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Hotspotting Report

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March 2017

The Nicholson Foundation

Camden Coalition of Healthcare Providers

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Pellerano MB, Jahn E, Tallia AF, and the Greater New Brunswick Hotspotting Project Team. *The Greater New Brunswick Hotspotting Report*, 2017, http://rwjms.rutgers.edu/nbhotspotting

This project was completed with the generous support of **The Nicholson Foundation.**

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The Greater New Brunswick[1] Hotspotting Project Report

Executive Summary

- During 2012-2013, of 45,316 total patients (primary patient cohort) from New Brunswick and Franklin Township, N.J. visiting Robert Wood Johnson University Hospital and Saint Peter's University Hospital, **1,370 patients** (3%) were Medicaid '**High Utilizers.'**

- **High Utilizers** visited the Emergency Department (ED) of one or both hospitals five or more times or had three or more hospitalizations during the two years; and the higher the utilization, the more likely the patient visited both hospitals.

- Ten percent of **Census blocks** in New Brunswick and Franklin Township account for almost 30 percent (29.4%) of adult high utilizing Medicaid patients and 37 percent (37.5%) of hospital receipts.

- Eight **individual buildings / complexes** consisting of apartment complexes, skilled nursing, and post-acute facilities were identified as '**Hotspots.**'

- Over the two-year study period, each Hotspot had hospital receipts totaling over $1 million (range is $1.08 million to $3.85 million), with two post-acute facility Hotspots having hospital receipts totaling over $3 million each ($3.49 and $3.85 million). The **average two-year cost per patient** from all 'Hotspots' was **$17,997 (range $4,479 to $38,889).**

- Diagnoses associated with High Utilizers reveal **multiple morbidities**, including **behavioral health diagnoses.**

- A higher percentage of **extreme ED** utilizing patients have **mental health and substance abuse comorbidities** than high inpatient utilizing patients or high ED utilizing patients.

- **Reducing costs** for these high utilizers will require **coordination and cooperation across** primary care, acute care, and behavioral health hospitals and facilities, and across neighboring county and municipal governmental jurisdictions providing social services.

[1] In this project, Greater New Brunswick encompasses the City of New Brunswick (zip codes: 08901 and 08903) and Franklin Township (zip code: 08873). More detail is provided in the body of the report.

Background

A National Problem

According to the Organization for Economic Cooperation and Development (OECD), the U.S. spends more money per capita than any other country on healthcare (Squires and Anderson, 2015). In 2013, the U.S. spent a total of $2.88 trillion on health care equaling $9,115 per person, which means that health care is responsible for 17.3 percent of the United States Gross Domestic Product (Peterson-Kaiser, 2015). The Agency for Healthcare Research and Quality (AHRQ) has shown that the sickest five percent of U.S. patients account for almost 50% of U.S. health care costs (Cohen, S.B. and Yu, W. 2012). In addition, AHRQ has shown that the five most expensive health conditions are heart disease, trauma-related disorders, cancer, mental disorders, and chronic obstructive pulmonary disease (COPD) / asthma. In 2012, these conditions accounted for 32.6% percent of total U.S. health care expenses. (Cohen, 2014).

A Local Problem

New Jersey has among the highest rates of avoidable hospital use in the United States particularly among low-income populations (Schoen, Radley, Riley, Lippa, Berenson, Dermody, and Shih, 2013). Compared to N.J. residents in high-income zip codes, residents in low-income zip codes are hospitalized two to three times as often for pediatric asthma, adult respiratory disease, and adult diabetes (Schoen, et al., 2013). The Greater New Brunswick area is no exception. Using data from 2008-2010, Rutgers Center for State Health Policy (CSHP) reviewed hospital utilization patterns for the two New Brunswick based hospitals – Saint Peter's University Hospital and Robert Wood Johnson University Hospital. CSHP researchers found that the two hospitals' overall catchment area's avoidable hospitalization and Emergency Department (ED) visit rates are lower than the state's average but the avoidable ED visit rate for New Brunswick residents is more than twice as high as N.J.'s overall rate (Chakravarty, Brownlee, Tong, Pellerano, Howard, Shaw, Chase, and Crabtree, 2012). More recent data (2011-2013) reviewed for the two hospitals found similarly high avoidable ED visit rates (Brownlee, Farnham, Chakravarty, and Zhang, 2016). In 2013, the Rutgers Center for State Health Policy specifically reviewed hospital utilization patterns in 13 low income communities. The researchers found that the hospitals could lower costs for patients from the Greater New Brunswick area[2] by improving avoidable emergency department (ED) visits, high ED utilization, and hospital readmissions (Chakravarty, Cantor, Tong, DeLia, Lontok, & Nova, 2013).

[2] The Greater New Brunswick Medicaid ACO area study included by CSHP researchers included New Brunswick (zip codes 08901 and 08903) and Franklin Township (zip code: 08873). Areas designated as "low income" included at least 5,000 Medicaid beneficiaries.

The Impact of Socioeconomics

In addition, researchers have shown that neighborhood socioeconomic disadvantage impacts long-term health outcomes and re-hospitalization rates. For example, Steven Woolf and colleagues at the Center on Society and Health at Virginia Commonwealth University have created a series of life expectancy maps that illustrate how life expectancy varies from one neighborhood or community to another (Center on Society and Health, 2016). These maps show that life expectancy differs by 4 to 20 years in neighborhoods only several miles apart from one another. As an example, the map of Trenton, N.J. in Figure 1 shows that life expectancy in one Trenton zip code (73 years) is 14 years less than that of the zip code for Princeton Junction, N.J. (87 years).



Figure 1: Expected Average Longevity, Trenton, N.J. Area

The Development of Hotspotting

During the past nine years, communities across the country analyzed health care information in an effort to identify those patients who excessively use the system. These patients often referred to as "high utilizers" use hospitals more frequently than other patients. To better understand

what this means at the local level, the Camden Coalition of Healthcare Providers (Camden Coalition) developed models for identifying high-utilizing patients in hopes of providing them with better coordinated medical and social services. This model is referred to as "hotspotting" and has become a nationally recognized model for addressing the needs of this most challenging population (Gawande, A., 2011). The goal of hotspotting is to identify patients who utilized the most hospital-based care in a given area and understand the characteristics these patients share to develop programs and interventions that can keep them healthier and out of the hospital. To date, the Camden Coalition has worked with seven other communities and counties in New Jersey and in the United States to analyze data and map hotspots[3].

Greater New Brunswick Hotspotting Research Team

Against this backdrop, the Department of Family Medicine and Community Health at Rutgers Robert Wood Johnson Medical School, Robert Wood Johnson University Hospital, and Saint Peter's University Hospital joined together as the Greater New Brunswick team to take advantage of a hotspotting opportunity. In 2014, the New Jersey Health Care Quality Institute and the Camden Coalition of Healthcare Providers received funding from The Nicholson Foundation to assist five additional N.J. communities with hotspotting. The Greater New Brunswick team responded to this call and was chosen to work with the Camden Coalition of Healthcare Providers to develop a hotspotting project for the Greater New Brunswick area. The research team was led by the Department of Family Medicine and Community Health at Rutgers Robert Wood Johnson Medical School, and included staff from Robert Wood Johnson University Hospital and Saint Peter's University Hospital, and the Camden Coalition of Healthcare Providers (Camden Coalition). This research team (NB Hotspotting team) wanted to better understand New Brunswick and Franklin Township, N.J.'s[4] hospital utilization patterns. It was expected that data from the Greater New Brunswick Hotspotting Project would inform New Brunswick Health Partners' application to the State to be certified as a Medicaid ACO Demonstration Project[5], and would provide actionable data for modifying existing, or starting new, health-related services.

[3] These include Trenton, N.J., Newark, N.J., North Jersey around Morris County, JFK Medical Center, Atlantic City, Maine (3 counties), and Howard County, Maryland.

[4] This report refers to zip code 08873 as Franklin Township throughout this report. The NB hotspotting team's adoption of New Brunswick and Franklin Township is consistent with the work previously done by the Center for State Health Policy (Chakravarty, et al., 2013).

[5] New Brunswick Health Partners is a 501(c)3 corporation established by Rutgers to serve the Medicaid population in collaboration with our local hospital partners. To learn more about New Jersey's Medicaid ACO demonstration projects see http://www.nj.gov/humanservices/dmahs/info/aco.html

Three Hypotheses

Researchers posited three hypotheses at the start of this project:

- The location of high utilizers will cluster geographically;
- High utilizing patients have at least two or more comorbidities;
- High utilizing patients have higher rates of behavioral health issues compared to appropriate hospital utilizers

Research Design and Methods

This study was a retrospective review of hospital claims data for patients residing in New Brunswick and Franklin Township, N.J. The study was approved by three Institutional Review Boards:[6] Rutgers Biomedical and Health Sciences for Rutgers Robert Wood Johnson Medical School and Robert Wood Johnson University Hospital; Saint Peter's University Hospital; and Cooper University Hospital for Camden Coalition of Healthcare Providers.

Hospital billing data for inpatient and Emergency Department (ED) care were requested from Robert Wood Johnson University Hospital and Saint Peter's University Hospital. These routine administrative datasets containing hospital reimbursement claims include useful data elements (variables) that are used for internal auditing and research purposes. These data elements provide demographic, clinical and financial information for patients who have utilized hospital services. The various data elements from these data sets are a starting point for the information needed for hotspotting.

In 2015, Robert Wood Johnson University Hospital and Saint Peter's University Hospital provided the Camden Coalition of Healthcare Providers (Camden Coalition) with electronic data for all patients discharged (from the ED and for hospitalization) in 2012 and 2013 with a reported address within New Brunswick (08901 and 08903 zip codes) and Franklin Township, N.J (08873 zip code) or who were homeless and had no address.

Analysts at Camden Coalition of Healthcare Providers cleaned, standardized and linked the Robert Wood Johnson University Hospital and Saint Peter's University Hospital datasets to create a Greater New Brunswick database. Camden Coalition analysts used probabilistic linkage to identify records belonging to the same patient. Probabilistic linkage[7] allows the researchers to link individuals across data sets despite no common identifier, a key step for understanding the

[6] The three Institutional Review Boards provided the researchers with a waiver of consent to this retrospective study.

[7] More information on this statistical procedure may be found at http://healthcarehotspotting.com/wp/data-cleaning/probabilistic-linkage/

full number of times a person used the hospitals and whether or not a particular patient accessed services at both hospitals.

Patient de-identification was central to the creation of the city-wide database. Each patient identified in the dataset was assigned a pseudo-id and all identifiers were removed (for example medical record numbers) or converted into less identifiable forms (for example, dates of birth were turned into age integer). The city-wide database was used for all analysis conducted by the Camden Coalition of Healthcare Providers. This analysis sought to understand: 1) the number of patients accessing hospital-based care including frequencies and costs associated with utilization; 2) classification of different sub-populations with different hospital utilization patterns; and 3) identification of geographic "hotspots" for high hospital utilization. The Camden Coalition of Healthcare Providers provided a report of its findings (attached as Appendix 1) to the NB Hotspotting Team. At the conclusion of the analysis, a complete de-identified dataset was returned to Robert Wood Johnson Medical School, and individual datasets of each hospital's own patient records were returned to Robert Wood Johnson University Hospital and Saint Peter's University Hospital.

Definitions

Table 1 provides definitions for the different types of patient utilization at the two New Brunswick hospitals during 2012-2013.

Table 1: Definitions for Individuals Using the Hospitals During the Two-Year Period (2012-2013)

DEFINITIONS	
Term	**Characteristics during two-year period**
High Utilizers	Five or more visits to the Emergency Department (ED) or three or more hospitalizations (includes the next three categories)
High ED Utilizers	Five or more ED visits
Extreme ED Utilizers	Ten or more ED visits
High Inpatient Utilizers	Three or more inpatient admissions
Infrequent Hospital Utilizers	Less than three inpatient admissions

Results and Findings

The Two Communities

The two communities studied for the Greater New Brunswick Hotspotting Project were New Brunswick, Middlesex County, N.J. (zip codes 08901 and 08903) and Franklin Township, Somerset County, N.J. (zip code 08873). New Brunswick and Franklin Township are contiguous, sharing

several borders along primary roads that lead directly into New Brunswick making it relatively easy to access the region's two hospitals, which are in New Brunswick. Even though these two towns border each other, the demographic make-up and socio-economic status of the two towns differ. See Table 2 for comparative demographic data for New Brunswick and Franklin Township, N.J.

Table 2: Selected Demographic and Socioeconomic Data for the Greater New Brunswick Hotspotting Population

	New Brunswick, N.J. (08901 and 08903)	Franklin Township, N.J. (08873)
Total Population	**55,804**	**51,722**
Race		
White	68.8%	47.3%
Black or African American	13.4%	27.4%
American Indian and Alaska Native	0.3%	0.3%
Asian	8.1%	19.6%
Native Hawaiian and Other Pacific Islander	0.0%	0.1%
Some Other Race	7.6%	2.7%
Two or More Races	1.7%	2.7%
Ethnicity		
Hispanic or Latino (of any race)	55.6%	12.4%
White alone, not Hispanic	22.4%	38.3%
Income		
Per capita income	$ 14,119	$ 38,784
Median household income	$ 38,399	$ 88,491
Percent of persons in last 12 months whose income is below poverty level	34.9%	6.0%
Education		
Less than high school graduate (population 25 years and over)	37.5%	7.8%
Health Insurance		
Population with no health insurance coverage	30.1%	9.6%

Source: U.S. Census, 2010-2014.

Patient Characteristics

During 2012-2013, 45,316 total patients (primary patient cohort) from New Brunswick and Franklin Township, N.J. visited Robert Wood Johnson University Hospital and Saint Peter's University Hospital, both located in New Brunswick. The NB Hotspotting Team was most interested in how Medicaid patients utilized the two hospitals[8]. A third (33.3%) of the primary

[8] As noted in the background section, the NB hotspotting team was interested in having the data inform New Brunswick Health Partners' application to become a NJ Medicaid ACO Demonstration Project.

cohort patients were insured with Medicaid (N=15,077) during the two-year period. Approximately 30% of the Medicaid patients were adults 18 years and older (N=4,555), of which 1,370 were classified as high utilizers. Table 3 provides a snapshot of the classifications used to describe different types of adult patients with Medicaid utilizing hospital services.

Table 3: Classification of Hospital Utilizers (Adult Patients with Medicaid)

Classification	N of patients (N = #)	Average number of inpatient admissions per two years	Average number of ED visits per two years
High Utilizers	Total N=1,370		
Extreme ED utilizers	N=96	1.5	22
High inpatient utilizers	N=190	5.2	3.2
High ED utilizers	N=1,084	0.4	6.1
Infrequent hospital utilizers	N=3,185	1.3	0.6

Hotspots

Our findings indicated that high utilizers clustered into "geographic hotspots." These geographic hotspots were largely found in neighborhoods, blocks, and buildings where there are high concentrations of elderly individuals, people who are disadvantaged economically and socially, and working adults and elderly with limited assets. Ten percent of Census blocks in New Brunswick and Franklin Township account for almost 30 percent (29.4%) of adult high utilizing Medicaid patients and 37 percent (37.5%) of hospital receipts. Eight individual buildings / complexes had Medicaid hospital receipts totaling over $1 million each (range is $1.08 million to $3.85 million) over the two-year period. These included apartment complexes, skilled nursing, and post-acute facilities in both New Brunswick and Franklin Township. The average receipts per patient from these buildings / complexes was $17,997 and ranged from $4,479 to $38,889 per patient for the two-year period (Camden Coalition, 2016).

High Utilizer Multiple Co-Morbidities

The data analyses revealed that high utilizers usually have comorbidities, which are two or more medical conditions that simultaneously occur. Our analysis indicated that both multiple chronic health conditions and mental health and/or substance abuse conditions co-occur in high utilizing patients. As Table 4 indicates, high inpatient utilizers have the greatest average number of chronic health conditions.

Table 4: Number of Chronic Conditions of Hospital Utilizers

	Average Number of Visits During 2012-2013:		
Classification	**Inpatient**	**ED**	**Average Number of Chronic Conditions**
High inpatient utilizers	5.2	3.2	8.6
Extreme ED utilizers	1.5	22	5.1
High ED utilizers	0.4	6.1	1.5
Infrequent hospital utilizers	1.3	0.6	0.8

Whereas high inpatient utilizers have the greatest average number of chronic health conditions, a higher percentage of extreme ED utilizing patients have mental health and substance abuse comorbidities than high inpatient utilizing patients or high ED utilizing patients. Table 5 provides data for mental health and substance abuse comorbidities in patients seeking services at the two New Brunswick hospitals.

Table 5: Percentage of Patients with Mental Health and Substance Abuse Comorbidities

	Average Number of Visits During 2012-2013:		Percent of Patients with Comorbidities	
Classification	**Inpatient**	**ED**	**Mental Health Comorbidity**	**Substance Abuse Comorbidity**
Extreme ED utilizers	1.5	22	53.1%	31.3%
High inpatient utilizers	5.2	3.2	43.7%	24.7%
High ED utilizers	0.4	6.1	17.2%	9.1%
Infrequent hospital utilizers	1.3	0.6	7.1%	3.1%

Hospital Utilization

Across the entire patient population in the study region, Medicaid patients and high utilizing patients were more likely to visit both hospitals. The higher the utilization rate, the more likely the patient visited both hospitals. Costs are higher among high utilizers. Top primary diagnoses vary by type of utilizer but are similar to those found by other researchers in previous studies.

As noted earlier in this document, 45,316 total patients (primary patient cohort) from New Brunswick and Franklin Township, N.J. visited Robert Wood Johnson University Hospital and Saint Peter's University Hospital during 2012 and 2013. A third of the patients in the primary cohort (33.3%; N=15,077) were insured with Medicaid. Across the entire primary patient cohort, Medicaid patients and high utilizing patients were more likely to visit both hospitals. Table 6 describes patterns of utilization for patients with all types of insurance and those with Medicaid. Over 45% of Medicaid high utilizing patients sought services at both hospitals (45.2%; N=619). Table 7 provides a breakdown for each classification of patients utilizing both hospitals.

Table 6: Utilization of the Two Hospitals by Insurance Type

Type of Patient	Number of Patient Visits to Both Hospitals	Number of Unique Patients	Number of Patients Utilizing Both Hospitals	Percent of Patients Utilizing Both Hospitals
Primary patient cohort, all insurances	50,163	45,316	4,847	10.7%
Medicaid patient cohort	17,152	15,077	2,075	13.8%
Medicaid 18 years and older	5,541	4,555	986	21.6%
High Utilizing Medicaid Population	1,990	1,371	619	45.2%

Table 7: Patients Utilizing Both Hospitals by Classification

Classification	Percent of Patients in Each Classification Utilizing Both Hospitals	Number of Patients in Each Classification Utilizing Both Hospitals
Extreme ED utilizers	77.1%	74
High ED utilizers	45.0%	488
High inpatient utilizers	30.0%	57
Infrequent inpatient utilizers	11.5%	985

Costs and Medicaid Spending

Medicaid spending on hospital-based services for New Brunswick and Franklin Township residents totaled $44.2 million during 2012 and 2013. This spending reflected 22% of total hospital revenue from claims. The high inpatient utilizing subset of high utilizers (n=190) represented 4% of unique adult Medicaid patients and 36.1% of receipts amounting to $9 million. Table 8 provides a breakdown of costs by type of utilizer.

Table 8: Costs by Type of Hospital Utilizer, Adult Patients

	Average Number of Visits During 2012-2013:		Total Receipts	Average Costs Per Patient	
Classification	Inpatient	ED		Charges	Receipts
High inpatient utilizers	5.2	3.2	$9.0 million	$481,000	$47,400
High ED utilizers	0.4	6.1	$3.7 million	$30,500	$3,400
Extreme ED utilizers	1.5	22	$1.5 million	$137,000	$15,700
Infrequent hospital utilizers	1.3	0.6	$10.7 million	$32,100	$3,400

Top Diagnoses by Patient Characteristic

With access to diagnosis codes, we found that the top primary diagnoses varied by type of utilizer. Table 9 provides a snapshot of the top five diagnoses by type of utilizer.

Table 9: Top Five Diagnoses by Type of Utilizer

	Infrequent Hospital Utilizer	**High ED Utilizers**	**High Inpatient Utilizers**	**Extreme ED Utilizers**
1	Abdominal pain	Abdominal pain	Congestive heart failure	Abdominal pain
2	Sprains and strains	Upper respiratory infections	Septicemia	Alcohol-related disorders
3	Upper respiratory infections	Complications of pregnancy	Abdominal pain	Back Pain (Spondylosis)
4	Back Pain (Spondylosis)	Back Pain (Spondylosis)	Asthma	Asthma
5	Contusions	Sprains and strains	Cardiac dysrhythmias	Upper respiratory infections

Limitations

There are three main limitations of this project. This study primarily looked at high utilizing adult Medicaid patients. This is an issue because the most recent Community Health Needs Assessment done for the two hospitals indicates that children under the age of 18 have the highest rate of avoidable ED visits (Brownlee, et al., 2016).

A second study limitation is that this project required permission from three Institutional Review Boards. The retrospective nature of this study required a waiver of consent, which limits public reporting of the data because many data elements are deemed protected health information. This only allowed aggregated reporting at the 5-digit zip code level. The inability to report at the Census Block level or even at the address level poses challenges when trying to develop interventions at the very local level with other community stakeholders.

A third study limitation is that this study did not address why high utilizing patients chose to utilize Emergency Department (ED) services for certain conditions instead of primary care settings. However, in previous work (2010), Robert Wood Johnson Medical School Family Medicine researchers examined ED user preference and patients' decision making processes for accessing services at an ED rather than in a primary care office. The ED was the default source of care for patients without knowledge of primary care options. For those patients who had a primary care provider or were aware of primary care options, the decision was based on assessment of benefits and barriers, which were influenced by factors such as: being instructed by a medical professional to go to the ED; access barriers to one's regular source of care; defining their current health need as an emergency; facing transportation/location barriers to primary care; costs of care; and perceived racial issues in available primary care settings (Shaw, Howard, Clark, Etz, Arya, & Tallia, 2013).

Discussion

Hotspots

This study has found a concentration of high utilizers living in geographic Hotspots in the Greater New Brunswick area. Moreover, high utilizer patients from these 'Hotspots' access services of both New Brunswick area hospitals and account for disproportionately high costs in the publically funded Medicaid insurance system. As in other localities, this presents potential opportunities for local healthcare providers to organize and target services to this population in a different way, including an emphasis on providing tertiary prevention, in addition to primary and secondary preventive interventions, as well as chronic care management in community residences.

Consistency with Prior Studies

Our analysis found similar diagnoses/conditions to those found statewide in a study by the Center for State Health Policy (CSHP) conducted in 13 N.J. low income communities (Chakravarty et al., 2013). However, there are a number of differences between the two studies (see Appendix 2). Despite the differences between the two studies, the diagnoses/conditions found in both studies are very similar and many of the conditions listed in Table 9 may have been prevented if managed better in a lower acuity setting.

Need for Collection of Consistent Reliable Long Term Community Oriented Quality Data

The desire for effective multifocal interventions for high utilizer/hotspot populations highlights the need for systems to support the long-term collection of consistent, reliable and valid metrics of community health. Examples of this are the AHRQ Prevention Quality Indicators and the Measurement to Support a Healthier New Brunswick at the national and local levels. The metrics put forth are examples of needed outcome measure that help assess effectiveness of community based interventions.

Reinforcing RBHS Medicaid Mental Health/Substance Abuse Policy Recommendations

In 2016, the Rutgers Biomedical and Health Sciences Working Group on Medicaid High Utilizers (RBHS Working Group) analyzed and made recommendations regarding clients in the top 1% of the Medicaid spending distribution. Fully 86.2% of New Jersey's high cost Medicaid recipients had mental health and/or substance abuse diagnoses and 32.9% of this population had severe mental illness (includes conditions such as psychoses, bipolar disorder, and chronic depression). Our study's local findings are totally congruent with these statewide results. The RBHS Working Group made five recommendations for impact with these populations (Appendix 3), and our findings at the local level reinforce that these recommendations are worthy of action.

Patient Access, Jurisdictional Challenges, and Need for Coordination of Services

This project reveals that in the Greater New Brunswick service area, high utilizing patients frequently access services at both area hospitals. It also suggests that many high utilizing patients are using hospital emergency departments for primary care. At the very least, this indicates the need for care coordination for individual patients between the two hospitals. Additionally,

because these patients originate from two separate towns in two separate counties, Middlesex and Somerset, providers and patients often face jurisdictional barriers in providing and obtaining services. For example, mental health services for patients from the two municipal civil divisions are organized as two separate systems of care. For providers and patients, this means services must be coordinated in two different counties. Lack of record sharing makes it difficult for such coordination to occur.

Transportation may also be a barrier. For patients who reside in Franklin Township, accessing behavioral health services may mean having to travel more than 12 miles to Somerville, N.J., and transportation barriers also may inhibit the ability of patients to receive local follow-up services. For the reasons outlined above, new models of service provision are warranted where coordination goes beyond traditional governmental jurisdictions.

Conclusion

Findings from this Greater New Brunswick Hotspotting Project study identified community 'Hotspots' and suggest the need for better coordination of care across primary care, hospitals, and post-acute care facilities (assisted living, skilled nursing facilities, and rehabilitation centers) to reduce over-utilization of expensive hospital resources by high utilizers living in these Hotspots and other parts of the community. The existence of Hotspots in our two communities argues for coordinated targeting of health services for patients in particular geographies in a different way, including possible residentially based preventive and chronic care services. The high percentages of patients with mental health and substance abuse co-morbidities indicates the need for new solutions for providing convenient, comprehensive physical and behavioral health care, such as the co-location of physical and mental health services, be it in Hotspot neighborhoods in the community, in primary care sites, or in hospital ED's. Finally, our findings highlight the need for multiple stakeholders from the healthcare, governmental, and social service sectors to work together to improve health and healthcare access for all patients in the Greater New Brunswick area.

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Appendix 1 – New Brunswick Health Partners Hotspotting Analysis by the Camden Coalition of Healthcare Providers, July 2015

Rutgers Robert Wood Johnson Medical School (RWJMS) in support of New Brunswick Health Partners ACO Initiative Hotspotting Analysis

Project Overview:
Our current health care system is not designed to ensure that the costliest patients with complex health problems receive effective, high-quality care. To try to assess the dimensions of this problem in the New Brunswick area Accountable Care Organization (ACO) region, the Camden Coalition of Healthcare Providers (the Coalition) partnered with the New Jersey Healthcare Quality Institute (NJHQI) and the Robert Wood Johnson Medical School, with support from the Nicholson Foundation, to provide hotspotting data analysis to better understand patterns of high-cost hospital utilization within New Brunswick's Medicaid population. To accomplish this, the Coalition united data from both of New Brunswick's hospitals (Robert Wood Johnson University Hospital and Saint Peter's University Hospital) to create a citywide hospital utilization database.

Medicaid spending on hospital-based services in the ACO region (zip codes 08873, 08901, and 08903) totalled $44.2 million during the two year period of 2012 through 2013, reflecting 22% of total hospital revenue. Through a combination of claims data analysis and geospatial techniques, we identified clusters of individuals with similar hospital utilization profiles as well as geographic hotspots. Within the 4,555 adult Medicaid patients in the ACO region, we identified a high inpatient subset (n=190) that represented 4% of patients and 36.1% of receipts. Additionally, the most expensive decile of blocks (n=138) accounted for 37.5% of total receipts, indicating that a small subset of buildings and neighborhoods are responsible for a disproportionate share of hospital spending in the region.

What we know about overlapping patients across hospitals:
- Across the entire patient population in the ACO region (n=45,316), 10.7% of individuals (n=4,847) visited both hospitals during the study period.
- Within the Medicaid population (n=15,077), 13.8% of individuals (n=2,075) visited both hospitals during over the two year period.
- Medicaid individuals with high hospital utilization were even more likely to have visited both hospitals (45.2% of individuals), highlighting the need for multi-hospital collaboration to effectively engage this subset of the population

What we know about Medicaid high utilizers:
- They used hospital services much more frequently than the rest of the population
- 45% have visited both Saint Peter's University Hospital and Robert Wood Johnson University Hospital
- There are three main segments: high ED utilizers (n=1,085), extreme ED utilizers (n=96), and high inpatient utilizers (n=190).
- High inpatient utilizers averaged 5 hospital admissions and 3 ED visits over the two year, with average hospital receipts totalling $47k.
- The extreme ED utilization subset averaged 1.5 admissions and 22 ED visits over the two years, and had total receipts average $16k.

What we know about New Brunswick's Medicaid Hotspots:
- 10% of census blocks accounted for 37.5% in total receipts for the region.
- These geographic hotspots were largely found in neighborhoods, blocks, and buildings where there are high concentrations of elderly individuals, people who are disadvantaged economically and socially, and working adults and elderly with limited assets.
- Eight buildings had the Medicaid hospital receipts totaling over $1 million over the two year period, with two rehabilitation-centers responsible for over $3 million each.

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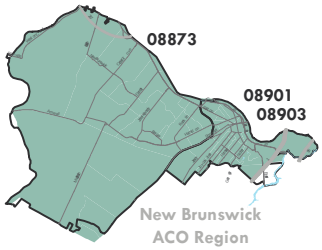
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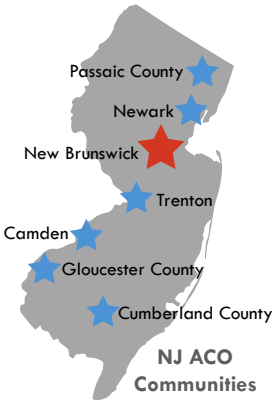


This report utilizes 2012 and 2013 Inpatient and Emergency Department claims data from Saint Peter's University Hospital and Robert Wood Johnson University Hospital.

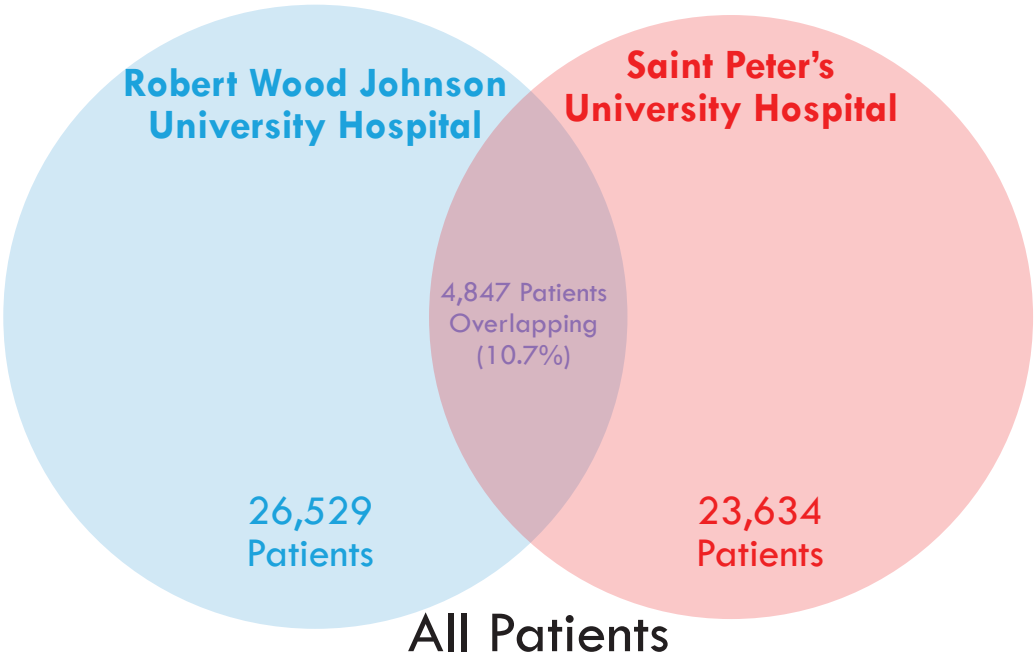
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RWJ ROBERT WOOD JOHNSON UNIVERSITY HOSPITAL

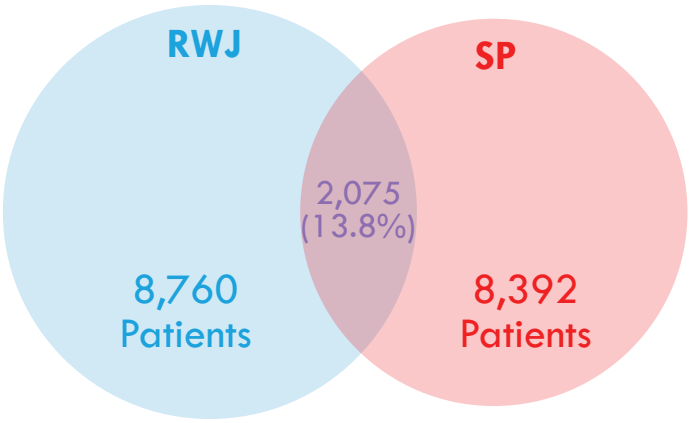
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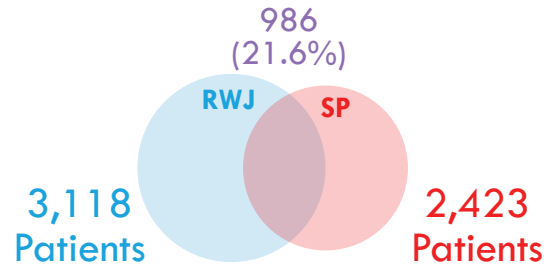
New Brunswick Health Partners Hotspotting Analysis (2012-2013)



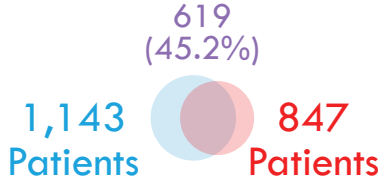
All Patients



Medicaid Patients



Medicaid 18 Years and Older



High Utilizing Medicaid Population

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Patient Overlap in New Brunswick

These venn diagrams demonstrate the extent to which patients living in the ACO zip codes overlap across Robert Wood Johnson and St Peter's - New Brunswick's two hospitals - during the two year period (2012-2013).

While 10.7% of all patients (including all insurance types) visited both Robert Wood Johnson and St Peter's, the percentage of shared patients increased within the Medicaid population, particularly among the high-utilizing population, where 45% of the region's high utilizers are shared across both systems.

High Utilizers included individuals who visited the ED 5+ times during the period or had 3+ admissions to the hospital. These individuals, often facing the most medical and social complexities, are perhaps most vulnerable to care fragmentation. With nearly half of individuals utilizing both health systems, there is a strong case for the need for regional collaboration for population health.

New Brunswick Health Partners Hotspotting Analysis

	Infrequent Hospital Utilizers	High ED Utilizers	High Inpatient Utilizers	Extreme ED Utilizers
	Average Age: 34	Average Age: 32	Average Age: 47	Average Age: 36
	3,185 patients (70%)	1,084 (24%)	190 (4%)	96 (2%)
	$10.7m receipts (43%)	$3.7m (15%)	$9.0m (36%)	$1.5m (6%)
2012-2013	Average / Median	Average / Median	Average / Median	Average / Median
Inpatient Visits:	1.3 / 1	0.4 / 0	5.2 / 4	1.5 / 1
ED Visits:	0.6 / 1	6.1 / 5	3.2 / 2	22 / 17.5
Total Charges	$32.1k / $16.8k	$30.5k / $18.0k	$481k / $322k	$137k / $64.5k
Total Receipts	$3.4k / $1.3k	$3.4k / $2.0k	$47.4k / $31.3k	$15.7k / $7.3k
	63.4% of RWJ Patients	28.6%	5.0%	3.0%
	65.0% of St Peter's Pts	28.1%	3.7%	3.1%
	11.5% visited multiple hospitals	45.0%	30.0%	77.1%
	50.5% RWJ only	37.2%	52.6%	20.8%
	38.0% St Peter's only	17.8%	17.4%	2.1%
Avg # of chronic conditions:	0.8	1.5	8.6	5.1
% w/ mental health comorbidity:	7.1%	17.2%	43.7%	53.1%
% w/ substance abuse comorbidity:	3.1%	9.1%	24.7%	31.3%
	Top Primary Dx for all visits	Top Primary Dx for all Visits	Top Primary Dx for all visits	Top Primary Dx for all visits
	1) Abdominal pain	1) Abdominal pain	1) Congestive heart failure	1) Abdominal pain
	2) Sprains and strains	2) Upper respiratory infections	2) Septicemia	2) Alcohol-related disorders
	3) Upper respiratory infections	3) Complications of pregnancy	3) Abdominal pain	3) Back pain (Spondylosis)
	4) Back pain (Spondylosis)	4) Back pain (Spondylosis)	4) Asthma	4) Asthma
	5) Contusions	5) Sprains and strains	5) Cardiac dysrhythmias	5) Upper respiratory infections
	6) Injuries due to external causes	6) Disorders of teeth and jaw	6) Device Complications	6) Disorders of teet and jaw
	7) Complications of pregnancy	7) Contusions	7) Renal Failure	7) Sick cell anemia
	8) Nonspecific chest pain	8) Urinary tract infections	8) Diabetes	8) Non-traumatic joint disorders
	9) Open wounds of extremities	9) Chest pain	9) Complications of surgical procedures	9) Sprains and strains
	10) Urinary Tract Infections	10) Asthma	10) Chronic obstructive pulmonary disease	10) Connective tissue disease

The Camden Coalition's approach to hotspotting "segments" populations based on multidimensional patterns of healthcare use and other social factors. The above typologies represent an initial attempt at segmenting the New Brunswick ACO's hospital going population. Individuals are broken down into one of four typologies: infrequent hospital utilizers (n=3,185), high utilizers of Emergency Departments (n=1,084), individuals with frequent hospital admissions (n=190), and individuals with extreme ED utilization (n=96). To effectively improve quality and lower costs at the population level, we will need data-driven processes for timely identifying these patterns - particularly the more extreme subgroups - and implementing targeted interventions to follow-up and better adress patient needs.

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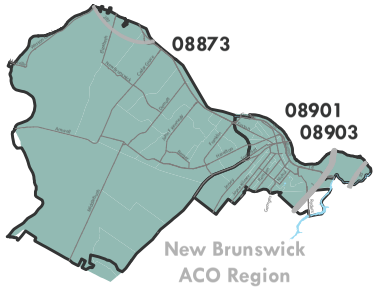
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Appendix 2 - Comparison of Camden Coalition Analysis and CSHP High Utilization Studies

As noted in the body of this report, the New Brunswick hotspotting analysis found similar conditions as those found previously by the Center for State Health Policy (CSHP) in a study conducted in 13 N.J. low income communities (Chakravarty et al, 2013). The Greater New Brunswick Hotspotting Project used the same zip codes for New Brunswick and Franklin Township that were used by the CSHP researchers in 2013. There are a number of differences between the two studies, including:

1. Center for State Health Policy (CSHP) researchers looked at New Jersey uniform billing data over the three-year period of 2008-2010 and the Camden Coalition of Healthcare Providers' (Camden Coalition) researchers reviewed claims data provided by each of the two hospitals directly to Camden Coalition for the two-year period of 2012-2013;
2. CSHP researchers looked at diagnoses from hospital claims data for hospitals in the 13 low income communities and reported the five most common principal diagnoses for inpatient and ED higher users in all 13 communities;
3. The CSHP researchers looked at all payers. Table 10 shows the top five diagnoses for high ED utilizers and high inpatient utilizers from the Hotspotting analysis and from CSHP 2013 study; and
4. The Camden Coalition defined ED high utilizers as those patients with 5 or more visits to the ED in a two-year period and high inpatient utilizers as those patients with 3 or more inpatient visits in the two-year period. CSHP defined ED high utilizers as those patients with 6 or more visits to the ED in a three-year period and high inpatient utilizers as those patients with 4 or more inpatient visits in the three-year period.

In spite of the differences between the two studies, the diagnoses found in both studies are very similar. See Table 10 for the top five diagnoses found for high ED utilizers and high inpatient utilizers.

Table 10: Top Five Diagnoses Found for High ED Utilizers and High Inpatient Utilizers (CSHP, 2013 and CCHP, 2015)

	High ED Utilizers		High Inpatient Utilizers	
	Camden Coalition's Hotspotting Analysis	**CSHP's Report on 13 Low Income NJ Communities***	**Camden Coalition's Hotspotting Analysis**	**CSHP's Report on 13 Low Income NJ Communities***
1	Abdominal pain	Other symptoms involving abdomen and pelvis	Congestive heart failure	Heart failure
2	Upper respiratory infections	Symptoms involving respiratory system and other chest symptoms	Septicemia	Septicemia
3	Complications of pregnancy	Other and unspecified disorders of back	Abdominal pain	Diabetes mellitus
4	Back Pain (Spondylosis)	Asthma	Asthma	Other forms of chronic ischemic heart disease
5	Sprains and strains	General symptoms	Cardiac dysrhythmias	Symptoms involving respiratory system and other chest symptoms
* The CSHP study looked at diagnoses across all payers and in all 13 low income communities.				

Using the same NJ Uniform Billing Data for 2008-2010 and looking at the same areas, CSHP researchers looked at the role of behavioral health conditions in hospital utilization in 13 New Jersey low income communities (see Table 11: Chakravarty, Cantor, Walkup, and Tong, 2014). The CSHP found higher rates of mental health and substance abuse comorbidities than the Camden Coalition of Healthcare Providers. The differences in these rates are possibly explained by differences in diagnosis codes captured as "behavioral health conditions" by the different research groups.

Table 11: Mental Health and Substance Abuse Co-Morbidities Found for High ED Utilizers and High Inpatient Utilizers

	High ED Utilizers		High Inpatient Utilizers	
	Camden Coalition's Hotspotting Analysis (Medicaid only)	**CSHP's Report on 13 Low Income NJ Communities***	**Camden Coalition's Hotspotting Analysis**	**CSHP's Report on 13 Low Income NJ Communities***
Mental Health	17.2%	45.1%	43.7%	63.2%
Substance Abuse	9.1%	40.3%	24.7%	37.9%
Behavioral Health		56.7%		69.6%

Appendix 3 – Recommendations from the RBHS Working Group on Medicaid High Utilizers

The RBHS Working Group on Medicaid High Utilizers identified five areas of recommendations and opportunities for impact with these populations. These recommendations are:

1. Integration of Behavioral and Physical Health
2. Identify and Develop Interventions for Populations with Persistently High Costs
3. Expand Opportunities to Coordinate Social Service and Public Health Initiatives with Medicaid
4. Adopting Best Clinical Practices
5. Strengthening Infrastructure and Accountability