A Retrospective Cross-Sectional Analysis of Asthma, Hypertension and Diabetes Emergency Encounters; New Insights for Community Health Needs Assessments

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Abstract

Community Health Needs Assessments and the developed strategies corresponding to any findings provide opportunities to improve the health of communities by targeted, coordinated efforts to meet the community needs. Thomas Jefferson University Hospital's 2016 Community Health Needs Assessment utilized numerous data sources yet found data gaps pertaining to the health status of immigrant populations due to limitations of surveying methods. Large amounts of electronic patient-specific information are generated, exchanged, and stored as "big data" in health information exchanges. The Greater Philadelphia region uses the HealthShare Exchange, the regional HIE, as a community asset to facilitate this data transfer. The HealthShare Exchange provides a Clinical Database Repository (CDR), which was used for this study to (1) identify rates and possible disparities of asthma, hypertension, and diabetes among emergency encounters in Philadelphia and (2) assess the utility of the CDR for Community Health Needs Assessments. There were significant disparities identified between race/ethnicities, genders (asthma and hypertension only), and geographic regions for these diagnoses. With the future acquisition of primary health facility data and subsequent to further validity testing, the HealthShare Exchange's Clinical Database Repository shows promise in identifying disparities for future needs assessments and targeted intervention.

Introduction

Community Health Needs Assessments

The Community Health Needs Assessment is a systematic assessment of a population's health which highlights public health challenges and assets and also informs local public health programs, policies and partnerships. Section 9007 of the Patient Protection and Affordable Care Act included additional requirements for non-profit institutions (including hospitals and health systems) in that they must conduct a Community Health Needs Assessment at least once every three years and implement progress towards addressing the identified needs (NIH 2014). The CHNA includes indicators which reflect health behaviors, health conditions, healthcare factors and social/environmental determinants of health (Philadelphia Department of Public Health 2016). The assessments and developed strategies corresponding to any findings provide opportunities to improve the community health by targeted, coordinated efforts to meet the community needs (ASTHO N.D.). The findings can further promote better clinical decision-making within healthcare systems and better connect community health improvement initiatives.

Thomas Jefferson University Hospital's 2016 Community Health Needs Assessment utilized numerous data sources, including the following: the Public Health Management Corporation's (PHMC) household health survey, secondary data and literature sources, ninety internal and external experts and representatives of healthcare and community-based organizations knowledgeable of health and social conditions within the communities, and focus groups (Brawer 2016). The PHMC Household Health Survey gathers a wealth of information on the Philadelphia community but relies on capturing its information primarily through telephone calls only offered in English and Spanish. This data, being captured by through respondent data, is also limited in its clinical veracity, as it is not being supplied by a healthcare provider (PHMC

2015). The CHNA also did not use primary clinical information directly from a providers' electronic health record (Brawer 2016). The previous factors contribute to the identified data gap: here was a lack of information on the health status of immigrant populations largely due to the language barriers from survey mechanisms (Brawer 2016).

Big Data

"Big Data" refers to large, complex, and difficult to manage with traditional software and/or hardware, electronic datasets. The complexity of these datasets stems from the diversity of data types and the pressure for speed of consumption and management (Frost & Sullivan N.D.). Regarding healthcare "big data", this dataset may include for a specific patient: clinical data, clinical decision support systems (physician written notes and prescriptions, medical imaging, laboratory, pharmacy, insurance, other administrative data), patient data in electronic medical records (EMRs), machine generated/sensor data (monitoring vital signs, social media posts) (Raghupathi 2013). The wealth of information included is ever-growing, as the healthcare industry generates large amounts of data continually, driven by record keeping, compliance and regulatory requirements, incentivization programs, and patient care (Raghupathi 2010, 2014), and the push towards the digitalization of healthcare data enables flexible data usage and application (Raghupathi 2014).

As the healthcare field currently operates, large amounts of patient-specific information are generated, exchanged, and stored, capturing data pertaining to all aspects of care (diagnosis, medication, laboratory test results and radiological imaging data) (Jenson 2012). Added to the healthcare dataset's potential, electronic health record (EHR) adoption is expanding due to

federal initiatives such as the HITECH Act (Blumenthal 2010), which allows for easier data use and analysis.

The massive amount of data yields unforeseen opportunities for analytical methods. In discovering associations and trends within the datasets, the results of these analytics have the capacity to improve the quality of and lower the cost of care. Electronic medical records are now often used to research health disparities and assist in identifying patient risk factors (Bergdall 2012). By extracting insights from the aforementioned analytics, providers have the capacity to make better informed clinical decisions, by having more thorough and insightful diagnoses and treatments, which may result in higher quality care (Knowledgent 2013).

The application of analysis of healthcare "big data" has been and is currently being utilized for the following purposes: predictive modelling for risk and resource use, population health management, drug and medical device safety surveillance, disease and treatment heterogeneity, precision medicine and clinical decision support, quality of care and performance measurement, public health, research, and detecting diseases at earlier stages (Meltzer 2015, Raghupathi W 2014). All of the previous contribute to the capacity for the analytical methods to improve the quality of and lower the cost of healthcare.

There is much potential for the mining of EHRs for establishing new patient-stratification principles, revealing unknown disease correlations, and better understanding populations as a whole (Jensen 2012). Clinical datasets have the capability to provide insight into clinical representations of socioeconomic, insurance or access-related inequities. Having the efficiency advantage of larger administrative datasets and having detailed specific clinical information allows for the documentation the presence and magnitude of disparities (Richards 2003).

However, it should be noted that the value and the strength of "big healthcare data" resides in finding the associations available, i.e. finding the correlation or patterns which exist amid the complex data. The causal/explanation to the correlations identified should use alternative study methods which have more power to elucidate the associations' meaning (Ketchersid 2013).

The HealthShare Exchange

The HealthShare Exchange (HSX) is the health information exchange in the greater Philadelphia region and is currently expanding its geographic reach. HSX engages providers, health systems and health plans in securely sharing patient information to ensure the interoperability between health information systems of its members. The HSX does this through linking the electronic medical record systems of its members to enable accessibility at inpatient and outpatient points of care and for care management. This promotes continuity of care, reduces the need to transmit or transport medication information manually, and reduces duplication of health services (HealthShare Exchange N.D.).

An entity such as HSX solves the issue of having large amounts of patient data scattered, heterogeneous, and difficult to access to assess (Kush 2008) by maintaining a Clinical Database Repository (CDR) of clinical information centralized and primarily populated with encounter data about patients across the continuum of care as represented by the HSX membership. Over time, the CDR will depict a patient's longitudinal medical record containing a variety of types of information including: patient demographics, patient's primary care provider, medication lists, allergies, hospital inpatient visits, emergency department encounters, outpatient practice visits, immunizations ,diagnoses, procedures, lap results, social history, and vitals. As HSX increases

the amount of service offerings and increases its membership, this is due to expand (HealthShare Exchange N.D.).

As of 2017, the Clinical Database Repository is permitted to be utilized for population health applications for the purposes of population health management, program evaluation, quality improvement, performance management, disease or health risk monitoring, public health reporting, outbreak investigations, population health assessments, community health needs assessments, and prevention services (HealthShare Exchange 2017). Thus, this "big health data" source is ripe for being tested for its utilization to assist in community health needs assessment and provide insight for the clinical decision-making and patient health benefit.

Project Goals

- To identify disparities of the following indicators present within the adult population within the City of Philadelphia: asthma, hypertension, diabetes without complications, diabetes with complications between race/ethnicities in emergent encounters.
- To investigate the HealthShare Exchange's Clinical Database Repository use for community health needs assessments and population evaluations.

Methods

To compare the rates of hypertension, diabetes mellitus with and without complications, and asthma diagnoses within the city of Philadelphia among different race and ethnicities, data from the HealthShare Exchange, the health information exchange in the greater Philadelphia region, was utilized as a primary source of healthcare information.

The HealthShare Exchange (HSX) maintains a Clinical Data Repository (CDR) which is a centralized repository containing medical record information about patients within the Greater Philadelphia region (The HealthShare Exchange, 2017). The CDR is amassed through the storage of clinical messages passed between members of the health information exchange, largely admission, discharge, transfer messages, but, with members who are passing clinical care documents (CCDs) through the exchange, more robust clinical information (e.g. including problems, procedures, medications, etc.) is being stored within the repository. The HealthShare Exchange, being a growing health information exchange, has acquired inbound data feeds from healthcare organizations at different start dates; thus, the clinical information held within the repository is constantly being supplemented over time.

Data were mined from the HSX CDR using Structured Query Language (SQL) for the following variables (gender, age, race, ethnicity, and patient class are further defined later within the method's section):

- Encounter label- a randomized numeric value differentiating healthcare encounters
- Person Key- a randomized numeric value differentiating persons
- Diagnosis- International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD10) coded value
- Diagnosis Description- a human readable description of the ICD10 value

- Gender
- Age
- Death Indicator- indicating if the person died during the encounter
- Ethnicity Label
- Language Label- the description of languages
- Zip Code- the patient's home address zip code
- Source Facility Key- a randomized identifier for healthcare facilities
- Patient Class
- Race Label

The data pull was narrowed based on the following specifications:

- Over the Time frame: '2017-01-01 00:00:00.000' and '2018-01-01 00:00:00.000' in reference to the calendar year 2017.
- The Health Care Utilization Project's (HCUP) clinically relevant diagnosis grouping were used to group diagnoses, in the form of ICD10 codes related to hypertension, asthma, diabetes mellitus without complications and diabetes mellitus with complications. A full list of these diagnosis codes can be found in Appendix A.
- Patient Class "E", referring to an Emergency encounter. This excludes concept classes such as inpatient, obstetrics, outpatient, preadmit, commercial account, and recurring patient (CDC 2018).

The data were supplied in twelve separate reports according to the calendar month specified within comma separated values (.csv) files.

From this data pull, the sample was further defined for more meaningful analysis by narrowing to the adult population, 18-105 years of age, to the city of Philadelphia zip codes (see

below for the full list), and to the encounters with complete sets of information for the following variables: person key, gender, age ethnicity label, source facility key, patient class, race label, diagnosis.

Diabetes with complications refers to the conditions specific in Table 3 defined and classified by the Healthcare Utilization Project's clinical classifications software (CCS) categories. These categories have widespread use including the Agency for Healthcare Research and Quality (AHRQ) (AHRQ 2018).

Race and ethnicity were defined using the Census Bureau's definition: race being defined as a person's self-identification with one or more social groups; ethnicity being defined as whether a person is of Hispanic origin or not (U.S. Census Bureau 2017). These definitions are utilized within Health Level 7 (HL7) standards. HL7 is a non-profit standards-developing organization which provides frameworks for the exchange, integration, sharing, and retrieval of electronic health information (HL7 N.D.).

Within the sample data set, race and ethnicity labels were cleaned according to HSX coding criteria, which includes specifications from each healthcare facility. For example, based on a particular organization's workflow, race and ethnicity may be recorded in a unique way or be solely reliant on descriptions (labels). The data was normalized with values not following the HSX specification excluded from the sample population.

For analysis and comparison purposes, the race and ethnicity labels were cleaned based upon the HSX specification and grouped into the following categories:

- Black non-Hispanic or Latino
- White non-Hispanic or Latino
- Asian non-Hispanic or Latino

- Hispanic or Latino of Any Race

Based on the HSX data specification (which is based upon HL7 and industry standards), gender is not yet being entirely captured within this population. Facilities are capturing biological sex consistently. Thus the U.S. Census Bureau's definition of sex was used: an individual's biological sex e.g. male or female (U.S. Census Bureau ND).

For analysis and comparison purposes, the gender label variable was cleaned based upon the HSX specification and grouped into the following categories:

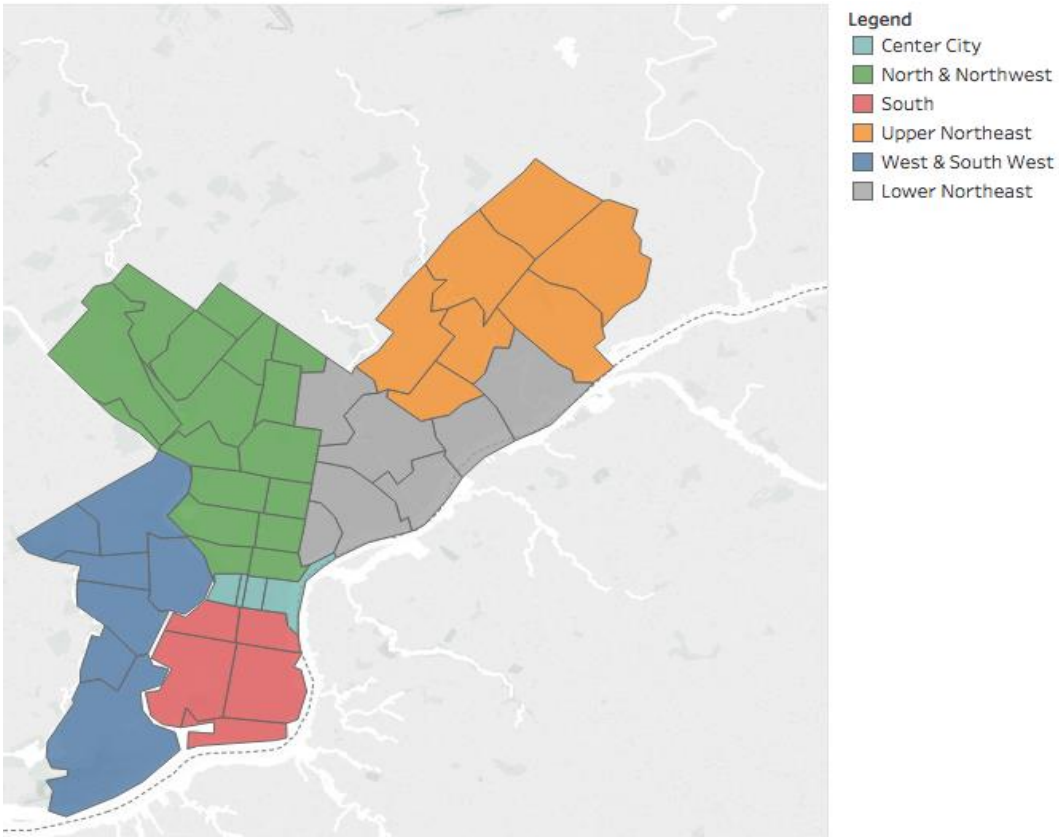
- Male
- Female

For analysis and comparison purposes, the sample was grouped by age based upon current industry (epidemiology) standards and census criterion (18-34; 35-64; 65-84; 84+) (Reijneveld 2003). As previously mentioned, the sample was narrowed to the age range 18-105 years of age to exclude the child/minor population.

For analysis and comparison purposes, the sample was geographically organized into the planning districts of Philadelphia (Philadelphia City Planning Commission 2017). However, the planning districts of Philadelphia do not correspond to exactly to zip code barriers. Due to this and small sample sizes, the sample was grouped geographically into the following categories referring to the specified zip code data:

Table 1. Definition of Geographic Regions based on City of Philadelphia Zip codes

North & Northwest	19118, 19119, 19121, 19122, 19123, 19126, 19127, 19128, 19129, 19130, 19132, 19133, 19138, 19140, 19141, 19144, 19150
Center City	19102, 19103, 19106, 19107
South	19112, 19145, 19148 19146, 19147
Lower Northeast	19120, 19124, 19125, 19134, 19135, 19136, 19137
Upper Northeast	19111, 19114, 19115, 19116, 19149, 19152, 19154
West & South West	19104, 19131, 19139, 19142, 19143, 19151, 19153



Thus, the following table describes the sample dataset utilized within this study:

Table 2. Sample Data Set Descriptive Characteristics

Male	26,110
Female	39,465
18-34	10,870
35-64	35,296
65-84	16,109
85+	3,300
Asian non-Hispanic	838
Black non-Hispanic	36,880
White non-Hispanic	18,622
Hispanic or Latino of Any Race	6,486
Total Sample Population	**65,575**

In order for the data to be normalized to the population within the city of Philadelphia, the denominator data was defined with the U.S. Census Bureau's 5-Year Estimates for 2016 using the America Fact Finder tool (U.S. Census Bureau ND) for the City of Philadelphia's zip codes and within the categories stated above (U.S. Census Bureau ND). The denominator values were thus:

Table 3. Denominator values from the U.S. Census Bureau's 5-Year Estimates (2016)

	City of Philadelphia	Asian non-Hispanic or Latino	Black non-Hispanic or Latino	White non-Hispanic or Latino	Hispanic or Latino of Any Race
Male	562015	40965	216688	229508	106632
Female	652172	45920	279987	246261	108138
18-34	460740	39096	173897	176450	137803
35-64	558106	38781	244289	204720	65591
65-84	166794	8434	68174	78066	10563
85+	28547	574	10315	16533	813
North & Northwest	353969	11139	207649	92244	40358
Central	50408	6895	3905	35880	2593
South	145554	19203	32556	80837	10662
Lower Northeast	221210	13834	63426	87316	57705

Upper Northeast	225090	22790	33736	141084	24337
West & South West	217956	13024	155403	38408	7159
Total Population	1214187	86885	496675	475769	214770

The sample was evaluated using IBM's SPSS statistical software using descriptive statistics and comparison analysis for statistically significant differences. Microsoft Excel was used to perform two sample z-test to determine significant differences between rates of emergency diagnoses. Microsoft Excel was used to complete risk ratios comparing found values to the City of Philadelphia rates and the white non-Hispanic Population.

Results

Hypertension

Table 1. Comparison of Rates of Adult Emergent Hypertension Diagnoses by Race/Ethnicity per 1000 Sample Population within the City of Philadelphia

	City of Philadelphia	Asian non-Hispanic	Black non-Hispanic	White non-Hispanic	Hispanic or Latino of Any Race
Male	23.68	4.88	31.60	20.20	9.61
Female	29.14	5.25	38.84	23.15	13.46
18-34	4.85	0.56	8.65	2.44	1.44
35-64	32.81	5.36	45.87	22.09	25.00
65-84	57.11	21.70	63.02	51.57	54.91
85+	78.43	48.78	69.61	82.20	75.03
North & Northwest	14.51	2.33	16.75	12.71	8.85
Center City	4.25	*	21.77	2.70	*
South	5.83	2.50	13.98	3.18	2.91
Lower Northeast	32.13	5.13	41.09	31.46	24.16
Upper Northeast	36.21	9.65	36.73	39.08	24.69
West & South West	49.80	4.84	63.45	14.35	12.99
Total Population	**26.61**	**5.08**	**35.69**	**21.73**	**11.55**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample z tests for the significance of the difference between two independent proportions were calculated between the corresponding rates of adult emergent hypertension diagnoses to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of emergent hypertension diagnoses, there were significant differences found in all comparisons *except* for between the Hispanic or Latino of Any Race 65-84, Hispanic or Latino of Any Race 85+, and the white non-Hispanic 85+ (Z= 0.95, 0.36, and 1.42 respectively).

When comparing to the white non-Hispanic populations, there were significant differences found in all comparisons *except* for between the Hispanic or Latino of Any Race 65-84, Hispanic or Latino of Any Race 85+, and the City of Philadelphia 85+ (Z=-1.45, 0.73, 1.42 respectively). For the calculated Z scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of emergent hypertension diagnoses, with a risk ratio of 1.34 and 1.64 when compared to the City of Philadelphia and the white non-Hispanic population respectively. The Asian non-Hispanic population had the lowest rates of emergent hypertension diagnoses, with a risk ratio of 0.19 and 0.23 when compared to the City of Philadelphia and the white non-Hispanic population respectively. This implies that there is a significant disparity between race/ethnic groups, and the black non-Hispanic population was most strongly affected by hypertension (as seen within emergent settings).

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. Significant differences were found between all age groups within the City of Philadelphia and within each race/ethnicity pairing. For the calculated Z scores, please see Appendix B. There was a similar trend within the City of Philadelphia and each race/ethnicity pairing indicating that there were higher rates of emergent hypertension diagnoses with older populations, with the 85+ population having the highest rates of emergent hypertension diagnoses in all race/ethnicities and seen throughout the City of Philadelphia.

To test for significant differences between the biological sexes groups within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences

between the biological sexes within the City of Philadelphia, black non-Hispanic, white non-Hispanic and the Hispanic or Latino of Any Race (Z=18.62, Z=13.64, Z=6.98, Z=8.33, respectively) with females of all of the previous populations having higher rates of adult emergent hypertension diagnoses. There was no significant difference between the biological sexes within the Asian non-Hispanic population (Z=0.75).

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences between all geographic districts within the City of Philadelphia. For the calculated Z scores for the comparisons, please see Appendix B. This implies that there is a significant disparity between geographic regions with the West & South West region having the highest rates of emergent diagnoses of hypertension than the other geographic regions; Center City had the lowest rates of emergent hypertension diagnoses.

Diabetes without Complications

Table 2. Comparison of Rates of Adult Emergent Diabetes without Complications Diagnoses by Race/Ethnicity per 1000 Sample Population

	City of Philadelphia	Asian non-Hispanic	Black non-Hispanic	White non-Hispanic	Hispanic or Latino of Any Race
Male	9.94	2.51	13.06	7.95	5.02
Female	11.28	2.68	15.00	7.69	7.27
18-34	2.07	0.46	3.50	0.93	0.95
35-64	13.12	2.81	17.64	8.27	12.85
65-84	24.11	10.32	27.14	19.59	30.48
85+	22.73	20.91	25.30	20.08	30.75
North & Northwest	5.75	1.62	6.63	3.94	5.77
Center City	1.75	*	11.01	0.81	*
South	2.12	0.83	5.04	1.13	*
Lower Northeast	14.14	2.89	17.26	12.23	13.48
Upper Northeast	14.00	5.57	15.38	13.84	10.44
West & South West	19.44	1.54	24.66	5.60	5.59
Total Population	**10.66**	**2.60**	**14.15**	**7.82**	**6.15**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample z tests for the significance of the difference between two independent proportions were calculated between the corresponding rates of adult emergent diabetes without complications diagnoses to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of emergent diabetes without complications diagnoses, there were significant differences found in all comparisons *except* for between the City of Philadelphia and the Asian non-Hispanic 85+, black non-Hispanic 85+, white non-Hispanic 85+, Hispanic or Latino of Any Race 85+, Hispanic or Latino of Any Race 35-64

populations (Z= 0.29, -1.48, 1.86, 1.50, 0.57 respectively). When comparing to the white non-Hispanic populations, there were significant differences found in all comparisons *except* between the white non-Hispanic and the City of Philadelphia 85+ and the Asian non-Hispanic 85+, (Z=1.86, 0.14 respectively). For the calculated Z scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of emergent diabetes without complications diagnoses, with a risk ratio of 1.33 and 1.81 when compared to the City of Philadelphia and the white non-Hispanic population respectively. The Asian non-Hispanic population had the lowest rates of emergent diabetes without complications diagnoses, with a risk ratio of 0.24 and 0.33 when compared to the City of Philadelphia and the white non-Hispanic population respectively. This implies that there is a significant disparity between race/ethnic groups with the black non-Hispanic population had the highest rates of adult emergent diabetes without complications diagnoses and the Asian non-Hispanic population having the lowest rates of diabetes without complications diagnoses.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. Significant differences were found between all age groups within the City of Philadelphia and within each race/ethnicity pairing with the exception of between the 64-84 and 85+ age groupings within the City of Philadelphia, black non-Hispanic, white non-Hispanic, and Hispanic or Latino of Any Race (Z=-1.40, -1.07, 0.42, 0.04 respectively). For the calculated Z scores of other comparisons, please see Appendix B. This implies that there is a significant disparity between age groups within each race/ethnicity pairing and within the City of Philadelphia. There was a trend of the rates of emergent diabetes

without complications diagnoses being higher as age increases and having no significant difference between the 64-84 and 85+ age group. The exception to the previous statement being the Asian non-Hispanic population which had an increase of the rate of adult emergent diabetes diagnoses increase with age increase.

To test for significant differences between the biological sexes within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences found between the biological sexes within the City of Philadelphia, the black non-Hispanic Population, and the Hispanic or Latino of Any Race populations (Z=7.17, 5.75, 6.67 respectively), with females having higher rates of emergent diabetes without complications diagnoses. There was no significant difference between the biological sexes within the Asian non-Hispanic and white non-Hispanic populations (Z=0.47, 1.02 respectively). This implies a disparity between the biological sexes in the City of Philadelphia, the black non-Hispanic population, and the Hispanic or Latino of any race which was not present within the Asian non-Hispanic and white non-Hispanic populations.

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences found between the geographic regions with the exception of the following comparisons: (1) between the Center City and South regions (Z=1.62) and (2) between the Lower Northeast and the Upper Northeast regions (Z= 0.40), which had no significant difference in rates of emergent diabetes without complications diagnoses. This implies that there is a significant disparity between geographic regions with Center City and South Philadelphia having the lowest rates of emergent

diabetes without complications diagnoses and the West & Southwest region having the highest rates of emergent diagnoses of diabetes without complications.

Diabetes with Complications

Table 3. Comparison of Rates of Adult Emergent Diabetes with Complications Diagnoses by Race/Ethnicity per 1000 Sample Population

	City of Philadelphia	Asian non-Hispanic	Black non-Hispanic	White non-Hispanic	Hispanic or Latino of Any Race
Male	4.03	0.73	5.86	2.82	1.86
Female	4.07	0.74	5.61	2.74	2.45
18-34	1.54	0.13	2.48	0.93	0.59
35-64	4.79	0.90	6.68	3.00	4.10
65-84	7.84	2.61	9.97	5.55	9.47
85+	8.20	3.48	9.69	6.71	15.99
North & Northwest	2.51	*	3.15	1.23	2.40
Center City	1.09	*	5.63	0.64	*
South	1.79	*	4.12	1.06	*
Lower Northeast	4.76	1.23	5.87	4.44	3.17
Upper Northeast	4.54	0.97	5.54	4.46	3.86
West & South West	7.54	*	9.47	2.16	9.50

Total Population	**4.05**	**0.74**	**5.72**	**2.78**	**2.16**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample z tests for the significance of the difference between two independent proportions were calculated between the corresponding rates of adult emergent diabetes with complications diagnoses to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of emergent diabetes with complications diagnoses, there were significant differences found in all comparisons *except* for between the City of Philadelphia and the Asian non-Hispanic 85+, black non-Hispanic 85+, white non-Hispanic 85+, Hispanic or Latino of Any Race 64-84 populations (Z= 1.25, -1.41, 1.74, 1.83, respectively). When comparing to the white non-Hispanic populations, there were significant differences found in all comparisons *except* between the White Non-Hispanic and the City of Philadelphia 85+ and the Asian non-Hispanic 85+ (Z=1.74, 0.94 respectively). For the calculated Z scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of emergent hypertension diagnoses, with a risk ratio of 1.41 and 2.06 when comparing to the City of Philadelphia and the white non-Hispanic population respectively. The Asian non-Hispanic population had the lowest rates of emergent diabetes with complications diagnoses, with a risk ratio of 0.18 and 0.27 when compared to the City of Philadelphia and the white non-Hispanic population respectively.

This implies that there is a significant disparity between race/ethnic groups with the black non-Hispanic population had the highest rates of adult emergent diabetes with complications diagnoses and the Asian non-Hispanic population having the lowest rates of diabetes with complications diagnoses.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences between all age groups within the City of Philadelphia and within each race/ethnicity pairing with the exception of between the 64-84 and 85+ age groups in the City of Philadelphia (Z=0.63) and in all race/ethnicity pairings, e.g. Asian non-Hispanic, black non-Hispanic, white non-Hispanic, Hispanic or Latino of Any Race (Z= 0.39, 0.37, 1.80, 1.81 respectively). There was a trend of the rates of emergent diabetes with complications diagnoses being higher as age increases and having no significant difference between the 64-84 and 85+ age group.

To test for significant differences between the biological sexes within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. There were no significant differences between the biological sexes within the City of Philadelphia, the Asian non-Hispanic, the black non-Hispanic and the white non-Hispanic populations (Z=0.32, 0.04, 1.18, 0.57). There was a significant difference between the biological sexes within the Hispanic or Latino of any race populations (Z=1.97). This implies that there is no disparity between the biological sexes with the exception of the Hispanic or Latino of any race where the female population had higher rates of emergent diabetes with complications.

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample z tests for the significance of the difference between two independent proportions were calculated. There were no significant differences between the Lower Northeast and the Upper Northeast geographic areas in diagnoses of emergent diabetes with complications (Z=1.08). This implies that there is a significant disparity

between geographic regions with Center City having the lowest rates of emergent diabetes with complications diagnoses; the West & Southwest geographic region having the highest rates of diabetes with complications diagnoses.

Asthma

Table 4. Comparison of Rates of Adult Emergent Asthma Diagnoses by Race/Ethnicity per 1000 Sample Population

	City of Philadelphia	Asian non-Hispanic	Black non-Hispanic	White non-Hispanic	Hispanic or Latino of Any Race
Male	18.59	1.76	29.25	9.30	14.39
Female	7.58	0.76	10.45	4.50	6.36
18-34	15.13	1.00	25.41	6.90	7.55
35-64	12.52	1.26	17.25	7.28	15.28
65-84	7.52	2.02	8.33	5.66	16.00
85+	6.24	3.48	6.30	5.69	13.53
North & Northwest	8.23	*	9.85	4.43	9.02
Center City	2.18	*	11.27	1.20	*
South	3.67	1.30	9.64	1.77	1.59
Lower Northeast	20.35	1.23	27.32	13.80	23.62
Upper Northeast	10.90	1.84	17.93	9.19	15.78
West & South West	22.41	*	29.11	3.83	11.73
Total Population	**12.68**	**1.23**	**18.69**	**6.82**	**10.35**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample z tests for the significance of the difference between two independent proportions were calculated between the corresponding rates of adult emergent diabetes with complications diagnoses to the City of Philadelphia and to the white non-Hispanic populations. When

comparing to the City of Philadelphia rates of emergent diabetes with complications diagnoses, there were significant differences found in all comparisons *except* for between the City of Philadelphia and the Asian non-Hispanic 85+, black non-Hispanic 85+, white non-Hispanic 85+, populations (Z= 0.83, -0.07, 0.73, respectively). When comparing to the white non-Hispanic populations, there were significant differences found in all comparisons *except* between the White Non-Hispanic and the City of Philadelphia 85+ , the Asian non-Hispanic 85+, the black non-Hispanic 85+, (Z=0.73, 0.69, 0.64 respectively). For the calculated Z scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of emergent asthma diagnoses, with a risk ratio of 1.47 and 2.74 when compared to the City of Philadelphia and the white non-Hispanic population respectively. The Asian non-Hispanic population had the lowest rates of emergent hypertension diagnoses, with a risk ratio of 0.10 and 0.18 when compared to the City of Philadelphia and the white non-Hispanic population respectively. This implies that there is a significant disparity between race/ethnic groups with the black non-Hispanic population had the highest rates of adult emergent asthma diagnoses and the Asian non-Hispanic population having the lowest rates of asthma diagnoses.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. Within the City of Philadelphia and within the black non-Hispanic population, there was significant differences between all age groups. Within the Asian non-Hispanic population, there were no significant differences between the age groups. Within the white non-Hispanic population, significant differences were found between the 18-34 and 65-84 age groups (Z=4.66) and between the 35-64 and 85+ age groups

(Z=2.34). Within the Hispanic or Latino of Any Race population, significant differences were found between the 18-24 and all other age groupings e.g. 35-64, 65-84 and 85+ (Z= 16.34, 13.24, 1.96 respectively).

This implies that age affects the rate of adult emergent asthma diagnoses in the race/ethnicity pairings differently. Within the Asian non-Hispanic population, there was no disparity between age groups. Within the City of Philadelphia and the black non-Hispanic population, the amount of emergent adult asthma diagnoses decreased with age. The white non-Hispanic population had an irregular trend in emergent adult asthma diagnoses. Within the Hispanic or Latino of any race population, adult emergent asthma diagnoses were seen to be the least seen in the 18-34 age range with all other age groups having no significant difference.

To test for significant differences between the biological sexes within the City of Philadelphia and within each race/ethnicity, sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences between the biological sexes in the City of Philadelphia and all race/ethnicity pairings (Z= 54.06, 4.18, 48.55, 20.08, 18.37). This implies that there is a disparity between the biological sexes with the male population having higher rates of emergent adult asthma diagnoses within all race/ethnicity pairings and City of Philadelphia.

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample z tests for the significance of the difference between two independent proportions were calculated. There were significant differences between all geographic areas. Please see Appendix B for Z scores. This implies that there is a significant disparity between geographic regions with the West & South West region having the

highest rate of emergent diagnoses of asthma and Center City having the lowest rates of emergent asthma diagnoses.

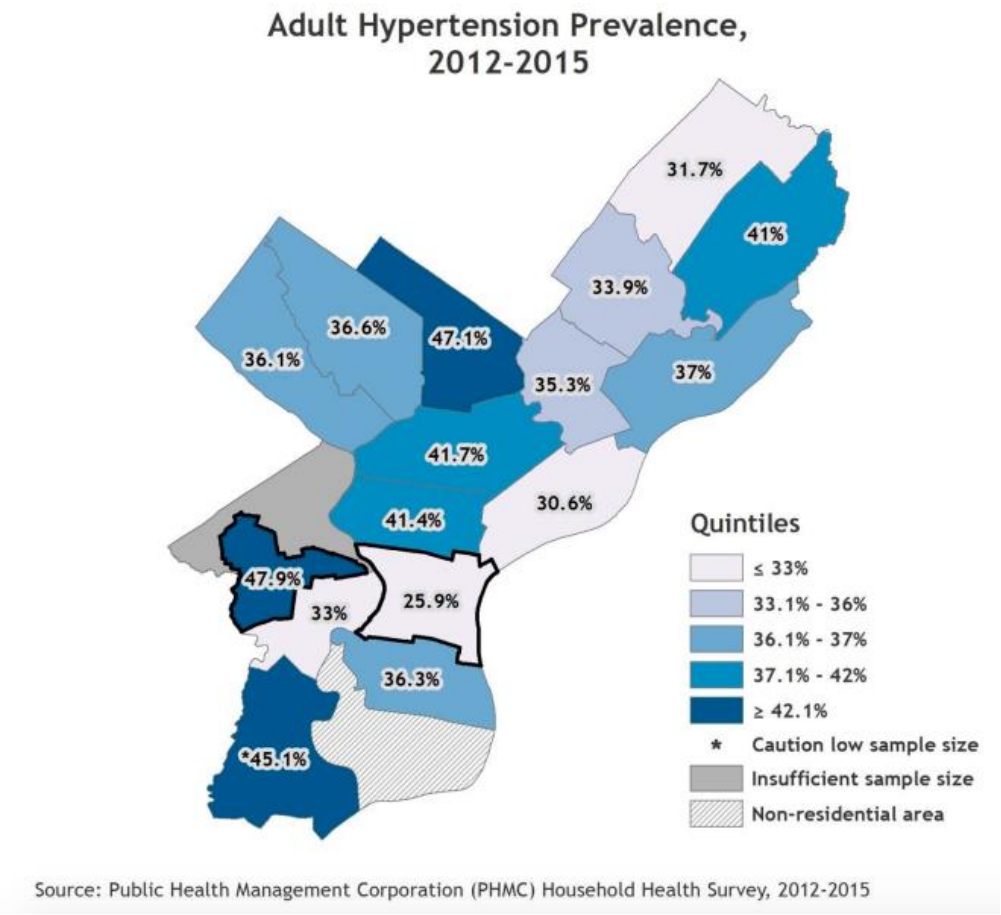
Discussion

Hypertension

The racial disparity in hypertension and hypertension-related outcomes has been recognized for decades with African Americans having with greater risks than Caucasians. Blood pressure levels, including having an earlier onset of hypertension, have consistently been higher for African Americans (Lackland 2014). From American national data, the prevalence of adult hypertension is similar between men and women, increasing with age, and highest among non-Hispanic black adults (Nwankwo 2013). This is consistent with Pennsylvania statewide analyses into chronic conditions: the black non-Hispanic adult population had a higher rate of hospitalization for hypertension compared to Hispanic adults and white non-Hispanic adults (Pennsylvania Health Care Cost Containment Council 2010).

The Philadelphia Department of Public Health, within their community health needs assessment, found that for the City of Philadelphia adult hypertension prevalence was highest amongst black non-Hispanic, white non-Hispanic, Hispanic, Asian non-Hispanic (however the Asian non-Hispanic value had a low sample size, using the Public health management corporation's household health survey). The prevalence in geographic region is shown below:

Figure 1. Community Health Needs Assessment Prevalence of Adult Hypertension within Geographic Regions of Philadelphia



(Philadelphia Department of Public Health 2016)

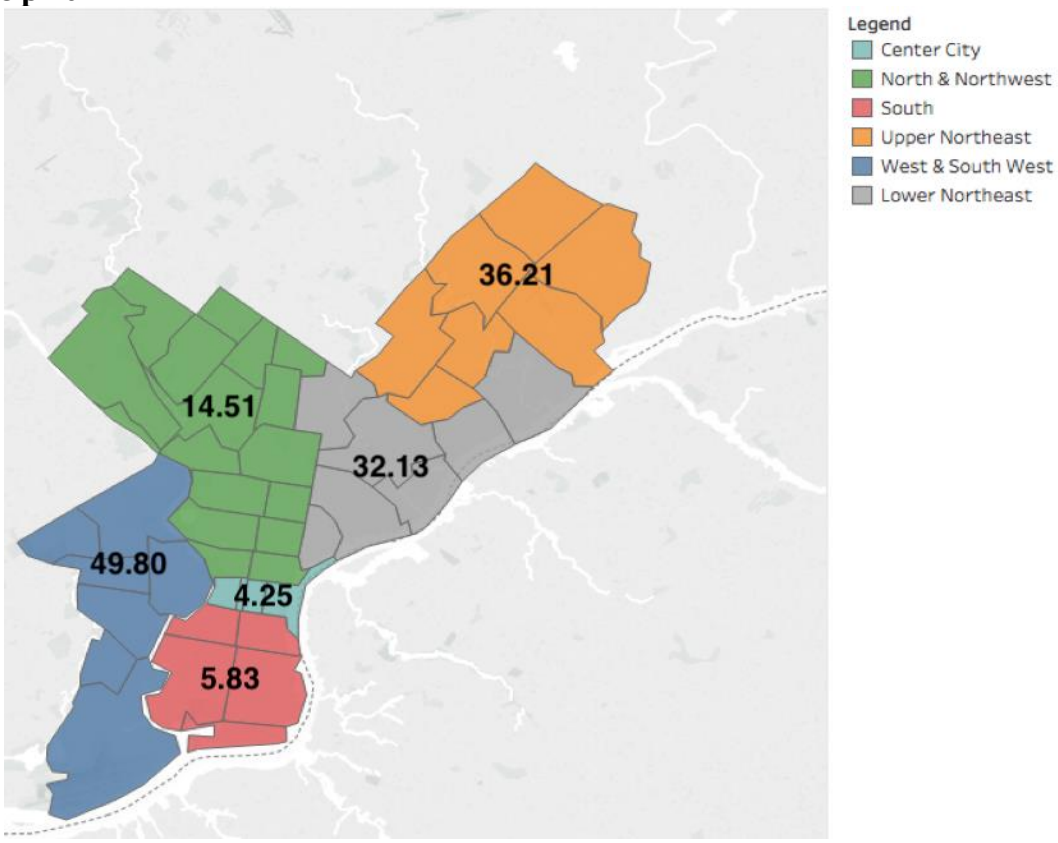
While prevalence statistics and therefore magnitude cannot be compared with the results in this study, the trends within the populations analyzed can be compared to elucidate additional information on the impact of hypertension within the City of Philadelphia.

This study had significant difference between the sexes, with the female population having higher emergent hypertensive diagnoses, which does not correspond to what was found in the national prevalence or Pennsylvania's prevalence. This may be due to the limitations discussed later in this section or may indicate a disparity between the sexes within emergent hypertension diagnoses. More insight should be made into the causation of the difference in the

rates of diagnoses between the biological sexes including a regional difference between the sexes in emergency department use for primary care conditions.

This study had a similar the trend found by the Philadelphia Department of Public Health in race/ethnicities with the higher rate of emergent hypertension diagnoses within the Black Non-Hispanic adult population. The geographic distribution of emergent hypertension diagnoses is shown below:

Figure 2. Rates of Adult Emergent Hypertension Diagnoses within Geographic Regions of Philadelphia



The geographic disparities found within this study somewhat aligned with what the Philadelphia Department of Public Health found in their community health needs assessment. The West & Southwest regions showed higher hypertension emergent diagnoses which was

similar to what the Philadelphia Department of Public Health found in their assessment for the region. This was also seen to be true for the Upper Northeast and Lower Northeast regions.

However, the other regions assessed in this study (Center City, North & Northwest, and South) did not align with what was found in the Philadelphia Department of Public Health's Community Health Needs Assessment. This difference may be due to the geographic distribution of the HealthShare Exchange's membership when the data was pulled or may be due to a disparity found within the population. Further investigation and assessment should be completed to determine if a disparity does indeed exist between these geographic regions in need of interventive methods.

Diabetes without Complications

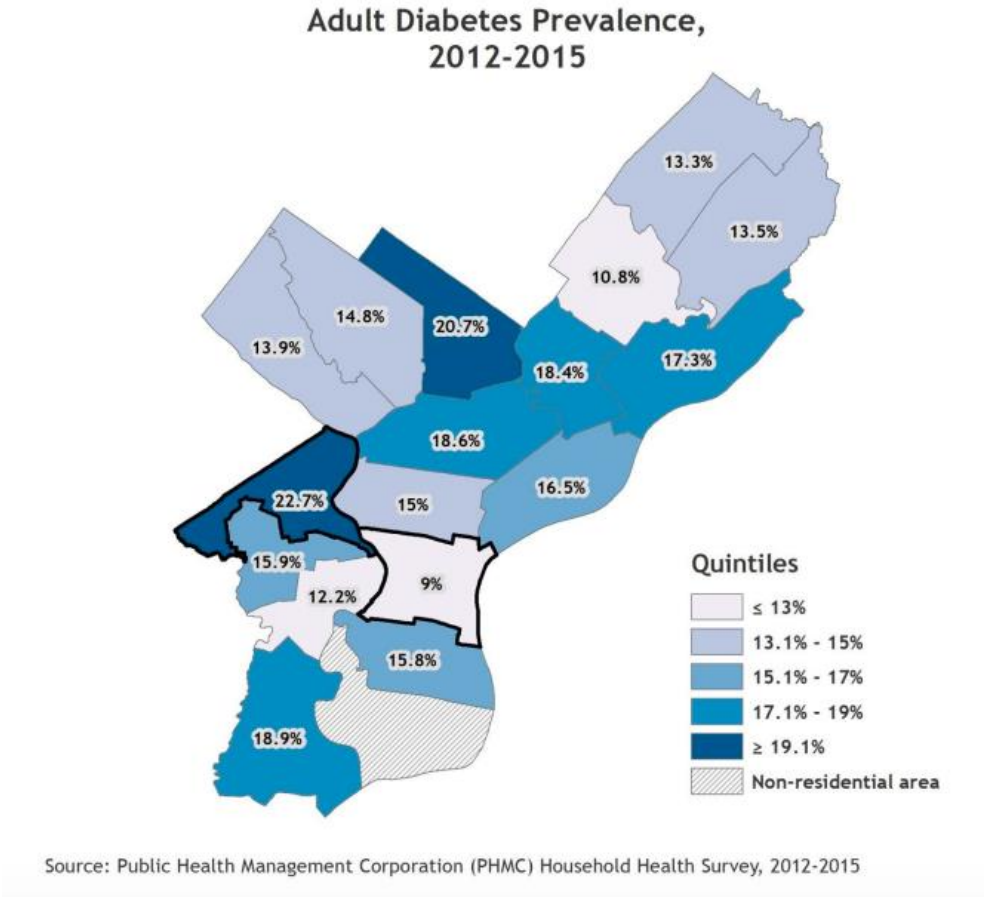
According to the National Diabetes Statistics Report (2017), the adult age group primarily affected by diabetes was the 45-64 age range. The race/ethnicity most prominently affected by diabetes was observed to be highest among the American Indian/Alaska Native population, closely followed by the non-Hispanic black population, and persons of Hispanic ethnicity. The diabetes among the non-Hispanic whites and the Asian non-Hispanic population was less prevalent. Nationally, women and men had very similar prevalence rates of diabetes (CDC 2017).

In Pennsylvania, hospital rates for diabetes increased as age increased, and the admission rate was higher in the male population than in the females (Pennsylvania Health Care Cost Containment Council 2010). In the City of Philadelphia, the adult diabetes prevalence was highest among black Non-Hispanic, white non-Hispanic, Hispanic of any race, Asian non-Hispanic. It should be noted that the Public Health Management Corporations' Household Health

Survey was used for the assessment, which had low sample sizes for the Asian Non-Hispanic Population. (Philadelphia Department of Public Health 2016).

In the City of Philadelphia, according to the Philadelphia's Department of Public Health's Community Health Needs Assessment, the adult diabetes prevalence was seen to differ throughout the geographic areas of the city:

Figure 3. Community Health Needs Assessment of Adult Diabetes Prevalence within the City of Philadelphia



(Philadelphia Department of Public Health 2016).

Again, it should be noted that while prevalence statistics and therefore magnitude cannot be compared with the results in this study. The trends within the populations analyzed can be compared to elucidate additional information on the impact of diabetes on different populations within the City of Philadelphia.

This study found results trending similarly to literature prevalence with the black non-Hispanic population having the highest rates of emergent diabetes without complications diagnoses, followed by white non-Hispanic, Hispanic, with the Asian non-Hispanic population having the least rates of emergent diabetes without complications diagnoses.

African Americans, Hispanics, and Native Americans experience a 50%-100% higher burden of illness and mortality due to diabetes than white Americans, yet the disease appears to be more poorly managed among minority patients. In a study of nearly 1,400 Medicare beneficiaries with a diagnosis of diabetes, Chin, Zhang, and Merrell (1998) found that even after controlling for patients' gender, education, and age, African-American patients were less likely to undergo a measurement of glycosylated hemoglobin, lipid testing, ophthalmologic visits, and influenza vaccinations than white patients after being diagnosed with diabetes. African-American patients with diabetes were also more likely to use hospital emergency departments and had fewer physician visits (Chin et al 1998).

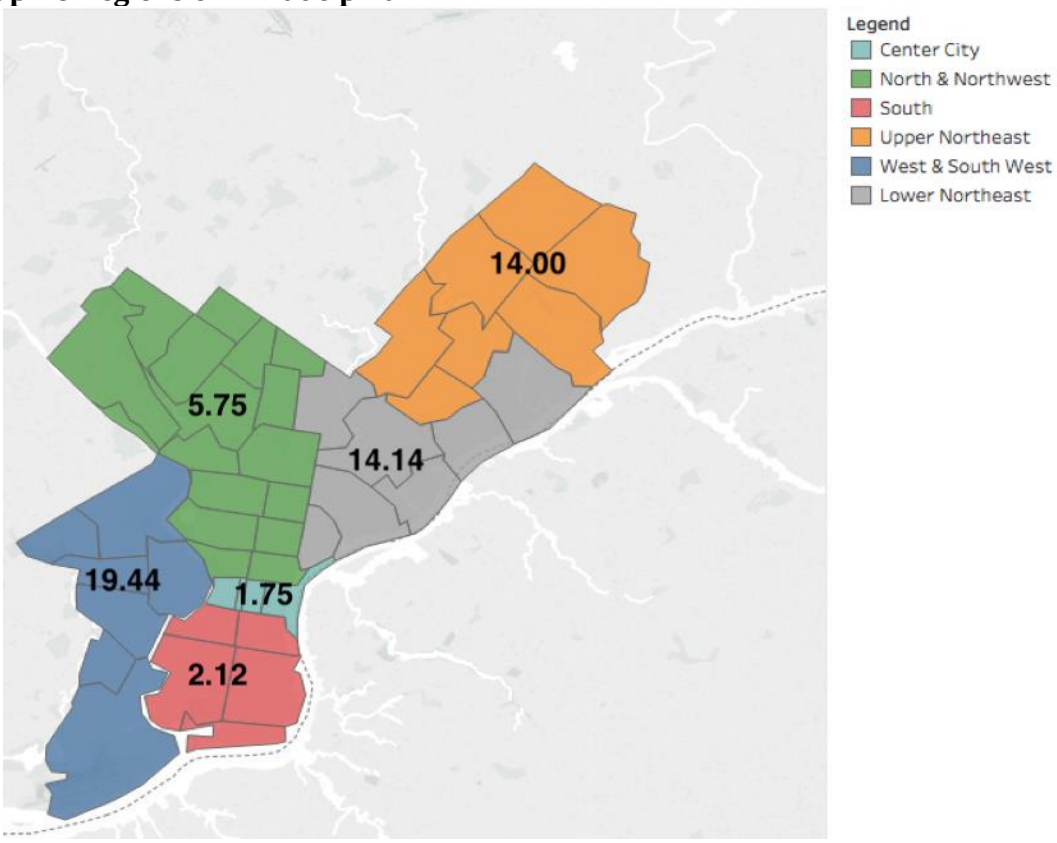
Thus, the differences in emergent diabetes without complication rates within race/ethnicity pairings may be due to the differences in the type of care utilized by the different populations (emergency department versus physician visits) and may have a biological component as well in that there is physiological different in how different race/ethnicities are affected by diabetes seen even when confounding variables are accounted for.

This study found significant differences in sexes in the majority of the race/ethnicities and within the City of Philadelphia with females having higher rates of emergent diabetes without complication diagnoses. This does not correspond to what was found in the literature for the state (which had indicated that the male population was more affected by diabetes than the female population) , which may be due to the limitations discussed later in this section or may

indicate a local disparity between the sexes in emergent diabetes without complications diagnoses. More insight should be made into the causation of the difference in the rates of diagnoses to better inform local intervention.

In this study, diabetes was separated out between the diagnoses of the patients who had complications with the condition and those without with the disease. For comparison purposes to the above:

Figure 4. Rates of Adult Emergent Diabetes without Complications Diagnoses within Geographic Regions of Philadelphia



The geographic trends did not match what was found within the Philadelphia Department of Public Health's Community Needs Assessment, especially pertaining to this study's North & Northwest regions. This difference may be due to the geographic distribution of the HealthShare Exchange's membership when the data was pulled or may be due to a disparity found within the

population. Further investigation and assessment should be completed to determine if a disparity does indeed exist between these geographic regions in need of interventive methods.

Diabetes with Complications

This study grouped together all complications coded to be associated with diabetes by the Healthcare Utilization Project's Clinical Classification Software (HCUP 2018). These complications may include amputations, macrovascular complications (such as coronary artery disease, strokes, and congestive heart failure), peripheral arterial disease, microvascular complications (such as retinopathy, nephropathy, neuropathy) and more (Spanakis 2013).

Nationally, the black non-Hispanic, Hispanic of any race, and Asian non-Hispanic populations were found to have had lower risk for developing cardiovascular complications of diabetes compared to the white non-Hispanic population (Lanting 2005). Data from the Centers for Disease Control and Prevention showed that Hispanic Americans with diabetes had a lower percentage of stokes or heart disease among those ages 35 years and older compared to the white non-Hispanic population or the black non-Hispanic population. Although the black non-Hispanic population and the Hispanic Americans seem to have a lower or equal incidence of diabetic cardiovascular disease (CVD) compared to the white non-Hispanic population, the mortality rate for the black non-Hispanic population from CVD and the mortality rate for Hispanic Americans from acute stroke is higher compared to the white non-Hispanic population (Lanting 2005).

In Pennsylvania, diabetes hospital rates with long-term complications were analyzed for two conditions and black non-Hispanic adults had the highest hospitalization rate for both of the

conditions analyzed (end stage renal disease, lower extremity amputations) analyzed (Pennsylvania Health Care Cost Containment Council 2010).

Again, it should be noted that while prevalence statistics and therefore magnitude cannot be compared with the results in this study, the trends within the populations analyzed can be compared to elucidate additional information on the impact of diabetes with complications on different populations within the City of Philadelphia.

In this study, the black non-Hispanic had the highest rates of adult emergent diabetes with complications with the Asian non-Hispanic population having the lowest rates. This does not align with national date but does align with what was found for the state. This discrepancy may be due to the difference in the definitions used for complications for diabetes, which was not uniform. This study included all complications possibly diagnosed and coded for diabetes, which neither the state nor national data accounted for. Some of the ethnic differences in prevalence between race/ethnicities have been shown to have a genetic basis, but socioeconomic and cultural factors have been shown to have a greater influence (Cusi 2011).

This study observed no difference between sexes except within the Hispanic or Latino of Any Race. This implies that there is no disparity between the biological sexes with the exception of the Hispanic or Latino of Any Race where the female population had higher rates of emergent diabetes with complications. While difficult to have a direct comparison, this does not align with literature suggesting women have more complications associated with diabetes than men with women have having all-cause mortality (Ametz 2014). However, the reasons for these differences remain very much unclear but bay include differences in physiology, treatment response and psychological factors (and treatment guidelines do not differentiate between sexes) (Ametz 2014).

Asthma

From national data, the prevalence of adult asthma is higher in adult women than adult men, highest in white non-Hispanic adults and lowest in the "other non-Hispanic adult" populations (CDC 2015). In Pennsylvania, 9.3% of the Pennsylvania adults were told they currently have asthma (in comparison to the 8.7% of adults nationwide). In Pennsylvania, women were more likely than men to be diagnosed with asthma, aligning with the national statistics. Hospitalizations for asthma were higher in adult females than males, higher in black non-Hispanic residents compared to the Hispanic of any races and white non-Hispanic residents (Pennsylvania Health Care Cost Containment Council 2010).

Again, it should be noted that while prevalence statistics and therefore magnitude cannot be compared with the results in this study, the trends within the populations analyzed can be compared to elucidate additional information on the impact of asthma on different populations within the City of Philadelphia.

In this study, the trends between genders was found to be dissimilar than the national and Pennsylvania trend: females in this study were seen to have less emergent asthma diagnoses than men. This may be due to not-quite a direct comparison between prevalence and emergent diagnoses rates completed in this study or limitations (discussed below); however, this may be due to the limitations discussed later in this section or may indicate a disparity between the sexes within emergent asthma diagnoses or a difference in using emergency departments for asthma care versus physician visits. More insight should be made into the causation of the difference in the rates of diagnoses between biological sexes

This study found that the black non-Hispanic population had the highest rates of adult emergent asthma diagnoses and the Asian Non-Hispanic population having the lowest rates of asthma diagnoses, which aligns with what the state of Pennsylvania observed but is dissimilar to what was observed nationally. This indicates that there are local geographical, socioeconomic and other factors affecting the rate of asthma within the studied population.

Historically, African Americans, especially those living in impoverished areas, are at a higher risk of morbidity and mortality due to asthma (Zoratti et al 1998), It has not been well established if the greater prevalence of asthma among African Americans is due to biologic or genetic predisposition, socioeconomic factors. However, African Americans are more likely to receive treatment for asthma in emergency rooms (Zoratti et all 1998), which was confirmed with this study. Zoratti et al. had found that even after controlling for income, marital status, gender and age, African American patients were seen to be more likely to access care in emergency, rooms, were hospitalized more often, and were less likely to be seen by an asthma specialist (Zoratti et al, 1998).

The Centers for Disease Control and Prevention (CDC) have reported that, of the adult age groups, the 15-24 age range has the highest prevalence of asthma (CDC 2016), which aligns with what was found in this study for all race/ethnicity pairings with the exception of the Asian non-Hispanic population and the white non-Hispanic population. This suggests that there may be local disparities seen in the city of Philadelphia in reference to age regarding effects of asthma, which should be explored further.

Conclusions

Access to care may explain the race/ethnicity population differences in rates of emergent diagnoses seen in this study. Black Non-Hispanic and Hispanic patients are more likely to receive their regular care in emergency departments (Richards 2003). However, it has been seen that differences in emergency department visit rates observed by race or ethnicity are may have been to be confounded by age, insurance coverage, regular source of care, and other barriers to health care (Baker 1996). Minorities have been observed to more likely access care in emergency departments and are less likely to have a regular source of care (Collins, Hall, and Neuhaus, 1999). Further, minorities tend to have lower access than whites to specialty care and are less likely to be treated in settings that offer higher-technology procedures (IOM 2003).

For all of the diagnoses analyzed, the Asian Non-Hispanic population was seen to have a lower rate of emergent diagnoses. This may be due to the aggregation of diverse Asian subgroups, which vary in disease occurrence, immigration patterns, socioeconomic background and dietary and cultural practices (Hastings 2015). Because subgroups were not separated out, the aggregated rate may not be accounting for nor identifying subgroup health issues, which may have individual higher rates of adult emergent diagnoses.

Rates of emergent diagnoses which did not correspond to literature may be due to limitations discussed below but, as this study used primary healthcare data, should indicate that more insight is needed to better elucidate the health issue and propose impactful solutions for the affected populations.

This data source was able to provide a higher number for the study population than the Public Health Management Corporation's Household Health Survey and the HSX data consists of primary health information. This, for clinical health indicators, provides stronger insight into

the impact of the conditions on the associated populations than the telephone, self-reported data. However, the PHMC is more poised to better capture non-diagnosis parameters, of which the HSX Clinical Database Repository does not capture as of yet (e.g. proximity to a grocery store or reported level of neighborhood safety).

Limitations

The limitations of this study are largely due to factors associated with the sampling mechanisms used and the data source itself. The majority of the limitations result in the underrepresentation of the health indicators, asthma, hypertension, diabetes with and without complications, within the sample population.

There is a limitation of using electronic health records as a source of information; the information is not infallible. Pertaining to ethnicity/race in particular, in a comparison of HealthPartners Medical Group (HPMG) EMR data to ethnicity/race to the self-reported classification, the agreement of data sources was high overall and among whites, African Americans, and Asians. Lower agreement was observed among Hispanic Native American and mixed-race patients (Bergdall 2012).

The sampling criterion separating emergent encounters from, for example, inpatient and outpatient criteria, may have limited the amount of diagnoses represented in the sample. The diagnoses analyzed in this study, asthma, diabetes with and without complications and hypertension, being chronic conditions typically treated in the inpatient healthcare space, not within emergency encounters.

Being reliant on coded information within this study would also limit the sample size in that patients who did not have coded values of race, ethnicity, diagnosis, and gender would have been excluded from the sample.

The HealthShare Exchange's Clinical Database Repository, being constantly added to with the addition of new inbound feeds, did not have universal coverage of the healthcare entities in this region over the year 2017 (data feeds were added within this time frame). The values in this study would be under reported due to this constraint.

The validity of this data source has not been established. This study provides information as to the capabilities of the resource, but comparisons between reported measures of the healthcare facilities supplying data versus the metrics developed within the HealthShare Exchanges' Clinical Database Repository have not been completed as of yet.

There is also limited comparison material for emergent diagnoses of this nature. Thus, direct comparisons to national or state statistics were difficult to identify and evaluate.

Next Steps

This study should poise as a springboard as to what the capabilities the HealthShare Exchange's Clinical Database Repository can and should be utilized for in terms of population health management. With the additional data feeds added late 2017 and early 2018, a better representation of the health issues, disparities, and indicators is available (HealthShare Exchange 2018). The information held within the repository will give a timely snapshot of the health status in the greater Philadelphia area.

However, more insight is needed to evaluate the representative nature of the source. There has been no analysis into the validity of the data held within the repository in terms of

measuring indicators from the hospital perspective nor the comparisons of reportable health indicators to city/national values. The potential for the data source, as an aggregation of clinical information for the Greater Philadelphia region, is high; additional studies modeled with more direct comparisons for previously known health indications should be completed to both verify the data and yield more insight into the community health status.

Due to the information within the repository largely consisting of admission, discharge, transfer messages carrying limited clinical information, it is likely underrepresenting the magnitude of health issues discussed within this study.

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Appendix A

Table 1. Healthcare Utilization Project ICD-10 Codes for Asthma, Essential Hypertension, Diabetes mellitus without complications

Asthma	Essential Hypertension	Diabetes mellitus without complications
'J45.20'	'I10'	'E08.9'
'J45.21'		'E09.9'
'J45.22'		'E10.9'
'J45.30'		'E11.9'
'J45.31'		'E13.9'
'J45.32'		'R73.01'
'J45.40'		'R73.02'
'J45.41'		'R73.03'
'J45.42'		'R73.09'
'J45.50'		'R73.9'
'J45.51'		'R81'
'J45.52'		'R82.4'
'J45.901'		'Z46.81'
'J45.902'		'Z96.41'
'J45.909'		
'J45.990'		
'J45.991'		
'J45.998'		

Table 2. Healthcare Utilization Project ICD-10 Codes for Diabetes mellitus with complications

Diabetes mellitus with complications												
'E08.00'	'E08.3522'	'E08.65'	'E09.3513'	'E09.638'	'E10.3512'	'E10.630'	'E11.3499'	'E11.621'	'E13.3491'	'E13.3543'	'E16.4'	'E27.49'
'E08.01'	'E08.3523'	'E08.69'	'E09.3519'	'E09.641'	'E10.3513'	'E10.638'	'E11.351'	'E11.622'	'E13.3492'	'E13.3549'	'E16.8'	'E27.5'
'E08.10'	'E08.3529'	'E08.8'	'E09.3521'	'E09.649'	'E10.3519'	'E10.641'	'E11.3511'	'E11.628'	'E13.3493'	'E13.3551'	'E16.9'	'E27.8'
'E08.11'	'E08.3531'	'E09.00'	'E09.3522'	'E09.65'	'E10.3521'	'E10.649'	'E11.3512'	'E11.630'	'E13.3499'	'E13.3552'	'E20.0'	'E27.9'
'E08.21'	'E08.3532'	'E09.01'	'E09.3523'	'E09.69'	'E10.3522'	'E10.65'	'E11.3513'	'E11.638'	'E13.351'	'E13.3553'	'E20.8'	'E28.0'
'E08.22'	'E08.3533'	'E09.10'	'E09.3529'	'E09.8'	'E10.3523'	'E10.69'	'E11.3519'	'E11.641'	'E13.3511'	'E13.3559'	'E20.9'	'E28.1'
'E08.29'	'E08.3539'	'E09.11'	'E09.3531'	'E10.10'	'E10.3529'	'E10.8'	'E11.3521'	'E11.649'	'E13.3512'	'E13.359'	'E21.0'	'E28.2'
'E08.311'	'E08.3541'	'E09.21'	'E09.3532'	'E10.11'	'E10.3531'	'E11.00'	'E11.3522'	'E11.65'	'E13.3513'	'E13.3591'	'E21.1'	'E28.8'

'E08.319'	'E08.3542'	'E09.22'	'E09.3533'	'E10.21'	'E10.3532'	'E11.01'	'E11.3523'	'E11.69'	'E13.3519'	'E13.3592'	'E2 1.2'	'E28 .9'
'E08.321'	'E08.3543'	'E09.29'	'E09.3539'	'E10.22'	'E10.3533'	'E11.10'	'E11.3529'	'E11.8'	'E13.3521'	'E13.3593'	'E2 1.3'	'E29 .0'
'E08.3211'	'E08.3549'	'E09.311'	'E09.3541'	'E10.29'	'E10.3539'	'E11.11'	'E11.3531'	'E13.00'	'E13.3522'	'E13.3599'	'E2 1.4'	'E29 .1'
'E08.3212'	'E08.3551'	'E09.319'	'E09.3542'	'E10.311'	'E10.3541'	'E11.21'	'E11.3532'	'E13.01'	'E13.3523'	'E13.36'	'E2 1.5'	'E29 .8'
'E08.3213'	'E08.3552'	'E09.321'	'E09.3543'	'E10.319'	'E10.3542'	'E11.22'	'E11.3533'	'E13.10'	'E13.3529'	'E13.37X1'	'E2 2.0'	'E29 .9'
'E08.3219'	'E08.3553'	'E09.3211'	'E09.3549'	'E10.321'	'E10.3543'	'E11.29'	'E11.3539'	'E13.11'	'E13.3531'	'E13.37X2'	'E2 2.1'	'E30 .0'
'E08.329'	'E08.3559'	'E09.3212'	'E09.3551'	'E10.3211'	'E10.3549'	'E11.311'	'E11.3541'	'E13.21'	'E13.3532'	'E13.37X3'	'E2 2.2'	'E30 .1'
'E08.3291'	'E08.359'	'E09.3213'	'E09.3552'	'E10.3212'	'E10.3551'	'E11.319'	'E11.3542'	'E13.22'	'E13.3533'	'E13.37X9'	'E2 2.8'	'E30 .8'
'E08.3292'	'E08.3591'	'E09.3219'	'E09.3553'	'E10.3213'	'E10.3552'	'E11.321'	'E11.3543'	'E13.29'	'E13.3539'	'E13.39'	'E2 2.9'	'E30 .9'
'E08.3293'	'E08.3592'	'E09.329'	'E09.3559'	'E10.3219'	'E10.3553'	'E11.3211'	'E11.3549'	'E13.311'	'E13.3541'	'E13.40'	'E2 3.0'	'E31 .0'
'E08.3299'	'E08.3593'	'E09.3291'	'E09.359'	'E10.329'	'E10.3559'	'E11.3212'	'E11.3551'	'E13.319'	'E13.3542'	'E13.41'	'E2 3.1'	'E31 .1'
'E08.331'	'E08.3599'	'E09.3292'	'E09.3591'	'E10.3291'	'E10.359'	'E11.3213'	'E11.3552'	'E13.321'	'E13.3543'	'E13.42'	'E2 3.2'	'E31 .20'
'E08.3311'	'E08.36'	'E09.3293'	'E09.3592'	'E10.3292'	'E10.3591'	'E11.3219'	'E11.3553'	'E13.3211'	'E13.3549'	'E13.43'	'E2 3.3'	'E31 .21'
'E08.3312'	'E08.37X1'	'E09.3299'	'E09.3593'	'E10.3293'	'E10.3592'	'E11.329'	'E11.3559'	'E13.3212'	'E13.3411'	'E13.44'	'E2 3.6'	'E31 .8'
'E08.3313'	'E08.37X2'	'E09.331'	'E09.3599'	'E10.3299'	'E10.3593'	'E11.3291'	'E11.359'	'E13.3213'	'E13.3412'	'E13.49'	'E2 3.7'	'E31 .9'
'E08.3319'	'E08.37X3'	'E09.3311'	'E09.36'	'E10.331'	'E10.3599'	'E11.3292'	'E11.3591'	'E13.3219'	'E13.3413'	'E13.51'	'E2 4.0'	'E32 .0'
'E08.339'	'E08.37X9'	'E09.3312'	'E09.37X1'	'E10.3311'	'E10.36'	'E11.3293'	'E11.3592'	'E13.329'	'E13.3419'	'E13.52'	'E2 4.1'	'E32 .1'
'E08.3391'	'E08.39'	'E09.3313'	'E09.37X2'	'E10.3312'	'E10.37X1'	'E11.3299'	'E11.3593'	'E13.3291'	'E13.349'	'E13.59'	'E2 4.2'	'E32 .8'
'E08.3392'	'E08.40'	'E09.3319'	'E09.37X3'	'E10.3313'	'E10.37X2'	'E11.331'	'E11.3599'	'E13.3292'	'E13.3491'	'E13.610'	'E2 4.3'	'E32 .9'
'E08.3393'	'E08.41'	'E09.339'	'E09.37X9'	'E10.3319'	'E10.37X3'	'E11.3311'	'E11.36'	'E13.3293'	'E13.3492'	'E13.618'	'E2 4.4'	'E34 .0'
'E08.3399'	'E08.42'	'E09.3391'	'E09.39'	'E10.339'	'E10.37X9'	'E11.3312'	'E11.37X1'	'E13.3299'	'E13.3493'	'E13.620'	'E2 4.8'	'E34 .1'
'E08.341'	'E08.43'	'E09.3392'	'E09.40'	'E10.3391'	'E10.39'	'E11.3313'	'E11.37X2'	'E13.331'	'E13.3499'	'E13.621'	'E2 4.9'	'E34 .2'
'E08.3411'	'E08.44'	'E09.3393'	'E09.41'	'E10.3392'	'E10.40'	'E11.3319'	'E11.37X3'	'E13.3311'	'E13.351'	'E13.622'	'E2 5.0'	'E34 .3'
'E08.3412'	'E08.49'	'E09.3399'	'E09.42'	'E10.3393'	'E10.41'	'E11.339'	'E11.37X9'	'E13.3312'	'E13.3511'	'E13.628'	'E2 5.8'	'E34 .4'
'E08.3413'	'E08.51'	'E09.341'	'E09.43'	'E10.3399'	'E10.42'	'E11.3391'	'E11.39'	'E13.3313'	'E13.3512'	'E13.630'	'E2 5.9'	'E34 .50'

'E08.3419'	'E08.52'	'E09.3411'	'E09.44'	'E10.341'	'E10.43'	'E11.3392'	'E11.40'	'E13.3319'	'E13.3513'	'E13.638'	'E26.01'	'E34.51'
'E08.349'	'E08.59'	'E09.3412'	'E09.49'	'E10.3411'	'E10.44'	'E11.3393'	'E11.41'	'E13.339'	'E13.3519'	'E13.641'	'E26.02'	'E34.52'
'E08.3491'	'E08.610'	'E09.3413'	'E09.51'	'E10.3412'	'E10.49'	'E11.3399'	'E11.42'	'E13.3391'	'E13.3521'	'E13.649'	'E26.09'	'E34.8'
'E08.3492'	'E08.618'	'E09.3419'	'E09.52'	'E10.3413'	'E10.51'	'E11.341'	'E11.43'	'E13.3392'	'E13.3522'	'E13.65'	'E26.1'	'E34.9'
'E08.3493'	'E08.620'	'E09.349'	'E09.59'	'E10.3419'	'E10.52'	'E11.3411'	'E11.44'	'E13.3393'	'E13.3523'	'E13.69'	'E26.81'	‘E35'
'E08.3499'	'E08.621'	'E09.3491'	'E09.610'	'E10.349'	'E10.59'	'E11.3412'	'E11.49'	'E13.3399'	'E13.3529'	'E13.8'	'E26.89'	‘Z94.83'
'E08.351'	'E08.622'	'E09.3492'	'E09.618'	'E10.3491'	'E10.610'	'E11.3413'	'E11.51'	'E13.341'	'E13.3531'	G32.89'	'E26.9'	'Z96.49'
'E08.3511'	'E08.628'	'E09.3493'	'E09.620'	'E10.3492'	'E10.618'	'E11.3419'	'E11.52'	'E13.3411'	'E13.3532'	'E15'	'E27.0'	
'E08.3512'	'E08.630'	'E09.3499'	'E09.621'	'E10.3493'	'E10.620'	'E11.349'	'E11.59'	'E13.3412'	'E13.3533'	'E16.0'	'E27.1'	
'E08.3513'	'E08.638'	'E09.351'	'E09.622'	'E10.3499'	'E10.621'	'E11.3491'	'E11.610'	'E13.3413'	'E13.3539'	'E16.1'	'E27.2'	
'E08.3519'	'E08.641'	'E09.3511'	'E09.628'	'E10.351'	'E10.622'	'E11.3492'	'E11.618'	'E13.3419'	'E13.3541'	'E16.2'	'E27.3'	
'E08.3521'	'E08.649'	'E09.3512'	'E09.630'	'E10.3511'	'E10.628'	'E11.3493'	'E11.620'	'E13.349'	'E13.3542'	'E16.3'	'E27.40'	

Appendix B

Hypertension

Table 1 The Z Scores for comparing between the City of Philadelphia emergent hypertension diagnoses and the following populations

	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
Male	24.82	19.73	9.44	29.08
Female	30.22	24.39	15.47	29.52
18-34	12.13	17.66	13.31	17.42
35-64	30.14	28.60	24.36	10.75
65-84	13.87	5.52	5.59	0.95*
85+	2.63	2.90	1.42*	0.36*
Total Population	39.15	31.97	18.20	41.75

*No statistical significant difference.

Table 2 The Z Scores for comparing between the White Non-Hispanic emergent hypertension diagnoses and the following populations.

	City of Philadelphia	Asian Non-Hispanic	Black Non-Hispanic	Hispanic or Latino of Any Race
Male	9.44	21.55	24.04	22.20
Female	15.47	24.96	32.52	18.90
18-34	13.31	7.34	24.78	6.21
35-64	24.36	21.88	43.17	4.35
65-84	5.59	12.11	9.42	-1.45*
85+	1.42*	2.88	3.76	0.73*
Total Population	18.20	32.93	41.10	29.02

*No statistical significant difference.

Table 3. The Z scores for comparing between different age-groups within race/ethnicity pairing for adult emergent hypertension diagnoses:

	Rate in Philadelphia City Limits	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
18-34 and 35-64	99.95	12.34	69.11	53.40	52.47
18-34 and 65-84	73.11	7.39	54.64	35.32	29.52
18-34 and 85+	126.78	32.32	55.10	102.29	48.35
35-64 and 85+	-40.89	-13.37	-11.18	-46.22	-8.97
64-84 and 85+	13.99	4.15	2.55	15.44	2.40

Table 4. The Z Scores for comparing emergent hypertension diagnoses rates between geographic locations within the City of Philadelphia.

	North & Northwest	Central	South	Lower Northeast	Upper Northeast	West & South West
North & Northwest	X					
Center City	18.87	X				
South	221.52	4.17	X			
Lower Northeast	45.04	34.88	53.50	X		
Upper Northeast	53.76	37.81	58.70	7.51	X	
West & South West	78.63	46.35	73.60	29.57	29.57	X

Diabetes without Complications

Table 5. The Z Scores for comparing between the City of Philadelphia emergent diabetes without complications diagnoses rates and the following populations

	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
Male	15.01	11.91	8.34	15.48
Female	17.31	14.87	15.05	11.88
18-34	6.95	10.22	9.77	8.60
35-64	17.70	15.59	17.34	**0.57**

65-84	8.17	4.27	7.01	4.11
85+	0.29*	-1.48*	1.86*	1.50*
Total Population	22.93	19.28	16.84	19.39

*No statistical significant difference.

Table 6. The Z Scores for comparing between the White Non-Hispanic emergent diabetes without complications diagnoses and the following populations.

	City of Philadelphia	Asian Non-Hispanic	Black Non-Hispanic	Hispanic or Latino of Any Race
Male	8.34	12.05	16.77	9.48
Female	15.05	11.91	24.73	1.34
18-34	9.77	2.89	16.23	**0.19**
35-64	17.34	11.51	27.21	10.58
65-84	7.01	5.97	9.59	7.35
85+	1.86*	0.14*	2.83	2.09
Total Population	16.84	16.94	29.87	7.53

*No statistical significant difference.

Table 7. The Z scores for comparing between different age-groups within race/ethnicity pairing for adult emergent diabetes without complications diagnoses:

	Rate in Philadelphia City Limits	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
18-34 and 35-64	61.80	8.13	41.80	32.47	36.34
18-34 and 65-84	44.70	5.10	32.41	21.30	20.44
18-34 and 85+	59.24	17.69	31.38	46.51	25.27
35-64 and 85+	-13.69	-7.77	-5.74	-15.33	-4.47
64-84 and 85+	-1.40*	2.35	-1.07*	0.42*	0.04*

*No statistical significant difference.

Table 8. The Z scores for comparing between different geographic regions within the City of Philadelphia for adult emergent diabetes with complications diagnoses:

	North & Northwest	Central	South	Lower Northeast	Upper Northeast	West & South West
North & Northwest	X					
Central	11.63	X				
South	234.55	1.62*	X			
Lower Northeast	32.84	23.22	36.96	X		
Upper Northeast	32.50	23.07	36.72	0.40*	X	
West & South West	48.30	28.43	46.03	13.67	14.14	X

*No statistical significant difference.

Diabetes with Complications

Table 9. The Z Scores for comparing between the City of Philadelphia emergent diabetes with complications diagnoses and the following populations:

	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
Male	10.47	10.75	8.07	10.75
Female	11.14	10.12	9.28	7.98
18-34	7.09	7.91	5.87	8.52
35-64	11.01	10.66	10.57	2.43
65-84	5.40	5.12	6.30	1.83*
85+	1.25*	-1.41*	1.74*	2.40
Total Population	15.29	14.74	12.29	13.23

*No statistical significant difference.

Table 10. The Z Scores for comparing between the White Non-Hispanic emergent diabetes with complications diagnoses and the following populations.

	City of Philadelphia	Asian Non-Hispanic	Black Non-Hispanic	Hispanic or Latino of Any Race
Male	8.07	7.80	15.50	5.21
Female	9.28	7.99	15.95	1.53*
18-34	5.87	5.12	11.13	3.40
35-64	10.57	7.34	17.40	4.30
65-84	6.30	3.54	9.72	4.89
85+	1.74*	0.94*	2.69	3.07
Total Population	12.29	11.17	22.22	4.72

*No statistical significant difference.

Table 11. The Z scores for comparing between different age-groups within race/ethnicity pairing for adult emergent diabetes with complications diagnoses:

	Rate in Philadelphia City Limits	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
18-34 and 35-64	28.40	4.77	19.10	14.12	17.87
18-34 and 65-84	22.10	3.11	15.62	10.49	10.67
18-34 and 85+	24.91	6.01	13.28	18.85	16.82
35-64 and 85+	-8.00	-2.00	-3.65	-8.04	-5.18
64-84 and 85+	0.63*	0.39*	0.27*	1.80*	1.81*

*No statistical significant difference.

Table 12. The Z scores for comparing between different geographic regions within the City of Philadelphia for adult emergent diabetes with complications diagnoses:

	North & Northwest	Central	South	Lower Northeast	Upper Northeast	West & South West
North & Northwest	X					
Central	6.16	X				
South	98.93	3.39	X			
Lower Northeast	14.35	11.66	14.71	X		
Upper Northeast	13.17	11.22	13.91	1.08*	X	

West & South West	27.87	16.46	23.53	11.80	12.92	X

*No statistical significant difference.

Table 13. The Z Scores for comparing between the City of Philadelphia emergent asthma diagnoses and the following populations.

	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
Male	36.34	42.13	43.06	13.78
Female	11.60	9.55	11.08	2.99
18-34	22.82	27.50	26.12	21.50
35-64	19.86	16.59	19.37	-5.93
65-84	5.81	2.04	5.16	-9.47
85+	0.83*	-0.07*	0.73*	-2.56
Total Population	30.04	29.95	32.82	9.03

*No statistical significant difference.

Table 14. The Z Scores for comparing between the White Non-Hispanic emergent asthma diagnoses and the following populations.

	City of Philadelphia	Asian Non-Hispanic	Black Non-Hispanic	Hispanic or Latino of Any Race
Male	43.06	21.66	70.35	18.83
Female	11.08	8.50	17.11	5.03
18-34	26.12	13.87	43.55	2.14
35-64	19.37	13.70	29.71	18.65
65-84	5.16	4.38	6.15	12.05
85+	0.73*	0.69*	0.64*	2.82
Total Population	32.82	19.68	51.92	15.32

*No statistical significant difference.

Table 15. The Z scores for comparing between different age-groups within race/ethnicity pairing for adult emergent asthma diagnoses:

	Rate in Philadelphia City Limits	Asian Non-Hispanic	Black Non-Hispanic	White Non-Hispanic	Hispanic or Latino of Any Race
18-34 and 35-64	11.28	1.10*	18.30	1.40*	16.34
18-34 and 65-84	-12.37	0.99*	-21.20	1.42*	13.24
18-34 and 85+	-12.16	1.84*	-12.24	-1.81*	1.96
35-64 and 85+	9.43	1.47*	8.47	2.34	0.40*
64-84 and 85+	2.35	0.74*	2.15	0.04*	0.54*

*No statistical significant difference.

Table 16. The Z scores for comparing between different geographic regions within the City of Philadelphia for adult emergent asthma diagnoses:

	North & Northwest	Central	South	Lower Northeast	Upper Northeast	West & South West
North & Northwest	X					
Central	14.74	X				
South	203.87	5.03	X			
Lower Northeast	39.65	28.49	42.47	X		
Upper Northeast	10.34	18.42	24.04	25.48	X	
West & South West	44.93	30.29	45.69	4.73	30.02	X