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SMALL AREA VARIATION IN RATES OF HIGH-COST HEALTHCARE USE ACROSS NOVA SCOTIA

MSSU - USSM
MARITIME SPOR SUPPORT UNIT
UNITÉ DE SOUTIEN SRAP DES MARITIMES

Strategy for Patient-Oriented Research
Stratégie de recherche axée sur le patient
SPOR✦SRAP
Putting Patients First
Le patient d'abord

FINAL REPORT

PROJECT INFO

PROJECT TITLE
SMALL AREA VARIATION IN RATES OF HIGH-COST HEALTHCARE USE ACROSS NOVA SCOTIA

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NS-PIHCI *Network*
IMPROVING HEALTH OUTCOMES THROUGH PRIMARY AND INTEGRATED HEALTH

DR. GEORGE KEPHART, PHD

George Kephart (PhD) is a Nova Scotia-based researcher and Professor in Dalhousie University's Community Health and Epidemiology Department.

When not knee-deep into statistical models, George can be found enjoying the great outdoors, or hosting live music in his home, packed with family, neighbours and friends.
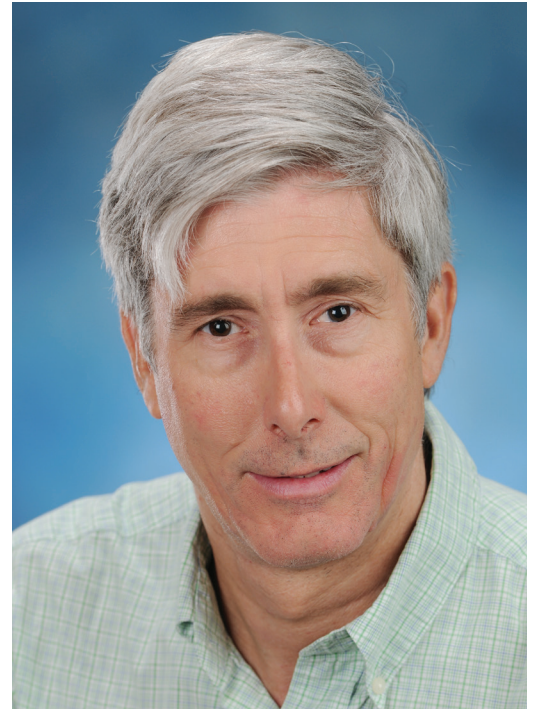
MESSAGE FROM THE

› Principal Investigator

As a health researcher, one of the things I find most rewarding is to conduct studies that can make a difference. As a Nova Scotian, I realize the challenges we face as a comparatively less healthy and wealthy population than other parts of Canada. Nova Scotians are declining in numbers and aging. Healthcare is our largest expenditure. We must figure out how to deliver it more effectively and efficiently. One of the most striking results from this study is the stark differences in healthcare outcomes between regions of the province. It is clear that solutions will have to be local as we learn from each other and, in some cases, pull each other into a better picture of health. By identifying **hot spots** (areas of high-cost and poor outcomes), I am hopeful that this report will help lay the groundwork for local innovation and targeted interventions. I know from my research that this is not as simple as allocating more resources...we all need to be a part of the solution.

In my career, I have done mostly quantitative database work and the biggest lesson I took from this project was the incredible insight and ideas contributed by the Patient Navigators. We owe much of the success of this project to the patients who participated. The experience of patient engagement has given me key insights on how to move this research forward. The next phase involves taking a closer look at the individuals behind the numbers. We want to talk with the patients, their families, and care providers in the hot spots identified in this report to better understand how to meet their needs and improve health outcomes for all Nova Scotians.

George

SARV REPORT
MESSAGES

A small number of individuals account for the majority of publicly funded healthcare costs. High rates of chronic disease and poor chronic disease management lead to poor health outcomes and avoidable, expensive contact with the healthcare system. Improving the efficiency and effectiveness of health service delivery to this high-cost population would have a significant impact on the overall fiscal sustainability of the provincial healthcare system.

Analysis of differences between small geographic areas (i.e. "variation") in rates of high-cost use of healthcare services is a powerful method to support targeted, high-yield healthcare interventions that will reduce costs and improve patient outcomes. As a first step to generating evidence on provincial healthcare service needs, uses and outcomes, the Maritime SPOR SUPPORT Unit (MSSU) has studied small area rate variation (SARV) in healthcare costs in Nova Scotia.

Small area rate variation research can help target healthcare interventions responsive to patient needs and improved patient outcomes. This report also suggests next steps for future work, some of which has started.

IMPROVED EFFICIENCY AND EFFECTIVENESS OF HEALTH SERVICES TO THE HIGH-COST POPULATION WILL HAVE A SIGNIFICANT IMPACT ON THE FISCAL SUSTAINABILITY OF THE PROVINCIAL HEALTHCARE SYSTEM AND, MORE IMPORTANTLY, LEAD TO BETTER HEALTH OUTCOMES.

SARV KEY FINDINGS

1. There is a high concentration of healthcare costs among a small percentage of the population. The top 1% of healthcare users account for one third of total inpatient hospital and physician costs. The top 5% of healthcare users account for two thirds of total inpatient hospital and physician costs.

2. Improving the effectiveness and efficiency of delivering healthcare to individuals who are in the top 5% of the population, would have a significant impact on the total cost of delivering healthcare in the province.

3. There is striking variation in the rate of high-cost healthcare use by geographic area. High-cost users are clustered in particular rural communities and urban neighbourhoods.

4. Differences in demographic characteristics and disease patterns explain some of the small area variation in rates of high-cost use, but not all. There are many areas that have higher or lower rates of high-cost use relative to the provincial average, even after the influence of demographics and disease patterns is removed.

5. Area characteristics and patient experiences shed light on additional factors that contribute to the rate of high-cost users in a geographic area, such as social determinants of health, hospital discharge planning, alternate levels of care, and continuity of care.

EXECUTIVE SUMMARY

SARV HAS CONSIDERABLE POTENTIAL TO SUPPORT HEALTHCARE PLANNING AND MANAGEMENT IN NOVA SCOTIA

RATIONALE

A small percentage of the population accounts for the majority of public healthcare costs. These high-cost patients typically have multiple, complex chronic health conditions, such as diabetes, heart disease, respiratory diseases, and mental health conditions. Inadequate disease management and care coordination leads to avoidable and expensive contact with the healthcare system, such as trips to the Emergency Department and hospitalizations. Improving the efficiency and effectiveness of health service delivery to this high-cost population would have a significant impact on the overall fiscal sustainability of the provincial healthcare system.

Analysis of small area variations in rates of health services and outcomes has considerable potential to support healthcare planning and management by informing targeted high-yield interventions to reduce costs and improve patient outcomes.

Small area rate variation(SARV) enables communication of geographic rate variations through easy to understand graphic maps. Making this information available through web-based applications has proven to be a powerful way to inform stakeholders and has facilitated greater accountability for more efficient and high-quality healthcare services in many jurisdictions in the world.

As a first step to generating evidence on small area variations in rates of health service needs, uses and outcomes in Nova Scotia, the Maritime SPOR SUPPORT Unit (MSSU) assessed geographic variations in the prevalence and characteristics of high-cost healthcare users.

OBJECTIVES

The study examined SARV in high-cost use of health services among persons aged 30 and above residing in 78 areas of Nova Scotia, defined using the first 3 digits of residential postal codes.

The primary objectives of the study were to:
1. Estimate rates of high- and low-cost use in 78 areas of Nova Scotia.
2. Identify the known contributors to SARV in high-cost use, including demographics, disease patterns, and multi-morbidity.
3. Identify additional factors that may account for SARV in high-cost use. These include:
    - Healthcare access and quality factors, such as continuity of primary care and resources to support patients upon discharge from hospital
    - Social and economic characteristics

RESEARCHERS ENGAGED WITH PATIENTS AND PATIENT NAVIGATORS FROM SEVERAL PROGRAMS TO INCORPORATE PATIENT EXPERIENCES AND INSIGHTS INTO THE STUDY. THE PATIENTS AND PATIENT NAVIGATORS WERE CONSULTED EARLY IN THE PROCESS TO INFLUENCE THE STUDY DESIGN AND LATER TO PROVIDE INSIGHT ON LOCAL CONDITIONS THAT CONTRIBUTE TO RATES OF HIGH-COST USE.

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Editor's Note: When reading this document you will notice that Figures, Tables and Maps are numbered sequentially corresponding to their Key Research Findings. Therefore, when you see Table 3, for example, it does not mean that this follows Table 2. It simply means that Table 3 is associated with Key Finding #3.

FINDINGS

Healthcare costs are concentrated among a small percentage of the population. The top 1% of healthcare users account for one third of total inpatient hospital and physician costs; the top 5% of healthcare users account for two thirds of these total costs.

Considerable variation exists between areas in rates of high-cost use. Rates of high-cost use across small areas ranged from a low of 2.5% (half the provincial average) to a high of 7.4% (50% higher than the provincial average). Some of this variation can be explained by differences in demographic and disease patterns among areas; however, some variation remained even after the influence of these factors was removed.

THE ANALYSIS IDENTIFIED SIX TYPES OF AREAS BASED ON THE FACTORS THAT CONTRIBUTED TO THE RATE OF HIGH-COST USE. THE TYPES ALIGN WITH ALTERNATIVE HEALTH SYSTEM APPROACHES TO REDUCE HIGH-COST USE

ABOVE PROVINCIAL AVERAGE RATE DUE TO	POLICY FOCUS	BELOW PROVINCIAL AVERAGE RATE DUE TO
DEMOGRAPICS	PLAN FOR AGING ←→	DEMOGRAPHICS
DISEASE PATTERNS	DISEASE PREVENTION ←→	DISEASE PATTERNS
OTHER FACTORS	DISEASE MANAGEMENT ←→	OTHER FACTORS

THE ROLE OF SPECIFIC DISEASE GROUPS AND MULTI-MORBIDITIES

- The most prevalent disease categories among high-cost users are diabetes, respiratory diseases (predominantly chronic obstructive pulmonary disease - COPD), ischemic heart disease, and heart failure. *The high impact of respiratory disease is noteworthy because while there are some services and supports, there is no formal integrated approach for COPD.*

- The number of chronic conditions was an important aspect of disease patterns explaining small area variation in rates of high-cost use. A viable approach to managing the healthcare needs of high-cost users must recognize the importance of multi-morbidity: **more than three quarters of high-cost users have two or more conditions and approximately one quarter have four or more conditions.**

POOR CHRONIC DISEASE MANAGEMENT

- Poor chronic disease management, linked to patient attributes (e.g. poor health literacy) and system attributes (e.g. poor continuity and coordination of care), is associated with high rates of hospitalization.

ACCESS TO AND COORDINATION OF ALTERNATE LEVEL OF CARE SERVICES (SUCH AS LONG-TERM CARE OR HOME CARE) TO SUPPORT PATIENTS AT DISCHARGE FROM HOSPITAL

- Poor access to alternate level of care services may delay discharge, resulting in high costs.
- Poor outcomes following discharge may also lead to repeat hospitalizations.

INTRODUCTION

IDENTIFYING GEOGRAPHIC CLUSTERS OF HIGH-COST USE CAN BE USED TO TARGET HIGH-YIELD INTERVENTIONS.

Building on pioneering work by John Wennberg and his colleagues who developed the *Dartmouth Pracstice Atlas*, an extensive body of research has documented striking variation by small geographic areas (e.g. towns, neighbourhoods, etc.) in how healthcare resources are distributed and delivered within many jurisdictions, including Canada (1-6). This research has shown that much of the variation cannot be explained by the characteristics of patients (e.g. age, sex) or their illnesses (e.g. severity, health status). Moreover, much of the variation is not associated with quality of care or outcomes, but reflects underuse, misuse, or overuse of healthcare services. Accessible and well-presented data on small area variations in rates of high-cost use of healthcare services, disseminated through atlases and web-based applications, have proven to be a powerful way to inform the public and healthcare decision makers about these variations. These data have also facilitated greater accountability in more efficient and quality provision of healthcare services (1-3, 5, 6).

While smal area rate variations in healthcare usage has been documented in Ontario, Manitoba and British Columbia (7-9), this research has not been systematically conducted in Nova Scotia. The Nova Scotia Department of Health and Wellness—inspired by the *Dartmouth Practice Atlas*— endeavours to generate evidence on small area rate variation in healthcare service needs, use, and outcomes. The Maritime SPOR SUPPORT Unit (MSSU) conducted a study examining variation between areas in rates of high-cost use of healthcare services among persons age 30 and above in Nova Scotia.

WHY STUDY SMALL AREA VARIATION IN HEALTHCARE COSTS?

Studies in many jurisdictions—including Ontario, Manitoba and British Columbia—have shown that there is large inequality in the use of healthcare services between members of the population. A small number of individuals account for the majority of healthcare costs (10-12). Thus, variations in healthcare costs between areas are largely determined by differences in the rates of high-cost users. The highest-cost patients typically have multiple, complex chronic health conditions, such as diabetes, heart disease, respiratory diseases, and mental health conditions. Inadequate care coordination, low capacity, and lack of support to manage chronic conditions leads to poor health outcomes and unnecessary and expensive contact with the healthcare system (such as trips to the emergency department and/or hospitalizations). Other high-cost users represent less complex patients with conditions requiring extensive care over long periods of time (12, 13). The former group is of particular interest as while they are recieving extensive care for common chronic diseases—that are largely preventable and manageable—they are still experiencing poor health outcomes.

In addition to examining observed variations in healthcare costs, there is also considerable benefit in examining variations in observed costs relative to **need-expected costs** (the expected costs of an area given the demographics and chronic disease patterns of a population) (14). Comparison of areas' need-expected costs to their observed costs indicates areas that are performing better or worse in terms of chronic disease prevention and management. Areas with populations that have higher percentages of elderly persons and persons with chronic disease will have higher expected healthcare costs (14, 15). Estimation of small area variations in need-expected costs can inform needs-based planning. It is equally important to identify areas which have lower-than-expected rates of high-cost users, as they may provide insight into strategies to improve outcomes and efficiencies.

There is growing policy and public interest in **hot spotting** to identify clusters of high users of healthcare services (16). This has proven to be a powerful tool in some jurisdictions of the United States for identifying and targeting interventions to improve care and manage healthcare costs. For example, in Camden, New Jersey, an emergency room physician used data to map high volume emergency room visits

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by city block, and upon finding a high percentage of emergency room visits originating from a few small areas, his team was able to target interventions and improve outcomes. This initiative has been expanded and adopted as a flagship project by the Robert Wood Johnson foundation. However, to date there are few peer-reviewed applications of this approach in the research literature (17).

Examining SARV in healthcare costs, by examining variations in rates of high-cost use, has considerable potential to inform healthcare planning and management in Nova Scotia. It can inform the targeting of "high-yield" interventions to reduce costs and improve patient outcomes.

STUDY OBJECTIVES

The overarching aim was to assess geographic variation in the prevalence and characteristics of high-cost users of healthcare among Nova Scotia communities. Healthcare costs were examined over a period of three years. Researchers focused on rates of chronic high-cost users of healthcare services (e.g. patients with multiple chronic diseases), as distinct from episodic high-cost users (e.g. trauma patients admitted to an ICU).

THE PRIMARY OBJECTIVES OF THE STUDY WERE TO:

Estimate and map Small Area Rate Variation (SARV) in the prevalence of high-cost healthcare use among all Nova Scotians, aged 30 and over.

Estimate the contribution of demographics (age-sex distribution and the percent of persons at the end-of-life) to SARV in high-cost users within Nova Scotia.

Estimate the contribution of chronic disease patterns and multi-morbidity to SARV in high-cost use.

Identify additional factors that may account for SARV in high-cost use that cannot be accounted for by demographics or chronic disease patterns. These include:
- Healthcare access and quality factors, such as continuity of primary care and resources to support patient upon discharge from hospital.
- Social and economic characteristics of the areas in which people live (rural vs urban, socioeconomic characteristics, and availability of health services).

A secondary objective of the study was to identify the data and technical requirements to support future work on SARV in health and healthcare.

THE STUDY

STUDY DESIGN

ASSEMBLED THE RESEARCH TEAM

Stakeholder group representation and research partnership. MSSU partnered with NS-PIHCI for this research. The research team was comprised of representatives from multiple stakeholder groups including the Nova Scotia Government Department of Health and Wellness, the Nova Scotia Health Research Foundation, and researchers from the Dalhousie University's Departments of Family Medicine, Community Health and Epidemiology, and School of Planning.

Patient representation. The research team recruited patients and Patient Navigators (people who could help interpret data through the lens of their lived experience) from *Your Way to Wellness, Nova Scotia Diabetes Centres,* and *Cancer Care Nova Scotia*.

External support. MSSU provided research services and patient engagement support; Health Data Nova Scotia provided data access and analytic support.

SET STUDY PARAMETERS

Study population. All Nova Scotians aged 30 and above as of April 1, 2010 who were eligible for provincial healthcare coverage for at least 365 days between April 1, 2010 and March 31, 2013.

Established definitions. High-cost users were defined as the top 5% of healthcare users in terms of cost of inpatient hospital and physician services. End of life refers to the final year of life when healthcare costs are often much higher. People who died during or shortly after the study period were identified to account for high costs associated with end of life.

Study timeframe. Inpatient hospital and physician costs incurred in the 2010 – 2012 fiscal years.

Geographic areas. Originally, geographic areas (i.e. small areas) were determined by Community Counts communities. However, because of reliability concerns with Community Counts geo-coding, Canada Post Forward Sortation Areas (FSA) were substituted.

ANALYSIS

Pattern of healthcare costs in Nova Scotia. Researchers calculated the collective amount consumed by individuals in the top 5% of healthcare users and the potential savings that could be realized with more efficient health services for this segment of the population.

Geographic variation in high-cost use. Researchers estimated and mapped rates of high-cost use for small areas throughout the province and then mapped the areas to display the variation between communities. To assess variation between communities, they compared the chance of an individual being a high-cost user in each community to that of the provincial mean.

Influence of contributing factors to the rate of high-cost use. Demographics, end of life and disease patterns (rates of common diseases and health conditions, and rates of multi-morbidity) are known contributors to high-cost use (18). Factors like demographics, the proportion of people at the end of life, and disease patterns vary by community. Because of these variations, some instances of deviation in the rate of high-cost use from the provincial averages can be explained by the influence of these characteristics. The influence of demographics and the proportion of people at the end of life were sequentially removed and it was noted when they explained the variation above or under the provincial mean. Communities were grouped into six types according to the factors that contributed to the rate of high-cost use in each area and whether they were high or low in comparison with the average provincial community.

Hypotheses to explain variation. Through additional analyses and consultation with Patient Navigators, the research team hypothesized possible contributing factors—other than demographics or disease pattern—to the rate of use in communities that displayed significantly high or low rates. These include social and economic conditions, continuity of physician care, the role of specific disease groups and multi-morbidities, and/or delayed discharge from hospital

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Engagement with Patient Navigators. Researchers engaged with Patient Navigators at multiple phases in the study process.

Patient Navigators were consulted early and influenced the study design in terms of, for example, what data should be included to determine healthcare service usage.

Patient Navigators were re-engaged to review study findings and provide insights on local conditions that could contribute to high or low rates of high-cost use that persist after the influence of demographics and disease pattern have been removed.

"WE OWE MUCH OF THE SUCCESS OF THIS PROJECT TO THE PATIENTS AND PATIENT NAVIGATORS WHO PARTICIPATED. THE EXPERIENCE OF PATIENT ENGAGEMENT HAS GIVEN ME KEY INSIGHTS ON HOW TO MOVE THIS RESEARCH FORWARD."

**DR. GEORGE KEPHART,
PRINCIPAL INVESTIGATOR**

FINDINGS

1 **THERE IS A HIGH CONCENTRATION OF HEALTHCARE COSTS AMONG A SMALL PERCENTAGE OF THE POPULATION IN NOVA SCOTIA.**

The top 1% of healthcare users account for 1/3 of total inpatient hospital and physician costs.

The top 5% of healthcare users account for 2/3 of total inpatient hospital and physician costs.

The distribution of combined hospital inpatient and physician average annualized healthcare costs for Nova Scotia was examined for fiscal years 2010–11 to 2012–13. Figure 1 shows the distribution of average annual costs per person in the population. The average annual cost in the 99th percentile (top 1%) is approximately $56,000 per year.

Table 1A outlines how healthcare costs are concentrated among a small percentage of the population. The top 1% of healthcare users account for one third of total inpatient hospital and physician costs. The top 5% of healthcare users account for two thirds of total inpatient hospital and physician costs. This concentration of health spending is why examining variation in rates of high-cost use is a sensible way to look at small area variation in healthcare costs.

Figure 1: Average annual costs by percentile of physician care and inpatient hospital stays for Nova Scotians aged 30 and over, fiscal years 2010-2012
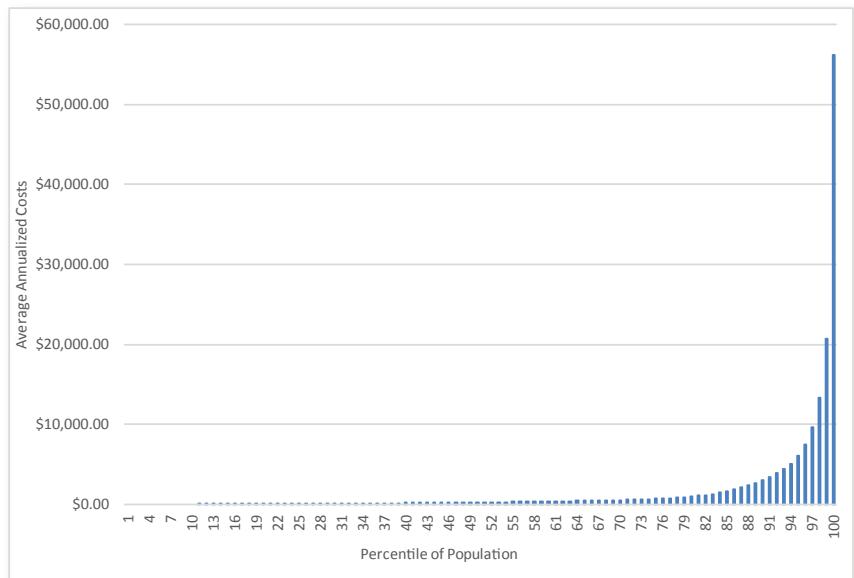

Table 1A: Percentage of total physician and inpatient hospital costs used by the top 1%, 5% and 10% of Nova Scotians aged 30 and over, fiscal years 2010 -2012

TOP GROUP (PERCENTAGE)	PERCENTAGE OF TOTAL COSTS (%)
TOP 10	77
TOP 5	64
TOP 1	33

Table 1B shows that a small percentage of the population also accounted for large shares of total physician costs, but not nearly to the extent as for overall costs. This is largely due to the fact that more than 90% of the study population had physician visits, while only 16% had inpatient hospitalizations. Inpatient hospital visits account for most of the costs of high-cost users. Among the top 5% of healthcare users, inpatient hospitalizations accounted for 87% of the costs.

2 REDUCING THE COST OF DELIVERING CARE TO THE TOP 5% OF HEALTHCARE USERS WOULD HAVE A SIGNIFICANT IMPACT ON HEALTH COSTS FOR THE PROVINCE.

The total annualized costs of physician and hospital inpatient visits for the study population is $1.115 billion, of which $711.3 million is used by the top 5% of users. This is a conservative estimate, as the study only includes physician and inpatient hospital costs. As shown in Table 2, even modest reductions in the costs of care for these high-cost individuals would have substantial returns.

TABLE 1B: Percentage of total physician cost used by the top 1%, 5% and 10% Nova Scotia residents aged 30 and over with 365 days of exposure, fiscal years 2010-13

TOP GROUP (PERCENTAGE)	PERCENTAGE OF TOTAL COSTS (%)
TOP 10	45
TOP 5	30
TOP 1	12

TABLE 2: The healthcare savings projected for percentage of reduction in cost for the top 5% group of healthcare users in Nova Scotia.

PERCENTAGE IN REDUCED COSTS (%)	PROJECTED COSTS RECOVERED
5	$36,000,000
10	$71,000,000
15	$107,000,000
20	$142,000,000
30	$213,000,000

A SMALL GROUP OF THE POPULATION ARE CONSUMING MOST OF THE HEALTHCARE RESOURCES IN NOVA SCOTIA. IT STANDS TO REASON THAT BY ADDRESSING THE NEEDS OF THIS GROUP WE COULD DRAMATICALLY REDUCE HEALTHCARE COSTS.

HEALTH RESOURCES

64%

POPULATION

5%
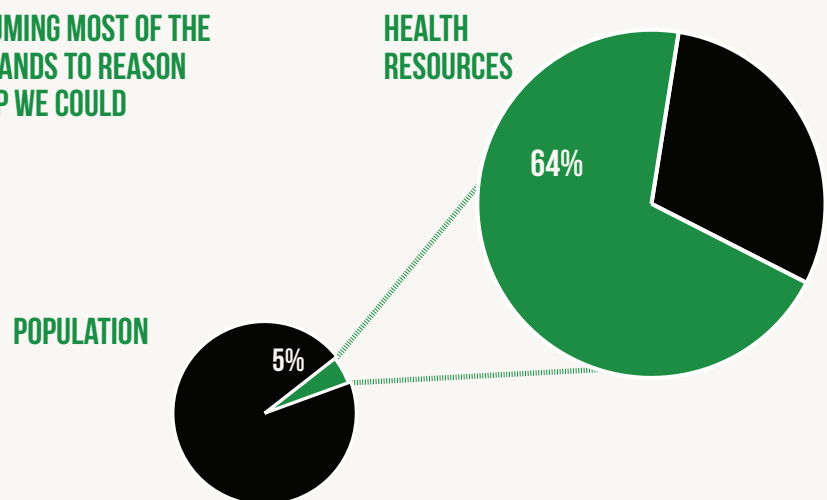
3 THERE IS STRIKING VARIATION IN THE RATE OF HIGH-COST HEALTHCARE USERS BY GEOGRAPHIC AREA ACROSS THE PROVINCE.

Rates of high-cost use across areas ranged from a low of 2.5% (half the provincial average) to a high of 7.4% (50% higher than the provincial average). Figure 3 shows a "caterpillar plot" of the estimated differences between area rates and the provincial average. Areas are sorted by rate of highest to lowest cost. The vertical line running down the middle of the graph represents the provincial average rate of 5%. Areas to the right of the vertical line have rates that are higher than the provincial average, while areas to the left of the line have rates that are lower than the provincial average. If the margin of error (horizontal line) for an area crosses the vertical line, then that area is not significantly different than the provincial average.

Maps 3A-3C (*Pages 26-27*) show the rates for the province as a whole (Map 3A), and for the Halifax (Map 3B) and Sydney (Map 3C) areas. Lower than average rates are concentrated in suburban areas of Halifax. Higher than average rates are concentrated in Cape Breton and in the Northern and South Western areas of mainland Nova Scotia.

4 DIFFERENCES IN DEMOGRAPHIC CHARACTERISTICS AND DISEASE PATTERNS EXPLAIN SOME OF THE VARIATIONS BETWEEN AREAS IN RATES OF HIGH-COST USE, BUT NOT ALL.

Many factors may explain why an area has rates of high-cost use that are higher or lower than the provincial average. For example, an area may have higher than average rates of high-cost use because it has a high concentration of elderly persons, or because it has high rates of disease and multi-morbidity. Additional system factors such as the quality of disease management, access to healthcare, or problems with discharging patients from hospital may also help to explain variations between areas in rates of high-cost use.

The researchers applied statistical modeling to first remove the influence of area variation in rates by area due to demographics (e.g. age, sex and end-of-life) and then disease patterns (e.g. types of diseases and multi-morbidities). These "adjustments" substantially changed the estimated rates for many areas, as well as the overall amount and distribution of small area rate variation. Yet, significant SARV remained even after the influence of demographics and disease patters was removed. For example, much of Cape Breton and parts of the South Shore, which had rates of high-cost use higher than the provincial average, are no longer higher than average after adjusting for demographics and disease patterns. Conversely, there are areas in Halifax that had lower rates of use before adjusting for demographics and disease patterns, but higher rates after adjusting.

Maps 4A-4F (*Pages 28-30*) show how area rates of high-cost use change once the effects of demographics, and then the effects of chronic disease patterns, are removed.

FIGURE 3: Caterpillar plot depicting variation in rates of high-cost use by Forward Sortation Areas in Nova Scotia
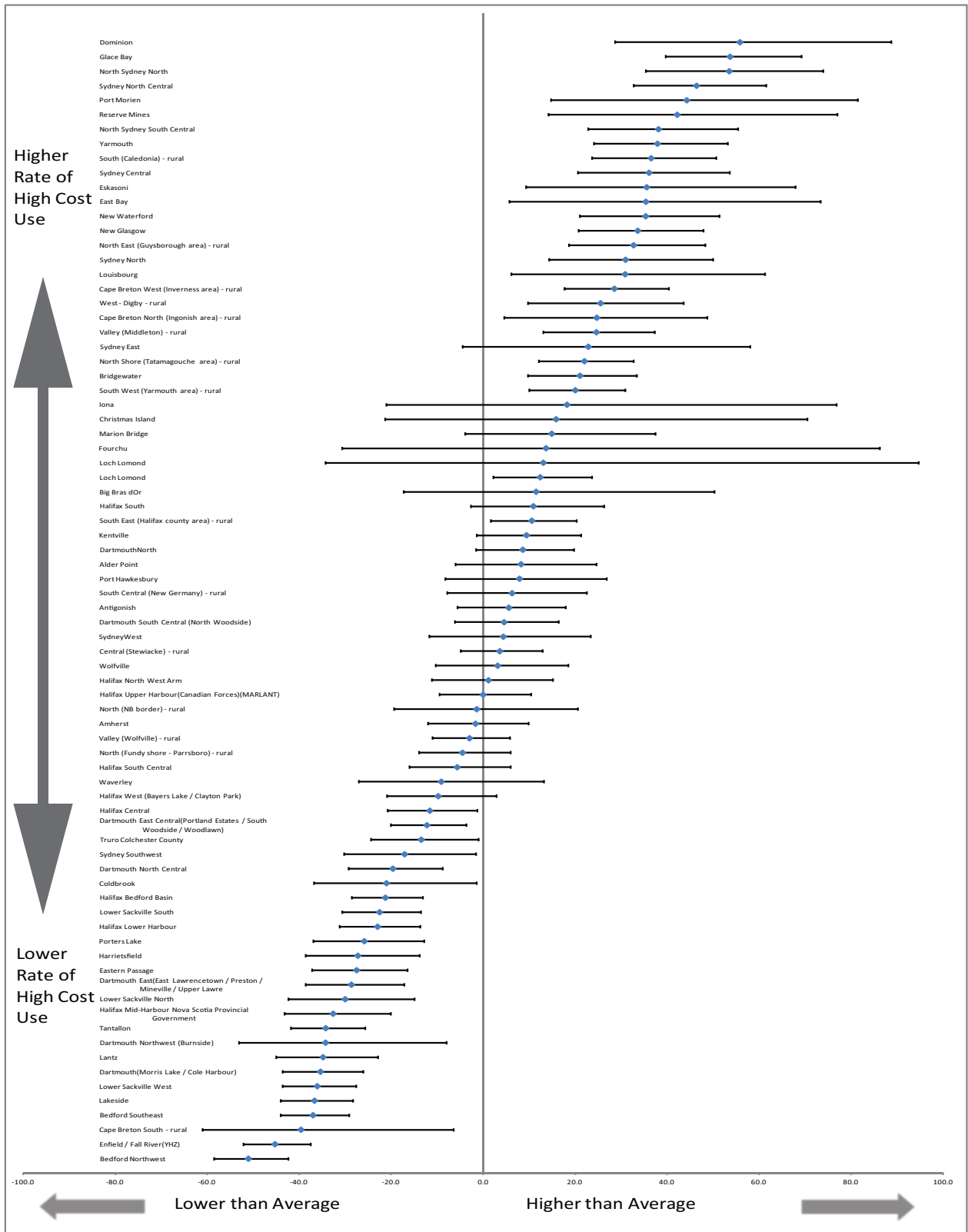
5 **SIX DISTINCT TYPES OF AREAS EMERGED BASED ON HOW DEMOGRAPHICS AND DISEASE PATTERNS CONTRIBUTE TO RATES OF HIGH-COST USE. AS A RESULT, DIFFERENT POLICY PRIORITIES ARE SUGGESTED FOR EACH TYPE OF AREA.**

By observing how area's rates of high-cost use change with adjustment, they can be characterized into distinct types according to the contribution of demographics and disease patterns to their rates of high-cost use. Table 5 shows six types of areas that were identified using this approach; Maps 5A-5C (*Pages 31 - 32*)show areas by type for Nova Scotia as a whole, Halifax and Sydney.

For example, the upper left panel of Table 5 lists eight areas with higher rates of high-cost use relative to the provincial average because they had more elderly people and persons near end of life in their populations. Once the influence of this population was removed, these areas no longer had higher than the provincial average rates of high-cost use. These areas are labeled *"high rates due to demographics."* Conversely, the lower left panel of Table 5 lists eleven areas that had lower rates of high-cost use relative to the provincial average because of their younger demographics. Once the influence of this younger population was removed, these areas no longer had lower than the provincial average rates of high-cost use. These areas are labeled: *"low rates due to demographics."*

Two other types of areas (middle column of Table 5) emerged with higher or lower rates of high-cost use than the provincial average because of their disease patterns (*"high rates due to disease"* and *"low rates due to disease"*).

These are areas that still had higher or lower rates of high-cost use relative to the provincial average after adjustment for demographics, but once the influence of disease patterns was removed they were no longer significantly different than the provincial average. These are areas where higher or lower rates of chronic disease account for rate variation.

Two final types of areas had higher or lower rates of high-cost use compared to the provincial average, even after adjusting for demographics and disease patterns (right-hand column of Table 5). These are particularly interesting areas where further investigation might identify other factors that affect rate variations, such as access to care or approaches to chronic disease management. These areas are labeled: *"high rates

"AREAS THAT STILL SHOW HIGH RATES OF HEALTHCARE USE AFTER THE INFLUENCE OF DEMOGRAPHIC AND DISEASE PATTERNS ARE REMOVED ARE INTERESTING TO US. THESE ARE THE POCKETS OF NOVA SCOTIA THAT WE NEED TO KNOW MORE ABOUT, AND POTENTIALLY WHERE COST RECOVERY AND IMPROVED OUTCOMES CAN MEET WITH GREAT SUCCESS."

DR. GEORGE KEPHART, PRINCIPAL INVESTIGATOR

for other reasons" and *"low rates for other reasons."*

Not all areas in Nova Scotia fall into one of these six types. There were 17 areas (*"neutral areas"*) that did not have significantly higher or lower rates of high-cost use than the provincial average, regardless of whether their rates were adjusted or not.

TABLE 5: Categorization of Areas in Nova Scotia by type and impact of contributing factors to high-cost use*

	DEMOGRAPHICS
ABOVE AVERAGE RATES OF HIGH-COST USE	CAPE BRETON NORTH (INGONISH AREA) - RURAL SOUTH EAST (HALIFAX COUNTY AREA) -RURAL WEST (DIGBY) - RURAL PORT MORIEN LOUISBOURG EAST BAY NORTH SYDNEY NORTH CENTRAL TRURO CENTRAL
PRIORITY POLICY RESPONSE	**PLANNING FOR AGING POPULATIONS**
LOWER THAN AVERAGE RATES OF HIGH-COST USE	CAPE BRETON SOUTH - RURAL DARTMOUTH NORTH CENTRAL DARTMOUTH EAST (EAST LAWRENCETOWN, PRESTON, MINEVILLE, UPPER LAWRENCETOWN) DARTMOUTH NORTHWEST (BURNSIDE AREA) PORTERS LAKE EASTERN PASSAGE HARRIETSFIELD LOWER SACKVILLE SOUTH LOWER SACKVILLE NORTH COLDBROOK TRURO COLCHESTER COUNTY

POTENTIAL POLICY IMPLICATIONS OF AREA TYPES

Characterizing areas into types based on both their variation from provincial average rates and by the reason for their variation, as shown in Table 5, has potential policy implications.

Disease prevention and disease management are important health policy objectives for all areas of the province.

However, in an environment of scarce resources, prioritizing interventions and resource allocation to areas of highest need makes sense. Small area rate variation analysis can be helpful in this regard. Areas with high or low rates of high-cost use due to demographics are not unusual with respect to their disease patterns and associated healthcare costs. These are areas where resource allocation decisions and planning need to take into account their demographics (e.g. more geriatric and pal-

DISEASE PATTERNS

CAPE BRETON WEST (INVERNESS AREA) - RURAL
NORTH EAST (GUYSBOROUGH AREA) - RURAL
SOUTH (CALEDONIA AREA) - RURAL
GLACE BAY
RESERVE MINES
DOMINION
NEW WATERFORD
SYDNEY NORTH
SYDNEY NORTH CENTRAL
NORTH SYDNEY NORTH
ESKASONI

OTHER CONTRIBUTING FACTORS

NORTH SHORE (TATAMAGOUCHE AREA) - RURAL
VALLEY (MIDDLETON AREA) - RURAL
SOUTH WEST (YARMOUTH AREA) - RURAL
NEW GLASGOW
DARTMOUTH NORTH
HALIFAX CENTRAL
HALIFAX SOUTH
KENTVILLE
BRIDGEWATER
YARMOUTH

DISEASE PREVENTION INTERVENTIONS

VALLEY (WOLFVILLE AREA) - RURAL
LANTZ
DARTMOUTH (MORRIS LAKE/COLE HARBOUR AREA)
DARTMOUTH EAST CENTRAL (PORTLAND ESTATES/SOUTH WOODSIDE/WOODLAWN)
HALIFAX LOWER HARBOUR
HALIFAX MID-HARBOUR
HALIFAX BEDFORD BASIN
HALIFAX NORTH WEST ARM
HALIFAX WEST (BAYERS LAKE/CLAYTON PARK)
TANTALLON
WOLFVILLE

DISEASE MANAGEMENT PROGRAMS

NORTH (NB BORDER) - RURAL
NORTH (FUNDY SHORE/PARRSBORO) - RURAL
SYDNEY SOUTHWEST
SYDNEY CENTRAL
ENFIELD / FALL RIVER
LAKESIDE
BEDFORD SOUTHEAST
BEDFORD NORTHWEST
LOWER SACKVILLE WEST
AMHERST

* THERE ARE FSAS NOT LISTED. THOSE THAT ARE UNLISTED ARE AREAS WHERE RATES OF HIGH-COST USE WERE NOT SIGNIFICANTLY DIFFERENT THAN THE PROVINCIAL AVERAGE.

liative care resources), but where special concern regarding disease patterns and resulting healthcare costs is not indicated.

Areas that have high rates of high-cost use due to disease patterns should be considered as priority targets for disease prevention efforts. Further data analysis can help to identify diseases and clusters of multi-morbidity where such efforts should be directed, and comparative analysis with areas that have low rates due to disease might be informative. For example, Figure 5 shows rates of contact with the health system by disease group for the "*high rates due to disease*" areas. Each of the bars show each disease group in an area. The most common chronic diseases are diabetes, respiratory disease (almost all of which is COPD) and ischemic heart disease. The figure also shows considerable variation in disease patterns among areas (e.g. one area stands out as having

much higher rates of diabetes, respiratory, and ischemic heart disease than the others). Further SARV work would be required to refine these estimates.

Areas that have high rates of high-cost use for "*other reasons*" are priority targets for disease management interventions. High-cost use is primarily a reflection of hospitalizations and length-of-stay in hospital. Research has shown that inadequate chronic disease management, linked to patient attributes (e.g. low health literacy) and system attributes (e.g. lack of continuity and coordination of care), is associated with high rates of hospitalization (19). Long length-of-stay in hospital may also occur if patients cannot be discharged from hospital due to lack of alternate care arrangements. To guide policy, additional study is needed to pin down why these areas have higher costs. A focused program of research examining the characteristics of high-cost users in these areas, and what could have prevented health outcomes resulting in hospitalizations, may help to identify targeted interventions with high rates of return. Comparative analyses of high-cost users in areas with "*low rates for other reasons*" may yield further insights, such as successful health team design for management of chronic disease or primary care delivery models.

6 AREA CHARACTERISTICS AND PATIENT EXPERIENCES SHED LIGHT ON ADDITIONAL FACTORS THAT CONTRIBUTE TO THE RATE OF HIGH-COST USERS IN A GEOGRAPHIC AREA.

The researchers conducted additional analyses and consulted Patient Navigators to shed light on the "*other reasons*" that account for higher or lower rates of high-cost use and to generate hypotheses for further investigation.

DISEASE AND MULTI-MORBIDITY AMONG HIGH-COST USERS

The researchers examined disease rates among high-cost users and compared them by area types, to determine which disease groups were most associated with high-cost use and to assess the extent of multi-morbidity among high-cost users. These numbers should be interpreted with caution as they are not age-sex adjusted and are based on diagnostic codes that may be subject to errors.

The most prevalent disease categories among high-cost users are diabetes, respiratory diseases (predominantly COPD), ischemic heart disease, cancer and heart failure (Figure 6A). The high impact of respiratory disease is noteworthy since there is no dedicated provincial program addressing this condition. No clear disease pattern differentiates the "*high for other*

FIGURE 5: Disease prevalence in areas with high rates of high-cost use due to disease

FIGURE 6A: Prevalence of disease among high-cost users by area type

The chart legend:
- NS provincial average
- Low - Due to Demographics
- High - Due to Demographics
- Low - Due to Disease
- High - Due to Disease
- Low - Due to Unexplained
- High - Due to Unexplained

Y-axis: PREVALENCE OF DISEASE (PERCENT)
X-axis: DISEASE GROUP

reasons" type of area. Some differences are evident, but they could easily be due to the lack of age-sex adjustment.

The results suggest that a viable approach to managing the healthcare needs of high-cost users must recognize the importance of multi-morbidity. The degree of multi-morbidity among high-cost users is striking. Figure 6B shows the distribution of a number of common chronic conditions among high-cost users by type of area. This only includes the common chronic conditions that were included in the study. More than three quarters of high-cost users have two or more conditions and approximately a quarter have four or more conditions. *The number of chronic conditions is more important than specific diseases in explaining small area variation in rates of high-cost use.*

Consultation with Patient Navigators indicated the significant challenge for many patients in coordinating multiple visits to specialists when they have multiple chronic conditions. The Patient Navigators noted that this problem is compounded in rural areas where visits to specialists often involve travel and other socioeconomic factors that influence patients' ability to manage their own healthcare (cost of travel, family support, etc.).

THE DEGREE OF MULTI-MORBIDITY AMONG HIGH-COST USERS IS STRIKING. MORE THAN THREE QUARTERS OF HIGH-COST USERS HAVE TWO OR MORE CONDITIONS AND APPROXIMATELY A QUARTER HAVE FOUR OR MORE CONDITIONS.

SOCIAL DETERMINANTS AND AREA TYPE

The researchers examined social and economic characteristics by area type. Characteristics included rural status; the percentage of the population identifying as aboriginal; the percentage of the population with education below Grade 12; the percentage of single parent (mother) families; the percentage of persons living alone; the percentage of persons unemployed; and the percentage of households with an income of less than $20,000 per year. Results are shown in Figure 6C.

Areas that have high rates of high-cost use for other reasons have lower socioeconomic characteristics and are more likely to be rural. This suggests that social determinants of health play an important role in explaining rates of high-cost use. This is consistent with evidence on disease management, which has found that the ability to navigate the healthcare system and manage one's condition is associated with socioeco-

FIGURE 6B: The distribution of a number of common chronic conditions among high-cost users by type of area. This only includes common chronic conditions that were included in the study.
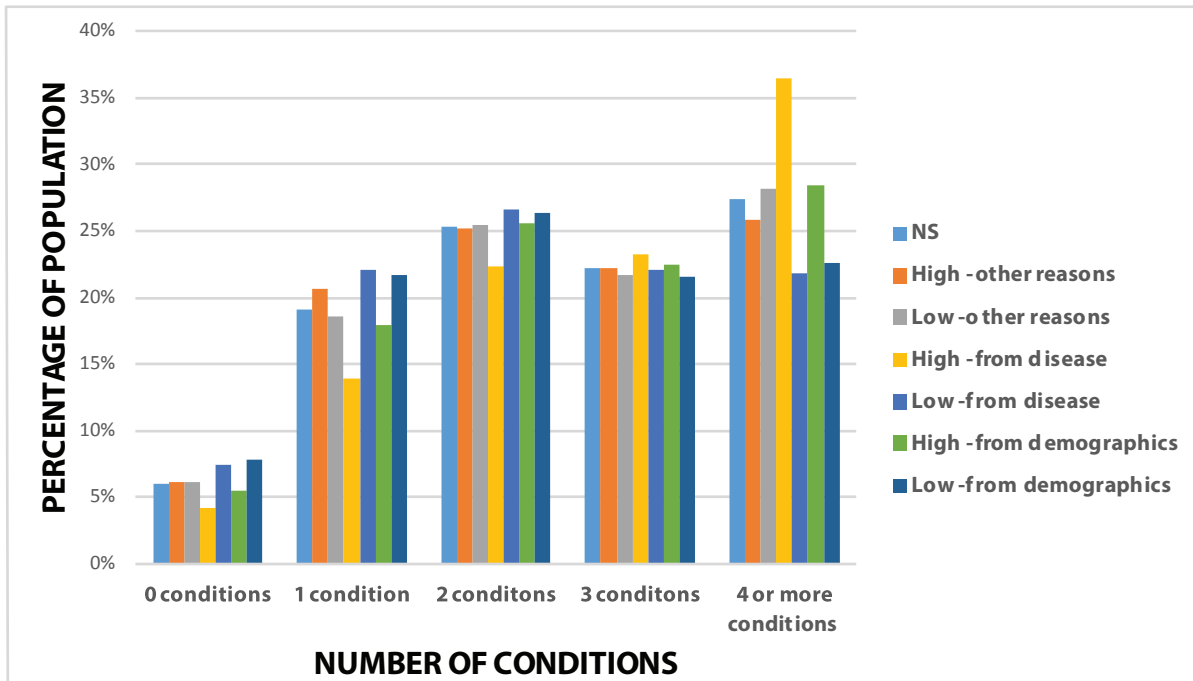
nomic status.

Patient Navigators further supported this hypothesis. Lack of family support, low income, poor literacy, and lack of public transportation were all identified as contributors to poor disease management.

HOSPITAL DISCHARGE PLANNING – RATE VARIATION AND ALTERNATE LEVELS OF CARE (ALC)

Among high-cost users, 87% of the total cost is due to inpatient hospitalizations. If resources are not in place to support patients in the community, more costly solutions (delayed discharge or readmission) may occur. Such resources may include access to a long-term care bed, rehabilitation care, or home care services. The days a patient spends in hospital while waiting for an alternate level of care in another setting are coded as Alternate Level of Care (ALC) days in discharge abstract data (20). Among high-cost users, there were low percentages of ALC days in the data. However, there have been ongoing concerns about the completeness and quality of this data.

It is noteworthy that the highest average number of ALC days among high-cost users is for the "*high for*

other reasons" type of area. This suggests that ALC days may play an important role in explaining small area variations in the rate of high-cost use. More detailed analyses of this should be considered.

A Patient Navigator who has worked in the southwestern part of the province also commented on challenges of discharge planning. Patients and their families often experience great difficulty arranging services in anticipation of discharge. Patients indicated that they are often left with a complex system to navigate on their own without the support of healthcare professionals or their primary care provider.

These navigation complications are often exacerbated for patients with low socioeconomic status and/or mental health conditions. Patients throughout areas with poor navigation and social supports tend to experience worse outcomes and access the health system more frequently than they would if the discharge and planning process was better supported and coordinated.

**FIGURE 6C: Average socio-demographic characteristics of FSAs by Type
(2011 National Household Survey Data)**
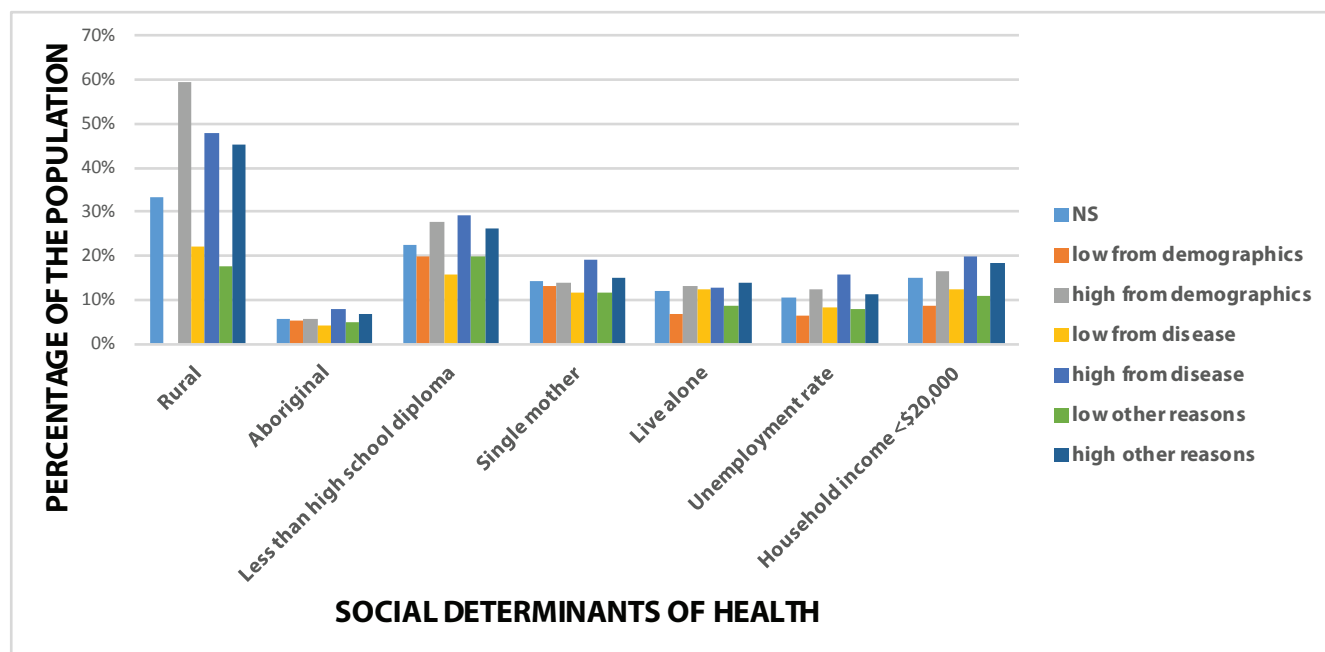
CONTINUITY OF CARE

Continuity of care means that patients have ongoing, regular contact with a healthcare provider. This is hypothesized to impact the quality of chronic disease management and healthcare outcomes.

A standard measure of continuity of care was employed to examine the hypothesis that if there is a high level of continuity of care, there is a lower risk of being a high-cost user. Continuity of care was associated with a lower risk of being a high-cost user, but performed a limited role in explaining small area rate variations in high-cost use (21).

A PATIENT NAVIGATOR IN SOUTHWESTERN NS COMMENTED ON CHALLENGES OF DISCHARGE PLANNING. PATIENTS AND THEIR FAMILIES OFTEN EXPERIENCE GREAT DIFFICULTY ARRANGING SERVICES IN ANTICIPATION OF DISCHARGE.

LOOKING FORWARD

RECOMMENDED NEXT STEPS FOR RESEARCH IN NOVA SCOTIA

As part of the Strategy for Patient-Oriented Research (SPOR), supported by the Canadian Institutes of Health Research (CIHR), the Maritime SPOR SUPPORT Unit (MSSU) and the Nova Scotia Primary and Integrated Health Care Innovations (NS-PIHCI) Network are working with the departments of health, and health authorities in the Maritime provinces to provide useful and responsive evidence to inform health care planning and evaluation.

This study was an important first step towards the creation of a Health Atlas for Nova Scotia, and the research team endeavours to extend this work to other Maritime provinces soon. This study has shown that statistical models for small area estimation can be used to produce reliable small area estimates to guide and inform health policy. The researchers learned a great deal about the technical requirements and statistical methods for generating and communicating small area information. Advanced statistical modelling techniques are required, and this project has laid the groundwork for ongoing improvements to these methods. Effective approaches were developed to engage patients and frontline healthcare workers to guide what should be examined to help interpret results. The researchers now have the capacity to estimate and map small area variations of other measures of health service use and outcomes. This lays the foundation for a "Health Atlas" covering many indicators to help better understand where problems are and how they might be addressed.

IMPROVING THE AREAS USED

The choice of areas for the study was based upon what was possible, not what was ideal. Areas were defined as the first three digits of the postal code. These areas often do not correspond to area boundaries used for healthcare planning and delivery, and in rural areas they can be very large. For example, most of rural Halifax County on the Eastern Shore and the South Shore are all part of a single large rural postal code (B0J). For planning, it doesn't make sense to group the St. Margaret's Bay area together with outlying areas of Halifax County on the Eastern Shore. Postal codes can be "geocoded" to other geographic areas, such as those used by Statistics Canada, but this often allocates people to the wrong communities and could produce misleading results.

A more reliable method for assigning people to areas is to use civic addresses instead of postal codes. Civic addresses are already collected and maintained in the Nova Scotia Provincial Health Insurance (MSI) registry. Use of civic address for geocoding would enable highly reliable and accurate location of place of residence. If civic address was used to assign people to a standard, consistent and meaningful set of geographic area definitions, and then only the areas were provided to researchers, the privacy risks would be lower than with the use of postal codes.

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Accurate geocoding alone is not enough. There needs to be agreement on a standard, consistent and meaningful set of geographic areas which can be used for healthcare planning and statistical analysis of area variation.

An ideal set of areas would be:
- Built on Statistics Canada geography to ensure that data from the census, vital statistics and surveys can be accessed and used in a timely and affordable manner.
- Nested in such a way that smaller areas aggregate to larger areas. Several layers of nesting are useful, as this facilitates planning at different levels and analysis at the smallest possible level of geography permitted by the data.
- Meaningful for healthcare planning. Geographic areas should correspond to, and aggregate up to, administrative planning areas. They should also be meaningful for defining catchment areas for different kinds of services.

MOVING FROM DATA TO HEALTH SYSTEM IMPROVEMENTS

Estimates of health status, health care utilization and healthcare outcomes for small areas can be of tremendous value, provided that they are used to focus innovation and improvements in care. Identification of areas that stand out in unique ways can be threatening, but it can also create constructive tension to motivate change and foster innovation. The results of this study suggest that efforts to address the needs of high-cost users should be targeted to particular areas, and that interventions should be specifically tailored to best suit the needs of different areas.

This report is only a first step. Moving forward, researchers need to supplement the information in this report with additional data analyses as well as on-the-ground insights from patients, their families and healthcare providers. Armed with a better understanding of the needs of high-cost patients, and how well those needs are being met, we will be in a better position to identify what can be done to improve outcomes. We need to learn from areas that have both low and high rates of high-cost use, intervene to improve systems of care so they are more efficient and effective at addressing the needs of high-cost patients, and evaluate the effectiveness of those interventions. We envision that this will become our primary research focus going forward. To succeed, this research will depend on the engagement of local communities, care providers and managers. ⌘
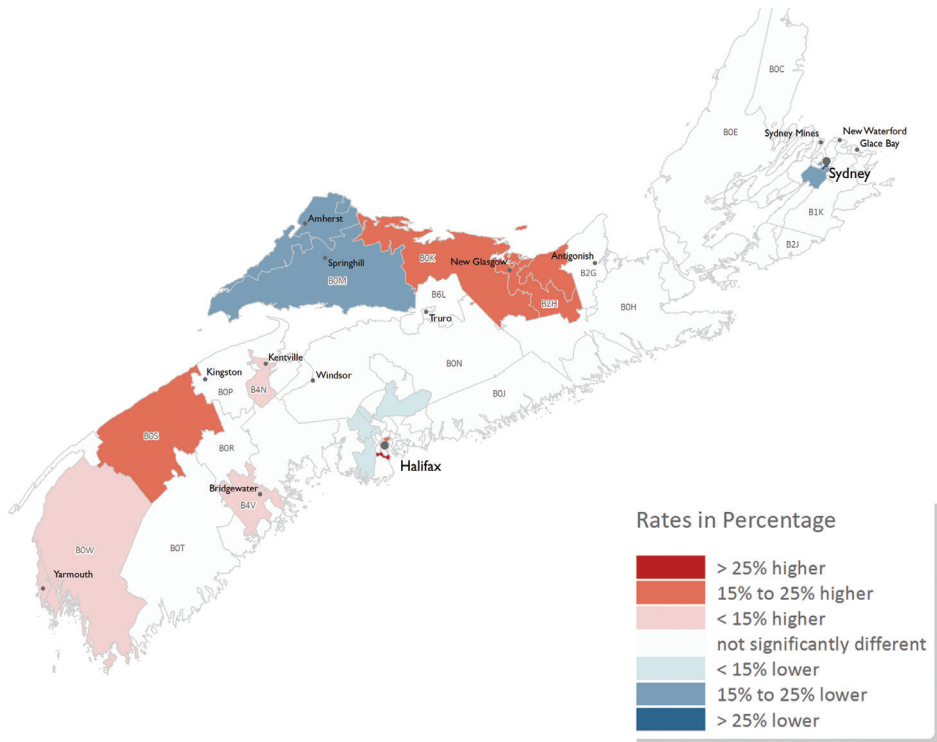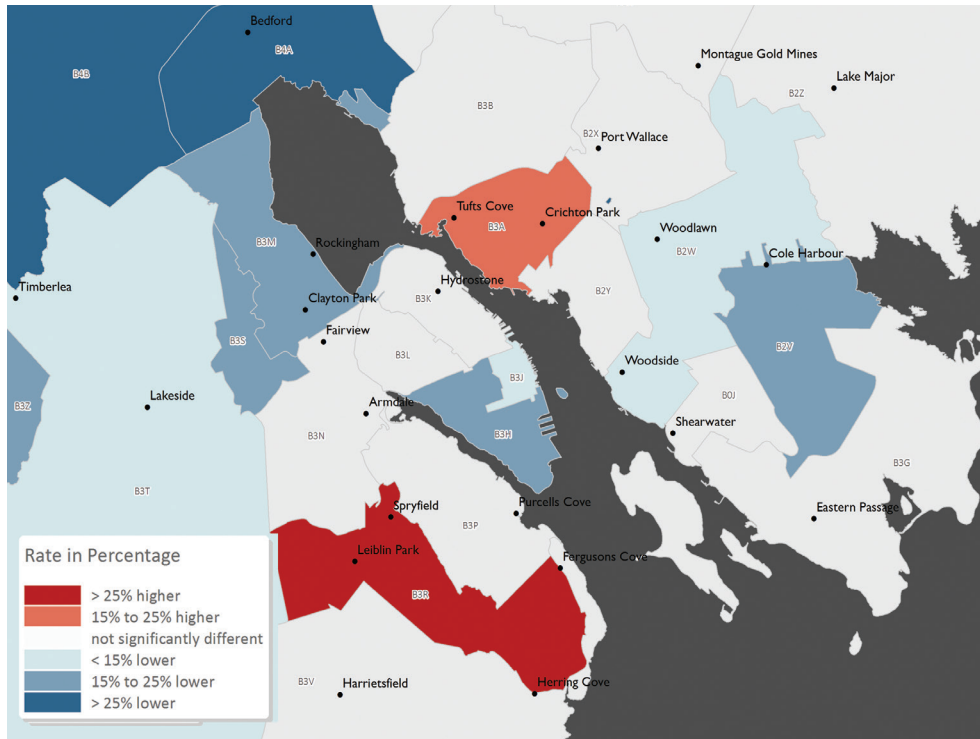
AREA MAPS

MAP 3A: Unadjusted rates of high-cost healthcare use compared to provincial average. Nova Scotia, 2010-2013
Key Finding #3

MAP 3B: Unadjusted rates of high-cost healthcare use compared to provincial average. Halifax, 2010-2013
Key Finding #3

MAP 3C: Unadjusted rates of high-cost healthcare use compared to provincial average. Sydney, 2010-2013
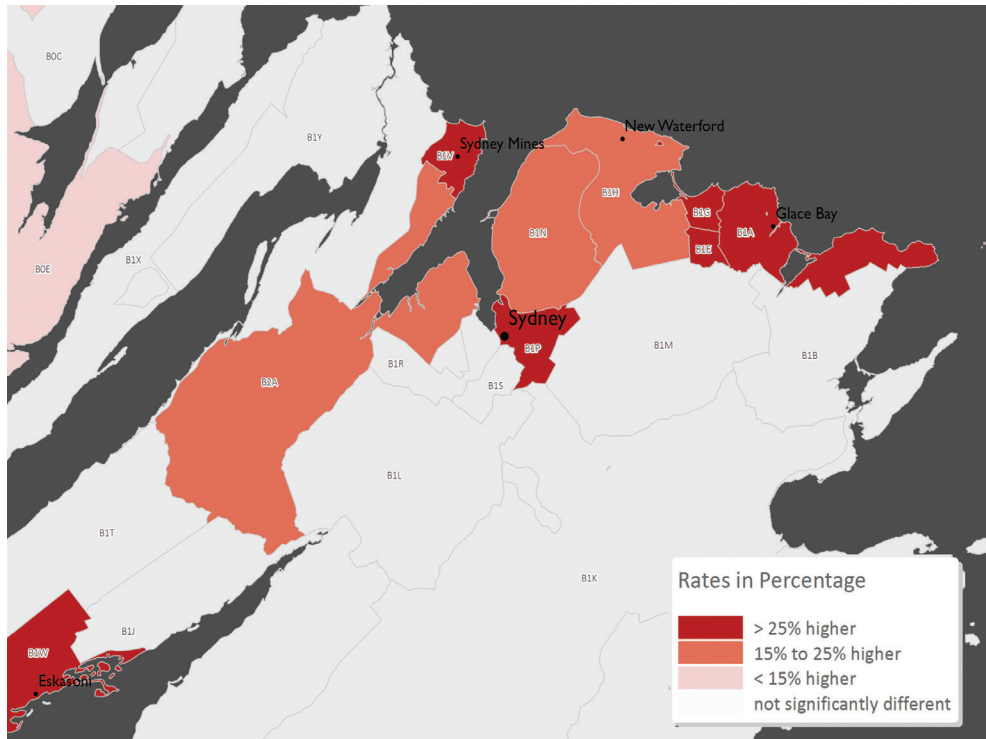**Key Finding #3**

MAP 4A: Rates of high-cost healthcare use compared to provincial average. Adjusted for demographics. Nova Scotia, 2010-2013   Key Finding #4

Rates in Percentage

> 25% higher
15% to 25% higher
< 15% higher
not significantly different
< 15% lower
15% to 25% lower
> 25% lower
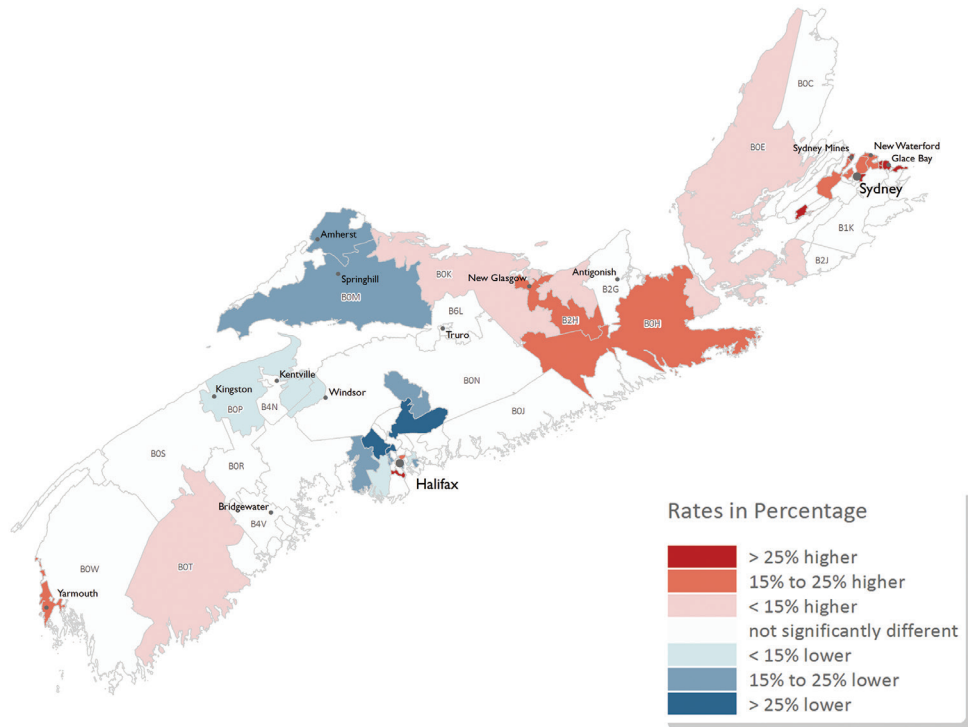
MAP 4B: Rates of high-cost healthcare use compared to provincial average. Adjusted for demographics and chronic disease. NS, 2010-2013   Key Finding #4


Rates in Percentage

> 25% higher
15% to 25% higher
< 15% higher
not significantly different
< 15% lower
15% to 25% lower
> 25% lower

MAP 4C: Rates of high-cost healthcare use compared to provincial average. Adjusted for demographics. Halifax, 2010-2013   Key Finding #4

MAP 4D: Rates of high-cost healthcare use compared to provincial average. Adjusted for demographics and chronic disease. Halifax, 2010-2013   Key Finding #4
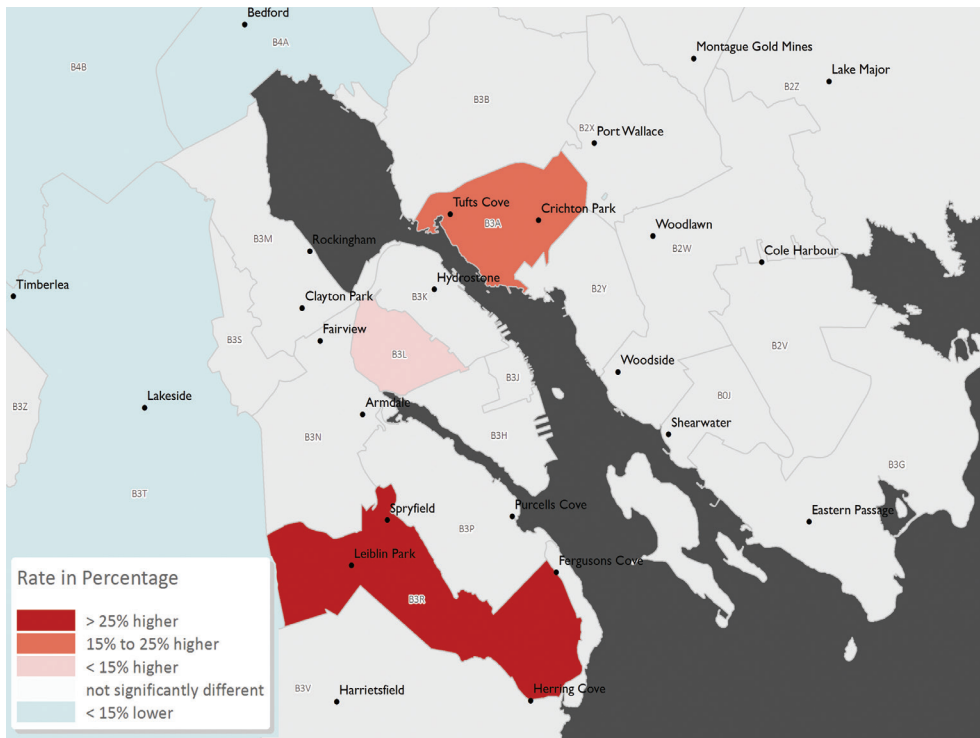
MAP 4E: Rates of high-cost healthcare use compared to provincial average adjusted for demographics. Sydney, 2010-2013   Key Finding #4
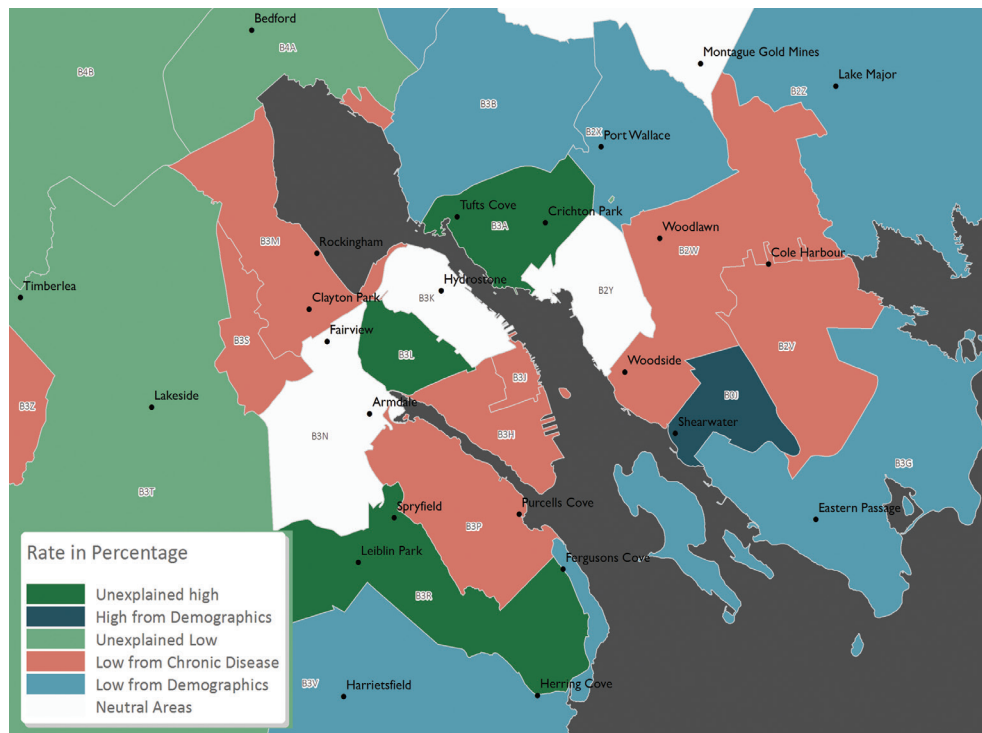

MAP 4F: Rates of high-cost healthcare use compared to provincial average adjusted for demographics and chronic disease. Sydney, 2010-2013   Key Finding #4
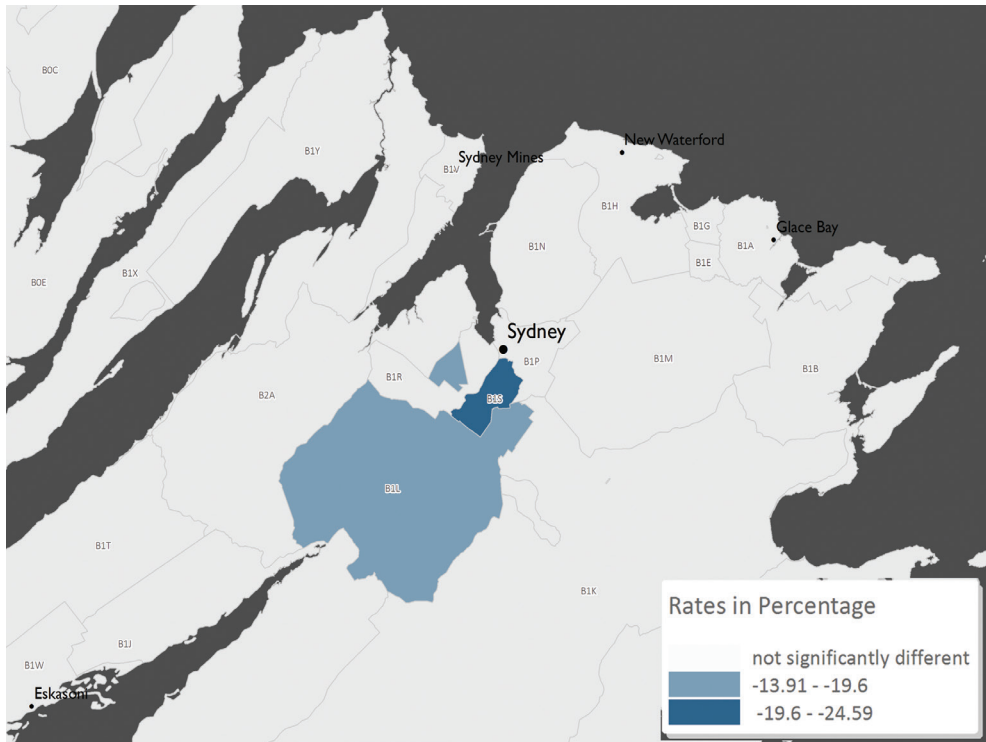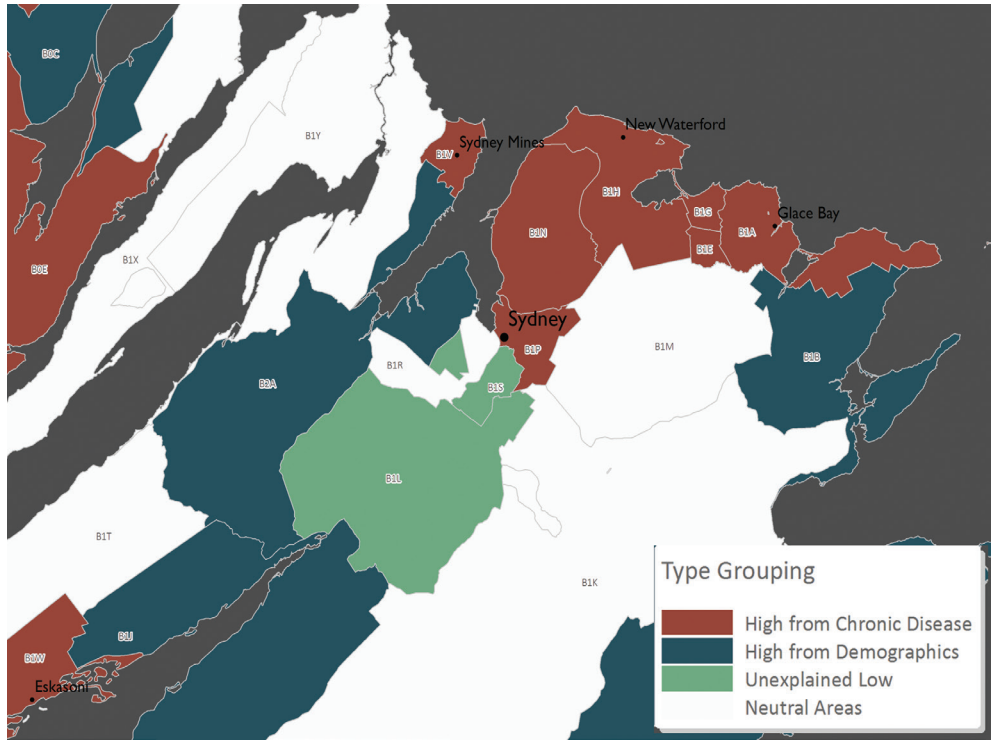
MAP 5A: Types of high-cost areas. Nova Scotia, 2010-2013   Key Finding #5
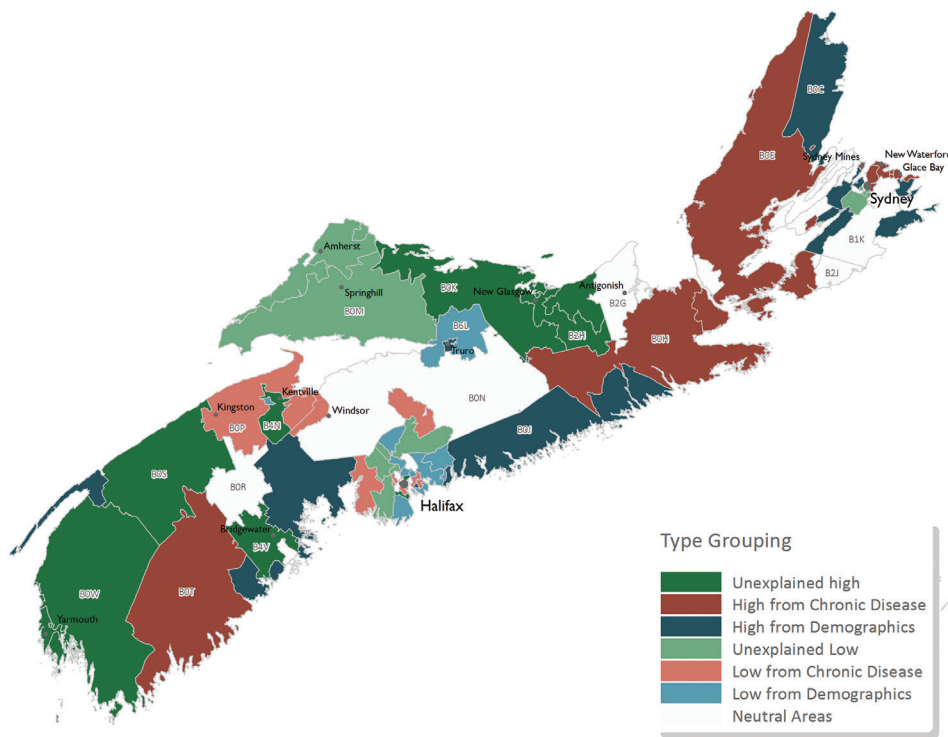
MAP 5B: Types of high-cost areas. Halifax, 2010-2013   Key Finding #5

MAP 5C: Types of high-cost areas. Sydney, 2010-2013   Key Finding #5

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