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.

Keywords: Community Health Needs Assessments, asthma, hypertension, diabetes, emergency encounters

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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 strategies and interventions to improve health and document progress towards meeting health goals (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 2015-2016 Public Health Management Corporation's (PHMC) household health survey, secondary data and literature sources, interviews with 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, captured through respondents, 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: 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 the following 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), and 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 available yields unforeseen opportunities for retrospective analysis. 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 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 can 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 documentation of 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.).

HIEs have ventured into the population health space; a couple examples being: Healthix, an HIE in New York, helping the NY AIDS Institute surveil and treat the HIV-positive (HIV+) population (Healthix 2017) and Maine HealthInfoNet focusing on the 13 Meaningful Use clinical quality measures including aspirin therapy, blood pressure, cholesterol and diabetes control and smoking cessation (Brino 2012)

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, laboratory results, social history, and vital signs. As HSX increases the amount of service offerings and increases its membership, the variety of data types and the depth of the record is due to expand (HealthShare Exchange N.D.).

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. The CDR contains largely admission, discharge, transfer messages, with the relatively recent addition of clinical care document (CCD) data which contains more robust clinical information (e.g. problems, procedures, and medications). The HealthShare Exchange is in a constant phase of growth and actively works to acquire additional inbound data feeds from healthcare organizations. This results in the addition of new data feeds occurring within multiple start dates.

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 racial/ethnic disparities of the following indicators present within the adult population utilizing emergent care within the City of Philadelphia: asthma, hypertension, diabetes without complications, diabetes with complications.
- To assess the utility of the HealthShare Exchange's Clinical Database Repository 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's Clinical Data Repository (CDR) was utilized as a primary source of healthcare information.

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 in 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 (HCUP 2018). 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 (HCUP 2018). These categories have widespread use including within the Agency for Healthcare Research and Quality (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

Any 'other' or 'unknown' race and ethnicity labels were removed from the race/ethnicity-based analysis. A total of 2,749 individuals were excluded. These were removed due to the variation

between data providers in the labeling and to align with the U.S. Census Population's groupings of race/ethnicity.

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

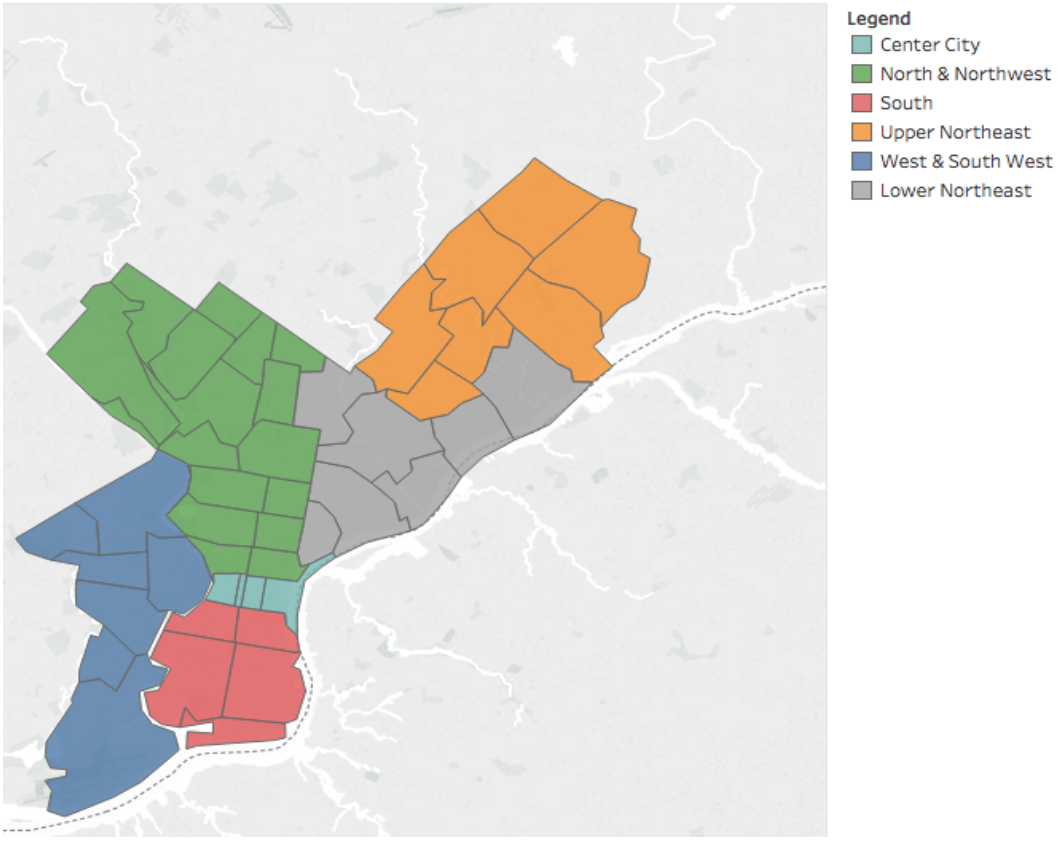
For analysis and comparison purposes, the sample was grouped by age based upon current industry (epidemiology) standards and census criterion (18-34; 35-64; 65-84; 84+) (Reijneveld 2003). As previously mentioned, the sample was narrowed to the age range 18-105 years of age to exclude the child/minor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

Descriptor	Count of Individual (n= 1 patient)
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	562,015	40,965	216,688	229,508	106,632
Female	652,172	45,920	279,987	246,261	108,138
18-34	460,740	39,096	173,897	176,450	137,803
35-64	558,106	38,781	244,289	204,720	65,591
65-84	166,794	8,434	68,174	78,066	10,563
85+	28,547	574	10,315	16,533	813
North & Northwest	353,969	11,139	207,649	92,244	40,358
Central	50,408	6,895	3,905	35,880	2,593
South	145,554	19,203	32,556	80,837	10,662
Lower Northeast	221,210	13,834	63,426	87,316	57,705
Upper Northeast	225,090	22,790	33,736	141,084	24,337
West & South West	217,956	13,024	155,403	38,408	7,159
Total Population	1,214,187	86,885	496,675	475,769	214,770

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 the Percentage of Adult Emergency Department Hypertension Diagnoses per Census Population between Race/Ethnicity Groups

	City of Philadelphia (%)	Asian non-Hispanic (%)	Black non-Hispanic (%)	White non-Hispanic (%)	Hispanic or Latino of Any Race (%)
Male	2.37	4.88	3.16	2.02	0.96
Female	2.91	0.53	3.88	2.32	1.35
18-34	0.49	0.56	0.87	0.24	0.14
35-64	3.28	0.54	4.59	2.21	2.50
65-84	5.71	2.17	6.30	5.16	5.49
85+	7.84	4.88	6.96	8.22	7.50
North & Northwest	1.45	0.23	1.68	1.27	0.89
Center City	0.43	*	2.18	0.27	*
South	0.58	0.25	1.40	0.32	0.29
Lower Northeast	3.21	0.51	4.11	3.15	2.42
Upper Northeast	3.62	0.97	3.67	3.91	2.47
West & South West	4.98	0.48	6.34	1.44	1.30
Total Population	**2.66**	**0.51**	**3.57**	**2.17**	**1.16**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample t tests for the significance of the difference were calculated between the corresponding

rates of adult hypertension diagnoses among emergency department patients to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of adult hypertension diagnoses among emergency department users, 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+ (t= 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+ (t=-1.45, 0.73, 1.42 respectively). For the calculated t scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of adult hypertension diagnoses among emergency department users/ patients, 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 adult hypertension diagnoses among emergency department users/ patients, 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 t tests for the significance of the difference were calculated. Significant differences were found between all age groups within the City of Philadelphia and within each race/ethnicity pairing. For the calculated t scores, please see Appendix B. There was a similar trend within the City of Philadelphia with each race/ethnicity

pairing indicating that there were higher rates of adult hypertension diagnoses among emergency department users/ patients with older populations, with the 85+ population having the highest rates of adult hypertension diagnoses among emergency department users/ patients in all race/ethnicities and seen throughout the City of Philadelphia.

To test for significant differences between the genders within the City of Philadelphia and within each race/ethnicity, sample t tests for the significance of the difference 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 ($t=18.62$, $t=13.64$, $t=6.98$, $t=8.33$, respectively) with females of all of the previous populations having higher rates of adult hypertension diagnoses among emergency department users/ patients. There was no significant difference between the biological sexes within the Asian non-Hispanic population ($t=0.75$).

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample t tests for the significance were calculated. There were significant differences between all geographic districts within the City of Philadelphia. For the calculated t 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 diagnoses of hypertension among emergency department users than the other geographic regions. Center City had the lowest rates of adult hypertension diagnoses among emergency department users/ patients.

Diabetes without Complications

Table 2. Comparison of the Percentage of Adult Emergency Department Diabetes without Complications Diagnoses per Census Population between Race/Ethnicity Groups

	City of Philadelphia (%)	Asian non-Hispanic (%)	Black non-Hispanic (%)	White non-Hispanic (%)	Hispanic or Latino of Any Race (%)
Male	0.99	0.25	1.31	0.80	0.50
Female	1.13	0.27	1.50	0.77	0.73
18-34	0.21	0.05	0.35	0.09	0.10
35-64	1.31	0.28	1.76	0.83	1.29
65-84	2.41	1.03	2.71	1.96	3.05
85+	2.27	2.09	2.53	2.01	3.08
North & Northwest	0.58	0.16	0.66	0.39	0.58
Center City	0.18	*	1.10	0.08	*
South	0.21	0.08	0.50	0.11	*
Lower Northeast	1.41	0.29	1.73	1.22	1.35
Upper Northeast	1.40	0.56	1.54	1.38	1.04
West & South West	1.94	0.15	2.47	0.56	0.56
Total Population	**1.07**	**0.26**	**1.42**	**0.78**	**0.62**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample t tests for the significance of the difference between two independent proportions were calculated between the corresponding rates of adult diabetes without complications diagnoses among emergency department users to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of adult diabetes without complications diagnoses among emergency department users/ patients, 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 (t= 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+, (t=1.86, 0.14 respectively). For the calculated t scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of adult diabetes without complications diagnoses among emergency department users, 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 adult diabetes without complications diagnoses among emergency department users, 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 having the highest rates of adult diabetes without complications diagnoses among emergency department users and the Asian non-Hispanic population having the lowest rates of adult diabetes without complications diagnoses among emergency department users.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample t tests for the significance of the difference 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 (t=-1.40, -1.07, 0.42, 0.04 respectively). For the calculated t 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 adult diabetes without complications diagnoses among emergency department users/ patients 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 diabetes diagnoses among emergency department users/ patients increase as age increased.

To test for significant differences between the biological sexes within the City of Philadelphia and within each race/ethnicity, sample t tests for the significance of the difference 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 (t=7.17, 5.75, 6.67 respectively), with females having higher rates of diabetes without complications diagnoses among emergency department users/ patients. There was no significant difference between the biological sexes within the Asian non-Hispanic and white non-Hispanic populations (t=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 t tests for the significance of the difference 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 (t=1.62) and (2) between the Lower Northeast and the Upper Northeast regions (t= 0.40), which had no significant difference in rates of adult diabetes without complications diagnoses among

emergency department users/ patients. This implies that there is a significant disparity between geographic regions with Center City and South Philadelphia having the lowest rates of adult diabetes without complications diagnoses among emergency department users/ patients and the West & Southwest region having the highest rates of adult diagnoses of diabetes without complications among emergency department users/ patients.

Diabetes with Complications

Table 3. Comparison of the Percentages of Adult Emergency Department Diabetes with Complications Diagnoses per Census Population between Race/Ethnicity Groups

	City of Philadelphia (%)	Asian non-Hispanic (%)	Black non-Hispanic (%)	White non-Hispanic (%)	Hispanic or Latino of Any Race (%)
Male	0.40	0.07	0.59	0.28	0.19
Female	0.41	0.07	0.56	0.27	0.25
18-34	0.15	0.01	0.25	0.09	0.06
35-64	0.48	0.09	0.67	0.30	0.41
65-84	0.78	0.26	1.00	0.56	0.95
85+	0.82	0.35	0.97	0.67	1.60
North & Northwest	0.25	*	0.32	0.12	0.24
Center City	0.11	*	0.56	0.06	*
South	0.18	*	0.41	0.11	*
Lower Northeast	0.48	0.12	0.59	0.44	0.32
Upper Northeast	0.45	0.10	0.55	0.45	0.39
West & South West	0.75	*	0.95	0.22	0.95
Total Population	**0.41**	**0.07**	**0.57**	**0.28**	**0.22**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample t tests for the significance of the difference were calculated between the corresponding

rates of adult diabetes with complications diagnoses among emergency department users/patients compared to the city of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of adult diabetes with complications diagnoses among emergency department users, 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 (t= 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+ (t=1.74, 0.94 respectively). For the calculated t scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of adult hypertension diagnoses among emergency department users/patients, 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 adult diabetes with complications diagnoses among emergency department users/patients, 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 having the highest rates of adult diabetes with complications diagnoses among emergency department users/patients and the Asian non-Hispanic population having the lowest rates of adult diabetes with complications diagnoses among emergency department users/patients.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample t tests for the significance of the difference

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 (t=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 (t= 0.39, 0.37, 1.80, 1.81 respectively). There was a trend of the rates of adult diabetes with complications diagnoses among emergency department users/patients 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 t tests for the significance of the difference 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 (t=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 (t=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 adult diabetes with complications among emergency department users/patients.

To test for significant differences between the geographic districts within the City of Philadelphia (irrespective of race/ethnicity), sample t tests for the significance of the difference were calculated. There were no significant differences between the Lower Northeast and the Upper Northeast geographic areas in diagnoses of adult diabetes with complications among emergency department users/patients (t=1.08). This implies that there is a significant disparity between geographic regions, with Center City having the lowest rates of adult diabetes with complications diagnoses among emergency department users/patients; the West & Southwest

geographic region having the highest adult rates of diabetes with complications diagnoses among emergency department users/patients.

Asthma

Table 4. Comparison of Percentage of Adult Emergency Department Asthma Diagnoses per Census Population between Race/Ethnicity Groups

	City of Philadelphia (%)	Asian non-Hispanic (%)	Black non-Hispanic (%)	White non-Hispanic (%)	Hispanic or Latino of Any Race (%)
Male	1.86	0.18	2.93	0.93	1.44
Female	0.76	0.08	1.05	0.45	0.64
18-34	1.51	0.10	2.54	0.69	0.76
35-64	1.25	0.13	1.73	0.73	1.53
65-84	0.75	0.20	0.83	0.57	1.60
85+	0.62	0.35	0.63	0.57	1.35
North & Northwest	0.82	*	0.99	0.44	0.90
Center City	0.22	*	1.13	0.12	*
South	0.37	0.13	0.96	0.18	0.16
Lower Northeast	2.04	0.12	2.73	1.38	2.36
Upper Northeast	1.09	0.18	1.79	0.92	1.58
West & South West	2.24	*	2.91	0.38	1.17
Total Population	**1.27**	**0.12**	**1.87**	**0.68**	**1.04**

*omitted due to small sample size

To test for significant differences between race/ethnicities in different populations, two-sample t tests for the significance of the difference were calculated between the corresponding rates of adult diabetes with complications diagnoses among emergency department users/patients to the City of Philadelphia and to the white non-Hispanic populations. When comparing to the City of Philadelphia rates of adult diabetes with complications diagnoses among emergency

department users/patients, 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 (t= 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+, (t=0.73, 0.69, 0.64 respectively). For the calculated t scores of other comparisons, please see Appendix B.

The black non-Hispanic population had the highest rates of adult asthma diagnoses among emergency department users/patients, 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 adult hypertension diagnoses among emergency department users/patients, 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 having the highest rates of adult asthma diagnoses among emergency department users/patients and the Asian non-Hispanic population having the lowest rates of asthma diagnoses among emergency department users/patients.

To test for significant differences between different age groups within the City of Philadelphia and within each race/ethnicity, sample t tests for the significance of the difference 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

(t=4.66) and between the 35-64 and 85+ age groups (t=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+ (t= 16.34, 13.24, 1.96 respectively).

This implies that age affects the rate of adult asthma diagnoses among emergency department users 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 prevalence of adult asthma diagnoses among emergency department users decreased with age. The white non-Hispanic population had an irregular trend in adult asthma diagnoses among emergency department users/patients. Within the Hispanic or Latino of any race population, adult asthma diagnoses among emergency department users/patients 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 t tests for the significance of the difference were calculated. There were significant differences between the biological sexes in the City of Philadelphia and all race/ethnicity pairings (t= 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 adult asthma diagnoses among emergency department users/patients 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 t tests for the significance of the difference were calculated. There were significant differences between all geographic areas. See Appendix B for t scores. This implies that there is a significant disparity between geographic regions, with

the West & South West region having the highest rate of adult diagnoses of asthma among emergency department users/patients and Center City having the lowest rates of adult asthma diagnoses among emergency department users/patients.

Discussion

Significant differences and disparities were seen for the majority of comparisons within almost every indicator and factor examined (gender, age, geography, race). This speaks to the diversity within the city of Philadelphia. However, due to the lack of commonality, no grouping of communities can be made to hypothesize underlying linking social determinants of health.

From this study, it was seen that among the health indicators examined, hypertension had the highest percentage associated emergent encounters within the City of Philadelphia as 2.66% of the City's population observed an emergent diagnosis. Across all health indicators, the highest percentage of associated emergency encounters within the City of Philadelphia occurred in the West and Southwest region. Across all health indicators, the highest percentage of associated emergency encounters occurred within the black non-Hispanic population.

To effectively examine results, each health indicator's findings were examined separately as follows, followed by an evaluation of the HealthShare Exchange's Clinical Database Repository's (CDR's) capacity to provide insight into Community Health Needs Assessments.

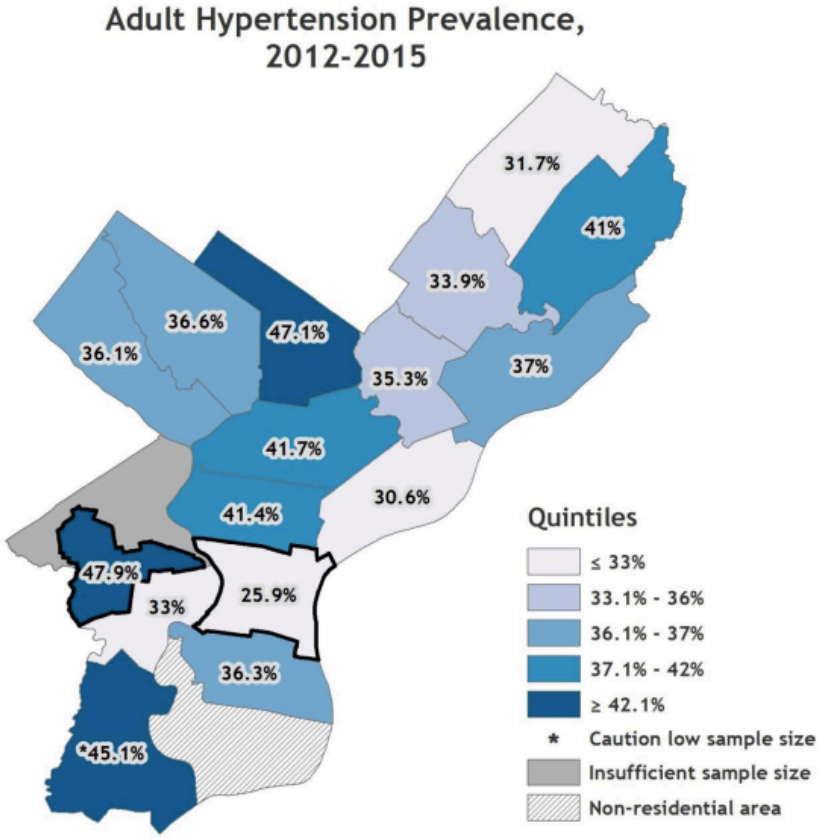
Hypertension

The racial disparity in hypertension and hypertension-related outcomes has been recognized for decades with African Americans having 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).

According to the Philadelphia Department of Public Health's Community Health Needs Assessment for the City of Philadelphia (2016), adult hypertension prevalence was ranked according to the following order: with the highest amongst Black non-Hispanic, then white non-Hispanic, then Hispanic, and with the Asian non-Hispanic population having the lowest hypertension prevalence. It should be noted that the Asian non-Hispanic population within the assessment had a low sample size, using the Public health management corporation's household health survey. The prevalence of hypertension as seen within geographic regions of Philadelphia is shown below:

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



(Philadelphia Department of Public Health 2016).

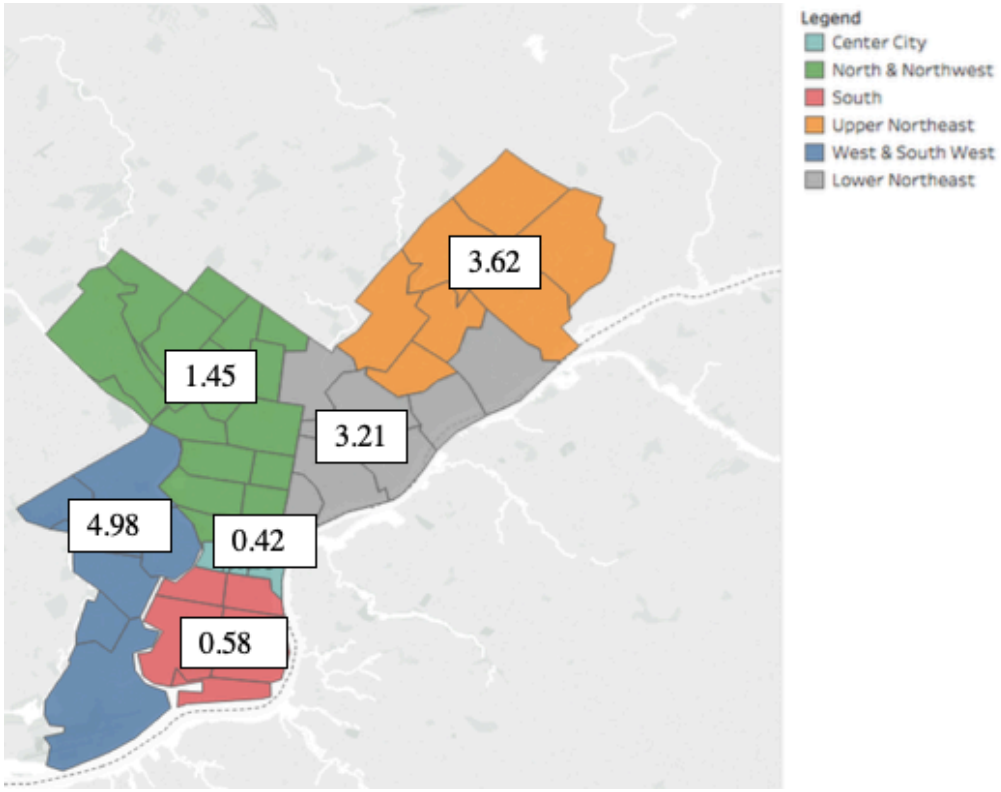
While prevalence statistics and therefore magnitude cannot be compared with the results in this study, the trends within the populations analyzed can be compared to elucidate additional information on the impact of hypertension within the City of Philadelphia.

This study had significant difference between the sexes, with the female population having higher adult hypertensive diagnoses among emergency department users/patients, 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 for emergency department use for hypertension (women were seen to be more likely to use the emergency department for hypertension).

This study had a similar hypertension trend to the Philadelphia Department of Public Health in race/ethnicity, with the highest rate of adult hypertension diagnoses found to be among emergency department users within the Black Non-Hispanic adult population.

The geographic distribution of adult hypertension diagnoses among emergency department users/patients is shown below:

Figure 2. Rates of Adult Hypertension Diagnoses Among Emergency Department Users/Patients 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 adult diagnoses among emergency department users/patients 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. The geographic sectioning completed in this study, not quite aligning with the zip code geographic boundaries within the planning analysis sections, may also contribute to the difference in that the make-up of these areas (e.g. race, ethnicity socioeconomic status, age, etc.) may be quite different.

Diabetes without Complications

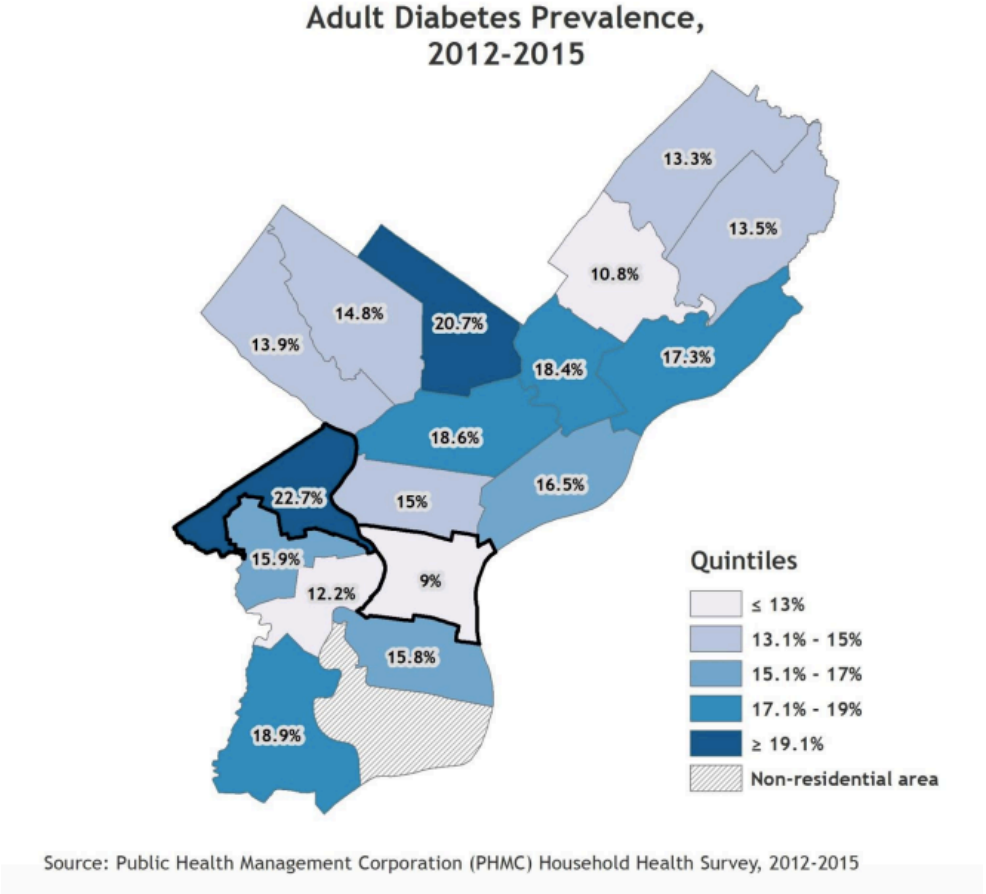
According to the National Diabetes Statistics Report (2017), the adult age group primarily affected by diabetes was the 45-64 age range. The race/ethnicity most prominently affected by diabetes was observed to be highest among the American Indian/Alaska Native population, closely followed by the non-Hispanic black population, and persons of Hispanic ethnicity. 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 among females (Pennsylvania Health Care Cost Containment Council 2010). In the City of Philadelphia, it was found in the city's community health needs assessment that the adult diabetes prevalence was highest amongst the black Non-Hispanic, followed by the white non-Hispanic, then Hispanic of any race, and with the Asian non-Hispanic population having the lowest rates of adult diabetes prevalence (Philadelphia Department of Public Health 2016). 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) and that this includes both diabetes with and without complications.

In the City of Philadelphia, according to the Philadelphia Department of Public Health's Community Health Needs Assessment, adult diabetes prevalence differs 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's results were similar to prevalence rates reported in the literature with the black non-Hispanic population having the highest rates of adult diabetes without complications diagnoses among emergency department users/patients, followed by white non-Hispanic, Hispanic, with the Asian non-Hispanic population having the least rates of adult diabetes without complications diagnoses among emergency department users/patients (Philadelphia Department of Public Health 2016).

African Americans, Hispanics, and Native Americans experience a 50%-100% higher burden of illness and mortality due to diabetes than white Americans, and 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).

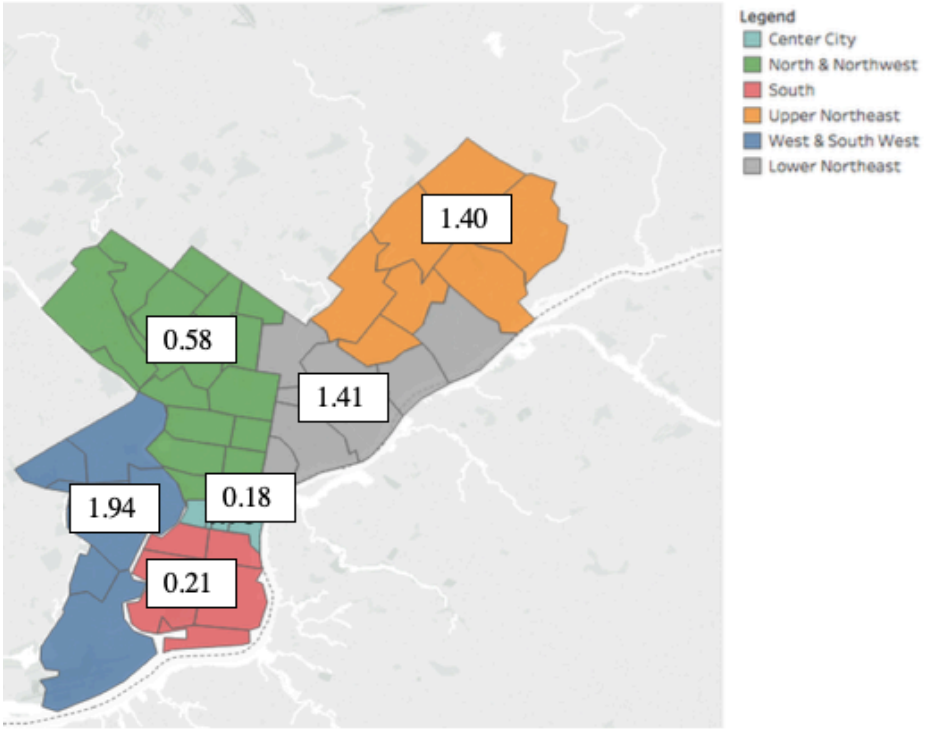
Thus, the differences in adult diabetes without complications rates among emergency department users/patients within race/ethnicity pairings may be due to the differences in the type of care utilized by the different populations (emergency department versus physician visits). A contributing factor towards the difference may be due to physiological differences: different races/ethnicities have been shown to be dissimilarly affected by diabetes, even when confounding variables are accounted for (Golden 2012).

This study found significant gender differences among in the majority of the race/ethnicities and within the City of Philadelphia with females having higher rates of adult diabetes without complications diagnoses among emergency department users/patients. 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 diabetes without complications diagnoses among emergency department users/patients. The trend of higher emergency department utilization amongst the female population was corroborated within the literature (Barata 2017). More insight is needed into the causation of the difference in the rates of diagnoses among emergency department users/patients 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 disease complications, per the H-CUP Clinical Classification Software's stratification of ICD-10 groupings (HCUP 2018).

For comparison purposes to the above geographic assessment of adult diabetes prevalence completed by the Philadelphia Department of Public Health's, this study's results comparing the geographic distribution of adult diabetes without complications diagnoses among emergency department users are below:

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 when comparing the Philadelphia Department of Public Health's information 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.

It also should be noted that the differences prevalence of diabetes versus the utilization of emergency department for diabetes does not align. This may be due to a slight mismatch in the comparison: the prevalence described above includes both diabetes with and without complications. However, the large difference between the West & Southwest versus the South geographic areas should be noted and investigated further.

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).

Generally, ethnic minorities have been seen to have higher mortality rates and higher risk of diabetes complications (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. This may be associated with higher obesity rates within the female Hispanic or Latino of Any Race population (Arroyo-Johnson 2016). 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 having higher all-cause mortality (Ametz 2014). However, the reasons for these differences remain unclear but may 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 the limitations of this study as discussed later in further detail. However, the results may indicate a true disparity between the sexes within emergent asthma diagnoses stemming from a possible difference in emergency department utilization for asthma care between the populations or other causes. More insight is needed to understand the differences 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 had 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 may be local geographical, socioeconomic and other factors affecting the rate of asthma within the studied population.

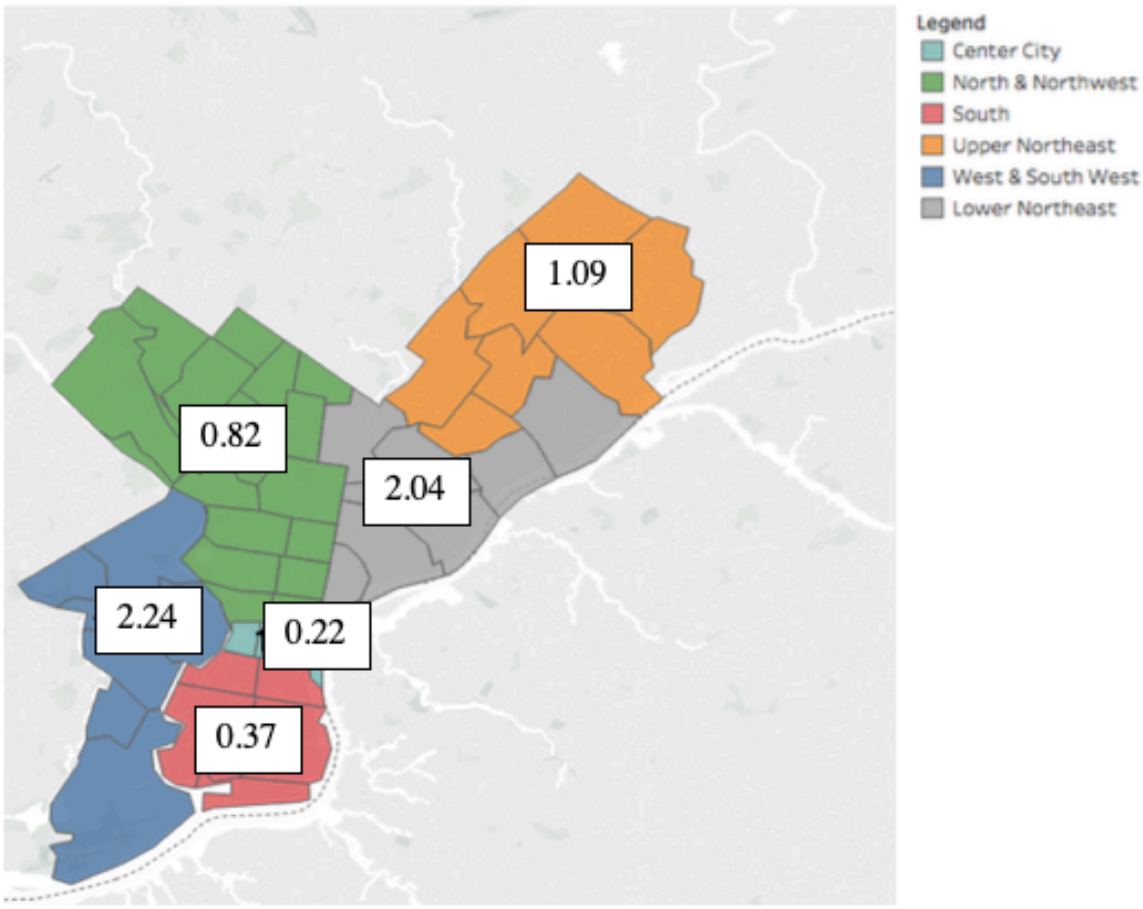
Historically, African Americans, especially those living in impoverished areas, are at a higher risk of morbidity and mortality due to asthma (Zoratti et al 1998), It has not been well

established if the greater prevalence of asthma among African Americans is due to biologic or genetic predisposition, or 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.

Within the City of Philadelphia's Community Health Needs Assessment, asthma was examined with the children's population (Philadelphia Department of Public Health 2016); thus, it would not be applicable to compare this study to the city's findings. However, the following depicts the rates of adult emergency asthma diagnoses within the City of Philadelphia.

Figure 5. Rates of Adult Emergent Asthma Diagnoses within Geographic Regions of Philadelphia



Utilization of Health Information Exchange Data for Community Health Needs Assessments

Evaluating the utilization of HIE services and data for population health purposes, has faced significant data challenges in terms of measuring both the intervention and outcome of HIE services, with complications due to HIE maturity, data availability, goal alignment, health policy, and data quality methodology, playing large roles (Yeager 2017).

In a study of HIE value analysis, HIE maturity was defined as where the technology is fully developed, the system usage being widespread, and information systems populated with data (Yeager 2017). From of longevity perspective, HealthShare Exchange (HSX), was founded

in 2012 to be the HIE for the Greater Philadelphia region. The HSX Membership currently includes hospitals and health systems, independent ambulatory practices, behavioral health organizations, health plans, and post-acute care organizations which amount to connecting to 7.4 million patients and 11,500 doctors in the region. This means that HSX has successfully captured clinical data for approximately a third of the combined census population of Pennsylvania, New Jersey, and Delaware (AAMC 2015).

The analysis of HIEs requires a diverse dataset for measuring HIE activity and outcome, of which may or may not be easily obtainable due to vendor or policy constraints (Yeager 2017). The HealthShare Exchange, being the trusted entity for exchange in the greater Philadelphia region, has actively maintained trusted relationships between the healthcare and payer entities in this region, which has enabled much of the required data elements to be shared between entities and thus held within the clinical database repository (HSX About HSX N.D.). However, key elements needed for community health needs assessments may not be included from every data source and may not be available for the timeframe requested, as HSX is constantly growing its membership and capturing more of the population within the Greater Philadelphia region and beyond (HSX HSX Service and Systems Status 2018). Data elements residing in genres such as social determinants of health may not be captured at all (HSX Participants Population Health Use Case 2018).

In their analysis of HIE success, stakeholder goal alignment was deemed to be key to success; however, these stakeholders may have different priorities and objectives (Yeager 2017). The original purpose for this clinical database repository was to assist in care coordination and diagnosis and treatment purposes; the utilization of the data for population health purposes is relatively new (HSX Participants Population Health Use Case 2018) within the HSX service

offerings. The HSX governance structure was established to have effective and comprehensive decision making focused on oversight and alignment with its membership's goals: its members are comprised of healthcare stakeholders including most of the hospital/health systems, and several large health plans, in the greater Philadelphia region, as well as a variety of other participant organizations (HSX Governance N.D.). When HSX established a new use case, for population health, it proceeded through the HSX Use Case Governance Policy's process, which is applicable for all non-treatment use cases and are reviewed by HSX standing committees, workgroups, and the HSX Board of Trustees (HSX 2015). Thus, HSX stakeholders have shown and demonstrated their support for supporting population health use cases, which include community health needs assessments. Through the above process, HSX has also established the appropriate health policy to enable supporting population health use cases, and community health needs assessments in particular.

Data quality with reliable and accurate health information is obligatory for monitoring health and evaluating services and programs (AbouZahr 2005). In terms of the data quality, HSX was recognized by the Strategic Health Information Exchange Collaborative, the national collaborative representing health information exchanges (HIEs), representing 70+ HIEs across the United States) for its achievement in advancing quality measurement, quality reporting, quality data and/or quality improvement within the industry (SHIEC 2018). Thus, amongst, HIEs, HSX has demonstrated the high capability to encourage and incorporate high quality data.

HSX, within its Clinical Database Repository, contains varied amounts of information from its data sources and its members. This is dependent on their respective connectivity to the HealthShare Exchange as well as the timing of the "go live" date of the many types of data feeds connected to HSX which contribute to the data included within these reports. Specifically, there

were “go lives” during the reporting period which may impact the report’s findings (HSX HSX Service and Systems Status 2018). The data received by HSX and held within the Clinical Database Repository is not always uniform or standardized across the membership. Throughout this study, it was observed that for some data elements, the information was standardized and present throughout the reporting period, specifically the following: age and zip code. However, fields such as ethnicity label, race label and gender are not uniform across the data set. The data was mined for this analysis through standardized fields, such as ICD-10 code, patient class code (emergency), which, by virtue of the method of pulling information, were standardized within this study.

While the data is not always uniform, the level of data quality generated from an electronic health record seen in this report is standard across the industry (Botus 2010, Mashoufi 2018). For the purposes of the specific questions asked of this report, namely, to identify disparities of the following indicators present within the adult population using the emergency department within the City of Philadelphia (asthma, hypertension, diabetes without complications, diabetes with complications) between gender, age, race/ethnicities and geographic areas, this dataset was able to shed light upon apparent disparities which previously may not have been possible due to a smaller population size.

Not all of the direct areas of interest for community health needs assessments nor all of the required components of the community health needs assessments will be able to be answered using the HSX Clinical Database Repository. The CHNA requirements for hospital facilities are as follows:

1. Define the community it serves.
2. Assess the health needs of that community.

3. In assessing the community's health needs, solicit and take into account input received from persons who represent the broad interests of that community, including those with special knowledge of or expertise in public health.
4. Document the CHNA in a written report (CHNA report) that is adopted for the hospital facility by an authorized body of the hospital facility.
5. Make the CHNA report widely available to the public.

(IRS 2018). HSX, and the HSX Clinical Database Repository (CDR) have the capacity to provide direct insight and assistance with the above in the following avenues of support:

HSX, receiving Admit, Discharge, and Transfer information from hospital facilities would be able to provide utilization data for a hospital facility, dependent on their connectivity to the health information exchange, defining the community it serves with utmost accuracy. The HSX CDR, in terms of assessing the health needs of the community, would be able to provide insight in identifying health needs to be further investigated by the hospital facility, examples of which include: identifying high levels of various diagnoses, identifying high utilizing zip codes, assessing readmissions, and other metrics currently able to be assessed on the encounter-level. As a required component to the HSX Population Health Use Case, information concerning the results of any population health effort must be disseminated across the HSX membership and on the HSX website (HSX Participants Population Health Use Case 2018), which enables the CHNA report to be widely available to the public.

Limitations

The limitations of this study are largely due to factors associated with the sampling mechanisms used and the data source itself. Given emergency department data was used, a

major limitation was the underrepresented prevalence of asthma, hypertension, and diabetes with and without complications within sample population compared to the general population .

There is a limitation of using electronic health records as a source of information; the information is not infallible. In a comparison of race/ethnicity data reported in HealthPartners Medical Group (HPMG) EMR data to the self-reported race/ethnicity classification, the agreement of data sources was high overall 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 underreported diagnoses represented in the general population. The diagnoses analyzed in this study, asthma, diabetes with and without complications and hypertension, are chronic conditions typically treated in the outpatient 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 diagnoses among emergency departments of this nature. Thus, direct comparisons to national or state statistics were difficult to identify and evaluate.

Conclusions and Future Study

Emergency Department utilization has been increasing for decades, exceeding what would be expected from population growth with regional and ethnographic disparities. Limited access to care is associated with increased Emergency Department use, and some ED visits are attributable to poor disease management. Differences in Emergency Department utilization appear, in part, to be a function of differences in education, health literacy, and learned behavior (Barata 2017).

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 primary care in emergency departments (Richards 2003). There are also racial disparities in ED utilization rates that are not attributable to differences in insurance status, access to care, or health literacy. In a few contexts, whites are higher utilizers, while in other settings various minority populations are overrepresented. The issue is further confused by the fact that some of the increases in emergency department volume reflect societal trends with the potential for disparate racial impact, e.g. drug use and abuse, poisonings, growing mental health issues and the increase in single parent households (Barata 2017).

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 (in the next section).

Relative emergency department utilization by gender appears to have changed with time. Studies done in the 1970s found that men were the heaviest users of emergency services. More recent investigations suggest that that trend has reversed, with females being more likely to use the emergency department. This apparent reversal may support study findings that women are more likely to have non-urgent complaints (Barata 2017).

Future study into the disparities seen should be completed to determine the causation behind the higher rates found. Evaluation of comorbidities may yield insight and support for targeted interventions to communities found in need. Providing evidence of populations in need promotes better investment to improve health (Secretary's Advisory Committee 2010).

This data source provided a larger study population than the Public Health Management Corporation's Household Health Survey. The HSX data uses primary health information versus self-reported information in the PHMC Household Health Survey. 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 better able to capture non-diagnosis non-clinical parameters including various social determinants of health. The HSX Clinical Database Repository does not yet capture these factors as of yet (e.g. proximity to a grocery store or reported level of neighborhood safety).

Given that the repository largely consists of admission, discharge, and transfer messages carrying limited clinical information, it is likely underrepresenting the magnitude of health issues discussed within this study.

As such, the HSX CDR does capture data in a usable format; however, the question or study being targeted may need to be defined specifically, in terms of the data source and in terms

of the time period being studied, to fully examine a topic of interest. Encounter-based analyses have the most validity and uniformity across the region for the HSX CDR.

This study should serve as a springboard for the exploration of the HSX CDR's capability for a multitude of population health management purposes. With the additional data feeds added late 2017 and early 2018, a better representation of the health issues, disparities, and indicators is possible (HealthShare Exchange 2018). The information held within the repository can give a timely snapshot of the health status in the greater Philadelphia area.

More insight should be completed to evaluate the representative nature of the data source in terms of effectively representing the region. As mentioned previously, encounter based analytics and utilization analysis through the admission, discharge, and transfer data received by HSX is very much present. However, in depth clinical analysis, e.g. laboratory results, evaluation of historical clinical information, is not available at this time. With the additional data feeds added late 2017 and early 2018, a better representation of the health issues, disparities, and indicators is possible (HealthShare Exchange 2018). The information held within the repository can give a timely snapshot of the health status in the greater Philadelphia area.

The potential for the data source, as an aggregation of clinical information for the Greater Philadelphia region through a direct connection to the electronic health record in a easily mineable structure, is high. Additional studies modeled with more direct comparisons for previously known health indicators should be completed to both verify the data and yield more insight into the community health status.

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Appendix A

Table 1. Healthcare Utilization Project ICD-10 Codes for Asthma, Essential Hypertension, Diabetes mellitus without complications (HCUP 2018)

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 (HCUP 2018)

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'	'E10.00'	'E11.3522'	'E11.65'	'E13.3513'	'E13.3591'	'E21.1'	'E28.8'

'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E11.	'E13.	'E13.	'E2	'E28
319'	3542'	22'	3533'	21'	3532'	01'	3523'	69'	3519'	3592'	1.2'	.9'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E11.	'E13.	'E13.	'E2	'E29
321'	3543'	29'	3539'	22'	3533'	10'	3529'	8'	3521'	3593'	1.3'	.0'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E29
3211'	3549'	311'	3541'	29'	3539'	11'	3531'	00'	3522'	3599'	1.4'	.1'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E29
3212'	3551'	319'	3542'	311'	3541'	21'	3532'	01'	3523'	36'	1.5'	.8'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E29
3213'	3552'	321'	3543'	319'	3542'	22'	3533'	10'	3529'	37X1'	2.0'	.9'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E30
3219'	3553'	3211'	3549'	321'	3543'	29'	3539'	11'	3531'	37X2'	2.1'	.0'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E30
329'	3559'	3212'	3551'	3211'	3549'	311'	3541'	21'	3532'	37X3'	2.2'	.1'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E30
3291'	359'	3213'	3552'	3212'	3551'	319'	3542'	22'	3533'	37X9'	2.8'	.8'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E30
3292'	3591'	3219'	3553'	3213'	3552'	321'	3543'	29'	3539'	39'	2.9'	.9'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
3293'	3592'	329'	3559'	3219'	3553'	3211'	3549'	311'	3541'	40'	3.0'	.0'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
3299'	3593'	3291'	359'	329'	3559'	3212'	3551'	319'	3542'	41'	3.1'	.1'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
331'	3599'	3292'	3591'	3291'	359'	3213'	3552'	321'	3543'	42'	3.2'	.20'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
3311'	36'	3293'	3592'	3292'	3591'	3219'	3553'	3211'	3549'	43'	3.3'	.21'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
3312'	37X1'	3299'	3593'	3293'	3592'	329'	3559'	3212'	3411'	44'	3.6'	.8'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E31
3313'	37X2'	331'	3599'	3299'	3593'	3291'	359'	3213'	3412'	49'	3.7'	.9'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E32
3319'	37X3'	3311'	36'	331'	3599'	3292'	3591'	3219'	3413'	51'	4.0'	.0'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E32
339'	37X9'	3312'	37X1'	3311'	36'	3293'	3592'	329'	3419'	52'	4.1'	.1'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E32
3391'	39'	3313'	37X2'	3312'	37X1'	3299'	3593'	3291'	349'	59'	4.2'	.8'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E32
3392'	40'	3319'	37X3'	3313'	37X2'	331'	3599'	3292'	3491'	610'	4.3'	.9'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
3393'	41'	339'	37X9'	3319'	37X3'	3311'	36'	3293'	3492'	618'	4.4'	.0'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
3399'	42'	3391'	39'	339'	37X9'	3312'	37X1'	3299'	3493'	620'	4.8'	.1'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
341'	43'	3392'	40'	3391'	39'	3313'	37X2'	331'	3499'	621'	4.9'	.2'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
3411'	44'	3393'	41'	3392'	40'	3319'	37X3'	3311'	351'	622'	5.0'	.3'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
3412'	49'	3399'	42'	3393'	41'	339'	37X9'	3312'	3511'	628'	5.8'	.4'
'E08.	'E08.	'E09.	'E09.	'E10.	'E10.	'E11.	'E11.	'E13.	'E13.	'E13.	'E2	'E34
3413'	51'	341'	43'	3399'	42'	3391'	39'	3313'	3512'	630'	5.9'	.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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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 T 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