Capstone Experience                                    Master of Public Health

8-2018

# Equity of Care Analysis at CHI Health Hospitals and Clinics in the Omaha Metro Area.

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# Equity of Care Analysis at CHI Health Hospitals and Clinics in the Omaha Metro Area.

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<u>Abstract</u>

The goal of the project is to identify if health disparities exist between patient groups based on race, ethnicity, language, payer type, and location of residence who received healthcare services from CHI Health system in the Omaha Metro area during January 2017 – March 2018. The health outcomes of interest are HPV vaccination rates, diabetes control rates, breast cancer screening rates, colorectal cancer screening rates, and 30-day hospital readmissions. Patient data from six Omaha area clinics and five hospitals was analyze in this study.

Among the six CHI Health clinics in this study, Lakeside had the highest rates of A1c control, cancer screening, and HPV vaccination; and the lowest rates of hospital readmissions. University had low rates for A1c control and cancer screening but high rates of HPV vaccinations. The significant racial differences were found in colorectal cancer screening which was highest for Whites, HPV vaccinations which was highest for Blacks, and hospital readmissions which was higher for Blacks than Whites or Asians. Breast cancer screening, colorectal cancer screening, and hospital readmissions rates were higher for Non-Hispanic than Hispanic patients, but Hispanic patients had higher rates of HPV vaccinations. English speaking patients had significantly higher rates of breast and colorectal cancer screening, but HPV vaccinations were higher for Spanish and Other language patients than English. Medicare patients had higher rates for A1c control and cancer screening than Medicaid and self-pay. Medicare however; had a significantly higher rate of hospital readmissions than all other payer types. Patients who live in Northwest and Western Douglas had significantly higher rates of cancer screening than those living in Northeast or Southeast Douglas. For HPV vaccinations, Southeast Douglas residents had a significantly higher dose completion rate than Northeast and Northwest Douglas residents. Northeast Douglas had a significantly higher hospital readmission

rate than all other regions of Douglas County. This analysis showed that the differences between demographic factors were not consistent across all the health outcomes being assessed.

Introduction

CHI Health identified health disparities analyses within hospitals and clinics as an area of need for their organization. Previously, CHI Health analyzed internal data and identified disparities by payer type for women getting mammograms. As a result, initiatives were started to help reduce this disparity. CHI Health wanted to ensure quality care for all patients but lacked the resources to thoroughly examine other health disparities within their hospitals and clinics. This capstone project filled that need by also examining health disparities in HPV vaccination rates, diabetes control rates, breast cancer screening rates, colorectal cancer screening rates, and 30-day hospital readmissions. Disparities based on race, ethnicity, language, payer type, and location of residence were analyzed. Health disparities found in this project will be the basis for quality improvement projects in the future. The research findings provide baseline health disparity data for CHI Health to determine if improvement projects are successful.

Literature Review

Identifying and addressing health disparities is important because certain segments of the U.S. population bear a greater burden of disease morbidity and mortality than others. A review of the Healthy People 2010 goals, which prioritized the reduction of health disparities, found an improvement in health disparities between racial and ethnic groups in only 27 of the 169 objectives measured. In the remaining 111 objectives, 86 objectives did not show a significant change and 25 objectives got worse (Hines et al., 2011). This shows that, even with targeted efforts to reduce health disparities, significant disparities still exist between racial and ethnic groups in the U.S.

The issue of health disparities is of interest in Omaha, Nebraska where racial and ethnic groups still live in siloes throughout the city. According to the U.S. Census Bureau (2010), 73.1% of the Omaha population reported they were White, 13.7% Black or African American, 2.4% Asian, and 13.1% Hispanic or Latino. The largest population of African Americans lives in the Northeastern Omaha area and the largest Hispanic population lives in the Southeastern Omaha area. Adding the geographical perspectives in the analysis of health disparities will help identify which communities should be prioritized for healthcare services and education.

Reducing health disparities is also important for health systems from a financial perspective. According to the Centers for Medicare & Medicaid Services, the total healthcare spending in the U.S. was $3.3 trillion in 2016, which equates to $10,348 per person. Containing healthcare costs has become a nationwide priority and reducing health disparities can significantly impact spending. Health inequalities and premature death cost the U.S. an estimated $1.4 trillion between 2003 and 2006. Considering direct medical costs, 59% of excess spending was attributed to African Americans, 35.7% to Hispanics, and 5% to Asians. For indirect costs, 77% of excess spending is attributed to African Americans, 22.3% to Hispanics, and 0.03% to Asians (LaVista, Gaskin, & Richard, 2009). Reducing health disparities will result in decreased excess spending, which, in turn, could save billions of dollars. These data show that reducing the health disparities for African Americans followed by Hispanics will have the greatest impact on reducing healthcare expenditures.

Disparities can be found across healthcare service areas. However, this study will focus on disparities in the following outcomes (1) HPV vaccination rates, (2) diabetes control rates, (3) breast cancer screening rates, (4) colorectal cancer screening rates, and (5) 30-day hospital readmissions.

*HPV Vaccine*

Across racial and ethnic groups in the U.S., females aged 13-17 years had a higher rate of completing the three doses of the HPV vaccine than males. White males (25.2%) and females (39.6%) had the lowest rates of vaccination series completion compared to other racial and ethnic groups. African Americans (males 26% and females 40.8%) had rates slightly higher than Whites followed by Asians (males 30.7% and females 53.5%) and Hispanics (males 35% and females 46.2%) (National Center for Health Statistics, 2017). It was found that African Americans initiate the HPV vaccine at a higher rate than whites but are less likely to receive all three doses of the vaccine. HPV vaccination rates are also lower among individuals with public insurance (Dempsey, Cohn, Dalton, & Ruffin, 2011). The overall rate of HPV vaccination series completion in Nebraska in 2016 was 45.9%. For females the completion rate was 50.6% compared to 41.3% for males (Reagan-Steiner, 2016).

*Diabetes*

Disparities in diabetes prevalence based on race and ethnicity are still present. Between 2011-2014, the prevalence of diabetes in the U.S. was 9.6% for Whites, 18% for African Americans and Hispanics, and 16.3% for Asians (National Center for Health Statistics U.S., 2017). These disparities also exist in the control of diabetes with 10.1%, 18.7% and 18.8% of White, African Americans, and Hispanics, respectively, having poor glycemic control. There are also differences in glycemic control among individuals with different insurance providers with 12.6% of Medicare users being poorly controlled compared to 7.2% for individuals with private insurance (Ali, McKeever Bullard, Imperatore, Barker, & Gregg, 2012). Diabetes disparities also exist in the Omaha area. According to the Omaha Area Community Health Needs Assessment

(2015) the diabetes prevalence was 8.6% for Whites, 18.3% for African Americans, and 12.2% for Hispanics.

*Mammograms*

In 2015, the rate of U.S. women 40-74 years old who got a mammogram within the last two years was the highest for African Americans (72.3%), followed by Whites (68.2%), Hispanics (62.8%), and Asians (62.7%) (National Center for Health Statistics, 2017). All groups fall below the Healthy People 2020 goal of 81.1% of women age 50-74 receiving a mammogram within the last 2 years. Women with private insurance had a mammogram rate of 72.2% compared to women with public insurance at 57.7% (National Center for Health Statistics, 2017).

In 2016, the rate of women aged 50-74 years old reporting an up-to-date breast cancer screening was 76.1% for Douglas County NE and 82.9% for Sarpy and Cass County NE. Racial differences in breast cancer screening exist in Nebraska with screening rates at 73.9% for Whites, 79.6% for Blacks, and 55.4% for Hispanics (Centers for Disease Control and Prevention BRFSS, 2016).

*Colorectal Cancer Screening*

For U.S. adults aged 50-75, there are three recommended measures for colorectal cancer (CRC) screening: fecal occult blood testing (FOBT) during the past year, sigmoidoscopy in the past 5 years, or colonoscopy in the past 10 years. Whites had the highest rate of CRC screening at 62% followed closely by African Americans at 59%. The most significant difference came between English speaking Hispanics and Spanish speaking Hispanics with CRC screening rates of 52.5% and 30.6% respectively (Liss & Baker, 2014). These racial differences existed after adjusting for insurance coverage. Whites were most likely to have insurance and a usual source

of care and African Americans were mostly likely to have an appointment within the last year. Spanish speaking Hispanics were least likely to be insured, have a usual source of care, and have an appointment within the last year. (Liss & Baker, 2014).

In 2016, the rate of adults aged 50-75 years old reporting an up-to-date colon cancer screening was 69.0% for Douglas County NE and 69.6% for Sarpy and Cass County in Nebraska. Females in Nebraska had a higher rate of colon cancer screening at 66.7% compared to 65.2% for males. There are also racial and ethnic differences in Nebraska with screening rates at 67.2% for Whites, 62.9% for Blacks, 46.0% for American Indians or Alaskan Natives, and 41.7% for Hispanics (Centers for Disease Control and Prevention BRFSS, 2016).

*30-day Hospital Readmission*

A study of Medicare patients in the U.S. between 2000-2012 found differences in the 30-day readmission rate for all diagnosis between racial and ethnic groups. The readmission rate for Whites was 15.1%, African Americans was 18.8% and Hispanics was 16.4% (Barnett, Hsu, & McWilliams, 2015). While most hospital readmissions result from patient frailty or chronic disease progression between 9-48% of readmissions are preventable (Benbassat, & Taragin, 2000). Identifying patient populations with the highest readmission rates allows the hospital to target interventions to reduce admissions towards these groups.

Research Methods

Research Question: What health disparities exists based on race, ethnicity, language, payer type, and location of residence among patient populations served by CHI Health clinics and hospitals in the Omaha metro area?

Data collected by six CHI Health Clinics in the Omaha area were analyzed. These clinics include: CHI Health Priority Care 42nd & L, CHI Health University Campus, CHI Health Clinic Family Medicine Bellevue, CHI Health Clinic Family Medicine La Vista, CHI Health Clinic Family Medicine Florence, and CHI Health Clinic Family Medicine Lakeside. These six clinics use the Patient-Centered Medical Home (PCMH) model of care and focus on utilizing data to ensure patient outcomes are achieved. The health factors that were analyzed for disparities from the clinic include A1c control, breast cancer screening, colorectal cancer screening, and HPV vaccinations. The numerator and denominator for these outcomes as well as CHI Health's goal for these outcomes is shown in Table 1 below.  All outcome variables are binary; either the patient met the outcome within the time frame or did not. If these measures align with quality measures from the Merit-Based Incentive Payment System (MIPS) from the Centers for Medicare and Medicaid Services (CMS), the CMS number is listed.  A three-month look back of data already collected by CHI Health was analyzed for all measures besides A1c, which will be a year-long look back.  The period of data utilized for analysis is listed in Table 1.

Analysis of 30-day hospital readmission rates for the following five CHI hospitals in the Omaha area was also completed; CHI Health Immanuel, CHI Health Creighton University Medical Center Bergan Mercy, CHI Health Lakeside, CHI Health Midlands, and CHI Health Mercy Council Bluffs. The database used for 30-day hospital readmission rates was provide by Premiere Quality Advisor. Readmissions for 1/1/2017-12/31/2017 will be analyzed.

For the clinic outcomes, data were sorted by race, ethnicity, language, payer type, and location of residence before using the numerator and denominator listed in Table 1 to calculate a rate. The same demographics will be analyzed for 30-day hospital readmissions besides language which is not available. For the analysis of race, the categories of American Indian or Alaska

Native and Native Hawaiian or Other Pacific Islander were excluded due to small sample size. Zip codes were sorted into four county categories (Cass, Sarpy, Pottawattamie, and Douglas) and five regions of Douglas County (Northeast, Northwest, Southeast, Southwest, and Western). The zip codes associate with each category are listed in Table 11 of the appendix.

Pearson's Chi Square testing was used to compare if rates differ significantly by demographic factors for both clinic outcomes and 30-day hospital readmissions. For demographic factors with more than 2 categories post hoc testing was used if the Pearson's Chi Square test shows significance to identify between which categories the differences exist. A Bonferroni corrected p-value was used to reduce the likelihood of a type 1 error.

Table 1: Clinic Outcome Definitions

| Health Outcome | Goal | Numerator | Denominator | Timeframe |
|---|---|---|---|---|
| Hemoglobin A1c Control (< 9): % of patients age 18-75 years with diabetes who had HbA1c less than 9<br><br>CMS 122 | Reduce % of diabetic patients who have an HbA1c less than 9 (Healthy People 2020 Goal 16.3%, or less have uncontrolled diabetes or 83.7% with controlled diabetes) | Patients whose most recent HbA1c level (performed during the measurement period) is < 9.0% | Patients 18-75 years of age with a diagnosis of diabetes with a visit during the measurement period | Yearly 2017 |
| Percentage of women 50-74 years of age who had a mammogram to screen for breast cancer<br><br>CMS 125 | 81.1% of women age 50-74 receive a mammogram within the last two (2) years (Healthy People 2020) | Women 51-74 years of age with one or more mammograms during the measurement period or the 15 months prior to the measurement period | Women 51-74 years of age with an eligible visit during the measurement period. | Quarterly Oct-Dec 2017 |
| Colorectal Cancer Screening. Percentage of patients 50-75 years of age who had appropriate screening for colorectal cancer<br><br>CMS 130 | Achieve Healthy People 2020 goal of 70.5% of patients age 50-75 complete a colorectal cancer screening | Patients with one or more screenings for colorectal cancer. Appropriate screenings are defined by any one of the following criteria: Fecal occult blood test (FOBT), flexible sigmoidoscopy, or colonoscopy during the measurement period | Patients 50-75 years of age with a visit during the measurement period | Quarterly Jan-March 2018 |
| HPV Vaccine Increase Gardasil vaccine series completion (2 shot series) Rates for patients age 12-15. | Achieve Health People 2020 goal of 80% of eligible patients completing Gardasil series vaccine by age 15 | Number of patients age 12-15 with series completion in Provider Panel | Total Patients age 12-15 on Provider Panel | Quarterly Jan-March 2018 |

Results

The demographic characteristic of the sample populations for clinic outcomes and

hospital readmissions are listed in Table 2 and Table 3 respectively.

Table 2: Descriptive Statistics for Clinic Outcomes

| | A1c Control | | | Breast Cancer Screening | | | Colorectal Cancer Screening | | | HPV Vaccination | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | | N | % | | N | % | | N | % |
| **Clinic** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| Bellevue | 488 | 11.1 | | 462 | 9.5 | | 937 | 10.1 | | 335 | 12.2 |
| Florence | 878 | 19.9 | | 751 | 15.5 | | 1502 | 16.3 | | 625 | 22.7 |
| L Street | 660 | 15.0 | | 693 | 14.3 | | 1272 | 13.8 | | 450 | 16.4 |
| Lakeside | 808 | 18.3 | | 1154 | 23.8 | | 2162 | 23.4 | | 308 | 11.2 |
| LaVista | 1020 | 23.1 | | 1346 | 27.8 | | 2295 | 24.8 | | 306 | 11.1 |
| University | 556 | 12.6 | | 442 | 9.1 | | 1073 | 11.6 | | 725 | 26.4 |
| **Sex** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| Male | 2211 | 50.1 | | 0 | 0.0 | | 4127 | 44.7 | | 1416 | 51.5 |
| Female | 2199 | 49.9 | | 4848 | 100.0 | | 5114 | 55.3 | | 1333 | 48.5 |
| **Age** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| 12-15 | 0 | 0.0 | | 0 | 0.0 | | 0 | 0.0 | | 2749 | 100.0 |
| 19-29 | 77 | 1.7 | | 0 | 0.0 | | 0 | 0.0 | | 0 | 0.0 |
| 30-39 | 282 | 6.4 | | 0 | 0.0 | | 0 | 0.0 | | 0 | 0.0 |
| 40-49 | 692 | 15.7 | | 0 | 0.0 | | 0 | 0.0 | | 0 | 0.0 |
| 50-59 | 1205 | 27.3 | | 1826 | 37.7 | | 4115 | 44.5 | | 0 | 0.0 |
| 60-69 | 1416 | 32.1 | | 2127 | 43.9 | | 3704 | 40.1 | | 0 | 0.0 |
| 70-76 | 738 | 16.7 | | 895 | 18.5 | | 1422 | 15.4 | | 0 | 0.0 |
| **Race** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| White | 2978 | 67.5 | | 3680 | 75.9 | | 6894 | 74.6 | | 1032 | 37.5 |
| Black or African American | 559 | 12.7 | | 431 | 8.9 | | 867 | 9.4 | | 391 | 14.2 |
| Asian | 165 | 3.7 | | 128 | 2.6 | | 313 | 3.4 | | 461 | 16.8 |
| American Indian or Alaska Native | 22 | 0.5 | | 12 | 0.2 | | 39 | 0.4 | | 19 | 0.7 |
| Native Hawaiian or Other Pacific Islander | 9 | 0.2 | | 5 | 0.1 | | 9 | 0.1 | | 5 | 0.2 |

| | A1c Control | | | Breast Cancer Screening | | | Colorectal Cancer Screening | | | HPV Vaccination | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | | N | % | | N | % | | N | % |
| Other/Blank | 677 | 15.4 | | 592 | 12.2 | | 1121 | 12.1 | | 841 | 30.6 |
| **Ethnicity** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| Hispanic or Latino | 374 | 8.5 | | 262 | 5.4 | | 512 | 5.5 | | 347 | 12.6 |
| Not Hispanic or Latino | 4036 | 91.5 | | 4586 | 94.6 | | 8729 | 94.5 | | 2080 | 75.7 |
| Unknown | 0 | 0.0 | | 0 | 0.0 | | 0 | 0.0 | | 322 | 11.7 |
| **Language** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| English | 4022 | 91.2 | | 4543 | 93.7 | | 8557 | 92.6 | | 1841 | 67.0 |
| Spanish | 210 | 4.8 | | 162 | 3.3 | | 342 | 3.7 | | 190 | 6.9 |
| Other | 169 | 3.8 | | 143 | 2.9 | | 336 | 3.6 | | 584 | 21.2 |
| Unknown | 9 | 0.2 | | 0 | 0.0 | | 6 | 0.1 | | 134 | 4.9 |
| **Payer** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| Commercial | 2336 | 53.0 | | 2496 | 51.5 | | 5113 | 55.3 | | | |
| Medicaid | 145 | 3.3 | | 119 | 2.5 | | 234 | 2.5 | | | |
| Medicare | 1549 | 35.1 | | 1955 | 40.3 | | 3287 | 35.6 | | | |
| Uninsured/ Self-Pay | 155 | 3.5 | | 98 | 2.0 | | 238 | 2.6 | | | |
| No Charge and No Typology Code | 225 | 5.1 | | 180 | 3.7 | | 369 | 4.0 | | | |
| **Location of Residence** | 4410 | 100.0 | | 4848 | 100.0 | | 9241 | 100.0 | | 2749 | 100.0 |
| Cass | 75 | 1.7 | | 89 | 1.8 | | 180 | 1.9 | | 39 | 1.4 |
| Pottawattamie | 119 | 2.7 | | 99 | 2.0 | | 218 | 2.4 | | 34 | 1.2 |
| Sarpy | 1127 | 25.6 | | 1431 | 29.5 | | 2584 | 28.0 | | 563 | 20.5 |
| Northeast Douglas | 1050 | 23.8 | | 894 | 18.4 | | 1855 | 20.1 | | 1010 | 36.7 |
| Northwest Douglas | 476 | 10.8 | | 539 | 11.1 | | 996 | 10.8 | | 277 | 10.1 |
| Southeast Douglas | 638 | 14.5 | | 645 | 13.3 | | 1231 | 13.3 | | 398 | 14.5 |
| Southwest Douglas | 680 | 15.4 | | 859 | 17.7 | | 1622 | 17.6 | | 300 | 10.9 |
| Western Douglas | 95 | 2.2 | | 136 | 2.8 | | 249 | 2.7 | | 41 | 1.5 |
| Out of state/ other | 148 | 3.4 | | 156 | 3.2 | | 306 | 3.3 | | 87 | 3.2 |

Table 3: Descriptive Statistics for Hospital Readmissions

|  | 30-day Hospital Readmissions | |
| --- | --- | --- |
|  | **N** | **%** |
| **Hospital** | 3396 | 100.0 |
| CUMC-Bergan Mercy Omaha-NE | 1489 | 43.8 |
| Immanuel Omaha-NE | 799 | 23.5 |
| Lakeside Omaha-NE | 511 | 15.0 |
| Mercy Council Bluffs-IA | 513 | 15.1 |
| Midlands Papillion-NE | 83 | 2.4 |
| **Race** | 3396 | 100.0 |
| White | 2637 | 77.7 |
| Black or African American | 484 | 14.3 |
| American Indian | 31 | 0.9 |
| Asian | 46 | 1.4 |
| Pacific Islander | 3 | 0.1 |
| Other/Blank | 195 | 5.7 |
| **Ethnicity** | 3396 | 100.0 |
| Hispanic or Latino | 82 | 2.4 |
| Not Hispanic or Latino | 3235 | 95.3 |
| Unknown | 79 | 2.3 |
| **Payer** | 3396 | 100.0 |
| Commercial | 572 | 16.8 |
| Medicaid | 552 | 16.3 |
| Medicare | 2126 | 62.6 |
| Self-Pay | 146 | 4.3 |
| **Location of Residence** | 3395 | 100.0 |
| Cass | 50 | 1.5 |
| Pottawattamie | 515 | 15.2 |
| Sarpy | 359 | 10.6 |
| Northeast Douglas | 785 | 23.1 |
| Northwest Douglas | 399 | 11.7 |
| Southeast Douglas | 338 | 10.0 |
| Southwest Douglas | 457 | 13.5 |
| Western Douglas | 70 | 2.1 |
| Out of State/other | 422 | 12.4 |

Tables 4-10 show the rates of A1c control, breast cancer screening, colorectal cancer, screening, HPV vaccination, and hospital readmissions across the demographics of interest (clinic/hospital, race, ethnicity, language, payer type, and location of residence). A chart of all chi-square and post hoc test results can be found in the appendix in Table 12.

Table 4: Health Outcomes by Clinic or Hospital

| | % met outcomes | | | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|---|---|
| | Bellevue (a) | Florence (b) | L Street (c) | Lakeside (d) | LaVista (e) | University (f) | | |
| A1c Control Rate (< 9%) | 76.8 | 80.0[f] | 75.2[d] | 82.2[c,f] | 77.5 | 71.6[b,d] | 26.618 | <0.001 |
| Breast Cancer Screening Rate | 54.5[d,e] | 49.9[d,e] | 56.6[d,e] | 76.6[a,b,c,e,f] | 69.5[a,b,c,d,f] | 57.4[d,e] | 203.178 | <0.001 |
| Colorectal Cancer Screening Rate | 36.0[d,e] | 33.6[d,e] | 31.2[d,e] | 53.7[a,b,c,f] | 52.5[a,b,c,f] | 30.6[d,e] | 399.26 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 31.3[d,c,f] | 28.3[c,d,e,f] | 59.8[a,b,d,e] | 47.7[a,b,c] | 42.2[b,c,f] | 54.9[a,b,e] | 165.917 | <0.001 |
| | % met outcomes | | | | | | Chi-square | p-value |
| | CUMC-Bergan Mercy (a) | Immanuel (b) | Lakeside (c) | Mercy (d) | Midlands (e) | | | |
| 30-Day Hospital Readmissions to CHI Health System | 10.25[b,c,d] | 13.59[a,c,b] | 8.10[a,b,d] | 11.81[a,c,e] | 8.51[b,d] | | 110.155 | <0.001 |

*Superscripts indicate significant differences from post-hoc testing between percentage of patients at that location meeting the outcome and location(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.008 for the post-hoc analysis of A1c control, breast cancer, colorectal cancer and HPV vaccination and p-value of 0.005 for hospital readmissions.*

Lakeside had the highest rates of A1c control (82.2%), breast cancer screening (76.6%), colorectal cancer screening (53.7%) and the lowest rates of hospital readmissions (8.10%). Florence had the lowest rate for breast cancer screening (49.9%) and HPV vaccinations (28.3%) but performed well in A1c control (80.0%). University had a low rate of A1c control (71.6%) and colorectal cancer screening (30.6%) but high rates of HPV vaccinations (54.9%). The lowest

rates of hospital readmissions were at Lakeside (8.10%) and Midlands (8.51%) hospital compared to high rates of readmissions at Immanuel (13.59%) and Mercy (11.81%).

Table 5: Health Outcomes by Race

| | % met outcomes | | | Chi-square | p-value |
|---|---|---|---|---|---|
| | White (a) | Black (b) | Asian (c) | | |
| A1c Control Rate (< 9%) | 78.6 | 74.6 | 78.2 | 4.494 | 0.106 |
| Breast Cancer Screening Rate | 66.1 | 61.0 | 64.1 | 4.611 | 0.100 |
| Colorectal Cancer Screening Rate | 45.6[b,c] | 33.9[a] | 30.0[a] | 67.247 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 41.7[c] | 55.8[c] | 43.6[a,b] | 28.345 | <0.001 |
| 30-Day Hospital Readmissions to CHI Health System | 10.65[b] | 13.95[a,c] | 8.83[b] | 36.504 | <0.001 |

*Superscripts indicate significant differences from post-hoc testing between percentage of patients of that race meeting the outcome and race(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.017.*

For A1c control and breast cancer screening rate a significant difference did not exist between White, Black, and Asian patients. Colorectal cancer screening rates were significantly higher for Whites (45.6%) than for Blacks (33.9%) or Asians (30.0%). HPV vaccinations were highest for Black patients (55.8%). Blacks had a significantly higher rate of hospital readmissions (14.0%) than Whites (10.7%) or Asians (8.8%).

Table 6: Health Outcomes by Ethnicity

| | % met outcomes | | Chi-square | p-value |
|---|---|---|---|---|
| | Non-Hispanic | Hispanic | | |
| A1c Control Rate (< 9%) | 78.2* | 71.4 | 9.273 | 0.002 |
| Breast Cancer Screening Rate | 64.0* | 53.4 | 12.991 | <0.001 |
| Colorectal Cancer Screening Rate | 43.4* | 27.5 | 49.960 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 44.9* | 62.0 | 34.901 | <0.001 |
| 30-Day Hospital Readmissions to CHI Health System | 11.21* | 4.22 | 92.496 | <0.001 |

*\* Indicates significant differences between Hispanic and Non-Hispanic (p ≤ 0.05)*

Non-Hispanics had significantly higher rates of A1c control (78.2%), breast cancer screening (64.0%), and colorectal cancer screening (43.2%) than Hispanics but significantly lower rates of HPV vaccinations (44.9%) and higher rates of hospital readmissions (11.21%).

Table 7: Health Outcomes by Language

|  | % met outcomes | | | Chi-square | p-value |
|---|---|---|---|---|---|
|  | English (a) | Spanish (b) | Other (c) | | |
| A1c Control Rate (< 9%) | 77.9 | 72.4 | 76.9 | 3.613 | 0.164 |
| Breast Cancer Screening Rate | 64.5[b] | 50.0[a] | 60.1 | 15.025 | 0.001 |
| Colorectal Cancer Screening Rate | 48.3[b,c] | 24.6[a] | 28.9[a] | 76.670 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 41.2[b,c] | 63.2[a] | 59.2[a] | 79.642 | <0.001 |

*Superscripts indicate significant differences from post-hoc testing between percentage of patients with that preferred language meeting the outcome and language(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.017.*

A significant difference in language existed for all outcomes besides A1c control. English speaking patients had significantly higher rates of breast (64.5%) and colorectal cancer screening (48.3%) than patients whose preferred language was Spanish (breast cancer 50.0%, colorectal cancer 24.6%) and higher colorectal cancer screening rates (48.3%) than other language patients (28.9%). However; HPV vaccination rates were significantly higher for Spanish (63.2%) and other language (59.2%) patients than for English (41.2%) speaking patients. There were not significant differences between Spanish and other language patients for any of the outcomes.

Table 8: Health Outcome by Payer Type

| | % met outcomes | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|
| | Commercial (a) | Medicaid (b) | Medicare (c) | Self-Pay (d) | | |
| A1c Control Rate (< 9%) | 75.6[c] | 70.3[c] | 83.7[a,b,d] | 66.5[c] | 53.977 | <0.001 |
| Breast Cancer Screening Rate | 64.9[d] | 53.8[c,d] | 65.8[b,d] | 35.7[a,b,c] | 43.375 | <0.001 |
| Colorectal Cancer Screening Rate | 42.3[b,c,d] | 29.1[a,c] | 47.1[a,b,d] | 20.2[a,c] | 92.594 | <0.001 |
| 30-Day Hospital Readmissions to CHI Health System | 5.60[b,c,d] | 10.18[a,c,d] | 14.36[a,b,d] | 9.31[a,b,c] | 494.393 | <0.001 |

*Superscripts indicate significant differences from post-hoc testing between percentage of patients with that payer type meeting the outcome and payer type(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.008.*

Medicare patients had the highest rates for A1c control (83.7%), breast cancer screening (64.9%) and colorectal cancer screening (47.1%) which were significantly higher than Medicaid and self-pay. Medicare patients also had significantly higher rates of A1c control (83.7%) and colorectal cancer screening (47.1%) than commercial payers (A1c control 75.6%, colorectal cancer 42.3%). Medicare however; had a significantly higher rate of hospital readmissions (14.36%) than all other payer types. Commercial payers consistently had the second highest clinic outcome rates behind Medicare and a significantly lower hospital readmission rate (5.60%) than all other payer types.

Table 9: Health Outcome by County

| | % met outcomes | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|
| | Cass (a) | Douglas (b) | Pottawattamie (c) | Sarpy (d) | | |
| A1c Control Rate (< 9%) | 81.3 | 77.4 | 76.5 | 77.7 | 0.805 | 0.848 |
| Breast Cancer Screening Rate | 69.7 | 62.2[d] | 58.6 | 66.9[b] | 11.926 | 0.008 |
| Colorectal Cancer Screening Rate | 48.9 | 40.7[d] | 37.6[d] | 47.2[b,c] | 36.366 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 25.6[b] | 47.3[a,d] | 35.3 | 39.3[b] | 18.962 | <0.001 |
| 30-Day Hospital Readmissions to CHI Health System | 8.32 | 11.57[d] | 11.85[d] | 8.11[b,c] | 51.513 | <0.001 |

***Superscripts indicate significant differences from post-hoc testing between percentage of patients from that county meeting the outcome and county(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.008.***

There were no significant differences in A1c control between the four counties. Sarpy County had significantly higher rates of breast cancer (66.9%) and colorectal cancer (47.2%) screening than Douglas County (breast cancer 62.2%, colorectal cancer 40.7%). Douglas County (47.3%) however; had significantly higher HPV vaccination rates than Sarpy (39.3%) and Cass (25.6%) County. Sarpy County (8.11%) had a significantly lower hospital readmission rate than Douglas (11.57%) and Pottawattamie (11.85%) counties.

Table 10: Health Outcome by Region of Douglas County

| | % met outcomes | | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|---|
| | Northeast (a) | Northwest (b) | Southeast (c) | Southwest (d) | Western (e) | | |
| A1c Control Rate (< 9%) | 77.2 | 77.7 | 75.9 | 78.4 | 81.1 | 2.008 | 0.734 |
| Breast Cancer Screening Rate | 54.0[b,d,e] | 69.0[a,c] | 54.0[b,d,e] | 71.7[a,c] | 68.4[a,c] | 89.988 | <0.001 |
| Colorectal Cancer Screening Rate | 31.8[b,d,e] | 48.2[a,c] | 33.5[b,d,e] | 49.7[a,c] | 53.0[a,c] | 179.938 | <0.001 |
| HPV Vaccination Series Completion (2 doses) | 44.0[c] | 44.8[c] | 57.8[a,b] | 48.3 | 36.6 | 24.816 | <0.001 |
| 30-Day Hospital Readmissions to CHI Health System | 14.37[b,c,d,e] | 10.19[a] | 10.77[a] | 10.61[a] | 7.91[a] | 66.526 | <0.001 |

*Superscripts indicate significant differences from post-hoc testing between percentage of patients from that region meeting the outcome and region(s) with the corresponding letter. We used Bonferroni-corrected p-value of 0.005.*

There were no significant differences in A1c control between the five regions of Douglas County. Northwest and Western Douglas had significantly higher rates of cancer screening than Northeast or Southeast Douglas. For HPV vaccinations Southeast Douglas (57.8%) had a significantly higher dose completion rate than Northeast (44.0%) and Northwest (44.8%) Douglas. Northeast Douglas (14.37%) had a significantly higher hospital readmission rate than all other regions of Douglas County.

Conclusion

This analysis showed that the differences between demographic factors are not consistent across all the health outcomes being assessed. This shows that it is important for CHI Health and other health systems to focus interventions towards improving specific health outcomes for specific target populations since differences cannot be extrapolated across all health outcomes. Unfortunately, this takes additional time and resources to identify areas of improvement. It is

important to not make assumptions about any population without looking at what the data is showing.

The fewest significant differences existed in A1c control which indicates that focusing interventions on other outcomes may have a larger impact. The demographic with the most potential for improvement for A1c control is payer. Medicare patients had a significantly better diabetes management than any other payer type. HPV vaccinations rates are high among minority populations, such as Blacks, Asians, Hispanics, and Spanish speakers, but improvements are necessary in cancer screening and hospital readmissions for minorities. White English speaking patients have the lowest rate of HPV vaccination rates and could benefit from targeted strategies to increase these rates.  Medicare patients had significantly better outcomes in A1c control and cancer screening than other payers, but Medicare did not result in lower hospital readmissions. Other payers may need more support from primary care where Medicare patients need additional follow-up support after hospital discharge.

Discussion/Recommendations

This analysis will provide a baseline of health equity data for CHI Health to compare against in the future. It can also provide a justification for targeted health interventions to improve outcomes among certain populations, clinics, and hospitals. The American Hospital Association (2016) toolkit on addressing health disparities recommends developing a system or dashboard to monitor key CMS and other health outcomes based on demographic factors such as race, ethnicity, language, payer type, and location of residence. A dashboard can help CHI Health continue to analyze health disparities and to identify where additional resources are needed to achieve the optimal health outcomes for all patient populations. CHI Health may

consider making the tasks associated with monitoring and addressing health disparities as a part of employee(s) job descriptions so there is a designated focus.

One of the main limitations of this analysis was race data that was marked unknown, declined, or other. About 6-30% of patients, had to be excluded from analysis because of the insufficient information on race. American Indian or Alaska Native and Native Hawaiian or Other Pacific Islander constitute a small portion of the Omaha metro population and CHI Health patient population, but it is still important to identify if these patients are receiving equal quality of care. Improving the options within the EHR to require a race be entered and allowing patients to select multiple races rather than an "other" race option would provide a better picture of the true racial makeup of CHI Health patients. The American Hospital Association (2016) also makes several recommendations about the collection of race, ethnicity, and language data. They recommend that registration staff rather than medical staff collect this information at patient check-in or over the phone when patient is scheduling an appointment. Having this information ahead of time can allow for better language services if necessary. It is also recommended that clinics and hospitals provide the option for patients to provide demographic data via paper form or tablet in addition to a verbal discussion for additional privacy (American Hospital Association, 2016). Looking back at a longer time period might provide a large enough sample size to analyze the health outcomes of these unique patient populations.

Another limitation of this analysis was in colorectal cancer screening data. The rates of colorectal cancer screening are lower than the target of 70.5% for a couple of reasons. First colorectal cancer screening is a year-long measure so analyzing only the first quarter of the year will provide a lower rate of screening since some individuals who are eligible for another screening will receive it later in the year. Currently analysis only included FOBT in the last year,

flexible sigmoidoscopy in the 5 years, and colonoscopy in the previous 10 years as appropriate colorectal cancer screening methods but some patients have been opting for a DNA fit test rather than other screening methods. In the future CHI Health will want to look at the portion of the patient population who is opting to use DNA fit test for screening.

Another level of analysis that was not looked at in this project but would be important for CHI Health in the future, is to look at cofounders. This project only looked at how one factor affected health outcomes, but often it is a combination of different factors. Caution should be used when interpreting the results of this study without the in-depth level of analysis.

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Table 11: Zip Code Regions

| Cass | Sarpy | Pottawattamie | Northeast Douglas | Northwest Douglas | Southeast Douglas | Southwest Douglas | Western Douglas |
|---|---|---|---|---|---|---|---|
| 68003 | 68005 | 51501 | 68178 | 68010 | 68105 | 68124 | 68007 |
| 68016 | 68028 | 51502 | 68101 | 68114 | 68106 | 68127 | 68022 |
| 68037 | 68046 | 51503 | 68102 | 68116 | 68107 | 68130 | 68064 |
| 68048 | 68056 | 51510 | 68103 | 68118 | 68108 | 68135 | 68069 |
| 68058 | 68059 | 51521 | 68104 | 68122 | 68117 | 68137 | |
| 68304 | 68113 | 51525 | 68109 | 68134 | | 68144 | |
| 68307 | 68123 | 51526 | 68110 | 68142 | | | |
| 68347 | 68128 | 51536 | 68111 | 68154 | | | |
| 68349 | 68133 | 51542 | 68112 | 68164 | | | |
| 68366 | 68136 | 51548 | 68131 | | | | |
| 68403 | 68138 | 51549 | 68132 | | | | |
| 68407 | 68147 | 51553 | 68139 | | | | |
| 68409 | 68157 | 51559 | 68145 | | | | |
| 68413 | | 51560 | 68152 | | | | |
| 68455 | | 51575 | 68182 | | | | |
| 68462 | | 51576 | | | | | |
| 68463 | | 51577 | | | | | |

Table 12: Clinic Outcome Chi Square Tests

| | A1c Control Rate (< 9%) | | Breast Cancer Screening Rate | | Colorectal Cancer Screening Rate | | HPV Vaccination Series Completion (2 doses) | |
|---|---|---|---|---|---|---|---|---|
| | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. |
| **Clinic** | | | | | | | | |
| Bellevue, Florence, L Street, Lakeside, LaVista, University | 0.000 | 26.618 | 0.000 | 203.178 | 0.000 | 399.26 | 0.000 | 165.917 |
| Bellevue-Florence | 0.177 | 1.819 | 0.119 | 2.436 | 0.223 | 1.484 | 0.327 | 0.961 |
| Bellevue-L Street | 0.508 | 0.439 | 0.498 | 0.459 | 0.019 | 5.499 | 0.000 | 62.245 |
| Bellevue-Lakeside | 0.020 | 5.445 | 0.000 | 76.876 | 0.000 | 82.328 | 0.000 | 18.075 |
| Bellevue-LaVista | 0.793 | 0.069 | 0.000 | 34.317 | 0.000 | 72.958 | 0.005 | 8.068 |
| Bellevue-University | 0.053 | 3.743 | 0.307 | 1.044 | 0.010 | 6.582 | 0.000 | 50.976 |
| Florence-L Street | 0.025 | 5.047 | 0.012 | 6.366 | 0.189 | 1.726 | 0.000 | 106.653 |
| Florence-Lakeside | 0.245 | 1.353 | 0.000 | 144.384 | 0.000 | 145.074 | 0.000 | 34.283 |

| | A1c Control Rate (< 9%) | | Breast Cancer Screening Rate | | Colorectal Cancer Screening Rate | | HPV Vaccination Series Completion (2 doses) | |
|---|---|---|---|---|---|---|---|---|
| | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. |
| Florence-LaVista | 0.185 | 1.759 | 0.000 | 79.074 | 0.000 | 131.719 | 0.000 | 17.825 |
| Florence-University | 0.000 | 13.354 | 0.008 | 7.12 | 0.110 | 2.553 | 0.000 | 96.957 |
| L Street-Lakeside | 0.001 | 10.819 | 0.000 | 81.396 | 0.000 | 163.42 | 0.001 | 10.723 |
| L Street-LaVista | 0.277 | 1.18 | 0.000 | 33.904 | 0.000 | 150.001 | 0.000 | 22.685 |
| L Street-University | 0.160 | 1.974 | 0.653 | 0.202 | 0.737 | 0.112 | 0.101 | 2.696 |
| Lakeside-LaVista | 0.013 | 6.191 | 0.000 | 15.656 | 0.424 | 0.638 | 0.165 | 1.925 |
| Lakeside-University | 0.000 | 21.449 | 0.000 | 54.671 | 0.000 | 154.457 | 0.035 | 4.458 |
| LaVista-University | 0.010 | 6.677 | 0.000 | 20.22 | 0.000 | 141.882 | 0.000 | 13.976 |
| | | | | | | | | |
| **Sex** | | | | | | | | |
| Male-Female | 0.085 | 2.972 | n/a | n/a | 0.272 | 1.209 | 0.001 | 10.897 |
| | | | | | | | | |
| **Language** | | | | | | | | |
| English, Spanish, Other | 0.164 | 3.613 | 0.001 | 15.025 | 0.000 | 76.67 | 0.000 | 79.642 |
| English-Spanish | | | 0.000 | 14.169 | 0.000 | 48.977 | 0.000 | 33.918 |
| English-Other | | | 0.289 | 1.123 | 0.000 | 29.458 | 0.000 | 57.822 |
| Spanish-Other | | | 0.076 | 3.152 | 0.205 | 1.607 | 0.326 | 0.963 |
| | | | | | | | | |
| **Ethnicity** | | | | | | | | |
| Hispanic-Non-Hispanic | 0.002 | 9.273 | 0.000 | 12.991 | 0.000 | 49.960 | 0.000 | 34.901 |
| | | | | | | | | |
| **Race** | | | | | | | | |
| White, Black, Asian | 0.106 | 4.494 | 0.100 | 4.611 | 0.000 | 67.247 | 0.000 | 28.345 |
| White-Black | | | | | 0.000 | 42.378 | 0.308 | 0.772 |
| White-Asian | | | | | 0.000 | 29.187 | 0.000 | 27.824 |
| Black-Asian | | | | | 0.211 | 1.567 | 0.000 | 12.503 |
| | | | | | | | | |
| **Payer** | | | | | | | | |
| Commercial, Medicaid, Medicare, Self-Pay | 0.000 | 53.977 | 0.000 | 43.375 | 0.000 | 92.594 | | |
| Commercial-Medicaid | 0.155 | 2.018 | 0.011 | 6.389 | 0.000 | 16.101 | | |
| Commercial-Medicare | 0.000 | 36.359 | 0.624 | 0.24 | 0.000 | 18.749 | | |
| Commercial-Self-Pay | 0.011 | 6.476 | 0.000 | 35.388 | 0.000 | 45.89 | | |

| | A1c Control Rate (< 9%) | | Breast Cancer Screening Rate | | Colorectal Cancer Screening Rate | | HPV Vaccination Series Completion (2 doses) | |
|---|---|---|---|---|---|---|---|---|
| | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. | P value | Chi sq. |
| Medicaid-Medicare | 0.000 | 16.318 | 0.007 | 7.172 | 0.000 | 28.613 | | |
| Medicaid-Self-Pay | 0.469 | 0.525 | 0.008 | 7.071 | 0.025 | 5.033 | | |
| Medicare-Self-Pay | 0.000 | 28.416 | 0.000 | 36.918 | 0.000 | 64.943 | | |
| | | | | | | | | |
| **Location** | | | | | | | | |
| Sarpy, Cass, Pottawattamie, Douglas | 0.848 | 0.805 | 0.008 | 11.926 | 0.000 | 36.366 | 0.000 | 18.962 |
| Sarpy-Cass | | | 0.597 | 0.28 | 0.656 | 0.198 | 0.091 | 2.858 |
| Sarpy-Pott | | | 0.089 | 2.901 | 0.007 | 7.387 | 0.646 | 0.211 |
| Sarpy-Douglas | | | 0.002 | 9.437 | 0.000 | 31.242 | 0.001 | 11.458 |
| Cass-Pott | | | 0.115 | 2.491 | 0.024 | 5.122 | 0.370 | 0.804 |
| Cass-Douglas | | | 0.153 | 2.043 | 0.027 | 4.892 | 0.007 | 7.198 |
| Pott-Douglas | | | 0.463 | 0.538 | 0.368 | 0.81 | 0.165 | 1.93 |
| | | | | | | | | |
| Northeast, Northwest, Southeast, Southwest, Western | 0.734 | 2.008 | 0.000 | 89.988 | 0.000 | 179.938 | 0.000 | 24.816 |
| Northeast-Northwest | | | 0.000 | 31.396 | 0.000 | 74.224 | 0.811 | 0.057 |
| Northeast-Southeast | | | 0.977 | 0.001 | 0.311 | 1.026 | 0.000 | 21.878 |
| Northeast-Southwest | | | 0.000 | 58.576 | 0.000 | 115.202 | 0.181 | 1.787 |
| Northeast-Western | | | 0.002 | 9.869 | 0.000 | 43.396 | 0.351 | 0.871 |
| Northwest-Southeast | | | 0.000 | 27.957 | 0.000 | 49.145 | 0.001 | 11.108 |
| Northwest-Southwest | | | 0.281 | 1.16 | 0.456 | 0.555 | 0.391 | 0.737 |
| Northwest-Western | | | 0.886 | 0.02 | 0.172 | 1.865 | 0.324 | 0.971 |
| Southeast-Southwest | | | 0.000 | 50.479 | 0.000 | 74.517 | 0.013 | 6.152 |
| Southeast-Western | | | 0.002 | 9.513 | 0.000 | 33.45 | 0.009 | 6.776 |
| Southwest-Western | | | 0.425 | 0.635 | 0.326 | 0.967 | 0.157 | 1.999 |

Table #: Hospital Readmissions Chi Square Tests

| | System Readmission | |
| --- | --- | --- |
| | P value | Chi sq. |
| **Hospital** | | |
| Bergan, Immanuel, Lakeside, Mercy, Midlands | 0.000 | 110.155 |
| Bergan-Immanuel | 0.000 | 46.707 |
| Bergan-Lakeside | 0.000 | 23.568 |
| Bergan-Mercy | 0.003 | 8.574 |
| Bergan-Midlands | 0.081 | 3.041 |
| Immanuel-Lakeside | 0.000 | 95.65 |
| Immanuel-Mercy | 0.008 | 7.023 |
| Immanuel-Midlands | 0.000 | 19.218 |
| Lakeside-Mercy | 0.000 | 40.888 |
| Lakeside-Midlands | 0.660 | 0.194 |
| Mercy-Midlands | 0.003 | 8.722 |
| | | |
| **Ethnicity** | | |
| Hispanic-Non-Hispanic | 0.000 | 92.496 |
| | | |
| **Race** | | |
| White, Black, Asian | 0.000 | 36.504 |
| White-Black | 0.000 | 33.815 |
| White-Asian | 0.182 | 1.778 |
| Black-Asian | 0.001 | 10.321 |
| | | |
| **Payer** | | |
| Commercial, Medicaid, Medicare, Self-Pay | 0.000 | 494.393 |
| Commercial-Medicaid | 0.000 | 111.645 |
| Commercial-Medicare | 0.000 | 482.809 |
| Commercial-Self-Pay | 0.000 | 32.802 |
| Medicaid-Medicare | 0.000 | 60.409 |
| Medicaid-Self-Pay | 0.000 | 30.241 |
| Medicare-Self-Pay | 0.000 | 20.241 |
| | | |
| **Location** | | |
| Sarpy, Cass, Pottawattamie, Douglas | 0.000 | 51.513 |
| Sarpy-Cass | 0.857 | 0.032 |
| Sarpy-Pott | 0.000 | 34.334 |
| Sarpy-Douglas | 0.000 | 43.887 |

| | | |
|---|---|---|
| Cass-Pott | 0.011 | 6.514 |
| Cass-Douglas | 0.014 | 6.055 |
| Pott-Douglas | 0.604 | 0.269 |
| | | |
| Northeast, Northwest, Southeast, Southwest, Western | 0.000 | 66.526 |
| Northeast-Northwest | 0.000 | 36.085 |
| Northeast-Southeast | 0.000 | 22.782 |
| Northeast-Southwest | 0.000 | 30.617 |
| Northeast-Western | 0.000 | 27.269 |
| Northwest-Southeast | 0.432 | 0.618 |
| Northwest-Southwest | 0.532 | 0.391 |
| Northwest-Western | 0.039 | 4.264 |
| Southeast-Southwest | 0.831 | 0.046 |
| Southeast-Western | 0.013 | 6.190 |
| Southwest-Western | 0.015 | 5.882 |