codes in Dallas County

Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.

Map 5: Median Income in High Diabetes Prevalence Zip Codes in Dallas County

1 Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.

Map 6: Food Resource Availability in High Diabetes Prevalence Zip Codes in Dallas County

1 Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.

Map 7: Fast Food Availability in High Diabetes Prevalence Zip Codes in Dallas County

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1 Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Map 8: Resources Availability in 1 Mile and 5 Mile Radius in High Diabetes Prevalence Zip Codes in Dallas County

DISCUSSION

In Dallas County, the median age of a resident was 29.8 years in 2010 whereas for a diabetic resident median age was 58 years. Race and ethnicity distribution in these zip codes showed that zip codes 75149 and 75150 had over 70% population from Caucasian/white race and from not- Hispanic ethnicity. Zip codes 75217 and 75227 had mixed race populations including

1 Data from the U.S. Census Bureau (2011), U.S. Department of Agriculture (2012), U.S. Department of Health Services (2011) and zip code information from Zip Atlas (2011) were used to determine the locations of environmental factors.
Caucasians/whites, blacks and others, and mixed ethnicity i.e. Hispanic or Latino as well as not Hispanic or Latino (Table1). Our analysis for Dallas County did not identify a higher prevalence of diabetes for a particular race or ethnicity. However, results indicated a higher prevalence of diabetes (56%-63%) in women as compared to men in all selected zip codes indicating the gender disparity, which has also been reported previously (Siddiqui et al. 2013).

Significant disparities in diabetes prevalence have been reported which contribute in higher prevalence rates, worse diabetes control, and higher rates of complications (Washington State Department of Health [WSDH], 2006). Factors associated with these disparities were cultural barriers (including language barriers), racial and ethnic differences (Peek et al. 2007; Miech et al. 2009), low socioeconomic status (Anderson & Armstead, 1995; McLaren, 2007; Kupelian et al. 2008; Fisher-Hoch 2010), inadequate access to care and suboptimal self-care behaviors (Kirk et al. 2008; Nwasuruba et al. 2009). Researchers have reported highest diabetes prevalence in low socioeconomic communities in a southern county in Texas (Fisher-Hoch et al. 2010). In Dallas County, unemployment and median income levels were unevenly distributed in these high diabetes prevalence zip codes, suggesting that a low economic status was not always a contributing factor to high prevalence of diabetes (Map5). However, two zip codes (75227 and 75217) with the high prevalence of diabetes had a very low median income (< $35,000), an unemployment rate between 6.80% and 7.02%.

Using GIS methodology, Siordia et al., 2012 concluded that economic disparity was not always associated with higher prevalence of diabetes in Galveston, Texas. Several studies using GIS technology have indicated the link between local resources (environmental factors) and prevalence of obesity, diabetes and other chronic diseases (Latetia et al. 2006; La Veist et al. 2008; Carol et al. 1994; Babey et al. 2008; Charreire et al. 2010). Researchers have explained the meaningful applications of GIS technology in public health and policy research (Nykiforuk & Flaman 2011). Geraghty et al. (2010) used the GIS tool to understand the disparities in health outcomes of diabetic patients and used this information to develop efficient diabetes management programs. Our results for Dallas County indicated that disparity in community resources (environmental factors) may be the most influential factor to diabetes prevalence rather than income, race and ethnicity. The Arc GIS mapping software enabled our data to be spatially analyzed to provide an in-depth detail of the resources available to the residents of these zip codes. The limited availability of community resources can greatly influence the health behaviors of those living in the community (Babey et al. 2008). Charreire et al. (2010) explained in their review the methodologies and potential of measuring the food environment using GIS technology. Brown et al. (2008) revealed that the socioeconomic environment and the traveling distance to supermarkets are associated with the rates of obesity and thus with an increase in diabetic patients. Maps 6-8 in our study illustrated the food deserts in these selected zip codes. A food desert can be defined as a “low-income census tract where a substantial number or share of residents has low access to a supermarket or large grocery store (United States Department of Health and Human Services [USDHHS] & Healthy Food Financing Initiative [HFFI] 2011). To qualify as a “low-income community,” a census tract must have either, a poverty rate of 20 percent or higher, or a median family income at or below 80 percent of the area's median family income; To qualify as a “low-access community,” at least 500 people and/or at least 33 percent of the census tract's population must reside more than one mile from a supermarket or large grocery store (for rural census tracts, the distance is more than 10 miles).
Zip code 75227 did not have any supermarket available to its population; only convenience stores were available for the residents to buy groceries. Since nutritious foods (like fresh fruits and vegetables) and a healthy diet are the key components for diabetes prevention and management, living in a food desert can be harmful to the residents. Even if there was a chain grocery store in a community, residents did not have fresh and healthy food choices. As reported by others, often in low socio-economic areas markets have smaller, limited selections of healthy fruits, vegetables and milk products (Brown et al. 2008).

Physical activity is another important component in the care and management of diabetes. Although there were some recreation centers and local parks in the area, most of them had limited daily accessibility. The absence of sidewalks by the roads made it difficult for residents to utilize these facilities and also caused a safety concern for those who prefer walking over other physical activities. Auchincloss et al. (2008) reported the association between limited neighborhood resources for physical activity and insulin resistance in Baltimore, Maryland, North Carolina and New York City.

Diabetes is often a companion of chronic illnesses and their symptoms. According to the CDC (2011), diabetes is the main cause of kidney failure. Data in Table 2 suggests that acute kidney failure with diabetes was the top inpatient diagnosis (45%) in Dallas County as well as in selected zip codes (39%-57%). Data on emergency department visits indicated that diabetes was a common co-morbidity of chest pain and abdominal pain, which were the top two reasons for ED visits by patients. The data revealed that even though diabetes was not the primary diagnosis for all of the hospital visits of these patients, it was a prevalent condition related to several top diagnoses in Dallas County. Our results showed that patients from these areas did not have easy access to medical facilities. Hospitals were not found within walking distance or a five minute driving distance of the zip codes with the most prevalent incidence of diabetes, and clinics were in clusters and not evenly spread throughout the four zip codes.

Overall, in addition to the gender disparity, the zip codes with the highest prevalence of diabetes had very few fresh food supermarkets, food banks, parks, sidewalks and hospitals (except for clustered medical clinics) indicating that addressing these disparities may be a prominent strategy for decreasing the high prevalence of diabetes in these zones in Dallas County.

CONCLUSION

This research is the first effort to identify the disparities associated with diabetes prevalence in Dallas County at zip code level. The strength of this research is our comprehensive data registry, which allowed us to analyze the inpatient, outpatient and emergency department data at the zip code level to identify the highest areas of diabetes prevalence. These results have major significance in terms of public health planning. With the identification of disparities in the high diabetes prevalence areas, public health efforts addressing prevention and management can be more efficiently targeted and appropriately implemented. Additionally, this information can also help hospital systems to evaluate the resources available for their patients, especially those diabetes patients who frequently visit the emergency department or are admitted as an inpatient.

As a future strategy, we would recommend that strengthening the primary care and community health care system may help in managing health conditions of diabetic patients at non-urgent levels to avoid the development of an urgent/emergent condition. We support improvements in health care data sharing for improved coordination of care between different health care
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providers, to prevent diabetes at an early stage and provide coordinated care at the treatment and management stage.

LIMITATION
The DFWHC Research Foundation’s database manages hospitals’ administrative data only. This database does not include the data from physicians, clinics, laboratories, post hospital discharge care, and long-term care facilities and other care providers. This limits us to tracking pre-diabetes and/or metabolic syndrome prevalence as well as post hospital discharge diabetes management information.

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