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

Lindsey Cork

Abstract

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 admission

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 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 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 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 ($p \leq 0.05$)*

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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Appendix

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
Region								
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