



MN  **APCD**
All Payer Claims Database

**CHRONIC CONDITIONS IN MINNESOTA:
New Estimates of Prevalence, Cost
and Geographic Variation for Insured
Minnesotans, 2012**

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EXECUTIVE SUMMARY



Executive Summary

Chronic Conditions in Minnesota: New Estimates of Prevalence, Cost and Geographic Variation for Insured Minnesotans, 2012

Chronic diseases are among the main causes of death and disability in the United States, and account for a significant amount of all spending on health care. As the population ages and people live longer, the rate and burden of chronic disease will continue to rise, creating an increase in health care spending. Although Minnesota is viewed as one of the healthiest states in the country, it faces the same challenges as the nation overall: an aging population, the presence of pervasive and modifiable risk factors associated with many chronic diseases, and rising health care spending.

Minnesota also experiences stark inequities in disease prevalence and outcomes among populations; and in the distribution of social determinants of health such as income, education, healthy and safe housing, and communities that promote health and wellness. As a result, people of color and American Indians enjoy fewer opportunities to achieve good health.

This report examines the extent of chronic disease in Minnesota and assesses its impact on health care spending using the Minnesota All Payer Claims Database (MN APCD). The analysis relies on previously unavailable, granular information on diagnoses and health care use for nearly all Minnesotans with health insurance coverage. This additional information facilitates a study of small-area variation in the prevalence of chronic disease overall, and for specific diseases in particular, as well as an analysis of health care spending for people diagnosed with chronic disease. This report includes estimates of overall chronic disease prevalence and spending. In addition, it highlights the burden associated with ten select chronic conditions that account for a substantial portion of all patients with chronic disease.

This report is the first in a potential series of studies that will help provide new and valuable information to assist with 1) prioritizing investments and efficiently allocating scarce public health resources; 2) making strategic investments in prevention and disease management that are effectively targeted; 3) developing policies targeted at making health care spending more sustainable; and 4) assessing the success of initiatives aimed at reducing costs and improving the quality of health care across the state.

This study also represents a key foundational element in the agency's effort to annually estimate progress toward managing prevalence and spending on chronic disease, as required by the 2015 Minnesota Legislature.

Key Findings

- In 2012, 35.4 percent of insured Minnesota residents had at least one diagnosed chronic condition;
- More than half of Minnesota residents with a chronic condition (57.8 percent) had multiple chronic conditions;
- Minnesotans with diagnosed chronic conditions accounted for 83.1 percent of all medical spending in the state in 2012, those who had five or more chronic conditions (5.6 percent of the population) accounted for 36.0 percent of all medical spending;
- Annual per-person medical spending for Minnesotans with one or more chronic condition was, on average, 8 times higher than that of residents with no chronic condition.
- Minnesota residents with just one chronic condition accounted, on average, for \$5,700 in medical spending. Each additional chronic condition increased annual per-person medical spending by \$4,000-\$6,000.
- Residents with one or more of ten select, but common, chronic conditions accounted for 71.0 percent of residents with any chronic condition in Minnesota;
- Even after adjusting for age, sex, length of enrollment, and payer differences across counties, certain counties exhibited higher prevalence rates of specific chronic conditions;
- The variation across counties in the prevalence of specific chronic conditions was greater than the variation in spending for those conditions.

In potential future analyses, the Minnesota Department of Health (MDH) will aim to use socio-demographic characteristics from secondary data to assess the relationship

between health inequities and disease prevalence, and examine the burden of other complex conditions and groups of diseases, including cancer and dementia.

Chronic diseases are among the main causes of death and disability in the United States, and account for a significant amount of all spending on health care.

Conclusion

Chronic diseases affect the lives of many Minnesotans who, because of these conditions, experience lower quality of life and higher health care expenditures than would otherwise be the case. Because of the volume of spending, and the near certainty that these costs will continue to rise as the population ages, chronic diseases also constrain policy priorities in other areas.

Compromised health, including the potential to develop a chronic disease, is heavily influenced by factors outside of the health care delivery system, including economic and social opportunities, biological and genetic factors, environmental and social stressors, behavioral choices, and the physical environment. Because of this, strategies to combat the rise and burden of chronic diseases need to be placed both inside and outside of the health care delivery system and include a focus on advancing health equity and addressing the fact that populations of color and American Indians enjoy fewer opportunities to be healthy. These strategies include 1) focusing on primary and secondary prevention, including community-based efforts to impact policies, systems, and environments; 2) strengthening delivery of primary care with appropriate chronic disease care management and coordination between providers and across all settings of support services; 3) empowering patients across the spectrum of health and health care; and 4) enhancing incentives to deliver efficient and high quality care to all patients.

Minnesota already has initiatives in most of these areas and a framework that establishes goals to modify appropriate risk factors by 2020. Analyses extending the new Minnesota-specific information presented in this report, using the rich information of the Minnesota-grown All Payer Claims Database (MN APCD), can help identify additional opportunities to “bend the prevalence and cost curve” and assess whether existing initiatives are successful.

CHRONIC CONDITIONS IN MINNESOTA: New Estimates of Prevalence, Cost and Geographic Variation for Insured Minnesotans, 2012

Introduction

Chronic diseases are ongoing illnesses or conditions that often need to be managed through medical treatment and/or medication therapy.¹ Examples include heart disease, asthma, cancers, and diabetes. Some chronic diseases are preventable or their progression can be delayed through early identification, lifestyle changes such as improved diet and exercise, and clinical treatment.

Because of their impact on a patient's quality of life and on health care spending, as well as demographics that are likely to increase the number of people who are living with a chronic disease, the Centers for Disease Control and Prevention (CDC) have declared chronic disease as the public health challenge of the 21st century.² Chronic diseases hold additional importance for Minnesota. Because of significant inequities and disparate opportunities for health for people of color and American Indians, chronic diseases, their causes and the consequences of living with them, are not equally distributed among Minnesota's population.³

In aggregate, chronic conditions are the nation's leading causes of death and disability.⁴ Nationwide, almost half of U.S. adults have at least one chronic condition. Because the incidence of chronic disease increases with age, the number of people who develop and live with chronic disease will increase as the population ages and people live longer. Both the volume and cost of treating patients with chronic disease over time makes chronic disease a major driver of health care spending. National data show that people with one or

more chronic condition accounted for more than 80 percent of all health care spending in 2010.⁵

The availability of the Minnesota All Payer Claims Database (MN APCD) provides a unique opportunity to examine the reach of chronic disease in Minnesota more carefully, and assess its impact across the state, by studying actual health care use and associated cost by Minnesota residents with a diagnosis of one or many chronic conditions. This will provide valuable information to help with 1) efficiently allocating scarce public health resources; 2) making strategic investments in prevention and disease management; 3) developing policies that help achieve sustainable growth in health care spending; and 4) assessing the success of initiatives aimed at reducing costs and improving the quality of health care care across the state.

This report presents estimates of prevalence and health care spending for Minnesotans with insurance coverage who have diagnosed chronic conditions. Although a subset of the total population, the insured represent the vast majority of Minnesota residents and likely account for a disproportionate share of people with chronic disease. Using data from across the spectrum of care and payers of health care services, this report represents an important step forward in analyzing the burden of chronic disease and its distribution across the state. The analysis also forms the starting point for work required by the 2015 Legislature to annually estimate the cost of health spending for *specific* chronic diseases and risk factors to assess the potential impact of public health efforts on the burden of disease.⁶

¹ The terms *chronic disease* and *chronic conditions* will be used interchangeably in this report.

² Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. The Power of Prevention. Chronic disease...the public health challenge of the 21st century, 2009.

³ Minnesota Department of Health, "Healthy Minnesota 2020: Chronic Disease & Injury" September 2012.

⁴ Office of Vital Statistics. Deaths: Leading Causes for 2010. National Vital Statistics Reports, 62:6, 2-97, 2013.

⁵ Anderson G., Chronic care: making the case for ongoing care. Robert Wood Johnson Foundation, Princeton (NJ), 2010.

⁶ Minnesota Statutes, Chapter 62U.10, Subd. 6.

Data and Methods Used in the Analysis

The Minnesota Department of Health (MDH) conducted this study using data from the Minnesota All Payer Claims Database (MN APCD), a large repository of health insurance claims, enrollment information, and costs for services provided to Minnesota residents.⁷ Both private and public insurers of Minnesota residents submit information on medical transactions for individuals with insurance coverage. Although the data allow us to assess care delivered to patients over time and across the spectrum of the health care system (including providers, settings, and payers), it is de-identified, meaning that personal identifying information is removed from the data. The MN APCD currently contains data from 2009-2015.

This analysis uses data from 2012 in order to establish a baseline against which future analyses can be compared. Because the MN APCD captures nearly all medical transactions for Minnesota residents, including both adults and children, it is well-representative of the state overall, and of smaller geographic areas. County-level estimates are based on the ZIP Code of each patient's residence.

By design, some medical transactions are not included in the MN APCD. This is either because state law does not authorize their collection, or because MDH tried to balance reporting burden with completeness of data when it developed the MN APCD. The following categories of data are not captured in this analysis of chronic conditions:

- Care provided to non-Minnesota residents, or paid for by the Indian Health Service, Veterans Affairs, Workers' Compensation, Tricare, or the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS);⁸
- Care provided to the uninsured – such claims are typically not presented to payers of health care costs who are data submitters to the MN APCD;
- Medicare services for the fee-for-services population with substance abuse conditions - the federal government currently withholds such claims from submission;
- Care paid for by health plans that have a small footprint in the state, with annual medical claims less than \$3 million or pharmacy claims less than \$300,000.

The estimates in this report may be conservative because in order to be identified with a chronic disease, a patient must have sought care, had at least two diagnoses for the same disease recorded, and have had the claim considered valid by an insurance company. While these exclusions do not meaningfully bias the analysis of the reach of chronic conditions – many of these limitations are associated with other research on chronic conditions as well – the estimate in this report would likely be somewhat greater if

data for all Minnesotans were available. For some populations, such as Veterans and American Indians, this may be of greater concern because of their higher risk for certain chronic diseases.^{9,10}

The analysis for this study was limited to residents with at least three months of documented enrollment in both health care and pharmacy insurance in 2012.¹¹ The three month minimum enrollment reflects a balance between the goal of capturing as many Minnesota residents as possible and evidence that this length of coverage creates stable estimates.¹² The final number of unique residents in this study was 4.5 million, representing approximately 84.2 percent of Minnesota's total population in 2012, and 93.5 percent of all insured residents.^{13,14}

Two approaches were used to identify the presence of chronic disease, both relying on software developed at the Johns Hopkins Bloomberg School of Public Health:¹⁵

- To identify the presence of any chronic condition, patients needed to have two or more diagnoses for at least one of the conditions listed in Appendix A.
- To identify the ten select chronic conditions that we examined more closely, patients generally needed to have two or more diagnoses or use medication that treats the condition.¹⁶

To enable the comparison of county-level prevalence and spending to statewide averages, we used indirect standardization to adjust for differences in age, sex, length of enrollment, payer mix (private, Medicaid, Medicare), as well as the degree to which residents were eligible for both Medicaid and Medicare (dual eligible).¹⁷ Because these factors are associated with a higher likelihood of chronic disease, differences between unadjusted estimates could simply be the result of differences in age and other demographic factors between counties. (Actual rates and spending at the county level are located in supplemental information to this report and available online at www.health.state.mn.us/healthreform/allpayer/publications.html.)

Estimates of health care spending reflect the cost of medical care services for a calendar year for patients with chronic diseases. This means that direct costs for services outside of medical care are not captured, nor are indirect economic costs considered such as costs associated with disability or absentia. Included in the estimates are both patient and insurer payments on medical claims, as well as pharmacy spending. Patient paid amounts included deductibles and copays. The estimates of spending for specific conditions, such as diabetes, averages all health care spending for patients with the condition, irrespective of the presence of other conditions. These estimates are averaged across patients living in a given county. To limit the effect of extreme values, we capped or truncated individual spending at \$100,000 when estimating average costs.

⁷ Additional information about the MN APCD is available online at www.health.state.mn.us/healthreform/allpayer/.

⁸ Individuals with multiple sources of insurance coverage, for instance, employer-based coverage in addition to coverage for certain services through the U.S. Department of Veterans Affairs, are most likely represented in the data.

⁹ Indian Health Service. Trends in Indian Health, 2014 Edition. Rockville, Maryland: U.S. Department of Health and Human Services, 2014.

¹⁰ Kramarow, EA, Pastor, PN. The health of male veterans and nonveterans aged 25-64: United State, 2007-2010, NCHS Data Brief, No. 101, 2012.

¹¹ Given that the data in the MN APCD are de-identified, it is possible that some patients are reflected more than once in the data due to a name change, typographical errors, transpositions, or the use of middle names. In the process of data aggregation various techniques are used to limit this occurrence.

¹² Chapter 3: Performance Assessment (2011). The Johns Hopkins ACG® System, Applications Guide, Version 10.0.

¹³ U.S. Census Bureau, Population Division. Annual estimates of the resident population: April 1, 2010 to July 1, 2013.

¹⁴ U.S. Census Bureau, Small Area Health Insurance Estimates (SAHIE): 2012 Highlights, U.S Government Printing Office, Washington, DC, 2014.

¹⁵ The analysis used version 10.0 of Johns Hopkins ACG® System with stringent selection criteria that err on the side of under-identifying chronic diseases. To more accurately identify patients with rheumatoid arthritis, we used version 11 of the ACG System.

¹⁶ The second approach raises estimates of prevalence by about three percentage points. Additional detail on selection criteria are available in the technical supplement to this report.

¹⁷ For the remainder of this report, data on Medicaid enrollees include residents eligible for Minnesota public health programs broadly, including MinnesotaCare.

Overview of Chronic Disease in Minnesota

Figure 1 shows that in 2012 more than one in three insured Minnesota residents, or approximately 1.6 million people, had diagnoses indicating the presence of a chronic disease. The rate was 41 percent for Minnesotans ages 18 years or older. Comparable national data does not exist, primarily because comprehensive data systems like the MN APCD are not available at a national level. However, comparing estimates from survey data and simulations for Minnesota and the U.S. shows prevalence rates for all conditions in Minnesota to be lower than the nation.¹⁸

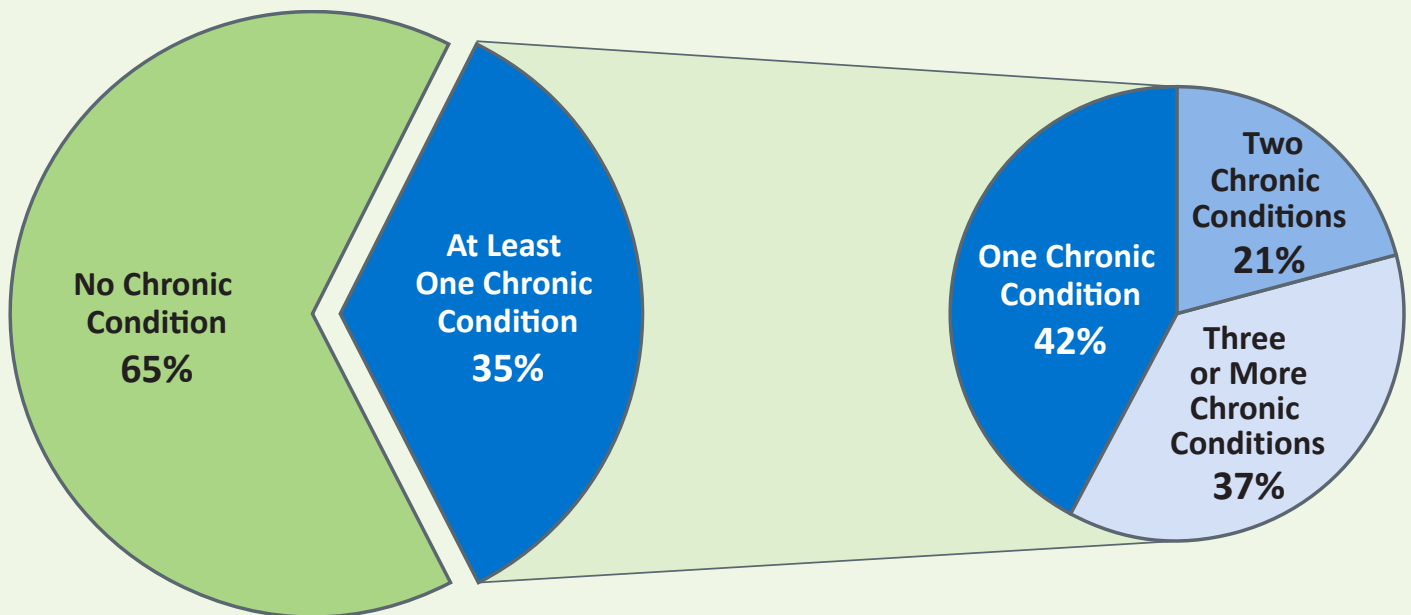
More than half of insured Minnesota residents with a chronic disease (57.8 percent) had more than one chronic condition and over one-third, or nearly 600,000 Minnesotans, had three or more chronic conditions (see Figure 1). The rates were higher for adults: 61.6 percent had more than one chronic condition, and 40.8 percent were diagnosed with three or more chronic conditions. People with multiple

chronic conditions are at higher risk of mortality and are more likely to use the emergency room and inpatient services than those with a single condition. Research also shows that people with multiple chronic conditions are more likely to be at greater risk for poor daily functioning.¹⁹

Prevalence of Chronic Disease by Patient Demographics

As shown in Figure 2, the prevalence of diagnosed chronic disease increases with age. Nearly three-quarters (72.0 percent) of Minnesota's population over the age of 64 had a chronic disease in 2012. In contrast, the prevalence of chronic disease for children under 18 years of age was just 18.3 percent. Although children exhibited lower prevalence than adults, this still translates into approximately 200,000 Minnesota children having a diagnosis for a chronic disease in 2012. As we show elsewhere in this report, nearly two-thirds of these children (65.8 percent) had asthma.

FIGURE 1: Percent of MN Residents with One or More Chronic Conditions (2012)



SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

¹⁸ The Centers for Disease Prevention and Control monitors rates of prevalence at the state level for the following conditions: arthritis, asthma, high cholesterol, high blood pressure, chronic kidney disease, COPD, and diabetes, among others. Centers for Disease Control and Prevention. Chronic Disease Indicators. http://nccd.cdc.gov/CDI/rdPage.aspx?rdReport=DPH_CDI.ComparisonReport. November, 2014.

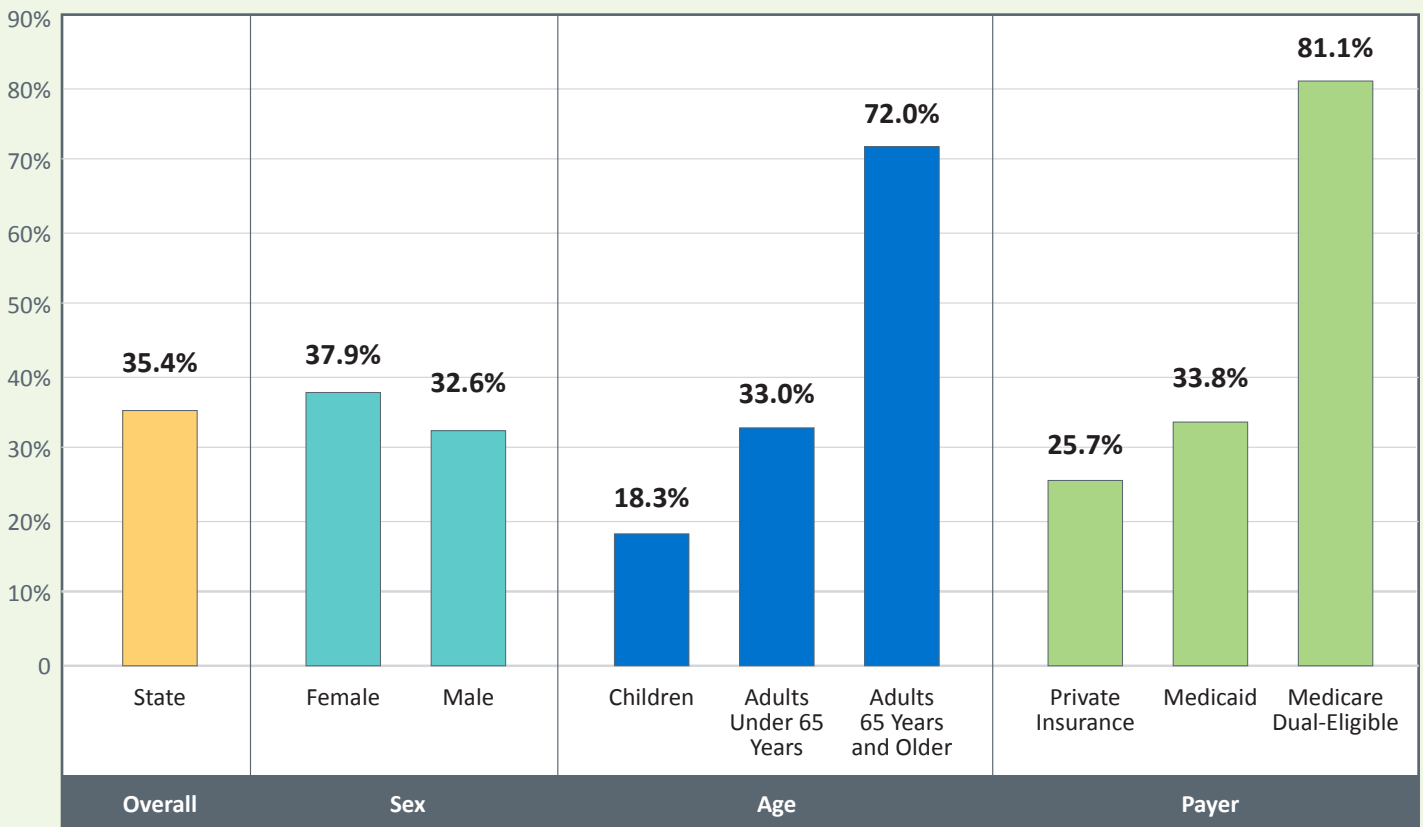
¹⁹ Gerteis J, Izrael D, Deitz D, LeRoy L, Ricciardi R, Miller T, Basu J. Multiple chronic conditions chartbook. AHRQ Publications No. Q14-0038. Rockville, MD: Agency for Healthcare Research and Quality. April 2014.

Females in Minnesota had slightly higher rates of diagnosed chronic disease (37.9 percent) than males (32.6 percent). Individuals who were covered by both Medicare and Medicaid, also known as “dually eligible,” had the highest prevalence of chronic disease. These high rates derive in part from eligibility criteria for the program, which is designed for beneficiaries who often have complex and costly health care needs.²⁰ Privately insured Minnesotans, who comprised about 60.9 percent of the population in 2012, exhibited some of the lowest rates of chronic disease prevalence (25.7 percent).²¹

County-Level Prevalence

Although we know much about chronic disease through prior work by chronic disease experts within MDH, their partners in the community, and efforts by the U.S. Centers for Disease Control and Prevention (CDC), direct granular estimates of the prevalence of diagnosed chronic disease at the county level have not existed until this research. Generally, available data have been derived from population surveys or through simulation analysis from national findings. The data presented here can help provide improved insight into the burden of chronic conditions at a local level, which has significant implications for the development and evaluation of local public health initiatives and for allocation of resources.

FIGURE 2: Percent of MN Residents with at Least One Chronic Condition, by Demographic Category (2012)



Difference in estimates within categories are statistically significant at the .05 level. Medicaid includes MinnesotaCare enrollees.
 SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

²⁰ Department of Health & Human Services, Centers for Medicare & Medicaid Services, Medicare Learning Network, Dual eligible beneficiaries under the Medicare and Medicaid programs. ICN 006977. November 2014.
²¹ This counts enrollees in the state high risk pool as privately insured individuals. See Minnesota Department of Health, Health Economics Program, “Minnesota Health Care Spending and Projections, 2012.” June 2014.

Map 1 shows that after adjusting for differences in age, sex, length of enrollment, and payer mix, the county-level prevalence of chronic disease among the insured population in Minnesota ranged from 29.7 percent (Roseau) to 39.3 percent (Pennington).²² While adjusting for demographic factors reduced the variation in estimates of county prevalence, other factors not considered in this initial analysis may account for some of the remaining variation among counties, including:

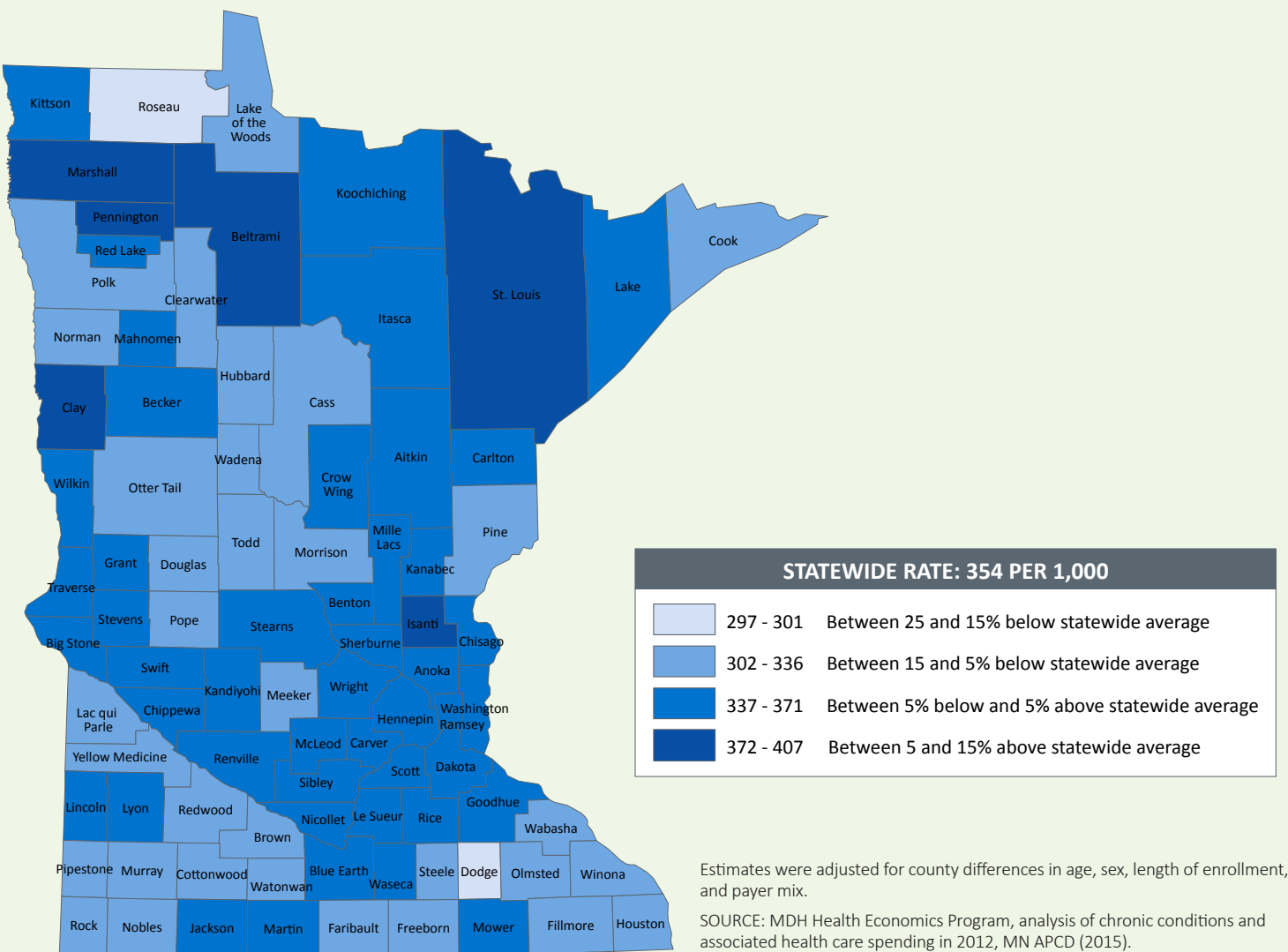
- Race, ethnicity, country of origin and primary language, which are not collected as part of the MN APCD. These and certain other socio-economic differences are

therefore not reflected in the standard adjustments;

- Differences in lifestyle and behavior, regardless of their cause;
- Variation in access to medical and social support services; and
- Practice pattern variations.

Counties with the highest rate of prevalence, with few exceptions, tended to be in northern Minnesota. Counties with the lowest prevalence were on opposite ends of the state in north central and southwest Minnesota.

MAP 1: Adjusted Prevalence of Chronic Conditions per 1,000 MN Residents by County (2012)



²² Rates and standard errors are provided in a technical supplement that is available online at www.health.state.mn.us/health/economics and www.health.state.mn.us/healthreform/allpayer.

Specific Chronic Conditions

For this section we examine the prevalence of a subset of conditions that represents some of the most prevalent chronic conditions in Minnesota. In addition to their prevalence, these ten conditions were selected because they account for a large share of spending and are viewed as actionable – meaning there is evidence that they can be managed through ongoing medication therapy and care coordination.²³ Definitions of these conditions are available in Appendix B.

Although these ten conditions do not necessarily comprise the ten *most* prevalent conditions, 71.0 percent of patients with a chronic condition in 2012 were diagnosed with one or more of these conditions. Some other highly prevalent chronic conditions, such as osteoarthritis and cancers, are not specifically highlighted in the analysis of this section for a variety of reasons:

- Because of their different etiology, or origin, various types of cancers were not considered as a single group. Had they been aggregated as a group, cancers would have represented the 7th most frequent chronic disease in Minnesota.

- Osteoarthritis was not identified as a specific chronic condition, primarily because it cannot be identified with great accuracy through health care claims data. That said, osteoarthritis is the most prevalent form of arthritis and one of the most common chronic conditions overall.²⁴
- As emerging conditions, dementia and Alzheimer’s disease can evade definitive and consistent diagnosis without extensive tests. As a result, these conditions are likely somewhat under-diagnosed and not necessarily consistently identified in medical claims data.

There are a few instances where the data presented in this section differ from published estimates, including by MDH. This reflects the difference between self-reported survey data, the most common source of data, and reporting on the basis of diagnostic information on medical claims, as done in this study. As noted, both study approaches have pros and cons; a strong point in favor of research through the MN APCD is that identifying patients with conditions eliminates error associated with patients’ inability to recall the information received from medical providers in the past.

As shown in Table 1, more than 1.6 million Minnesotans were affected by one or more of the ten select conditions.

TABLE 1: Statewide Prevalence of Ten Select Chronic Conditions in Minnesota (2012)

CHRONIC CONDITION	RATE PER 1,000 MINNESOTANS	NUMBER OF MINNESOTANS AFFECTED
High Blood Pressure	208.2	943,218
High Cholesterol	153.4	695,093
Asthma	112.1	508,031
Diabetes	63.5	287,918
Depression	57.9	262,210
Congestive Heart Failure	23.2	105,044
Ischemic Heart Disease	21.4	96,920
Chronic Kidney Disease	13.0	58,936
COPD	12.0	54,259
Rheumatoid Arthritis*	11.7	52,954
Any condition	359.2	1,627,528

COPD is Chronic Obstructive Pulmonary Disease.

Patients with multiple conditions appear in all of their respective chronic condition categories.

* Estimates for rheumatoid arthritis are derived from Version 11 of the Johns Hopkins AEG System because the prior version over-identified people with this disease.

SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015).

²³ As noted earlier, this analysis identifies the presence of a specific chronic condition and relies on both medical and pharmaceutical claims, while the broader analysis only considers medical claims. When aggregated, this increases the estimate of people affected by chronic conditions by about three percentage points.

²⁴ Arthritis Foundation National Office. www.arthritis.org/about-arthritis/types/osteoarthritis/.

The rate at which Minnesotans were affected by specific chronic conditions in 2012 ranged from 11.7 to 208 per 1,000 individuals for rheumatoid arthritis to high blood pressure, respectively.

The rate of chronic disease differed by age and sex for the state overall, as shown in Table 2. Some of the primary findings include:

- Females had higher rates of high blood pressure, asthma, and rheumatoid arthritis than males.
- Females had diagnosed depression at nearly twice the rate of men (75 per 1,000 versus 39 per 1,000 respectively).
- Males had higher rates of high cholesterol and diabetes than females.
- Males had nearly twice the rate of ischemic heart disease compared to females (28 per 1,000 versus 15 per 1,000, respectively).

It is worth noting that some of these differences may reflect gender differences in how care is sought or whether certain diagnostic tests are ordered.

Except for depression, people 65 years or older exhibited the highest rates of prevalence for the ten select chronic conditions of this section. They had almost four times the rate of high blood pressure and high cholesterol than adults under age 65. They also had eight times the rate of congestive heart failure, nine times the rate of COPD, 11 times the rate of ischemic heart disease, and 12 times the rate of chronic kidney disease (also referred to as chronic renal failure).

Although the rates of most chronic diseases increased with age, this was not true for asthma or depression. Children had higher rates of asthma than adults under age 65 (121.9 per 1,000 versus 99.4 per 1,000, respectively). Adults under age 65 had higher rates of depression compared to adults age 65 or older (71.9 versus 67.8 per 1,000, respectively). High blood pressure was the most prevalent chronic condition for adults under age 65 (170.9 out of 1,000).

TABLE 2: Prevalence of Ten Select Chronic Conditions, by Sex and Age (2012)

CONDITION	RATE PER 1,000 MINNESOTANS				
	FEMALES	MALES	CHILDREN	ADULTS UNDER 65 YRS	ADULTS 65 YRS AND OLDER
High Blood Pressure	214.3	201.6	16.8	170.9	666.5
High Cholesterol	147.0	160.3	< 1	126.8	507.0
Asthma	124.1	99.2	121.9	99.4	145.9
Diabetes	62.1	65.1	3.5	54.8	195.8
Depression	74.9	39.5	18.5	71.9	67.8
Congestive Heart Failure	25.3	20.9	< 1	12.6	101.5
Ischemic Heart Disease	14.9	28.4	< 1	9.6	102.4
Chronic Kidney Disease	12.9	13.1	< 1	5.3	64.1
COPD	12.6	11.3	< 1	6.1	54.1
Rheumatoid Arthritis	15.1	8.0	1.2	12.3	26.5
Any Condition	378.3	338.6	151.7	333.9	797.3

Difference in prevalence estimates within demographic categories (sex, age) are statistically significant at the 0.05 level.

Patients with multiple conditions appear in the respective chronic condition categories.

SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015).

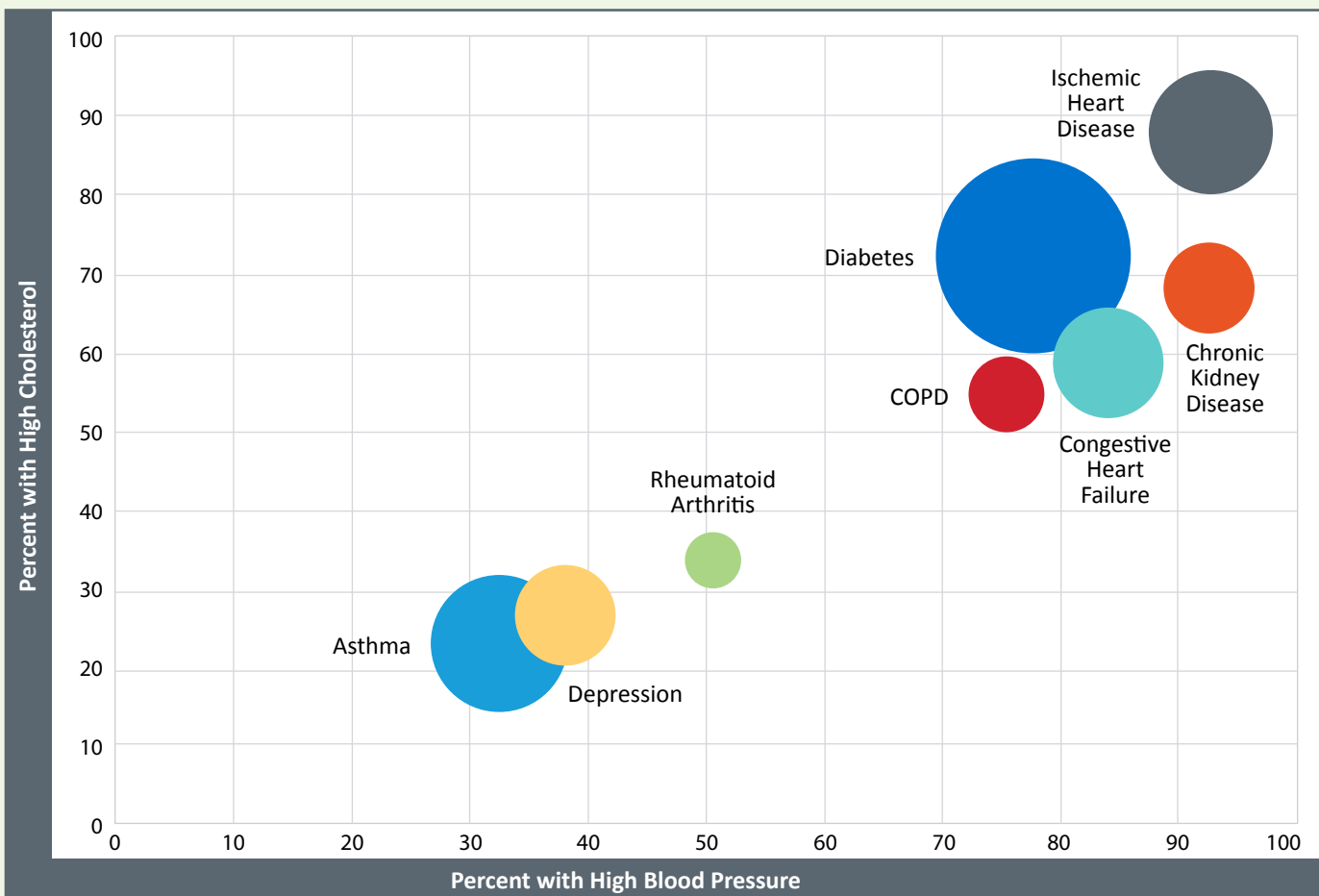
Multi-Morbid (Co-Occurring) Chronic Conditions

As indicated earlier, 58 percent of people in Minnesota with a chronic condition were diagnosed with more than one such condition, placing them at greater risk for high health care use and poor functioning. National research and analysis for this report indicates that high blood pressure and high cholesterol are the most common conditions to co-occur with other conditions, regardless of age or sex.²⁵

Figure 3 shows the percentage of Minnesotans with one of the ten select chronic conditions who also had high blood pressure or high cholesterol. As shown, more than half of

people with COPD, congestive heart failure, chronic kidney disease, diabetes, and ischemic heart disease (IHD) also had a diagnosis of high cholesterol (54.2 percent, 58.7 percent, 68.0 percent, 71.9 percent, and 87.5 percent, respectively). More than 70 percent of these patients also had diagnosed high blood pressure (75.3 percent, 84.5 percent, 92.7 percent, 77.7 percent, and 92.7 percent, respectively). Minnesotans with asthma, depression, and rheumatoid arthritis had lower rates of co-occurring high blood pressure or high cholesterol. The size of the bubble in Figure 3 reflects the volume of patients with the disease who had both high cholesterol and high blood pressure.

FIGURE 3: Percent of MN Residents with Specific Chronic Conditions Who had Co-occurring High Blood Pressure or High Cholesterol (2012)



Fifty-three percent (53%) of residents with high blood pressure had high cholesterol; seventy-two percent (72%) of residents with high cholesterol had high blood pressure. SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015).

²⁵ Machlin, SR, Soni A. Health care expenditures for adults with multiple treated chronic conditions: estimates from the medical expenditure panel survey, 2009. *Prev Chronic Dis* 2013; 10:120172. DOI: <http://dx.doi.org/10.5888/pcd10.120172>.

Prevalence of Specific Conditions by County

The box plots in Figures 4a, 4b, 4c, and 4d, and the maps in Appendix C, show the distribution of prevalence rates by county for ten select chronic conditions in Minnesota. We divided conditions by high, medium high, medium low, and low prevalence to capture similar scales in the range of variation. In the box plots, the median rate for each condition across Minnesota counties is represented as the middle line of the box, with half the counties having rates less than and half having rates greater than this median. The left and right ends of the box represent the 25th and 75th percentile, respectively. The ends of the “whisker” represent rates for the counties with the lowest and highest prevalence for each condition.

Figures 4a, 4b, 4c, and 4d illustrate that the prevalence of chronic disease differed by geography, even after accounting for certain factors that contributed to a greater likelihood of the presence of chronic disease.

Cook County in northeastern Minnesota, for instance, showed lower rates compared to the statewide average for seven of the ten chronic conditions. Although we did not study the underlying factors systematically in this report, there may be a number of reasons driving the rates for Cook County. One contributing factor could be that the MN APCD does not

include health care use data from Indian Health Services (IHS). American Indians comprise approximately nine percent of Cook County’s population. To the extent that a share of this population exclusively obtains care primarily from IHS service providers, estimates of prevalence for Cook County and other counties where American Indians represent a sizable share of the population could be artificially low.²⁶ On the other hand, Mahnommen County, a county with a high share of American Indian population, had the highest rates for two of the conditions (diabetes and COPD).

Pennington County in northwestern Minnesota exhibited the highest rates of high blood pressure and high cholesterol, and Stevens County in west central Minnesota had the highest rates of asthma and congestive heart failure compared to the state average.²⁷

Maps in Appendix C further visually demonstrate the regional patterns of disease-specific rates throughout the state. Generally, the northwestern part of the state had higher rates of a number of conditions, including high blood pressure, rheumatoid arthritis, congestive heart failure, ischemic heart disease, and COPD. Congestive heart failure rates were generally higher along the western border of Minnesota and adjacent counties compared with the rest of the state; rheumatoid arthritis rates were higher in the northern half of the state compared with the southern half.



²⁶ Other Minnesota counties where the American Indian population accounts for a larger share of the population include: Clearwater (9.3 percent); Cass (11.9 percent); Beltrami (20.8 percent); and Mahnommen (41.3 percent). Source: U.S. Census Bureau, 2013 population estimates.

²⁷ Rates for individual counties with statistical information to make comparisons to the state average and other counties are available in a technical appendix online at www.health.state.mn.us/health/economics and www.health.state.mn.us/healthreform/allpayer.

FIGURES 4a, 4b, 4c, and 4d: Adjusted Rates per 1,000 MN Residents for High, Medium High, Medium Low, and Low Prevalence Chronic Conditions, by County (2012)



Estimates were adjusted for county differences in age, sex, length of enrollment and payer mix.

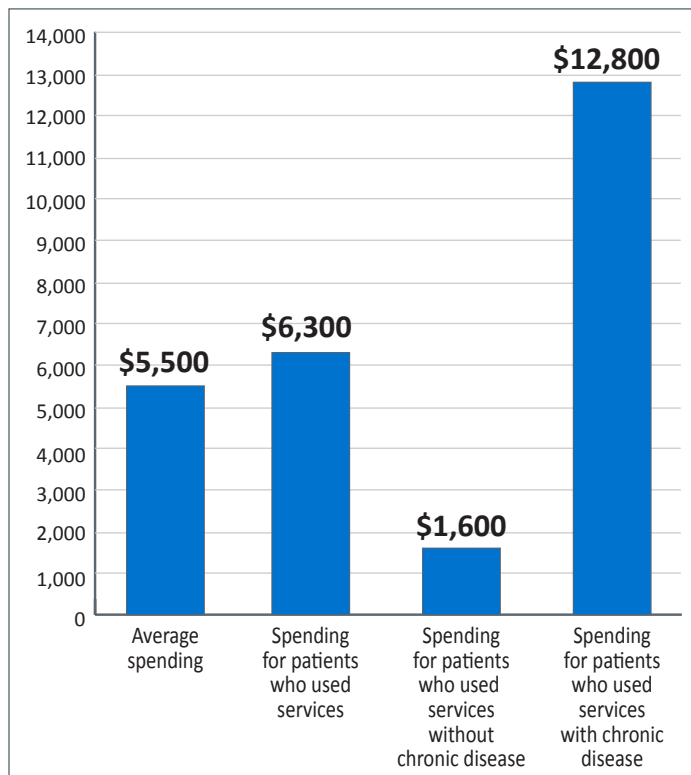
SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

Spending for Health Care Services in Minnesota

On average, annual per-person spending for health care services and prescription drugs for Minnesota residents in 2012 was \$5,500.^{28,29} When the roughly 12 percent of health plan enrollees who did not use health services in 2012 were excluded from the analysis, average per-person health care spending increased to \$6,300.

As shown in Figure 5, chronic conditions contributed significantly to health care spending. Annual health care spending for residents who used services and had no chronic condition was approximately \$1,600 in 2012. Residents who had at least one chronic condition accounted, on average, for \$12,800 in health care spending.

FIGURE 5: Average Per-Person Spending by Level of Health Care Use (2012)



SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)



Minnesotans with **diagnosed chronic conditions** accounted for **83%** of all medical spending in the state in 2012.

Those who had **five or more chronic conditions** accounted for **36%** of all medical spending.

Includes spending for prescription drugs.

Spending for Multiple Chronic Conditions

Not surprisingly, health care spending increases with the number of chronic conditions present. Figure 6 shows that in 2012 each additional chronic condition added, on average, \$4,000 to \$6,000 to annual per-person health care spending. This approximately proportionate relationship of chronic conditions and average annual health care spending explains, to a significant extent, the concentration of health care spending in the state and nation.³⁰

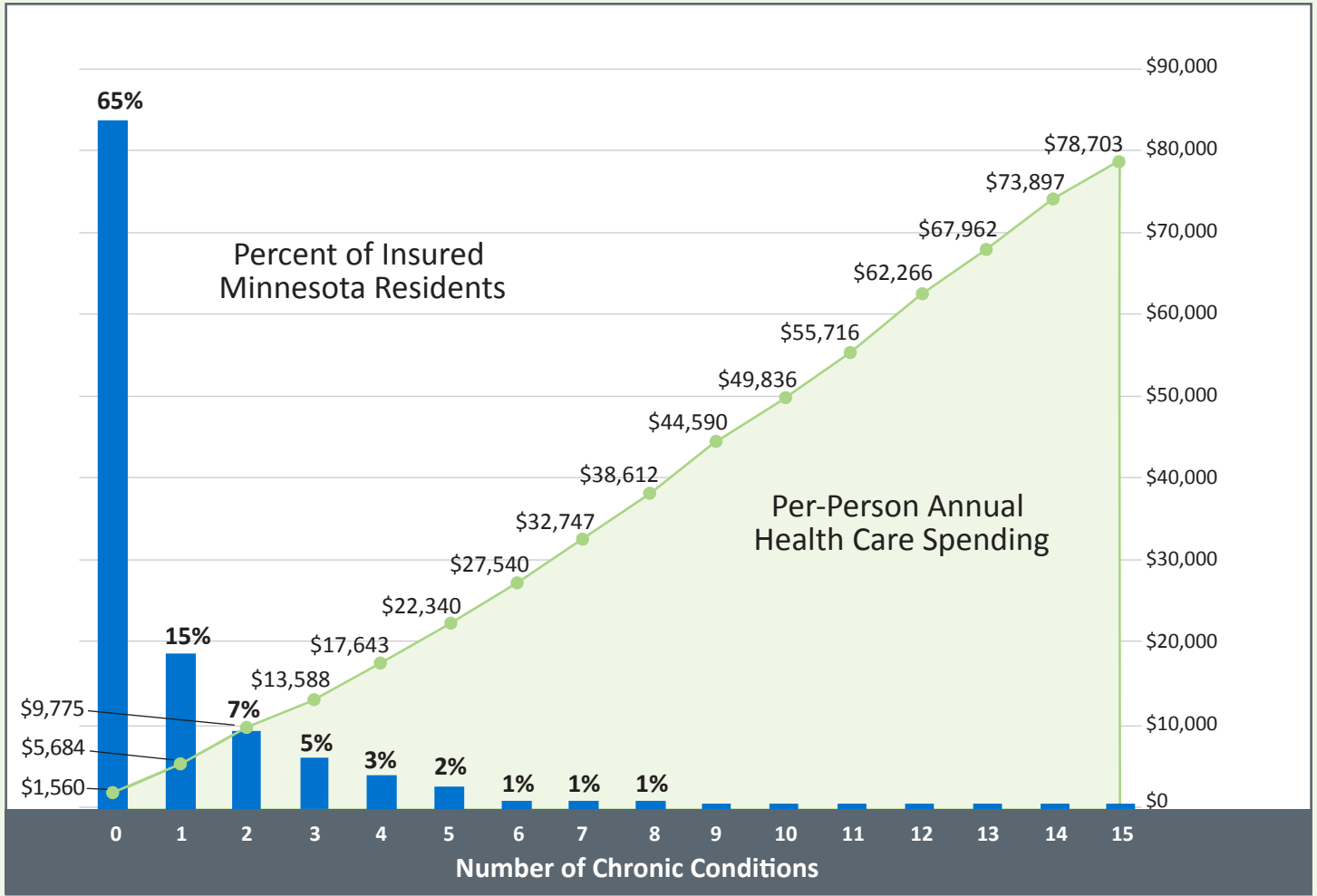
People with at least one chronic condition (about 35.4 percent of Minnesotans) accounted for the vast majority (83.1 percent) of medical spending in 2012. Those who had five chronic conditions or more (5.6 percent of the population) accounted for 36.0 percent of all medical spending in Minnesota in 2012 (not shown).

²⁸ High outlier spending was capped at \$100,000 to avoid averages being driven by few extreme cases. These outliers are included in the calculation of total spending.

²⁹ MDH also produces annual estimates of total spending on health care, including public health spending, spending by automobile insurance and worker's compensation, as well as spending by certain federal payers not considered in this analysis. These broader estimates of health care spending are available online at www.health.state.mn.us/health/economics. Per-person spending for Minnesota residents in 2012 amounted to approximately \$7,400.

³⁰ An unpublished analysis shows that spending for the five percent of Minnesotans with the greatest spending accounts for nearly half of all medical care spending in the state. MDH Health Economics Program, Concentration of Health Care Spending in Minnesota in 2012, forthcoming.

FIGURE 6: Distribution of MN Residents by Average Annual Health Care Spending and Number of Chronic Conditions (2012)



SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

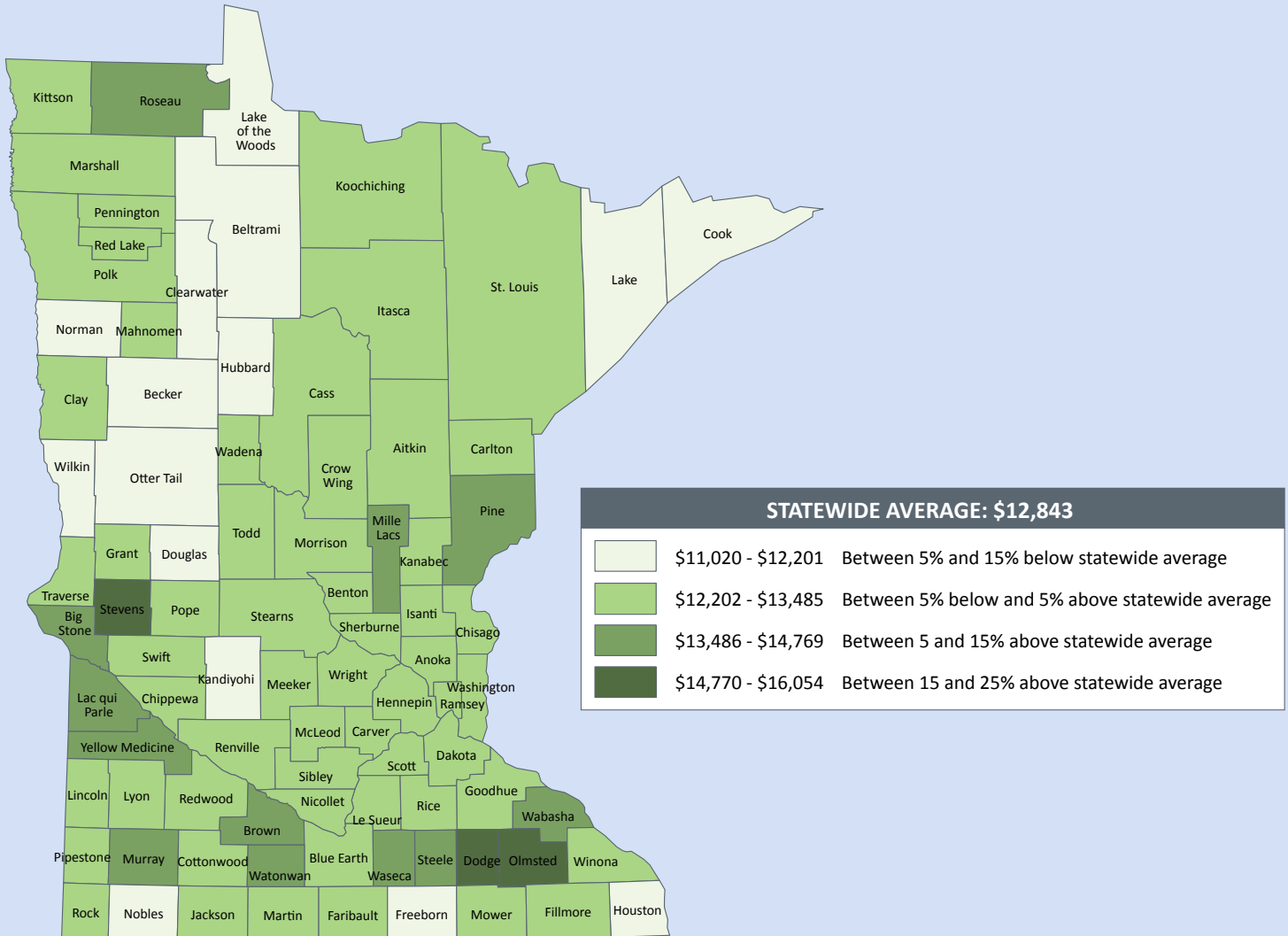


Spending by County for Residents with Any Chronic Condition

Similar to the analysis of prevalence, county-level variation in average annual health care spending for residents with any chronic condition was modest after adjusting for age, sex, length of enrollment, and payer mix. As shown on Map 2, Stevens, Olmsted, and Dodge counties had the highest

adjusted average annual per-person spending for individuals with chronic disease (\$15,310, \$15,100, and \$14,770, respectively). These levels of spending were between 15 and 25 percent above the statewide average. In contrast, 15 counties fell between five and 15 percent below the statewide average, including Cook County, with the lowest adjusted cost at \$11,020.

MAP 2: Adjusted Average Annual Health Care Spending by MN County for Residents with Any Chronic Condition (2012)



SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

Spending for Specific Chronic Conditions

Table 3 displays the per-person and total spending for residents who had any of the ten select chronic conditions studied in this section. Also shown is the estimated share of total health care spending represented by these conditions. Spending for patients with more than one of the ten conditions appears in each of the chronic condition categories present. In other words, the health care spending for patients with diabetes includes medical spending associated with treating present co-morbid conditions, such as high-blood pressure.

Average per-person spending differed by chronic disease, largely as a result of differences in the type of care necessary, the cost of specific therapies and medications, and the duration for which health care services were provided. In general, the per-person costs of treating the most expensive chronic conditions (i.e. COPD, and kidney disease) were:

- 1.7 times higher than treating the conditions of medium-high prevalence (diabetes and depression), and
- 2.4 times higher than treating the high prevalence conditions (high blood pressure, high cholesterol, and asthma).

Total spending was largely driven by the volume of residents affected with each chronic disease. Out of the ten chronic conditions, total spending for residents with high blood pressure, which affected more than an estimated 900,000 residents in 2012, was highest at \$13.4 billion; total spending for residents with rheumatoid arthritis, which affected around 53,000 residents, was lowest at \$1.3 billion. Treating patients with high blood pressure (and any comorbid conditions) accounted for nearly half of all health care spending in 2012.

TABLE 3: Health Care Spending for Residents with Specific Chronic Conditions (2012)

CHRONIC CONDITION	PER-PERSON ANNUAL SPENDING*	TOTAL SPENDING (IN BILLIONS)	PERCENT OF TOTAL SPENDING**
High Blood Pressure	\$12,900	\$13.4	49.3%
High Cholesterol	\$12,600	\$9.5	34.7%
Asthma	\$11,700	\$6.7	24.7%
Depression	\$18,600	\$5.5	20.0%
Diabetes	\$16,300	\$5.2	19.1%
Congestive Heart Failure	\$25,900	\$3.2	11.7%
Ischemic Heart Disease	\$27,200	\$3.0	10.8%
Chronic Kidney Disease	\$34,500	\$2.5	9.1%
COPD	\$31,100	\$1.9	7.1%
Rheumatoid Arthritis	\$21,700	\$1.3	4.8%
Any condition ³¹	\$11,100	\$19.8	72.5%

*rounded to the nearest \$100

**Includes spending for prescription drugs.

SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015).

³¹ This estimate represents the share of total medical spending, including pharmaceutical care, for the ten select chronic conditions in the table.

Spending by Condition for Multiple Morbidities

As shown in Table 4, across all of the ten select chronic conditions, average annual per-person spending was significantly affected by the presence of a co-morbidity. Compared to spending without co-morbidities, spending for conditions with co-morbidities ranged from a two-fold difference for chronic kidney disease (renal failure), to a nine-fold difference for congestive heart failure. The difference may have limited meaning for two reasons: 1) these conditions have a high likelihood for co-morbidity and the absence of another diagnosed condition may be a result of incomplete coding, 2) patients with these conditions who do not have a diagnosed co-morbidity generally represent a small share of people with the condition, ranging from 0.3 percent for ischemic heart disease and kidney disease to 37.0 percent for asthma.

County-Level Spending for Minnesotans with Specific Chronic Conditions

The box plots in Figure 7 and maps in Appendix C show the distribution of spending by county for ten select chronic conditions in Minnesota. In the box plots, the median annual county-level of spending for residents with each condition is represented as the middle line of the box, with average spending of half the counties being below and half above this line. The top and bottom of the box represent the 75th and 25th percentile, respectively. The ends of the “whisker” represent the counties with the highest and lowest spending for each condition, relative to the statewide average.

As shown, the average spending on health care at the county level for residents with congestive heart failure, asthma, depression, high blood pressure, and COPD was within 25

TABLE 4: Average Health Care Spending for Patients with Specific Chronic Diseases with and without Co-morbidities (2012)

CONDITION	RESIDENTS WITH DIAGNOSED CO-MORBIDITIES		RESIDENTS WITHOUT DIAGNOSED CO-MORBIDITIES	
	NUMBER	AVERAGE ANNUAL SPENDING	NUMBER	AVERAGE ANNUAL SPENDING
High Cholesterol	642,463	\$13,406	52,630	\$2,519
High Blood Pressure	835,549	\$14,232	107,699	\$2,660
Asthma	319,907	\$16,855	188,124	\$3,060
Congestive Heart Failure	101,432	\$26,754	3,612	\$3,202
Depression	224,451	\$20,986	37,759	\$4,232
Diabetes	275,605	\$16,779	12,313	\$5,207
Ischemic Heart Disease	96,666	\$27,231	254	\$5,405
COPD	53,878	\$31,282	381	\$7,737
Rheumatoid Arthritis	45,968	\$23,262	6,986	\$11,142
Chronic Kidney Disease	58,772	\$34,501	164	\$17,605

The total number of affected individuals is in Table 1.

SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

percent of the statewide average. The widest variation in county-level health care spending occurred for residents with chronic kidney disease. At approximately \$24,690 per year, residents of Houston County incurred health care spending at 72 percent of the statewide average, whereas at \$50,760 per year, residents of Stevens County incurred spending at 147 percent of the statewide average. Wider county-level variation in spending also occurred for residents with ischemic heart disease, diabetes, rheumatoid arthritis, and high cholesterol.

Figure 7 also shows that there is some sorting between counties. Houston County in southeastern Minnesota had the lowest average spending for high blood pressure, high cholesterol, and chronic kidney disease. In contrast, Stevens County in west central Minnesota had the highest spending

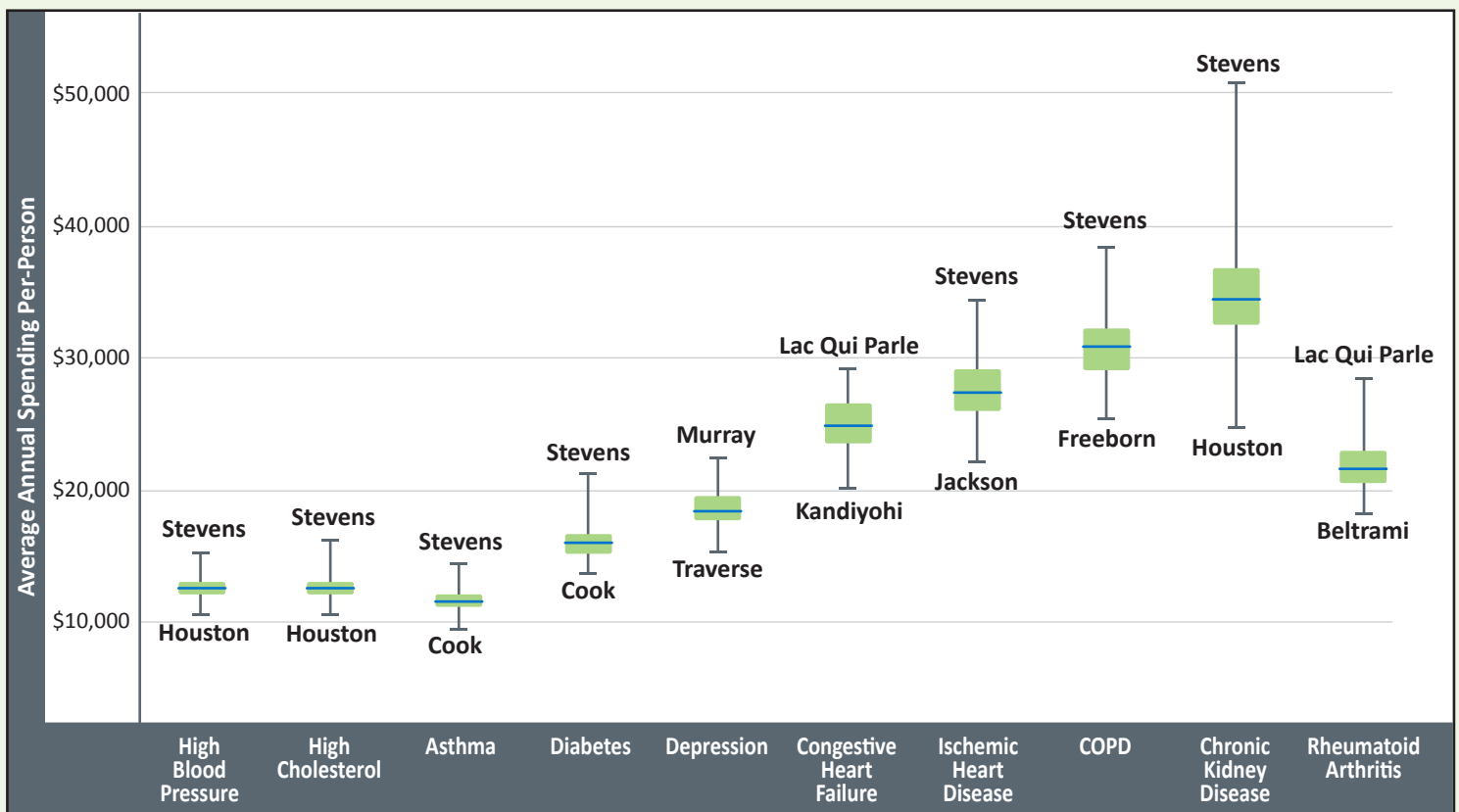
for seven of the ten chronic conditions studied in this report.

The associated maps in Appendix C show few regional patterns of spending throughout the state, except for congestive heart failure. Even though the western part of the state exhibited on average higher prevalence of congestive heart failure, spending per person was higher in the eastern half of the state.

Comparison of County-Level Variation in Chronic Disease Prevalence and Health Care Spending

To assess how much county-level variation there was in 2012 in the rate of prevalence and average spending for chronic conditions, we calculated standardized ratios for both metrics. The standardized ratios are county-level rates or averages, divided by statewide rates or averages. The values

FIGURE 7: Adjusted Annual Health Care Spending for MN Residents with Specific Chronic Conditions, by County (2012)



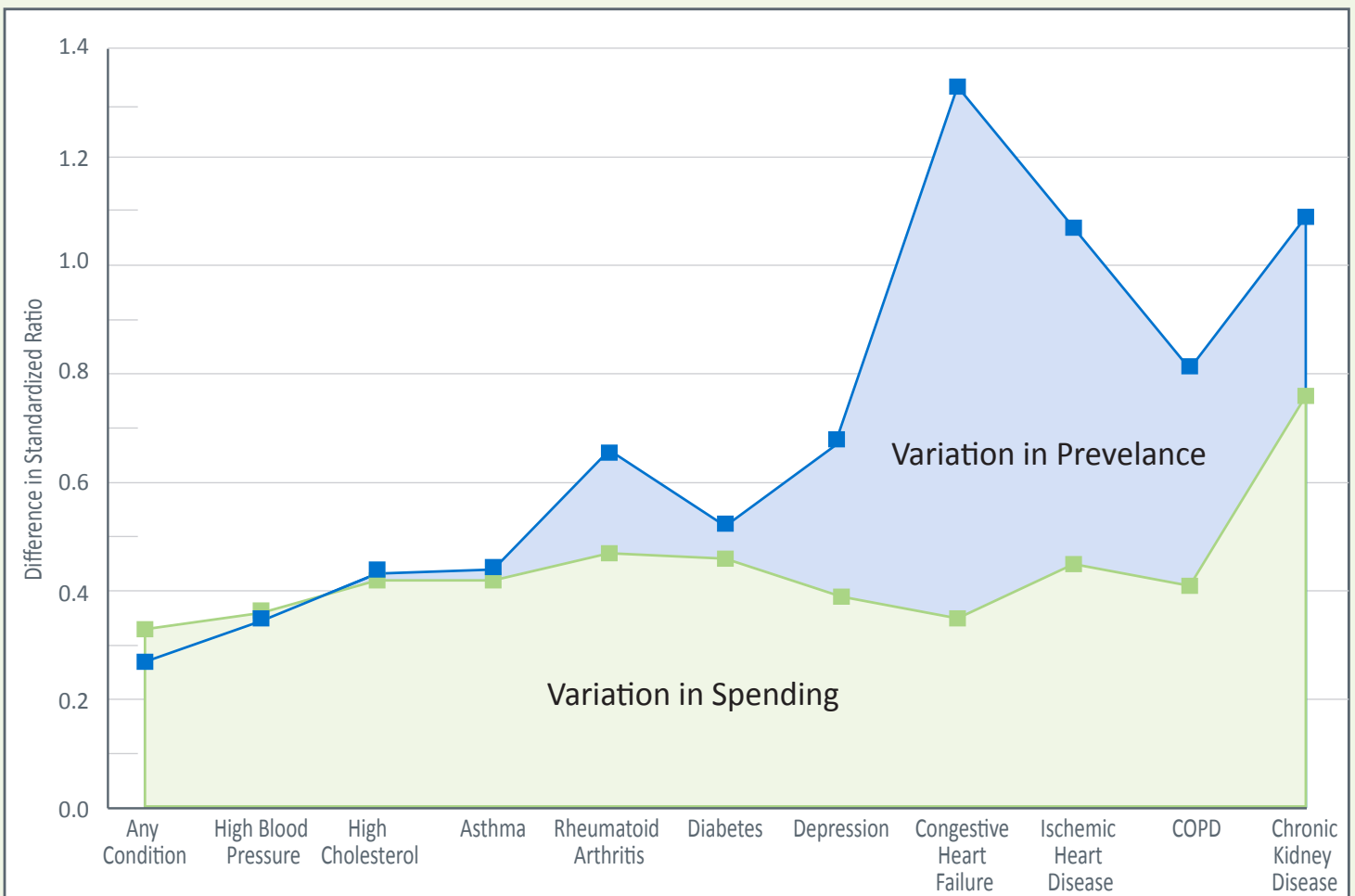
Estimates were adjusted for county differences in age, sex, length of enrollment, and payer mix.
 SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015).

in Figure 8 represent the numerical difference between the minimum and maximum standardized ratio calculated for each Minnesota county. A greater value means there is a broader spread between a minimum and maximum ratio, or greater variation around the state average.

Figure 8 shows results from comparing degrees of variation of prevalence across counties and of average per-person spending also across counties.

- Generally, across Minnesota counties there was greater variation in prevalence of chronic disease than in spending for patients who had chronic diseases;
- The greatest variation in county-level prevalence existed for some of the least frequent chronic conditions, including congestive heart failure, ischemic heart disease, COPD, and kidney disease.³²

FIGURE 8: Standardized Ratios for Prevalence and Spending for Ten Select Chronic Conditions in MN (2012)



SOURCE: MDH Health Economics Program, analysis of chronic conditions and associated health care spending in 2012, MN APCD (2015)

³² The systematic component of variation, a measure of variation that is less influenced by prevalence rates based on a small number of cases, also indicates greater variation across counties in the rates of congestive heart failure, chronic kidney failure, and ischemic heart disease in particular; see also: Ibáñez, B. Librero, J., Bengual-Delgado, E., Peiró, S, López-Volcarcel, BG, Martínez, N, and Aizpuru, F. Is there much variation in variation? Revisiting statistics of small area variation in health services research. BMC Health Services Research, 2009, 9:60.

Discussion and Policy Implications

In national comparisons, Minnesota ranks as one of the healthiest states in the nation, with a comparatively efficient health care system.^{33,34} Nevertheless, Minnesota faces some of the same challenges as the nation overall: an aging population, the presence of pervasive and modifiable risk factors associated with many chronic diseases, and rising health care spending. Minnesota also experiences stark and stubborn inequities between populations, with people of color and American Indians experiencing higher rates of chronic conditions and enjoying fewer opportunities to achieve good health.

Currently, chronic diseases play a substantial role in the lives of many Minnesotans who, because of these conditions, often experience lower quality of life and higher health care expenditures than would otherwise be the case. This new analysis using the MN APCD shows that patients with at least one chronic disease account for an astounding 83 percent of total medical and drug spending in the state; the roughly six percent of the population with five or more chronic conditions account for 36 percent of all spending.

As the population ages and life expectancy continues to increase, more Minnesotans will be newly diagnosed with one or more chronic disease or will need to manage their condition(s) for a longer time period. And, of course, there are other costs of chronic disease that this analysis doesn't capture, such as time away from work that results in lost wages for individuals and lost productivity for employers; here too, disparities in access to paid sick leave increase this burden for some populations. This volume of spending and the potential for future growth that impacts businesses, individuals, and state government as well as private payers, will be unsustainable and put pressure on a range of other policy priorities.

The literature and public health practice point to a number of tools to manage the future of chronic disease through delaying onset of disease, slowing its progression, and helping patients to live well with chronic disease. They include:

- Focusing on primary and secondary prevention, including community-based initiatives;

- Strengthening the provision of care delivery through primary care providers, with appropriate coordination between providers and across all settings of support services;
- Empowering patients across the spectrum of health and health care; and
- Enhancing incentives to deliver efficient and high quality care to patients.

Health, including the potential to develop chronic disease, is also very heavily influenced by factors outside of the care delivery system, including economic and social opportunities, biological and genetic factors, environmental and social stressors, behavioral choices, and the physical environment in which individuals live. These social determinants of health are often unequally distributed. Those with lower incomes, along with populations of color and American Indians, often experience the greatest inequities in the social and economic conditions that are such strong predictors of health, as well as experiencing barriers to making lifestyle changes that can prevent the development of disease. Because of this, efforts to impact health and prevent chronic disease will need to look beyond the care delivery system, and focus on efforts that can give all Minnesotans the opportunity to be healthy.³⁵ A number of strategies represent a good start in Minnesota in this area, but will require further scaling up to address the expected increase in chronic disease in the state.

Creating healthy communities: Efforts such as the Statewide Health Improvement Program (SHIP), that focus on implementing policy, system, and environmental changes to support healthy living in communities across the state, have already shown results in the areas of improving healthy eating, reducing smoking, and increasing physical activity, all of which are linked to chronic disease prevalence. In addition, the 15 Accountable Communities for Health (ACH) established under Minnesota's federal State Innovation Model (SIM) grant are showing early promise by focusing on actively and meaningfully engaging populations that experience health disparities in developing local solutions to high rates of chronic conditions and other issues.

³³ Radley DC, McCarthy D, Lipka JA, Hayes, SI, Higher, SC. Results from a scorecard on state health system performance, 2014, The Commonwealth Fund, April 30, 2014.

³⁴ 2013 Annual Report: A Call to Action for Individuals and Their Communities. America's Health Rankings: UnitedHealth Foundation, 2013.

³⁵ See for example: Booske BC, Athens JK, Kindig A, et al. Different Perspectives for Assigning Weights to Determinants of Health (Madison, Wis: University of Wisconsin Population Health Institute, February, 2010).

Primary care and care coordination: Minnesota’s certified Health Care Homes, which focus on providing coordinated, team-based primary care to complex patients, have shown an ability to achieve higher performance on key quality measures related to chronic disease, while lowering costs for Medicaid and Medicare recipients. As part of the overall health reform mandate, Minnesota has also worked to promote the use of multi-disciplinary care teams that manage care coordination in community and clinic settings, and include the use of community paramedics, community health workers, dental therapists, and other emerging professions.

Payment reform: Slowly evolving performance-based payment models introduced by federal payers and Minnesota private and public purchasers aim to change the focus from delivering units of health care services to delivering health for patients and the broader community. These models support the establishments of quantitative benchmarks for care delivery to patients that may include population health components and are targeted to specific populations.

The Minnesota Department of Health and its partners have developed a **strategic framework for public health action** on chronic disease (and injury) that is grounded in many of these initiatives and establishes twelve objectives built around risk factors with explicit, actionable performance targets in Minnesota for 2020.³⁶ By aiming to 1) increase knowledge and skills of the population to live the healthiest possible lives; 2) support patients in receiving the right care at the right time in the right place; and 3) ensure that Minnesotans have the best information about disease, risk factors, and treatment practices, the framework hopes to help bend the curve that describes the upward trend in chronic disease prevalence and spending.

This analysis represents the first in a series of reports that will support this important work by using the MN APCD to investigate the burden of chronic disease in Minnesota and document opportunities associated with improving care delivery for people with a range of complex and multi-faceted diseases. It represents an analytical addition to previous work already conducted by chronic disease experts in the Department of Health and across the state. The 2015 Minnesota Legislature also acknowledged the importance of this analytic tool by directing MDH to use the MN APCD to annually estimate progress toward managing prevalence and spending on specific chronic diseases; this report is an important foundational element for that work.

By collaborating with experts and stakeholders, future analyses could help determine:

- To what extent factors such as primary prevention, access to timely primary care, broadening roles and responsibilities for care coordination, the presence of new payment models, transparency, and patient engagement can meaningfully affect rates of chronic disease, their progression, and trends in spending associated with treating affected patients;
- Whether the observed modest variation in prevalence and spending at the county level is more variable when analyzed at different geographies (such as ZIP Codes) and by distinguishing between resources and pricing differences;
- How well socio-demographic factors such as race, ethnicity, language, education or income – in the form of community variables, as they are not directly available in the MN APCD – can explain small-area variation and inequities in opportunity to achieve health and wellness;
- If there are populations or condition categories that lend themselves particularly well to delivering care in a more effective, timely, and high-quality fashion;
- How the reach and burden of other complex conditions or groups of diseases, such as cancer and dementia, has changed over time.

Given the challenges posed by the astounding reach of chronic disease in Minnesota and the nation and the concern about associated health care spending today and into the future, it is more important than ever that we use available data to inform policy options. By bringing together data on patient demographics, diagnosis, and health care spending for nearly all Minnesotans, the MN APCD represents a qualitative change in the opportunity to understand the impact of chronic disease in Minnesota and address this threat to health and well-being.

With previously unavailable granular data on geographic variation we can work towards supporting evidence-based public health investments in different geographies. And with data on what is attainable across Minnesota, we can set measurable goals against which to measure success and need for improvement.

³⁶ Minnesota Department of Health, “Healthy Minnesota 2020: Chronic Disease & Injury.” Sept. 2012.

Appendix A: Chronic Conditions Included in the Chronic Condition Count³⁷

Acute hepatitis	Disorders of Newborn Period	Muscular dystrophy
Acute leukemia	Disorders of the immune system	Musculoskeletal disorders, other
Adverse events from medical/ surgical procedures	Emphysema, chronic bronchitis, COPD	Musculoskeletal signs and symptoms
Age-related macular degeneration	Endometriosis	Nephritis, nephrosis
Anxiety, neuroses	Eye, other disorders	Neurologic disorders, other
Aplastic anemia	Failure to thrive	Neurologic signs and symptoms
Arthropathy	Gastrointestinal signs and symptoms	Newborn Status, Complicated
Asthma, w/o status asthmaticus	Gastrointestinal/Hepatic disorders, other	Obesity
Asthma, with status asthmaticus	Generalized atherosclerosis	Osteoporosis
Attention deficit disorder	Genito-urinary disorders, other	Other endocrine disorders
Autoimmune and connective tissue diseases	Glaucoma	Other hemolytic anemias
Behavior problems	Gout	Other male genital disease
Benign and unspecified neoplasm	Hematologic disorders, other	Other skin disorders
Bipolar disorder	Hemophilia, coagulation disorder	Paralytic syndromes, other
Blindness	High impact malignant neoplasms	Parkinson's disease
Cardiac arrhythmia	HIV, AIDS	Peripheral neuropathy, neuritis
Cardiac valve disorders	Hypertension, w/o major complications	Peripheral vascular disease
Cardiomyopathy	Hypertension, with major complications	Personality disorders
Cardiovascular disorders, other	Hypothyroidism	Prostatic hypertrophy
Cataract, aphakia	Inflammatory bowel disease	Psychosocial disorders, other
Central nervous system infections	Inherited metabolic disorders	Pulmonary embolism
Cerebral palsy	Irritable bowel syndrome	Quadriplegia and paraplegia
Cerebrovascular disease	Ischemic heart disease (excluding acute myocardial infarction)	Renal disorders, other
Chromosomal anomalies	Kyphoscoliosis	Respiratory disorders, other
Chronic cystic disease of the breast	Lactose intolerance	Retinal disorders (excluding diabetic retinopathy)
Chronic kidney disease (chronic renal failure)	Low back pain	Rheumatoid arthritis
Chronic liver disease	Low impact malignant neoplasms	Schizophrenia and affective psychosis
Chronic pancreatitis	Malignant neoplasms of the skin	Seizure disorder
Chronic ulcer of the skin	Malignant neoplasms, bladder	Short stature
Cleft lip and palate	Malignant neoplasms, breast	Sickle cell disease
Congenital anomalies of limbs, hands, and feet	Malignant neoplasms, cervix, uterus	Sleep apnea
Congenital heart disease	Malignant neoplasms, colorectal	Spinal cord injury/disorders
Congestive heart failure	Malignant neoplasms, esophagus	Strabismus, amblyopia
Cystic fibrosis	Malignant neoplasms, kidney	Substance use
Deafness, hearing loss	Malignant neoplasms, liver and biliary tract	Thrombophlebitis
Deep vein thrombosis	Malignant neoplasms, lung	Tracheostomy
Degenerative joint disease	Malignant neoplasms, lymphomas	Transplant status
Dementia and delirium	Malignant neoplasms, ovary	Type 1 diabetes without complication
Depression	Malignant neoplasms, pancreas	Type 1 diabetes with complication
Developmental disorder	Malignant neoplasms, prostate	Type 2 diabetes without complication
Diabetic retinopathy	Malignant neoplasms, stomach	Type 2 diabetes with complication
Disorders of lipid metabolism	Migraines	Vesicoureteral reflux
	Multiple sclerosis	

³⁷ Derived from Table 5 of the Technical Reference Guide, The Johns Hopkins ACG® System, Version 10.0 (pages 6-6 through 6-8): EDCs Considered in the Chronic Condition Count Marker. The ACG® System defines a chronic condition as an alteration in the structures or functions of the body that is likely to last longer than twelve months and is likely to have a negative impact on health or functional status.

Appendix B: Ten Select Chronic Conditions Studied at Greater Detail in this Report

High blood pressure (hypertension) occurs when blood flows through blood vessels at higher than normal pressures.³⁸ It frequently co-occurs with high cholesterol. High blood pressure, high cholesterol, and diabetes are three of six major risk factors for heart disease and stroke.

High Cholesterol (Disorders of Lipid Metabolism) is a build-up of cholesterol, a fat-like substance, in the walls of blood vessels. High cholesterol is one of the major risk factors of heart disease.³⁹

Asthma. Asthma is a disease that causes inflammation and constriction of the airways.⁴⁰

Heart disease is a disorder of the arteries of the heart that can lead to a heart attack. In the U.S., it is the leading cause of death.

Congestive Heart Failure occurs when the heart muscle cannot pump enough blood and oxygen through the body, resulting in a build-up of fluid in the legs, lungs, or other tissues.

Ischemic Heart Disease is caused by narrowed heart arteries that reduce the blood and oxygen supply to the heart.

Rheumatoid Arthritis is a progressive autoimmune disease that causes inflammation and pain of the joints and can lead to joint deformity and bone and joint damage.

Depression is a mood disorder characterized by sadness, loss of energy, and loss of interest in life that lasts longer than two consecutive weeks.

Diabetes is a problem converting food into energy, resulting in high blood sugar levels. It is the leading cause of kidney failure, non-traumatic lower-extremity amputations, and blindness among adults aged 20-74.⁴¹

Chronic Kidney Disease (Chronic Renal Failure) is a gradual loss of kidney function. If left untreated, it can result in toxic levels of waste in the blood. The most common causes of chronic renal failure are uncontrolled high blood pressure (hypertension) and uncontrolled high blood sugar (diabetes).

Chronic Obstructive Pulmonary Disease (COPD) is a progressive disease that impairs breathing due to impaired or clogged airways and air sacs.⁴² It is the third leading cause of death in the United States. The leading cause of COPD is cigarette smoking.

³⁸ U.S. Department of Health & Human Services, National Heart, Lung, and Blood Institute, 2015, www.nhlbi.nih.gov/health/health-topics/topics/hbp.

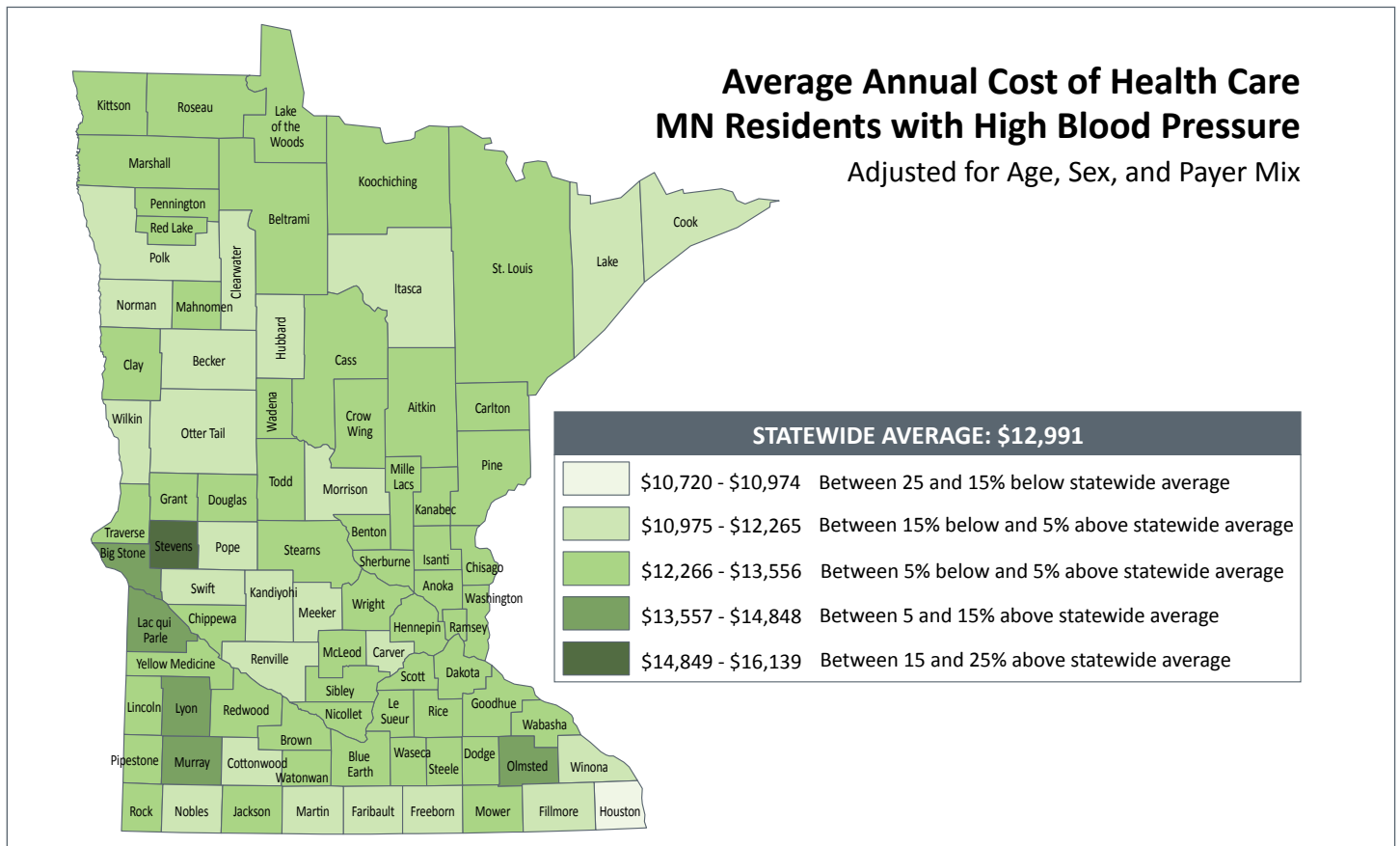
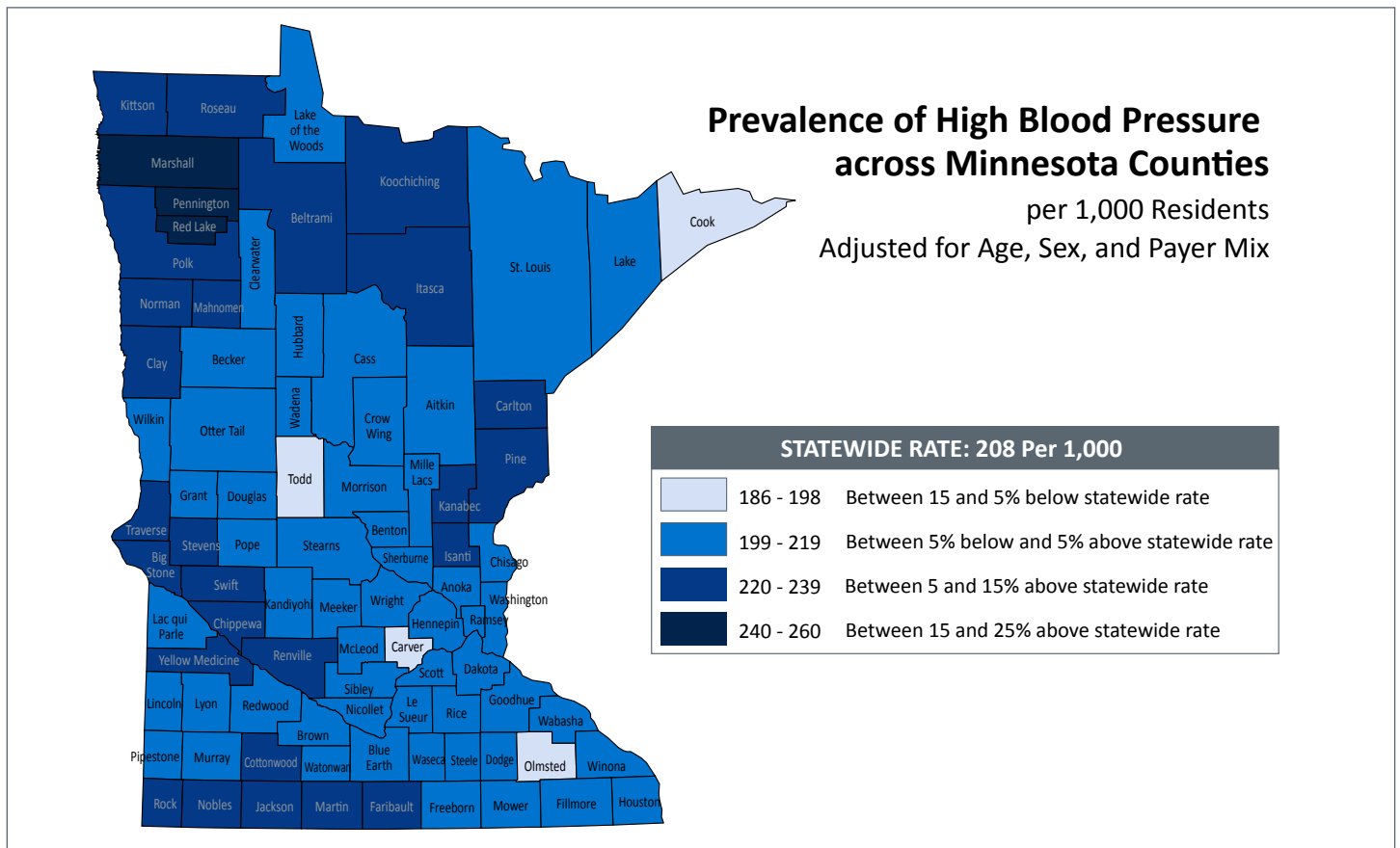
³⁹ U.S. Department of Health & Human Services, National Heart, Lung, and Blood Institute, 2015, www.nhlbi.nih.gov/health/resources/heart/heart-cholesterol-hbc-what.html.

⁴⁰ U.S. Department of Health & Human Services, National Heart, Lung, and Blood Institute, 2015, www.nhlbi.nih.gov/health/health-topics/topics/asthma.

⁴¹ Knowler WC, Barrett-Conner E, Folwer SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002; 346(6): 393-403.

⁴² U.S. Department of Health & Human Services, National Heart, Lung, and Blood Institute, 2015, www.nhlbi.nih.gov/health/health-topics/topics/copd.

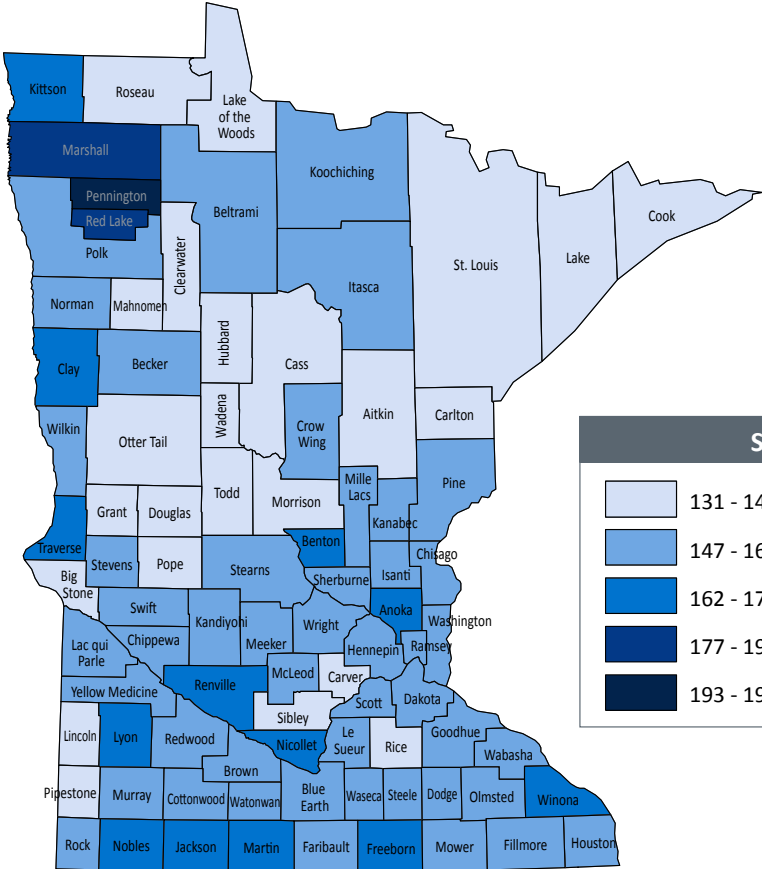
Appendix C: Maps of Prevalence and Spending for Specific Chronic Diseases



Prevalence of High Cholesterol across Minnesota Counties

per 1,000 Residents

Adjusted for Age, Sex, and Payer Mix

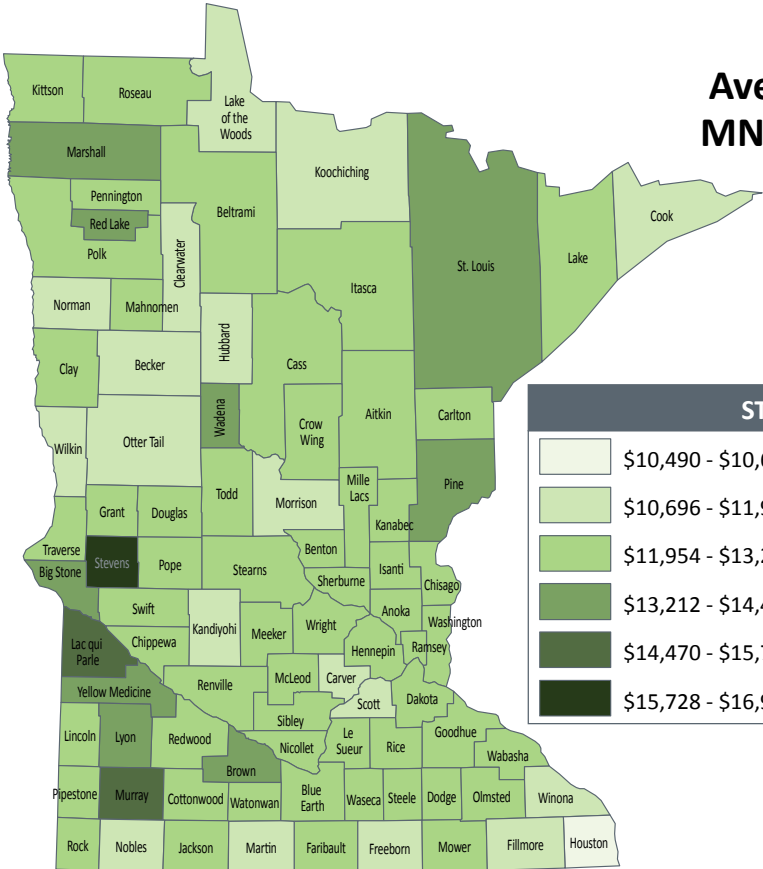


STATEWIDE RATE: 153 PER 1,000

Lightest Blue	131 - 146	Between 15 and 5% below statewide rate
Light Blue	147 - 161	Between 5% below and 5% above statewide rate
Medium Blue	162 - 176	Between 5 and 15% above statewide rate
Dark Blue	177 - 192	Between 15 and 25% above statewide rate
Darkest Blue	193 - 198	More than 25% above statewide rate

Average Annual Cost of Health Care MN Residents with High Cholesterol

Adjusted for Age, Sex, and Payer Mix

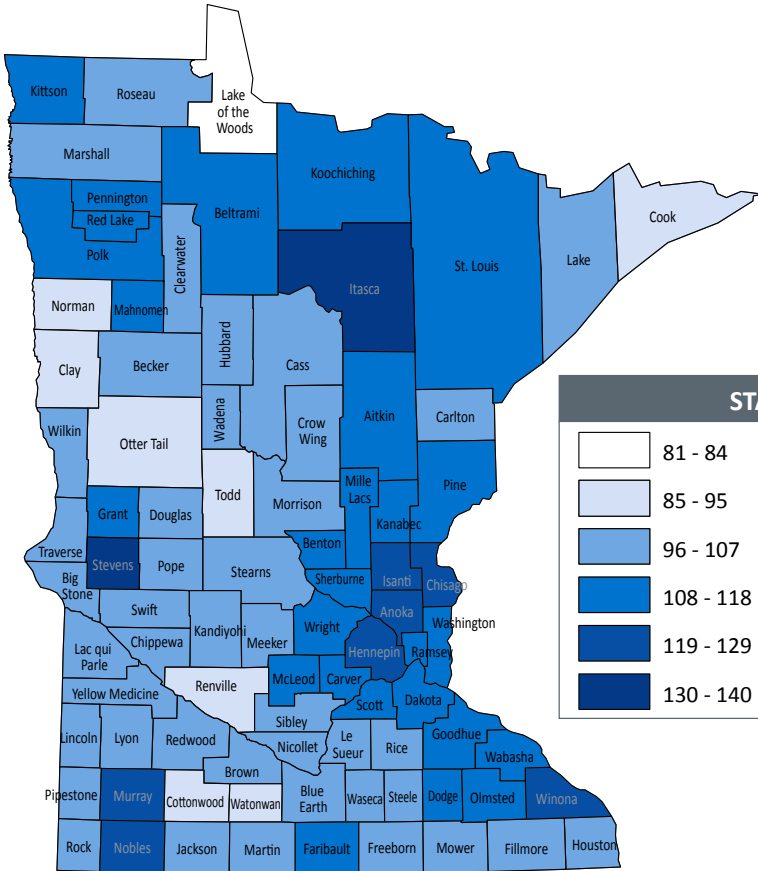


STATEWIDE AVERAGE: \$12,582

Lightest Green	\$10,490 - \$10,695	Between 25 and 15% below statewide average
Light Green	\$10,696 - \$11,953	Between 15 and 5% below statewide average
Medium Green	\$11,954 - \$13,211	Between 5% below and 5% above statewide average
Dark Green	\$13,212 - \$14,469	Between 5 and 15% above statewide average
Darker Green	\$14,470 - \$15,727	Between 15 and 25% above statewide average
Darkest Green	\$15,728 - \$16,986	More than 25% above statewide average

Prevalence of Asthma across Minnesota Counties

per 1,000 Residents
Adjusted for Age, Sex, and Payer Mix

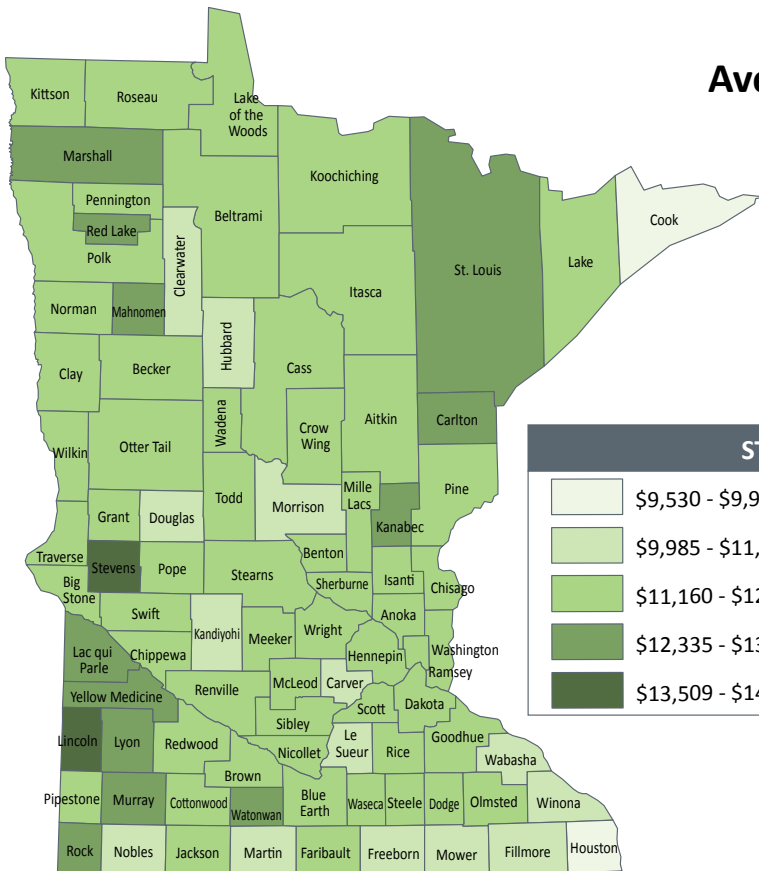


STATEWIDE RATE: 112 PER 1,000

81 - 84	More than 25% below statewide rate
85 - 95	Between 25 and 15% below statewide rate
96 - 107	Between 15 and 5% below statewide rate
108 - 118	Between 5% below and 5% above statewide rate
119 - 129	Between 5 and 15% above statewide rate
130 - 140	Between 15 and 25% above statewide rate

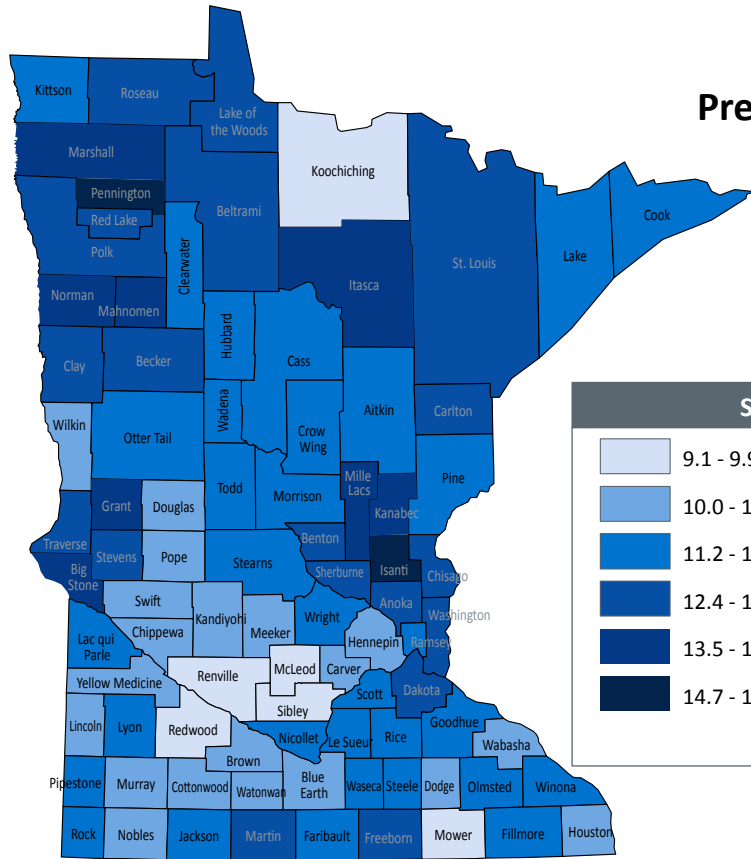
Average Annual Cost of Health Care MN Residents with Asthma

Adjusted for Age, Sex, and Payer Mix



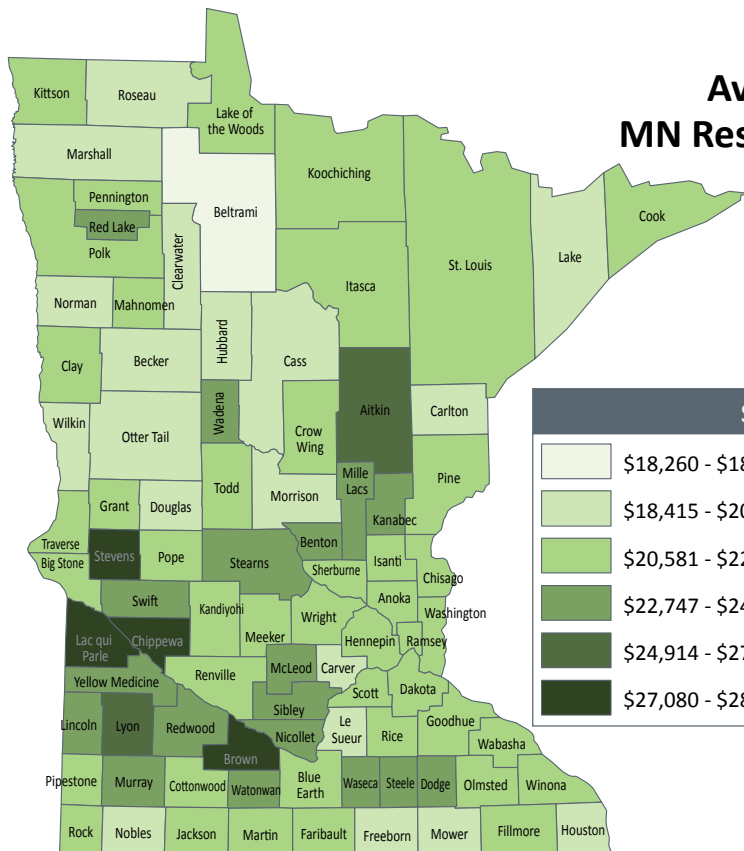
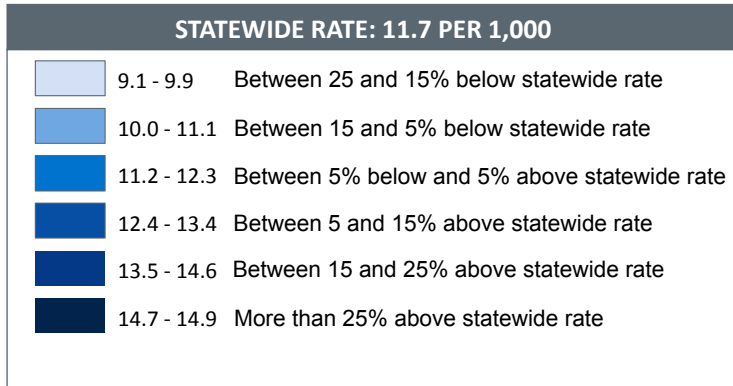
STATEWIDE AVERAGE: \$11,746

\$9,530 - \$9,984	Between 25 and 15% below statewide average
\$9,985 - \$11,159	Between 15 and 5% below statewide average
\$11,160 - \$12,334	Between 5% below and 5% above statewide average
\$12,335 - \$13,508	Between 5 and 15% above statewide average
\$13,509 - \$14,683	Between 15 and 25% above statewide average



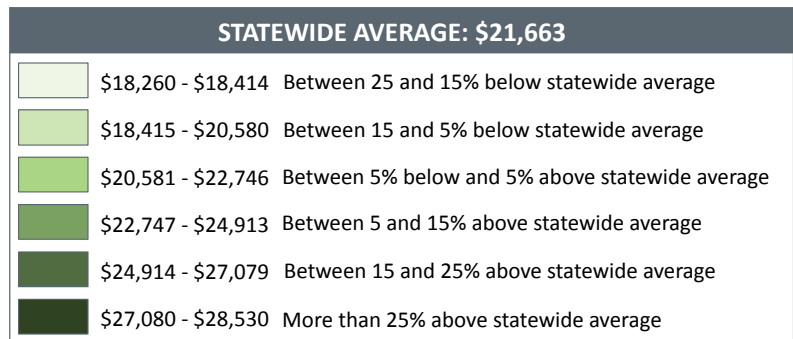
Prevalence of Rheumatoid Arthritis across Minnesota Counties

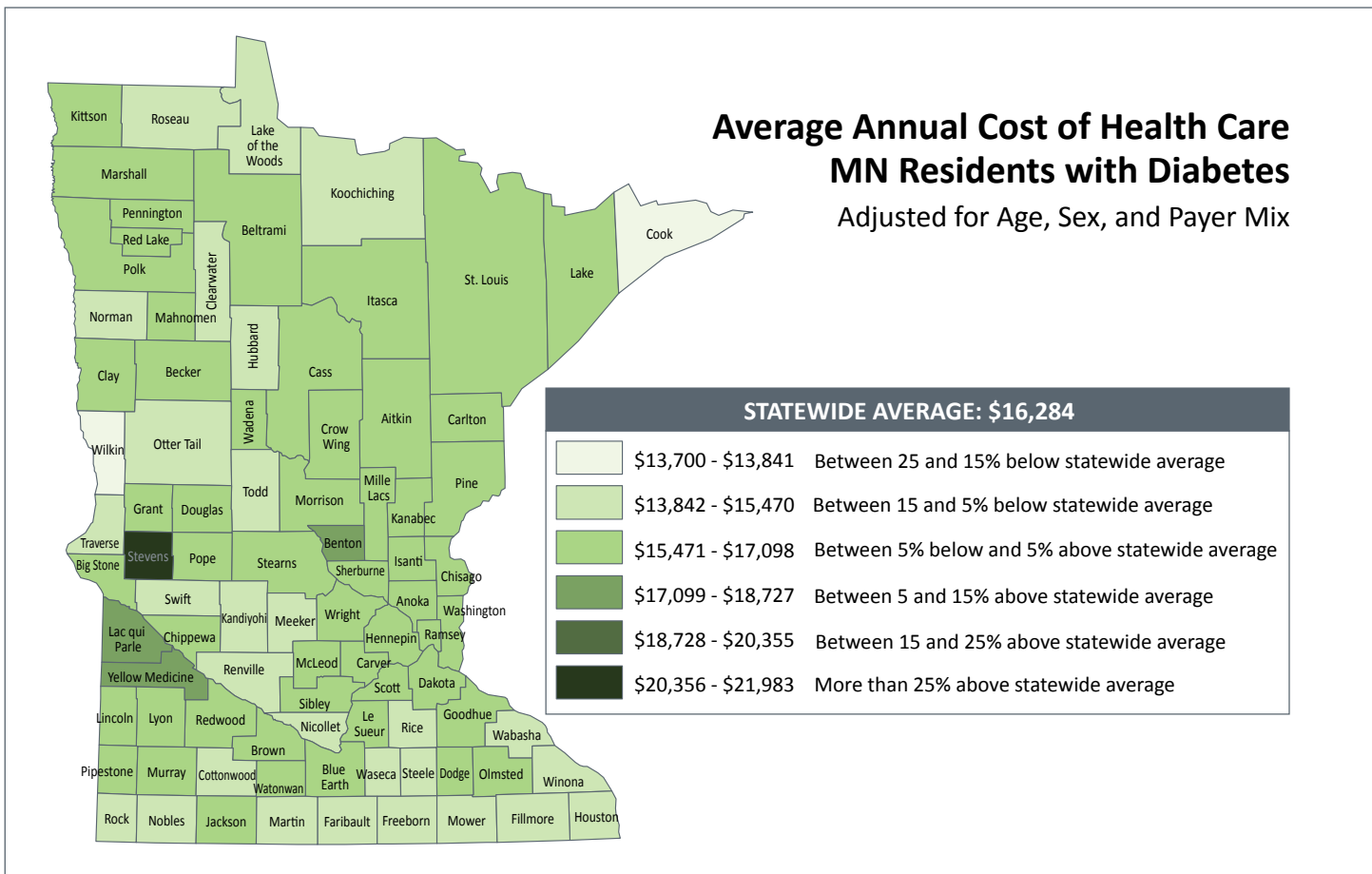
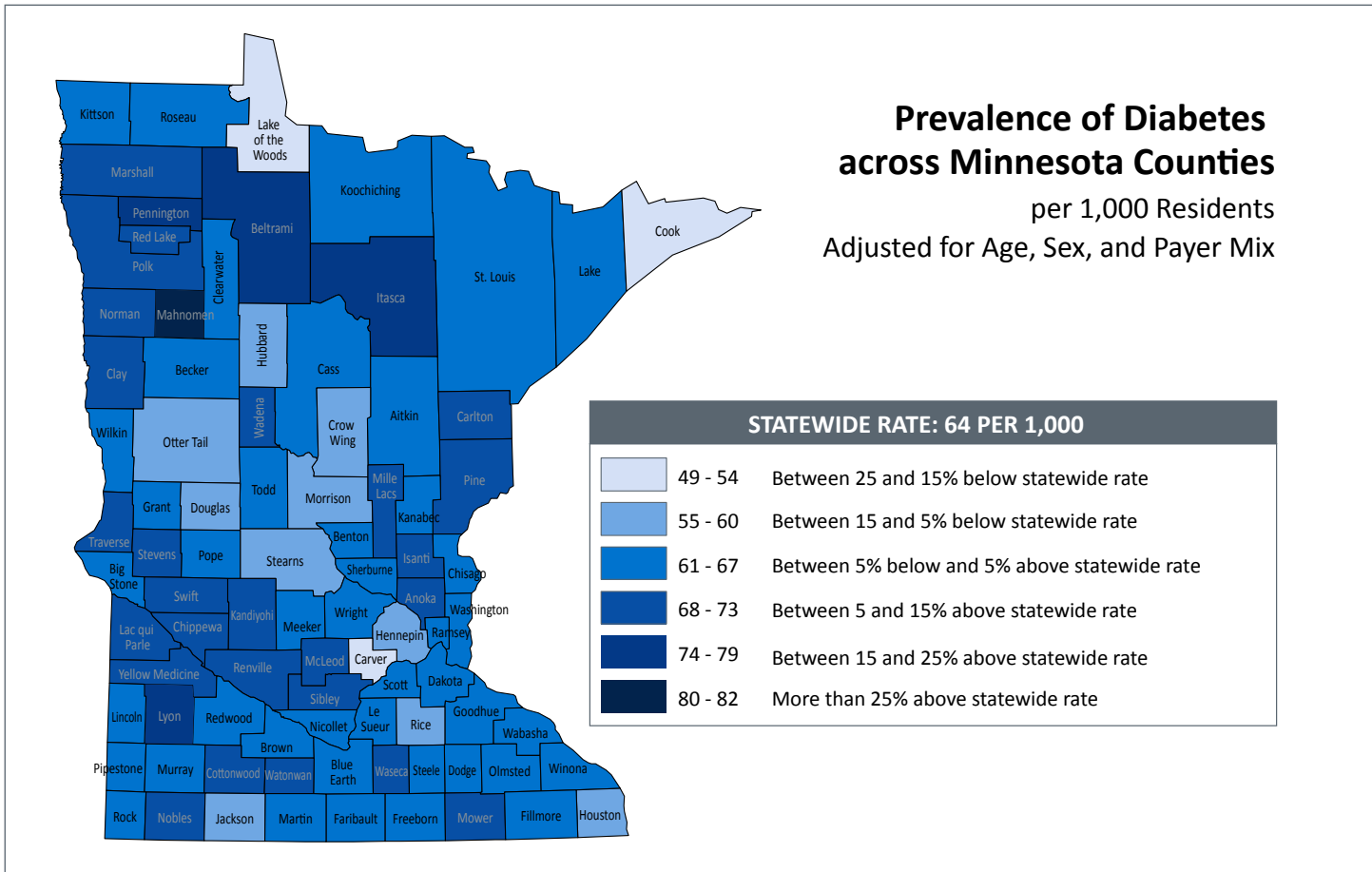
per 1,000 Residents
Adjusted for Age, Sex, and Payer Mix

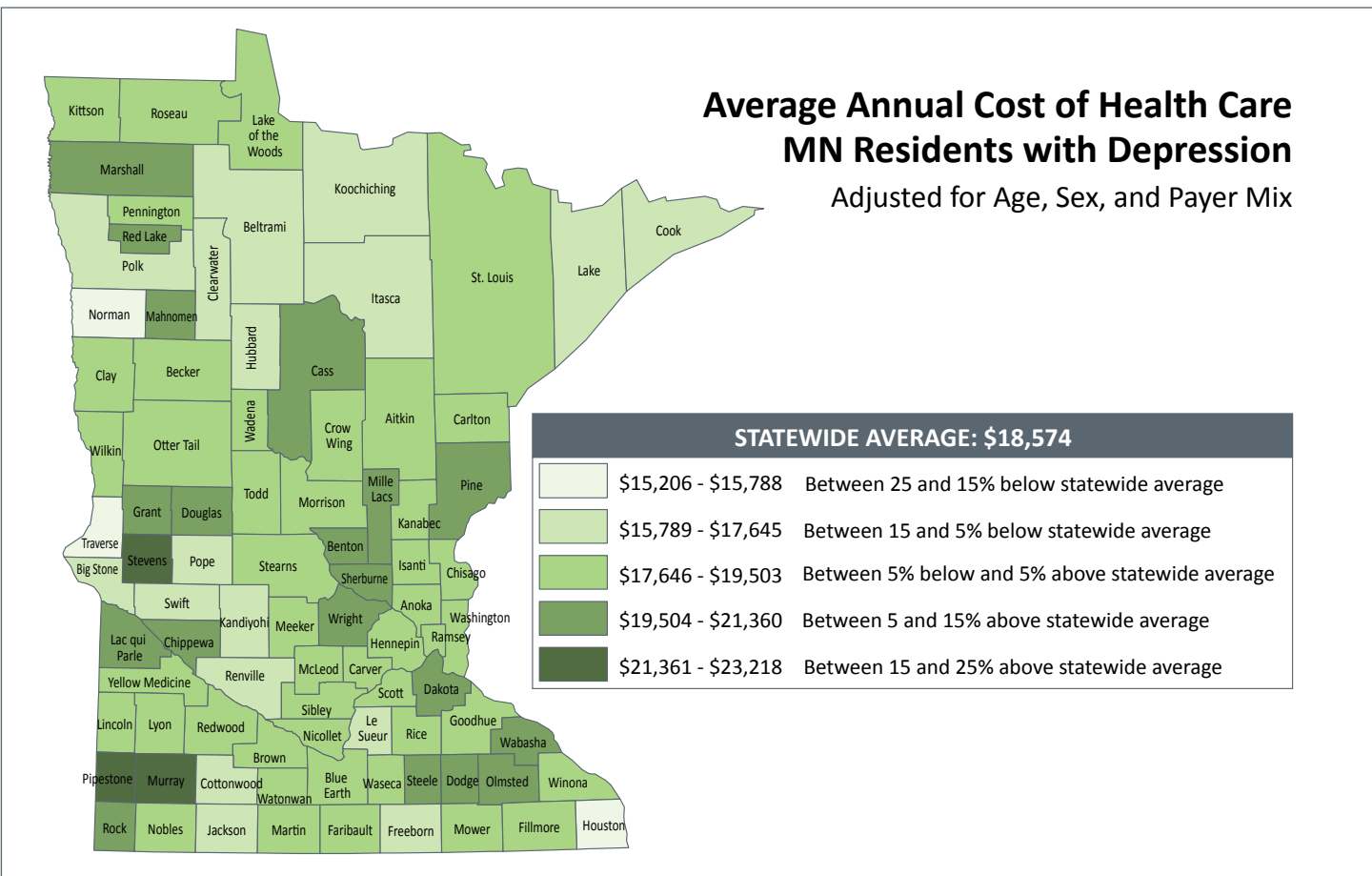
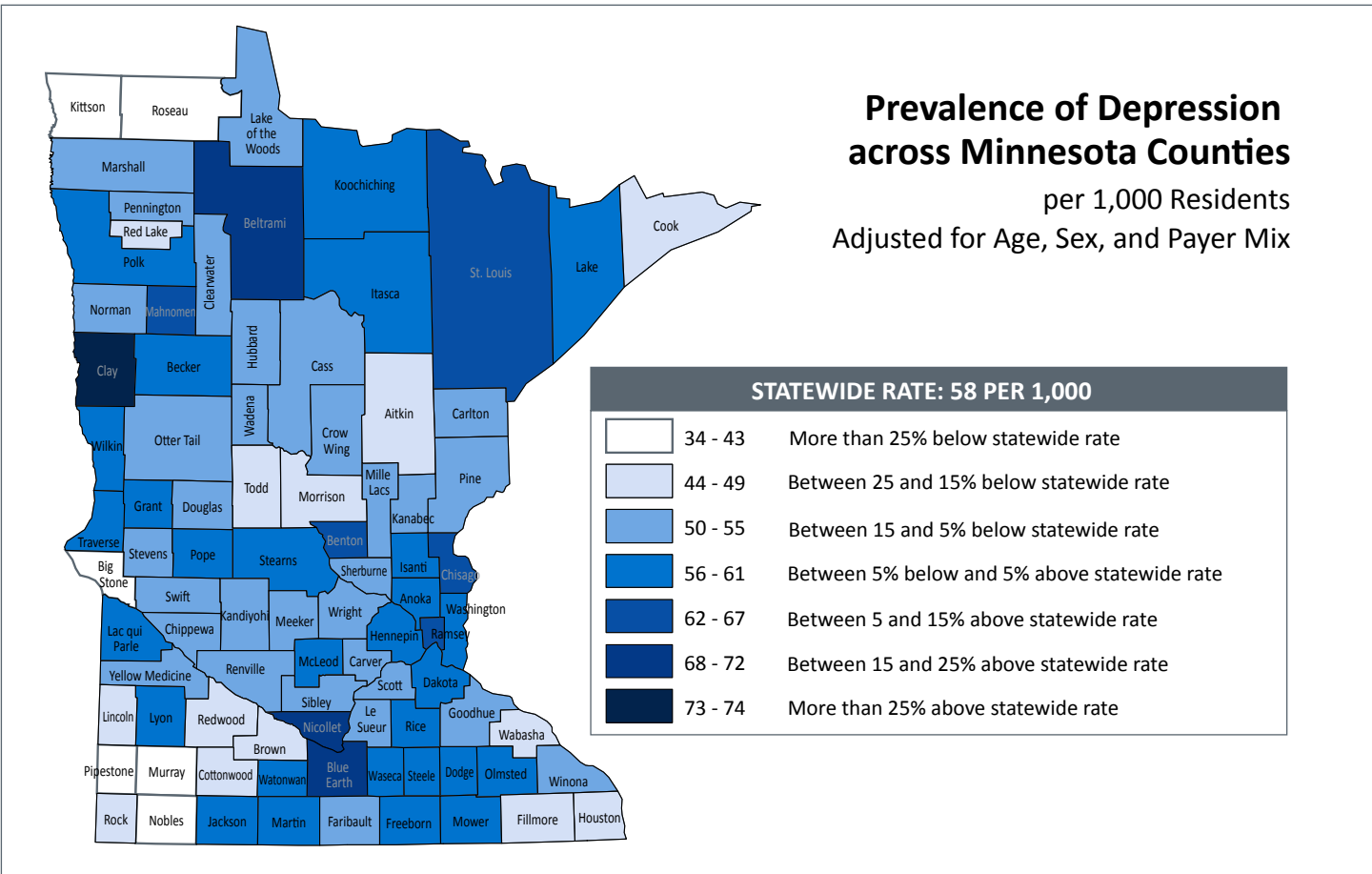


Average Annual Cost of Health Care MN Residents with Rheumatoid Arthritis

Adjusted for Age, Sex, and Payer Mix

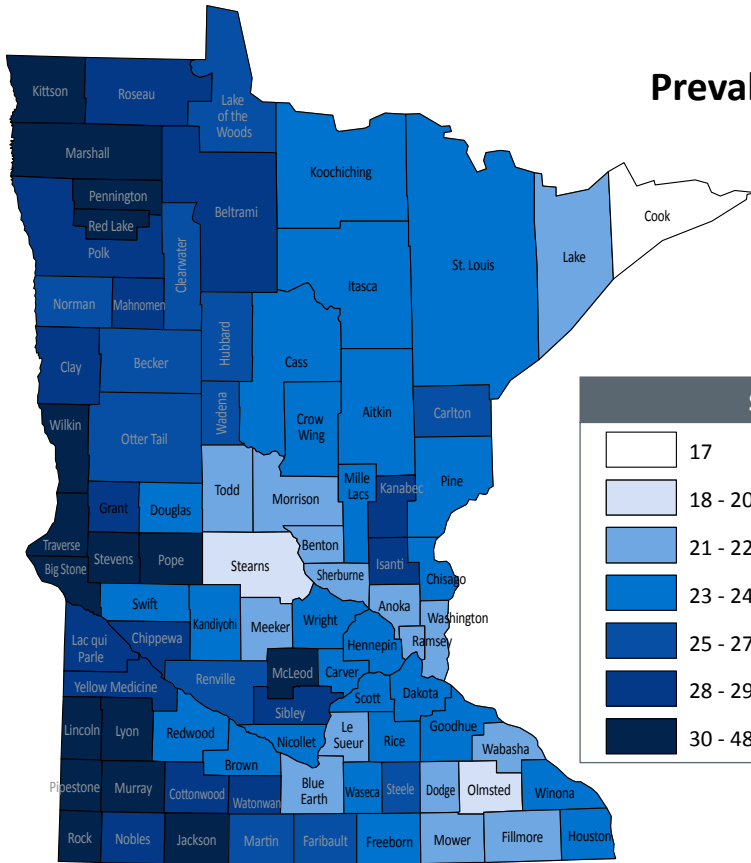




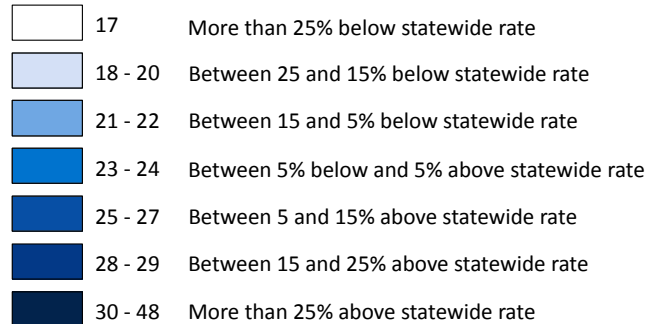


Prevalence of Congestive Heart Failure across Minnesota Counties

per 1,000 Residents
Adjusted for Age, Sex, and Payer Mix

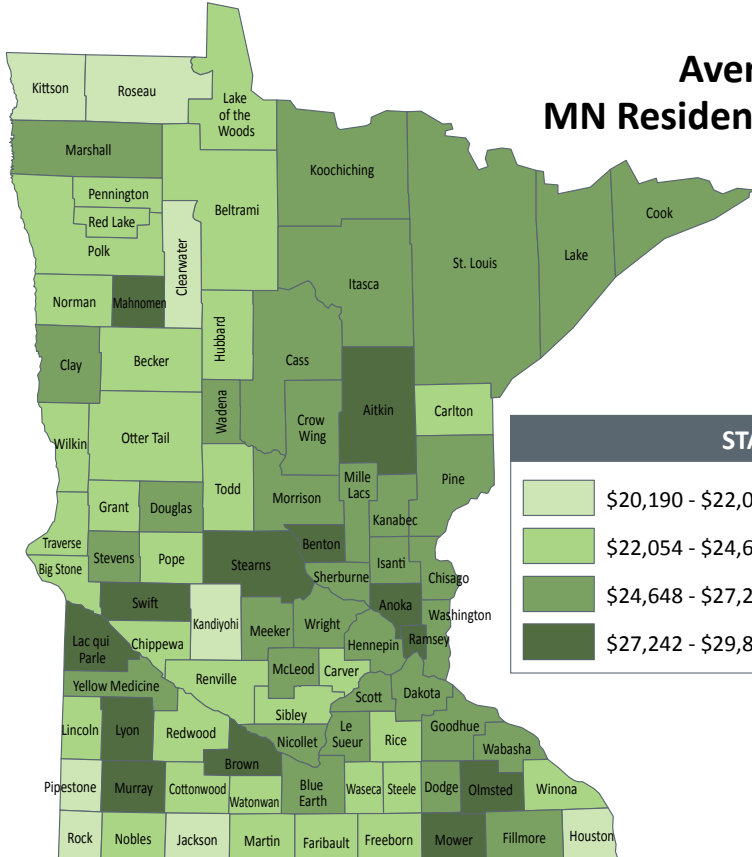


STATEWIDE RATE: 23 PER 1,000

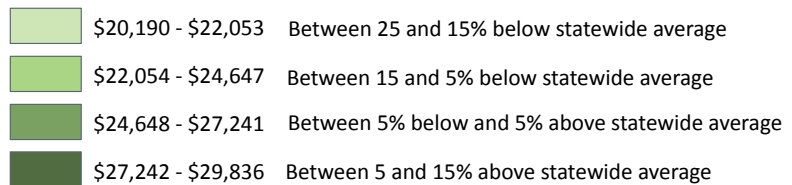


Average Annual Cost of Health Care MN Residents with Congestive Heart Failure

Adjusted for Age, Sex, and Payer Mix



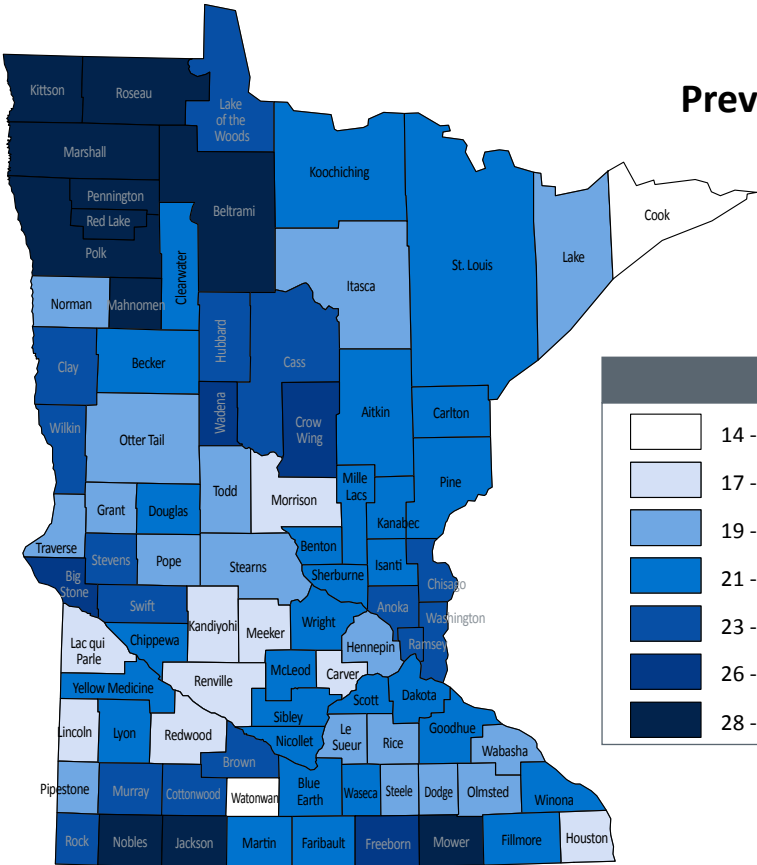
STATEWIDE AVERAGE: \$25,944



Prevalence of Ischemic Heart Disease across Minnesota Counties

per 1,000 Residents

Adjusted for Age, Sex, and Payer Mix

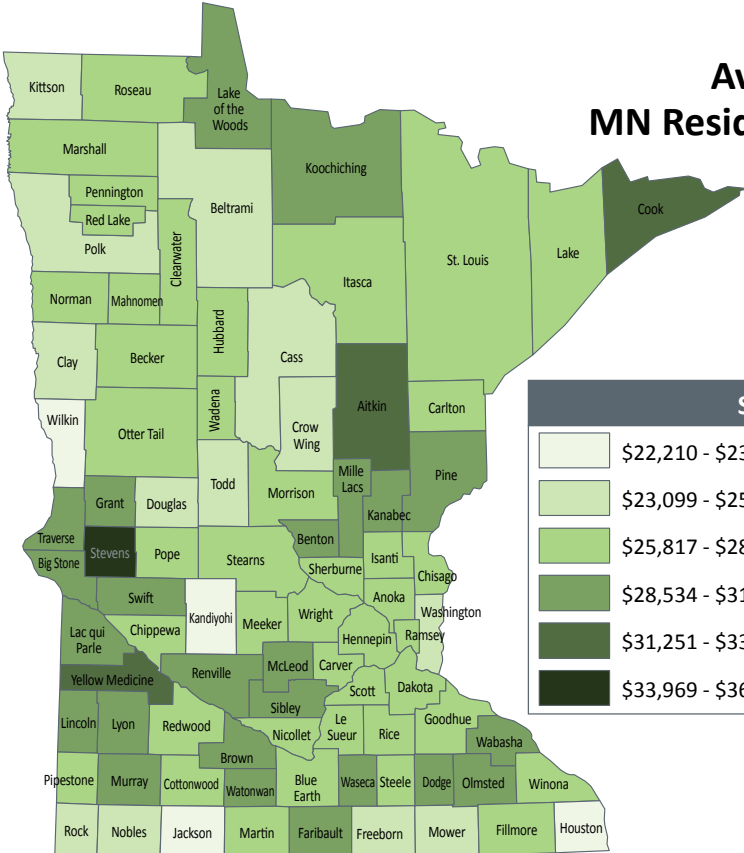


STATEWIDE RATE: 21 PER 1,000

14 - 16	More than 25% below statewide rate
17 - 18	Between 25 and 15% below statewide rate
19 - 20	Between 15 and 5% below statewide rate
21 - 22	Between 5% below and 5% above statewide rate
23 - 25	Between 5 and 15% above statewide rate
26 - 27	Between 15 and 25% above statewide rate
28 - 37	More than 25% above statewide rate

Average Annual Cost of Health Care MN Residents with Ischemic Heart Disease

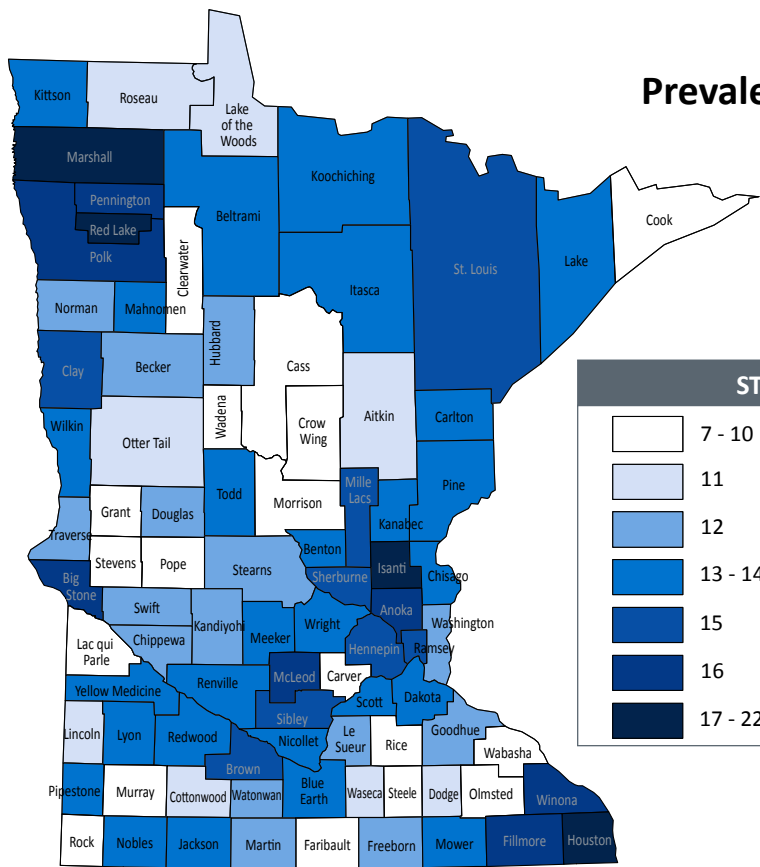
Adjusted for Age, Sex, and Payer Mix



STATEWIDE AVERAGE: \$27,176

\$22,210 - \$23,098	Between 25 and 15% below statewide average
\$23,099 - \$25,816	Between 15 and 5% below statewide average
\$25,817 - \$28,533	Between 5% below and 5% above statewide average
\$28,534 - \$31,250	Between 5 and 15% above statewide average
\$31,251 - \$33,968	Between 15 and 25% above statewide average
\$33,969 - \$36,685	More than 25% above statewide average

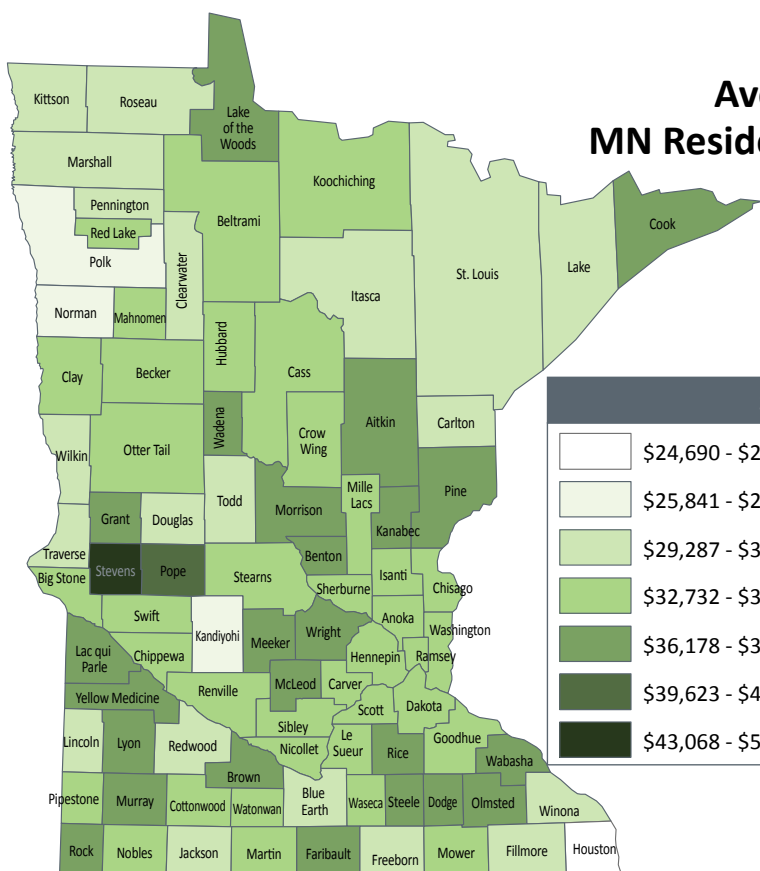
Prevalence of Chronic Kidney Disease across Minnesota Counties per 1,000 Residents Adjusted for Age, Sex, and Payer Mix



STATEWIDE RATE: 13 PER 1,000

7 - 10	More than 25% below statewide rate
11	Between 25 and 15% below statewide rate
12	Between 15 and 5% below statewide rate
13 - 14	Between 5% below and 5% above statewide rate
15	Between 5 and 15% above statewide rate
16	Between 15 and 25% above statewide rate
17 - 22	More than 25% above statewide rate

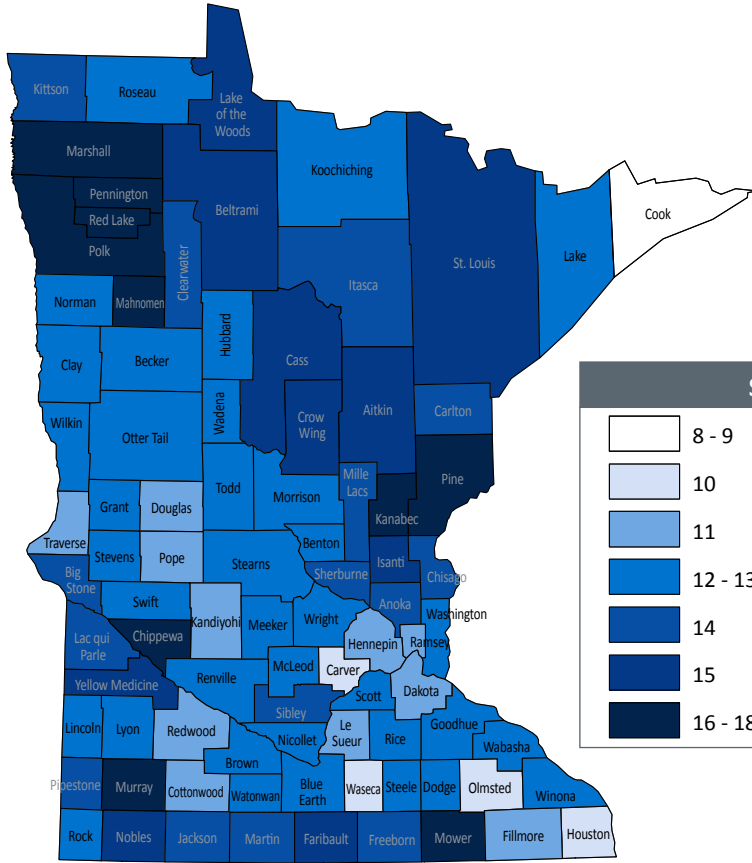
Average Annual Cost of Health Care MN Residents with Chronic Kidney Disease Adjusted for Age, Sex, and Payer Mix



STATEWIDE AVERAGE: \$34,454

\$24,690 - \$25,840	More than 25% below statewide average
\$25,841 - \$29,286	Between 25 and 15% below statewide average
\$29,287 - \$32,731	Between 15 and 5% below statewide average
\$32,732 - \$36,177	Between 5% below and 5% above statewide average
\$36,178 - \$39,622	Between 5 and 15% above statewide average
\$39,623 - \$43,067	Between 15 and 25% above statewide average
\$43,068 - \$50,760	More than 25% above statewide average

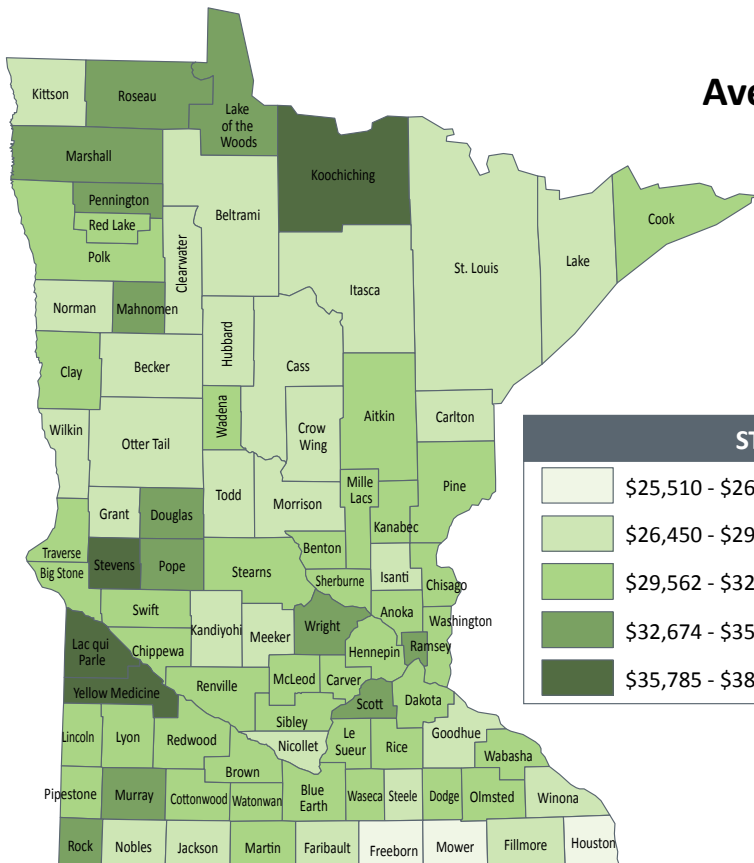
Prevalence of COPD across Minnesota Counties per 1,000 Residents Adjusted for Age, Sex, and Payer Mix



STATEWIDE RATE: 12 PER 1,000

8 - 9	More than 25% below statewide rate
10	Between 25 and 15% below statewide rate
11	Between 15 and 5% below statewide rate
12 - 13	Between 5% below and 5% above statewide rate
14	Between 5 and 15% above statewide rate
15	Between 15 and 25% above statewide rate
16 - 18	More than 25% above statewide rate

Average Annual Cost of Health Care MN Residents with COPD Adjusted for Age, Sex, and Payer Mix



STATEWIDE AVERAGE: \$31,117

\$25,510 - \$26,449	Between 25 and 15% below statewide average
\$26,450 - \$29,561	Between 15 and 5% below statewide average
\$29,562 - \$32,673	Between 5% below and 5% above statewide average
\$32,674 - \$35,784	Between 5 and 15% above statewide average
\$35,785 - \$38,896	Between 15 and 25% above statewide average

Contact Information

For further information about the MN APCD:

Online: www.health.state.mn.us/healthreform/allpayer/index.html

Email: health.apcd@state.mn.us



