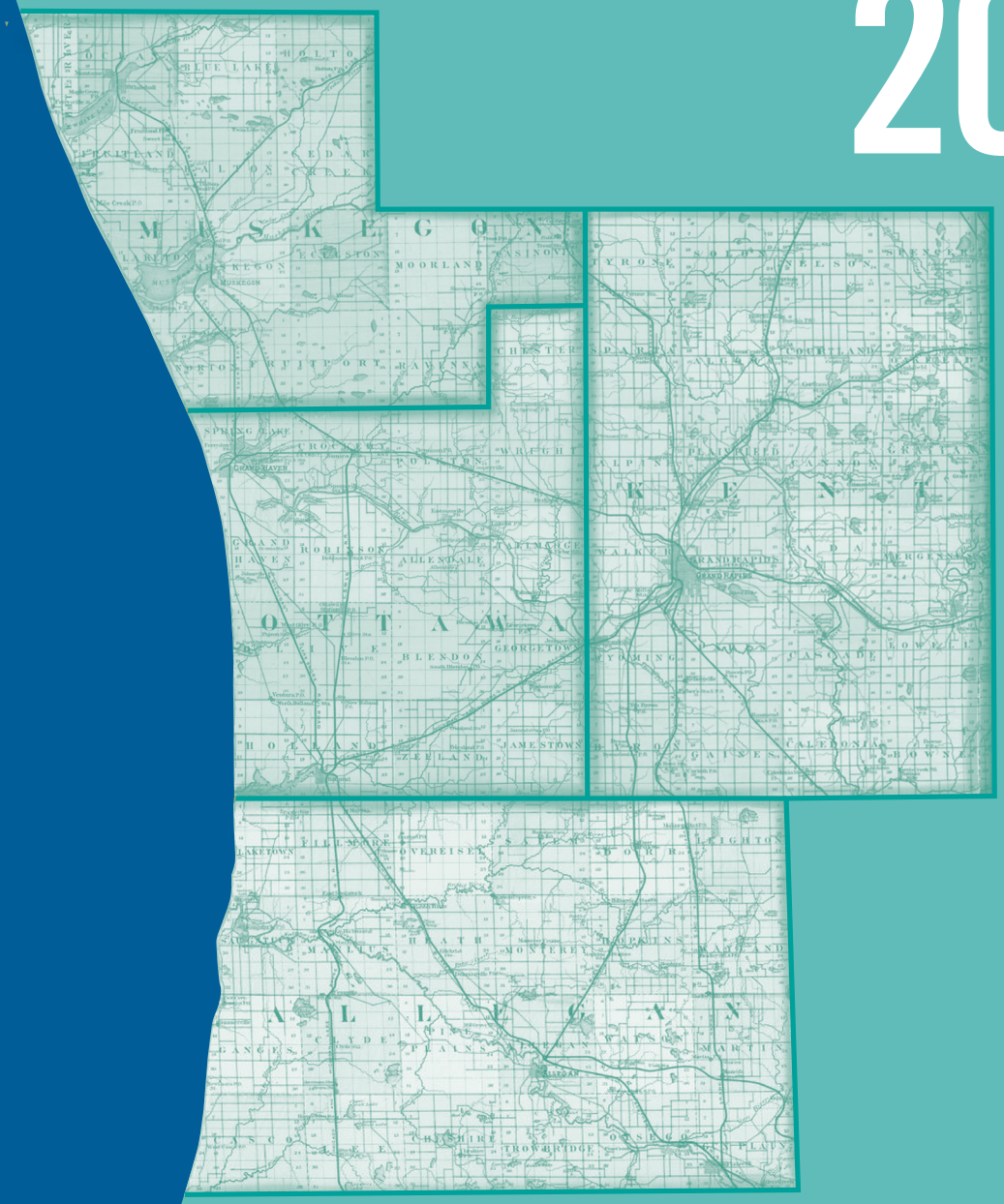
KENT COUNTY OTTAWA COUNTY MUSKEGON COUNTY ALLEGAN COUNTY

Health Check

ANALYZING TRENDS IN WEST MICHIGAN

2020



Made possible by grants from
Blue Cross Blue Shield of Michigan,
Blue Care Network, and Priority Health.

gvsu.edu/vphealth

Grand Valley State University

Health Check:
Analyzing Trends in West Michigan 2020

Sebastian Linde, Ph.D., and Gerry Simons, Ph.D.

Seidman College of Business, Grand Valley State University

Please consult **gvsu.edu/vphealth** for the most current version of this publication.

GRAND VALLEY STATE UNIVERSITY
OFFICE OF THE VICE PROVOST FOR HEALTH

January 10, 2020

Dear Colleagues,

We are pleased to present *Health Check 2020: Analyzing Trends in West Michigan* to our community. The study, in its 11th year, has been consistently well received by leaders in business, health care, and higher education organizations. The report has been widely used as a tool for health-related policy development, program planning, and decision-making. The study is a result of a partnership with Grand Valley State University's Office of the Vice Provost for Health, Seidman College of Business, Blue Cross Blue Shield of Michigan, and Priority Health.

This study uses primary and secondary data from a variety of sources to examine the current status of and analyze changes in health-related professional education and job growth, medical patents, and health trends in the Kent, Ottawa, Muskegon, and Allegan (KOMA) counties region. Additionally, KOMA area data are compared with data from the Detroit region, selected benchmarking communities, and the U.S., providing additional insights into the health-related trends in the West Michigan region.

An important addition to this year's study is the examination of opioid use, drug overdose deaths, suicide deaths, and self-reported mental health, comparing the KOMA region to the Detroit area. Perhaps most significant in this new data is an increase in overdose deaths in both Detroit and Grand Rapids, despite the decrease in opioid prescriptions. Data also indicate an increase in suicide rates from 1999 onward, while self-reported mental health has held fairly constant. We have also added a review of e-cigarette usage as it compares to use of cigarettes in 2017 to establish baseline data points for future comparisons.

The report continues to monitor trends in health care expenditures for asthma, coronary artery disease, depression, diabetes, hyperlipidemia, and lower back pain through member data provided by our insurance partners. The assessment is enhanced this year by the introduction of risk-score-adjusted analyses when comparing expenditure differences between KOMA and the Detroit region. Large expenditure increases were observed in patients with coronary artery disease and hyperlipidemia.

Data reveal a continued recovery in state job growth even though the state still lags behind national job growth. The Grand Rapids area has experienced large gains in health care jobs. Generally, Michigan and Grand Rapids wages for many health-related positions have not kept pace and have, in fact, declined compared to national wage averages. Health care services utilization trends in Michigan include higher inpatient admission rates, higher use of emergency department visits, and higher prescription fills in the Detroit region over the KOMA region.

Health care systems and providers, businesses, educators, and government all play critical roles in developing and innovating programs and systems to meet our health-related challenges. Collaboration among our community organizations will remain central in finding innovations and solutions to positively impact the costs, safety, and quality of care in our community.

Respectfully,

Jean Nagelkerk

Jean Nagelkerk, Ph.D., F.N.P, FNAP
Vice Provost for Health

Cook-DeVos Center for Health Sciences • 301 Michigan Street, N.E. • Grand Rapids, MI 49503-3314 • (616) 331-5500

Acknowledgments

We are grateful to Jean Nagelkerk, vice provost for health, for her support and funding from Grand Valley State University. Carl Ver Beek has been a constant source of support and guidance. We also thank Violet H. Barkauskas, Ph.D., M.P.H., RN., FAAN, emeritus faculty, School of Nursing, University of Michigan, for diligently proofreading several drafts of the report and to Diane Dykstra, special projects coordinator, for her support and coordination of this project. We thank Rachael Passarelli who helped us with the enrollment and graduation data for Grand Valley State University and Kevin Callison, Ph.D., School of Public Health and Tropical Medicine, Tulane University, for his help and valuable input.

The publication authors especially thank **Priority Health, Blue Cross Blue Shield of Michigan**, and **Blue Care Network** for providing us the average cost data. In particular, the following persons were invaluable for providing timely feedback and suggestions: Matt Botma, business intelligence analyst, Priority Health; Heath Taylor, data engineer, Priority Health; Elizabeth McCormick, advisor, Priority Health; Todd Osbeck, principal, Advanced Analytics, Priority Health; Ines Vigil, M.D., M.P.H., M.B.A., vice president, Advanced Analytics, Priority Health; Jian Yu, chief actuary officer and senior vice president, Advanced Analytics, Priority Health; Erin Villarreal, manager, HCV Analytics and Insights, Blue Cross Blue Shield of Michigan and Blue Care Network; David O. Brown, director, Provider Relations West Michigan, Blue Cross Blue Shield of Michigan and Blue Care Network; Denice M. Logan, D.O., FACOI, west region medical director, Blue Care Network; Peter Albert, manager, HCV Analytics and Insights, Blue Cross Blue Shield of Michigan and Blue Care Network; Shlynn Rhodes, administrative manager, Blue Cross Blue Shield of Michigan; and Steven Nelson, analyst, Blue Cross Blue Shield of Michigan.

We are deeply indebted to Carrie Thrall, marketing communications coordinator; Nancy Crittenden, marketing communications manager; and the staff of Institutional Marketing at Grand Valley State University for their diligence, hard work, and effective response to tight deadlines.

All the data used in this project are based on primary and secondary sources. We acknowledge our data sources in each section by listing source information; these sources are not duplicated or specifically cited in text discussions to preserve readability.

We are particularly indebted to the following organizations for use of their data:
American Hospital Association (AHA)
Behavioral Risk Factor Surveillance System (BRFSS), based on CDC protocol and the Michigan BRFSS
Bureau of Labor Statistics (BLS)
Center for Disease Control (CDC)
Institute of Medicine of the Academies
Michigan Department of Community Health (MDCH)
Michigan Department of Health and Human Services (MIDHHS)
Michigan Health and Hospital Association (MHHA)
Michigan Labor Market Information (milmi.org as part of michigan.gov)
U.S. Census Bureau
U.S. Department of Health and Human Services (ARF file 2011-2012)
United States Patent and Trademark Office (USPTO)
World Intellectual Property Organization (WIPO)

Enrollment and graduation data were collected via direct contact with, or from, websites owned by these colleges and universities:
Albion College
Andrews University
Calvin College
Central Michigan University
Cornerstone University
Davenport University
Ferris State University
Grand Valley State University
Kuyper College
Michigan State University
Western Michigan University

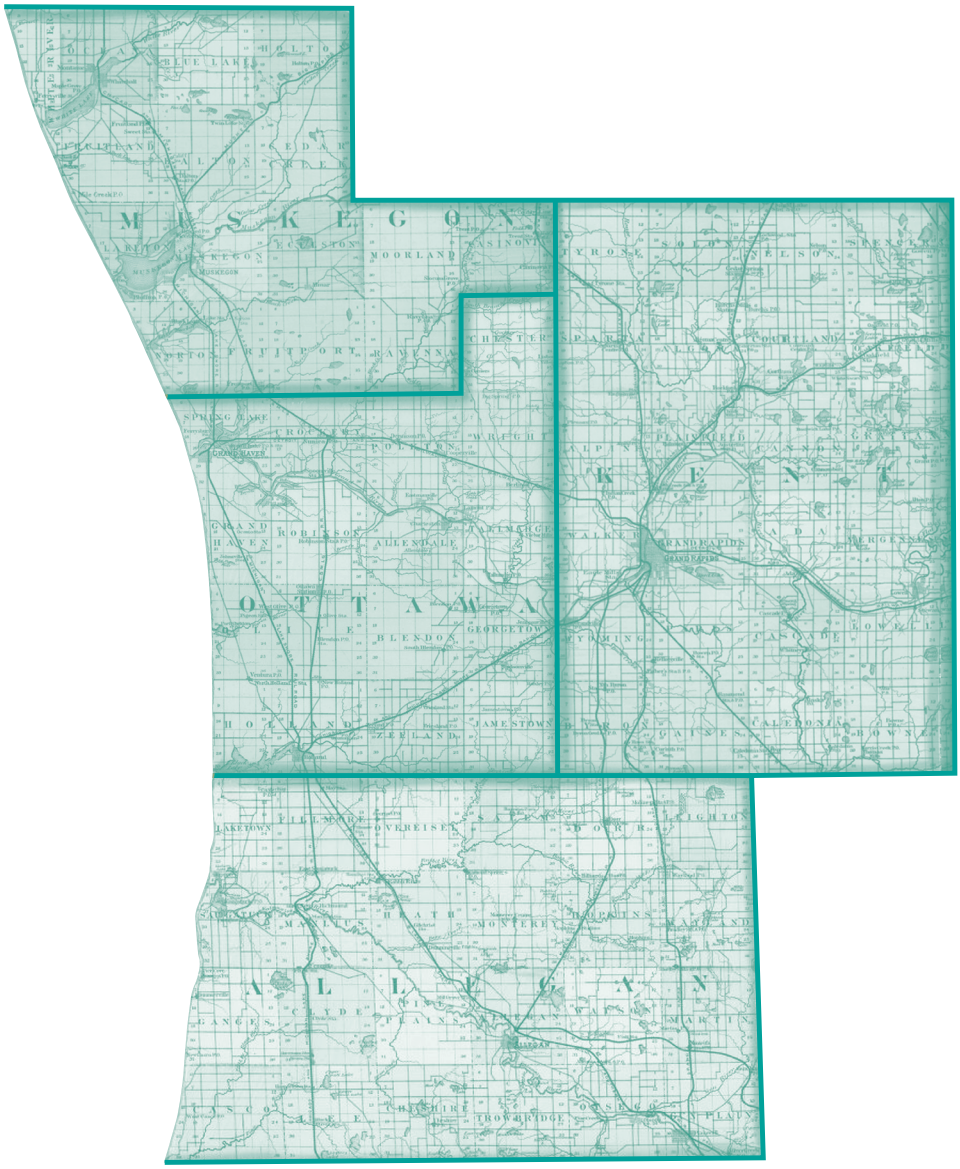


Table of Contents

Executive Summary

Knowledge Foundations

Education and Job Growth

January 2018 marked a return to prerecession job levels for the State of Michigan, while the U.S. as a whole met that mark as early as 2014. Furthermore, while the State of Michigan demonstrated positive job growth at 0.85 percent from April 2018 until April 2019, the growth gap between Michigan and the entire U.S. continued to widen from a gap of 11.3 percent in January 2018 to 12.5 percent in April of 2019. Despite the substantial impact of the recession on job loss in Michigan and the slow recovery in positive job growth, we continue to see large gains in health care industry jobs in Grand Rapids. Specifically, based on data from the Bureau of Labor Statistics (BLS), we expect to see the highest number of annual job openings for registered nurses, nursing assistants, and home health aides at both the city and state levels. Additionally, we compared earning gains and losses for Grand Rapids to the State of Michigan and the U.S. as a whole. Since 2005, real wages for diagnostic medical sonographers, dietitians and nutritionists, EMTs and paramedics, medical assistants, nursing assistants, respiratory therapists, registered nurses, speech-language pathologists, and surgical technologists increased nationally, but have declined in both Michigan and Grand Rapids. Between 2017 and 2018, we further observed real annual earnings gains above seven percent for family and general practitioners, home health aides, and optometrists.

Medical Patents

There has been an increase in medical patent activity in West Michigan since the 1990s, along with a growing number of new innovators. Patents with inventors residing in Kent County have increased from an annual average of 12.6 patents from 1990 to 1999, to 16.3 patents from 2000 to 2009, and to 20.2 patents from 2010 to 2018. However, behind these averages is a concerning recent development — a significant decrease in the number of medical patents since 2014, mirroring a decline seen nationally and statewide. In addition, medical patenting in the region is coming from a relatively small number of companies. Because patented medical innovations have a great potential for creating wealth and economic growth in West Michigan, continued R&D support is vital.

Health Care Trends

Demographic Changes

In this year's report, we continue to monitor trends in population demographics, comparing West Michigan to the Detroit region and the U.S. as a whole. We continue to note a shift in population density from East Michigan to West Michigan, with the Detroit region demonstrating a 0.09 percent growth rate in 2018, compared to 0.73 percent in the KOMA counties (Kent, Ottawa, Muskegon, and Allegan). While the 2018 growth rate in West Michigan is below the 1.26 percent growth rate noted in 2013, population growth still surpasses the 2018 national average. We also continue to track the increase in population age, with the proportion of the population over the age of 65 continuing to increase across both the KOMA and Detroit regions. In 2018, the 65 and over population made up 14.71 percent of the KOMA region population and 16.22 percent of the Detroit region population.

Health Care Overview

In this year's report, we continue to examine health risk behaviors and access to health care, adding trends related to opioid use, drug overdose deaths, suicide deaths, and self-reported mental health. For the Detroit region, we see an increase in opioid prescriptions from 2006 until 2012, with an annual decrease year after year from 2012 onward. However, the Detroit area has experienced an ongoing increase in the rate of overdose deaths despite this drop in legal prescription of opioids. While the KOMA region had a lower prescription rate than the Detroit region in 2017, the number of overdose deaths in the KOMA region has also increased drastically since 1999, although in recent years it has not continued to rise at the same rate as the Detroit region. Overall, our findings suggest that drug usage and drug overdose deaths continue to be a major public health concern in Michigan, despite the decrease in the number of legal opioid prescriptions.

When examining suicide rates in the Detroit and KOMA regions, we see an increase from 1999 onward. In contrast, the rate of self-reported mental health issues has held fairly constant from 2011 to 2017. Additionally, risk factors related to alcohol consumption, smoking, and obesity have all remained stable. This year, we also introduced measures related to e-cigarette usage in 2017. We find a lower rate of e-cigarette usage when compared to cigarettes, with 1.3 percent of respondents reporting smoking e-cigarettes every day, 3.4 percent reporting smoking some days, and 15.3 percent reporting being former e-cigarette smokers.

We continue to monitor access to health care with respect to individual health insurance status and utilization of routine and preventative care. While we find that a lower percentage of individuals lacked health insurance in 2016 when compared to 2011, we observe a slight increase in the percent of uninsured within the KOMA region from 2016 to 2017. Similarly, the share of individuals reporting they could not access health care due to cost in the KOMA region rose slightly from 2016 to 2017, although measures are still lower than 2011 rates. We also report positive trends in the number of individuals reporting having had routine checkups, from two-thirds of the KOMA population in 2011 up to three-fourths in 2017.

Economic Analysis

Benchmarking Communities

We continue to compare Grand Rapids' performance with respect to health care utilization and expenditures to a number of other communities: a group of similarly sized cities with similar demographic composition and income levels, the Detroit region, and the U.S. as a whole. Grand Rapids demonstrates lower hospital inpatient admission rates with a shorter length of stay than the benchmark comparison group; however, a continued increase in the number of hospital outpatient visits is noted. Total hospital expenses per admission continued to grow in all areas, with the exception of the Detroit region, which saw a slight decrease in 2017. In Grand Rapids, total expenses per admission rose in real terms by $470 in 2017. Despite the fall in Medicare expenditures per enrollee from 2010 to 2015, in 2017 we see a reversal of this trend for Grand Rapids, the benchmark communities, and the U.S. as a whole. In Grand Rapids, the adjusted Medicare expenditures per enrollee increased by about $374 between 2016 and 2017.

Major Medical Conditions: Expenditure and Utilization Analysis

In this year's report, we continue to monitor trends in health care expenditures for six major medical conditions: asthma, coronary artery disease (CAD), depression, diabetes, hyperlipidemia, and low back pain. Data was provided by Blue Care Network, Blue Cross Blue Shield of Michigan, and Priority Health. While we observe reductions between 2017 and 2018 in expenditures for members diagnosed with depression and low back pain, we also observe increased expenditures for those diagnosed with asthma, CAD, diabetes, and hyperlipidemia. In particular, we note large expenditure increases for members with CAD (19.4 percent) and hyperlipidemia (10.7 percent). New this year, we also introduce risk score adjusted analysis when comparing expenditure differences across the KOMA and Detroit regions, which allows us to adjust for population health differences between the two regions when comparing expenditures. We find that population risk score differences appear to explain a good deal of regional variation in expenditures for members with a diagnosis of asthma, depression, or hyperlipidemia. However, we find that expenditure gaps remain across the two regions for members diagnosed with CAD or diabetes, even after we adjust for regional differences in population health.

When examining utilization trends across the state, we find higher inpatient admission rates, higher use of emergency department visits, and higher prescription fills in the Detroit region as compared to the KOMA counties. This year, we also note a marked increase in the number of telemedicine appointments in both regions. The west side of the state demonstrates greater utilization of telehealth when compared to the Detroit region, although the Detroit region saw an increase of 800 percent or more for telemedicine appointments among individuals with hyperlipidemia, diabetes, and depression. Telemedicine has the potential to reduce the burden of care associated with chronic conditions, and this finding suggests an increase in the adoption of this technology, which may lead to better health outcomes and reduced expenditures in the future.

Knowledge Foundations

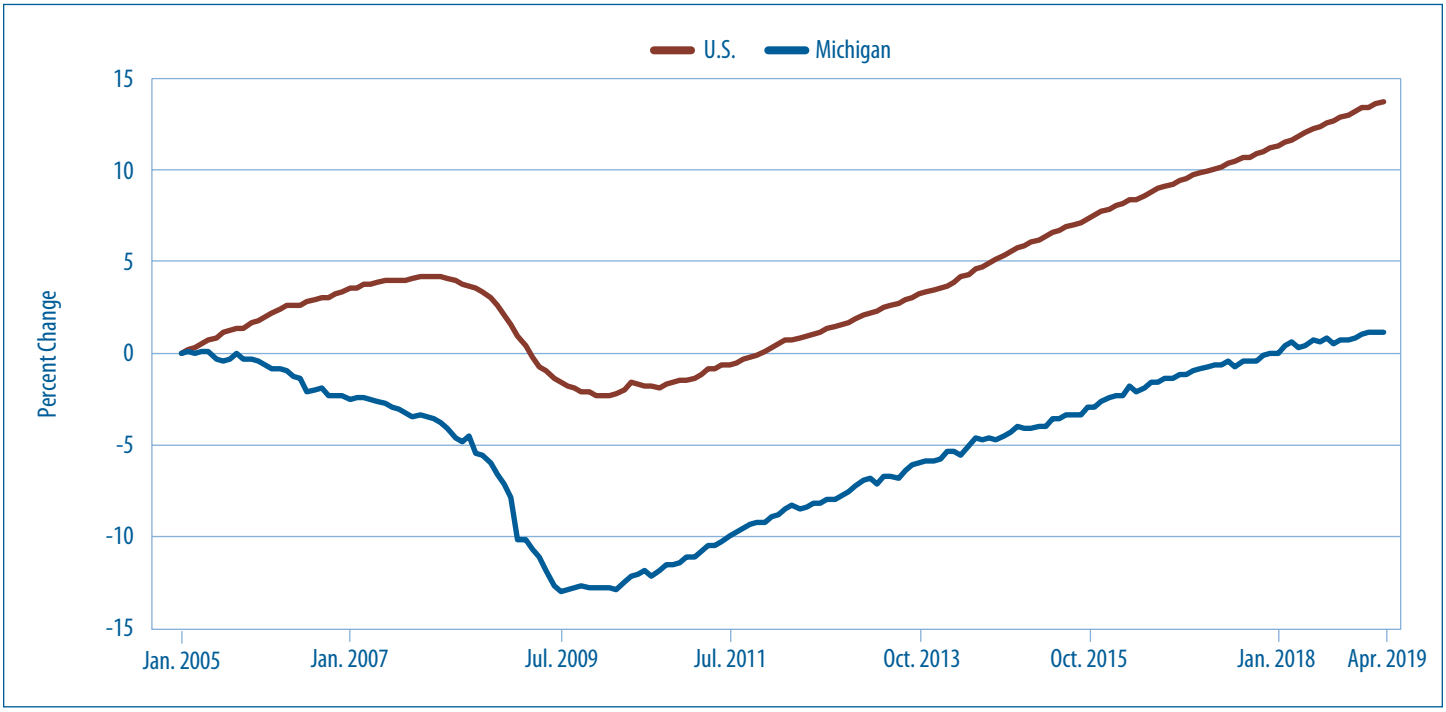
GRAND VALLEY STATE UNIVERSITY

www.gvsu.edu

Education and Job Growth

We begin the discussion of trends in job growth by tracking changes in total employment for the U.S. and for the State of Michigan relative to January 2005. **Figure 1** plots growth in nonfarm payroll jobs from January 2005 through April 2019. The recession in 2008 led to a drastic loss of jobs for both Michigan and the U.S. as a whole. At the height of the recession, jobs had fallen by more than two percent nationally and by nearly 13 percent in Michigan from their 2005 levels. Both the State of Michigan and the U.S. began adding jobs in early 2010. By April 2014, job growth in the U.S. had recovered to its prerecession level and has continued to increase. As of April 2019, the number of nonfarm payroll jobs in the U.S. has increased by more than 12 percent since early 2005. While Michigan has also experienced steady job growth since the recession, job losses in Michigan were much higher, relative to the U.S. as a whole. As a result, Michigan did not recover to prerecession job levels until January 2018, meaning that the state has experienced only a small net gain in payroll jobs over the past 14 years. From April 2018 until April 2019, Michigan nonfarm payroll jobs increased 0.85 percent. However, the discrepancy between the U.S. job growth and that of Michigan has begun to further increase from a gap of 11.3 percent in January 2018 to a gap of 12.5 percent in April 2019.

Figure 1: Nonfarm Payroll Jobs Percent Change, January 2005 to April 2019

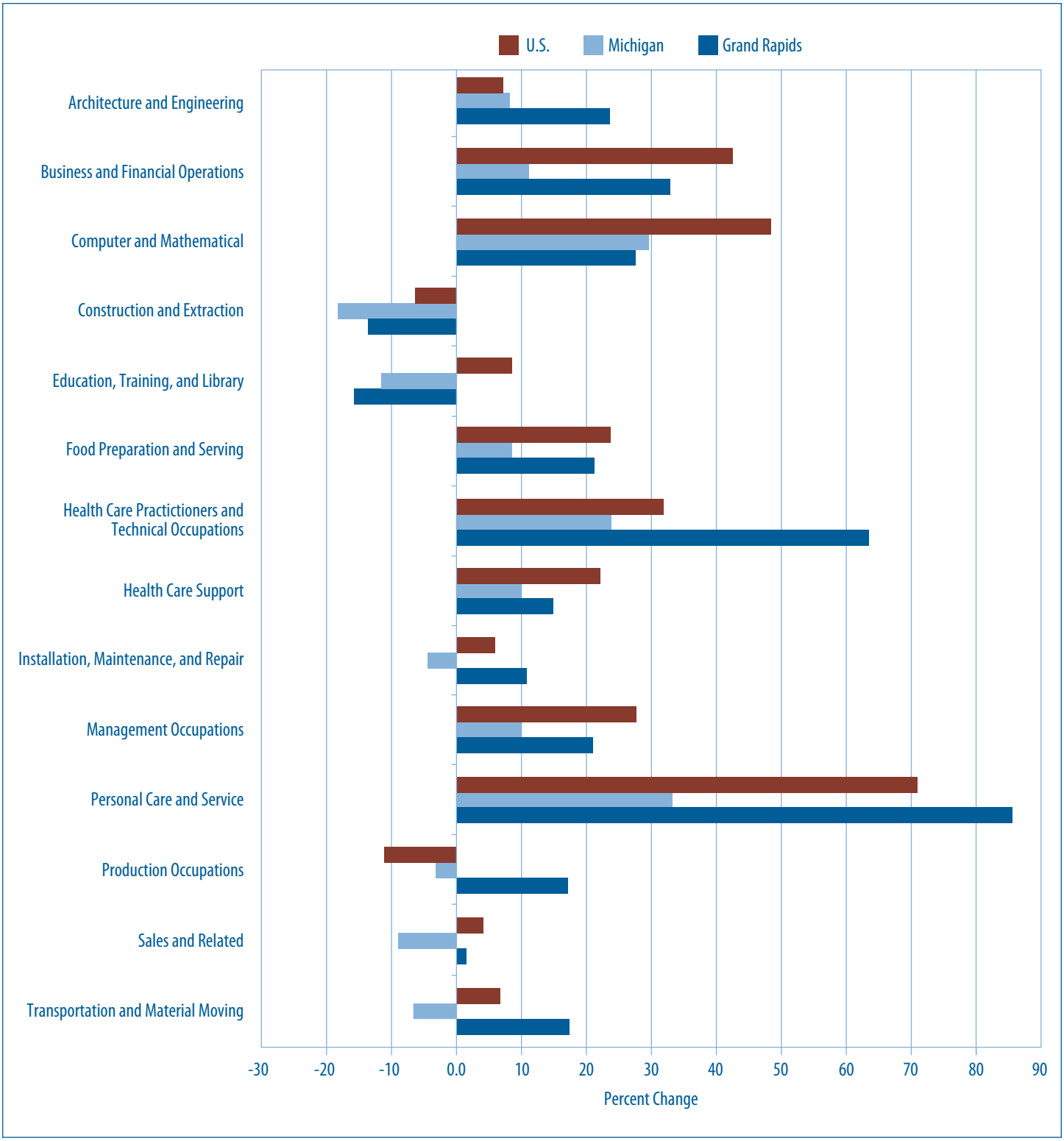


U.S. Source: http://data.bls.gov/cgi-bin/srgate. U.S. Series ID: CES0000000001.
State Source: http://data.bls.gov/cgi-bin/srgate. State Series ID: SMS26000000000000001.

Figure 2 provides a more detailed analysis of employment changes by examining job growth or job losses at the industry level from 2005 to 2018. We plot data for the Grand Rapids metropolitan statistical area (MSA), the State of Michigan, and the entire United States. The Grand Rapids region has experienced significant job growth (more than 20 percent) over this period in seven occupational categories: personal care and service (85 percent), food preparation and serving (21 percent), health care practitioners and technical occupations (64 percent), architecture and engineering (23 percent), computer and mathematical occupations (28 percent), business and financial operations (33 percent), and management occupations (21 percent).

Grand Rapids has continued to see substantial employment growth over the past decade in occupations categorized by health care practitioners and technical occupations. Local growth in these occupations has surpassed growth rates for the state and for the nation as a whole. In fact, employment for health care practitioners and technical occupations in Grand Rapids grew at nearly three times the state and double the national rates since 2005. Employment sectors in the U.S. that suffered the largest job losses over this period include construction and extraction and production occupations, as noted previously.

Figure 2: Job Growth for Select Major Occupational Groups, 2005–2018



National 2005: http://www.bls.gov/oes/2005/may/oes_nat.htm.
National 2018: http://www.bls.gov/oes/2018/may/oes_nat.htm.

Michigan 2005: http://www.bls.gov/oes/2005/may/oes_mi.htm.
Michigan 2018: http://www.bls.gov/oes/2018/may/oes_mi.htm.

Grand Rapids 2005: http://www.bls.gov/oes/2005/may/oes_24340.htm.
Grand Rapids 2018: http://www.bls.gov/oes/2018/may/oes_24340.htm.

We also note an increasing negative growth rate this year within education, training, and library occupations, both across the state as a whole and particularly within Grand Rapids, where we observe close to a 16 percent drop since 2005. These trends may be related to a decrease in the school aged population, which has shown a steady decline (beyond a 13 percent drop since 2002) in Michigan, as reported in data from the Michigan Department of Education, National Center for Education Statistics. Related to the decrease in the school aged population, reports of a smaller number of high school graduates in Michigan may impact the number of individuals seeking university level education to continue to supply a labor force for these in-demand occupations (Bransberger & Michelau, 2016).

Given these trends, we next examined whether universities in the central and western parts of the state are producing students equipped with the skills required to meet the health care sector's continued growing labor demand.

To analyze this issue, we proceeded in four steps:

1. We observed job growth for selected health care occupations since 2005.
2. We undertook an inventory of health services education programs in colleges and universities in the western and central parts of the state.
3. We made specific predictions for employment demand in the Grand Rapids area for several selected health professions.
4. We measured changes in earnings over the past decade for these professions.

Table 1 provides historic employment levels and growth for a variety of health care occupations identified in the Bureau of Labor Statistics (BLS) data for the Grand Rapids metro area and the State of Michigan. We report growth figures, since 2005 and since 2017, to illustrate long-term as well as recent changes. In general, Grand Rapids has experienced greater job growth in the health care sector compared to the state as a whole. Growth has been especially robust in the areas of diagnostic medical sonographers, dietitians and nutritionists, registered nurses, occupational and physical therapy assistants, optometrists, pediatricians, surgeons, and surgical technicians. Only a few occupations experienced job losses in Grand Rapids since 2005; those include home health aides, medical transcriptionists, and nuclear medical technologists. The State of Michigan saw significant job growth among pharmacy technicians, physician assistants, pediatricians, and surgical technologists, and it saw job losses among audiologists, dentists, nuclear medicine technologists, licensed practical or licensed vocational nurses, medical transcriptionists, and recreational therapists.

Tables 2 through 5 provide data on enrollment and graduation in health-related fields from several central and west Michigan universities. These data are from a number of different programs and, although likely incomplete, represent our best attempt at collecting information on local educational trends.

Table 6 presents employment projections for Michigan and Grand Rapids generated by matching data on historic and projected employment levels from the Bureau of Labor Statistics to estimates of employment growth rates from the Michigan Department of Technology, Management, and Budget. The left-hand columns in **Table 6** display occupation-specific employment in 2018, the corresponding annualized average growth rates, and projected employment in 2024. In the next two columns, we convert the growth rates into annual job growth numbers. Replacement rate figures in the next two columns indicate the share of current employment that is expected to turn over through retirements or other forms of employment transitions. Projected employment has two components: job growth (i.e., new positions) and replacement (i.e. existing positions that have been vacated). We combine these two components to estimate the average annual job openings in both Michigan and in the Grand Rapids metro area in the last two columns of **Table 6**. Occupations for which we expect to see the highest number of annual job openings include registered nurses (551 in Grand Rapids and 3,345 for the state), nursing assistants (265 in Grand Rapids and 1,537 for the state), and home health aides (90 in Grand Rapids and 1,192 for the state).

Finally, **Table 7** presents inflation-adjusted growth in annual earnings for health professions in three locations: Grand Rapids, Michigan, and the United States. Once again, data for the wage estimates came from the Bureau of Labor Statistics, and we compared changes in these estimates for the long term (from 2005 to 2018) and the shorter term (2017 to 2018). We specifically focused on fields in which real earnings have increased or decreased by more than seven percent over the 2005 to 2018 period. In Grand Rapids, the occupations with the largest decline in real earnings include diagnostic medical sonographers, licensed practical or licensed vocational nurses, occupational therapists, respiratory therapists, speech-language pathologists, and surgical technologists. Dental hygienists, diagnostic medical sonographers, optometrists, and surgical technologists all experienced real earnings losses beyond seven percent for the State of Michigan. Occupations experiencing the largest real earnings gains in the Grand Rapids region from 2005 to 2018 include family and general practitioners, occupational therapy assistants, optometrists, and physician assistants. Family and general practitioners, occupational therapists, physician assistants, and physical therapists all saw wage growth in excess of seven percent for the state as a whole.

When we compared earnings changes in Grand Rapids to those in Michigan or the entire U.S., we found several similarities but also several interesting differences. For example, since 2005, real wages for diagnostic medical sonographers, dietitians and nutritionists, EMTs and paramedics, medical assistants, nursing assistants, respiratory therapists, registered nurses, speech-language pathologists, and surgical technologists increased nationally, but have declined in both Michigan and Grand Rapids.

Looking at more recent changes between 2017 and 2018 in Grand Rapids, we further note three occupations above seven percent growth in real annual earnings: family and general practitioners, home health aides, and optometrists. The growth for all three of these occupations is furthermore considerably higher in Grand Rapids than in both Michigan and the U.S. at large.

We emphasize that any estimates presented within this section are subject to change based on changes in the economy or changes in the regulatory environment in which health care providers and health systems operate. Furthermore, a decrease in the number of high school graduates, along with a notable decrease in the number of education jobs this year, suggests that the pool of individuals entering university programs may decrease in future years. As such, policy and community efforts will be vital to retain the current skilled health care workforce, as well as encourage talented individuals to pursue degrees leading to employment within the health care sector.

Reference

Bransberger, P., & Michelau, M. (2016). *Knocking at the College Door - Projections of high school graduates,* Dec 2016 edition. Retrieved September 16, 2019 from https://static1.squarespace.com/static/57f269e19de4bb8a69b470ae/t/58d2eb93bf629a4a3878ef3e/1490217882794/Knocking2016FINALFORWEB-revised021717.pdf.

Table 1: Health Care Job Growth for Selected Occupations, 2005-2018

Occupation	Grand Rapids				
	Employment (2005)	Employment (2017)	Employment (2018)	Employment Growth (%) Since 2005	Employment Growth (%) Since 2017
Anesthesiologists	NA	NA	NA	NA	NA
Audiologists	NA	NA	30	NA	NA
Cardiovascular Technologists/Technicians	NA	390	400	NA	2.6
Dental Assistants	860	920	1,060	23.3	15.2
Dental Hygienists	690	1,190	1,010	46.4	-15.1
Dentists, General	350	520	420	20.0	-19.2
Diagnostic Medical Sonographers	130	310	330	153.8	6.5
Dietitians and Nutritionists	140	230	260	85.7	13.0
EMT and Paramedics	450	440	520	15.6	18.2
Home Health Aides	1,950	1,710	1,840	-5.6	7.6
Medical Assistants	1,540	2,500	2,440	58.4	-2.4
Medical Records/Health Info Technicians	510	660	630	23.5	-4.5
Medical Transcriptionists	290	90	90	-69.0	0.0
Nuclear Medicine Technologists	110	60	70	-36.4	16.7
Nurse Practitioners	NA	370	350	NA	-5.4
Nurses, RN	6,310	11,450	12,550	98.9	9.6
Nurses, LPN or LVN	1,870	2,060	2,030	8.6	-1.5
Nursing Aides and Assistants	4,950	6,940	7,280	47.1	4.9
Occupational Therapists	230	650	580	152.2	-10.8
Occupational Therapy Assistants	50	200	260	420.0	30.0
Opticians, Dispensing	320	340	400	25.0	17.6
Optometrists	80	240	260	225.0	8.3
Pharmacists	560	890	930	66.1	4.5
Pharmacy Technicians	700	1,400	1,370	95.7	-2.1
Physical Therapists	330	1,020	980	197.0	-3.9
Physical Therapist Assistants	100	530	560	460.0	5.7
Physician Assistants	180	780	610	238.9	-21.8
Physicians, Family and General Practitioners	270	830	NA	NA	NA
Physicians, Obstetricians and Gynecologists	NA	70	130	NA	85.7
Physicians, Pediatricians	30	NA	150	400.0	NA
Physicians, Psychiatrists	NA	50	80	NA	60.0
Physicians, Surgeons	100	120	210	110.0	75.0
Physicians and Surgeons, All Other	380	1,120	1,260	231.6	12.5
Radiologic Technologists and Technicians	380	650	820	115.8	26.2
Recreational Therapists	60	100	110	83.3	10.0
Respiratory Therapists	240	540	650	170.8	20.4
Speech-language Pathologists	390	570	620	59.0	8.8
Surgical Technologists	220	540	730	231.8	35.2

Sources: Michigan 2015: http://www.bls.gov/oes/2015/may/oes_mi.htm.
Grand Rapids 2015: http://www.bls.gov/oes/2015/may/oes_24340.htm.

Michigan 2017: http://www.bls.gov/oes/2017/may/oes_mi.htm.
Grand Rapids 2017: http://www.bls.gov/oes/2017/may/oes_24340.htm.

Michigan 2018: http://www.bls.gov/oes/2018/may/oes_mi.htm.
Grand Rapids 2018: http://www.bls.gov/oes/2018/may/oes_24340.htm.

Note: NA = Not Available

	Michigan				
	Employment (2005)	Employment (2017)	Employment (2018)	Employment Growth (%) Since 2005	Employment Growth (%) Since 2017
	NA	580	NA	NA	NA
	690	440	450	-34.8	NA
	1,940	2,470	2,510	29.4	1.6
	9,650	9,550	9,960	3.2	4.3
	7,850	10,090	9,510	21.1	-5.7
	4,570	4,060	3,810	-16.6	-6.2
	1,510	2,510	2,670	76.8	6.4
	1,410	1,790	2,010	42.6	12.3
	6,670	6,850	7,100	6.4	3.6
	26,150	27,100	26,580	1.6	-1.9
	14,490	22,790	23,680	63.4	3.9
	4,820	5,890	6,050	25.5	2.7
	3,080	1,950	1,810	-41.2	-7.2
	960	670	630	-34.4	-6.0
	NA	3,970	4,490	NA	13.1
	81,370	94,090	96,680	18.8	2.8
	17,850	14,920	14,840	-16.9	-0.5
	48,960	51,640	49,760	1.6	-3.6
	3,510	4,780	4,580	30.5	-4.2
	890	1,140	1,140	28.1	0.0
	3,550	3,650	3,580	0.8	-1.9
	1,290	1,440	1,590	23.3	10.4
	8,110	9,420	9,140	12.7	-3.0
	8,560	14,390	15,580	82.0	8.3
	5,170	8,250	7,970	54.2	-3.4
	2,550	3,870	3,800	49.0	-1.8
	2,320	4,780	4,490	93.5	-6.1
	3,030	4,860	3,320	9.6	-31.7
	750	680	730	-2.7	7.4
	370	730	930	151.4	27.4
	400	590	630	57.5	6.8
	1,640	1,270	1,320	-19.5	3.9
	10,220	16,370	16,480	61.3	0.7
	6,020	6,390	6,710	11.5	5.0
	700	610	710	1.4	16.4
	3,390	4,270	4,580	35.1	7.3
	3,340	3,400	3,950	18.3	16.2
	2,610	4,010	4,240	62.5	5.7

Table 2: College and University Programs — Associate's Degree/Certificate

Color Key: Students Enrolled Over Last Three Years / Graduates Over Last Three Years	Davenport University		Ferris State University		Grand Rapids Community College		Kellogg Community College	
Allied Health Sciences			1,183	53				
Biology								
Chemistry								
Dental Assistant/Assisting					78	42		
Dental Hygiene/Hygienist			196	115	188	94	151	54
Diagnostic Medical Sonography			93	55				
Dietary and Food Service Management			6	8				
Electrocardiogram (ECG) Technician								
Emergency Medical Services							69	20
Emergency Medical Technician[1]							51	81
Fire Science								
Gerontology			0	153	12	0		
Health Information Technology	354	153	122	103				
Kinesiology								
Magnetic Resonance Imaging (MRI)							13	0
Medical Assistant[2]	386	202					45	28
Medical Billing								
Medical Laboratory Technology			7	9			0	5
Medical Office Administration								
Nursing Assistant (CNA)								
Nursing[3]	97	97			682	429	1,011	870
Occupational Therapy Assistant					144	58		
Phlebotomy								
Physical Therapist Assistant							138	69
Psychology			95	12				
Radiography[4]			201	120	139	58	89	52
Respiratory Care			112	72				
Surgical Technology								

Notes:
[1]Combined Emergency Medical Technician (SMC) and EMT-Basic and EMT-Paramedic (KCC).
[2]Includes Medical Administrative Assistance (KCC), Medical Assistant (Davenport and Montcalm), Medical Assistant Office and Clinical (SMC).
[3]Includes Practical Nursing (Davenport), Practical Nurse (GRCC), Nursing LPN (Muskegon CC), and Nursing-Practical (KCC). Nursing (RN, Practical Nursing LPN, Paramedic to RN, LPN to RN) (SMC).
[4]Includes Radiologic Technology (GRCC).
Tables do not include programs with no information readily available and programs with a value of 0 for both enrollment and graduates.

Lansing Community College		Montcalm Community College		Muskegon Community College		Southwestern Michigan College		West Shore Community College		TOTAL ENROLLMENT	TOTAL GRADUATES
										1,183	53
1,317	40									1,317	40
465	20									465	20
										78	42
269	66									804	329
										93	55
										6	8
						4	0			4	0
										69	20
						16	1			67	82
206	78					15	8			221	86
										12	153
						61	25			537	281
724	42									724	42
										13	0
		110	20					47	4	588	254
								22	9	22	9
										7	14
		136	30							136	30
						3	0	53	2	56	2
2,137	1,098	533	139	986	451	440	167	174	196	6,060	3,447
										144	58
						10	0			10	0
										138	69
										95	12
234	100							3	0	666	330
				212	60					324	132
21	63									21	63

Table 3: College and University Programs — Bachelor's Degree

Color Key: Students Enrolled Over Last Three Years / Graduates Over Last Three Years	Albion College		Calvin College		Central Michigan University		Cornerstone University		Davenport University	
Allied Health Sciences										
Animal Science/Pre-Vet										
Athletic Training	31	16			234	67				
Biochemistry	89	24	402	114	206	65				
Biochemistry and Molecular Biology										
Biochemistry and Molecular Biology/Biotechnology										
Biology	317	115	618	139	689	685	139	4		
Biomedical Laboratory Science										
Biomedical Sciences										
Biopsychology										
Biosystems Engineering										
Cardiac Rehabilitation							26	0		
Cell and Molecular Biology										
Chemistry	56	14	133	22	91	30				
Clinical Laboratory Sciences										
Communication Disorders					668	214				
Community Health							1	0		
Dental Hygiene										
Diagnostic Medical Sonography										
Dietetics					339	105				
Environmental Biology/Microbiology										
Environmental Biology/Plant Biology										
Exercise Science	184	54			1,702	585	164	69		
Genomics and Molecular Genetics										
Health Administration					451	151				
Health Care Systems Administration										
Health Communication										
Health Fitness in Preventive and Rehabilitative Programs					2	175				
Health Information Management									375	71
Health Services Administration									542	138
Human Biology										
Kinesiology			498	103						
Medical Case Management									525	0
Medical Laboratory Sciences										
Microbiology										
Molecular Diagnostics										
Neuroscience	16	0			532	141				
Nuclear Medicine Technology										
Nursing[1]			883	186					2,050	454
Nutritional Sciences										
Occupational Therapy										
Physics	19	11	64	10	38	8				
Physiology										
Public Health										
Psychology	264	90	567	155			230	137		
Radiation Therapy										
Radiologic and Imaging Sciences										
Social Work			298	100	621	162	163	36		
Sociology	79	21	125	39	157	169				
Speech Pathology and Audiology			416	95						
Therapeutic Recreation			154	35						

Notes:
Tables do not include programs with a value of 0 for both enrollment and graduates.
[1]Nursing program for Aquinas College is a partnership with Detroit Mercy and students graduate from Detroit Mercy with a B.S.N.

Ferris State University		Grand Valley State University		Hope College		Michigan State University		Western Michigan University		Aquinas College		Kuyper College		TOTAL ENROLLMENT	TOTAL GRADUATES
457	183	2,826	713											3,283	896
						1,874	381							1,874	381
		528	72	55	20	384	63	77	35	63	24			1,372	297
21	4	325	51					223	32					1,266	290
				126	32	866	186							992	218
102	27					302	55							404	82
135	301	1,721	329	429	136	28	6	685	101	214	92			4,975	1,908
						966	188							966	188
		3,595	710					1,919	310					5,514	1,020
		20	12											20	12
						674	132							674	132
														26	0
		280	57											280	57
		300	53			775	180	190	22	26	8			1,571	329
						95	63							95	63
														668	214
														1	0
115	47													115	47
		614	80											614	80
						522	193	76	74					937	372
						59	7							59	7
						76	12					2	0	78	12
		3,184	750	400	135			1,012	255	74	35	5	1	6,725	1,884
						600	147							600	147
														451	151
460	235													460	235
		315	119											315	119
														2	175
185	68													560	139
														542	138
						4,721	1,092							4,721	1,092
						3,452	955							3,950	1,058
														525	0
119	60	280	57											399	117
						500	156							500	156
48	22													48	22
						2,068	411							2,616	552
130	87													130	87
1,540	744	1,356	618	519	130	1,411	595	1,011	388	567	0			9,337	3,115
						603	158							603	158
								287	137					287	137
		118	21	46	6	751	116	124	17					1,160	189
						912	207							912	207
87	13													87	13
380	95	2,944	828	763	232	3,626	1,053	861	421	207	73			9,842	3,084
		336	53											336	53
		42	20											42	20
592	198	1,218	345	254	87	598	197	344	249			163	24	4,251	1,398
31	10	276	101	234	61	322	116	286	108	48	19			1,558	644
								216	92					632	187
		462	113											616	148

Table 4: College and University Programs — Master's Degree

Color Key: Students Enrolled Over Last Three Years / Graduates Over Last Three Years	Calvin College		Central Michigan University		Davenport University		
Animal Science							
Biology/Biological Sciences			72	111			
Biomedical Laboratory Science/Operations							
Biomedical Sciences							
Biostatistics							
Cell and Molecular Biology							
Chemical Engineering							
Chemistry			63	19			
Communication Disorders			0	120			
Comparative Medicine and Integrative Biology							
Counseling Psychology							
Dietetics			29	87			
Epidemiology							
Exercise Physiology							
Health Administration			85	393			
Health and Risk Communication							
Integrative Pharmacology							
Kinesiology							
Medical and Bioinformatics					131	10	
Neuroscience			17	18			
Nursing					57	12	
Occupational Therapy					240	52	
Physician Assistant			220	107			
Pharmacology and Toxicology							
Physics			39	32			
Physiology							
Psychology							
Public Health							
Speech-language Pathology	102	92	241	120			
Social Work							
Sociology							
Vision Rehabilitation Therapy							

Note:
Tables do not include programs with a value of 0 for both enrollment and graduates.

	Ferris State University		Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
					39	16			39	16
			118	34			109	39	299	184
					60	13			60	13
			60	17					60	17
			100	45	40	19			140	64
			106	34					106	34
					17	15	35	17	52	32
							25	10	88	29
					188	94			188	214
					47	7			47	7
							392	118	392	118
									29	87
					34	19			34	19
							66	26	66	26
			209	66					294	459
					37	17			37	17
					17	11			17	11
					167	88			167	88
			70	22					201	32
					2	1			19	19
	302	74	32	18	469	177	61	14	921	295
			407	165			554	286	1,201	503
			423	138			225	117	868	362
					437	121			437	121
					8	43	10	10	57	85
					13	4			13	4
					85	48	304	137	389	185
			308	134	380	256			688	390
			238	98			176	90	757	400
	216	66	963	473			1,111	383	2,290	922
					1	9	26	7	27	16
							83	47	83	47

Table 5: College and University Programs — Doctoral Degree

Color Key: Students Enrolled Over Last Three Years / Graduates Over Last Three Years	Central Michigan University		Ferris State University		
Animal Science					
Audiology	152	30			
Biochemistry and Molecular Biology					
Biochemistry and Molecular Biology-Environmental Toxicology					
Biological Sciences					
Biosystems Engineering					
Cell and Molecular Biology					
Cell and Molecular Biology- Environmental Toxicology					
Chemical Engineering					
Chemistry					
Communicative Sciences and Disorders					
Comparative Medicine and Integrative Biology					
Counseling Psychology					
Epidemiology					
Genetics					
Genetics-Environmental Toxicology					
Health Administration	0	51			
Human Nutrition					
Kinesiology					
Medicine	1,179	155			
Neuroscience	51	3			
Nursing					
Optometry			445	106	
Pathobiology					
Pharmacology and Toxicology					
Pharmacy			1,722	420	
Physics					
Physiology					
Psychology					
Physical Therapy	534	160			
Rehabilitation Counseling					
Social Work					
Sociology					

Note:
Tables do not include programs with a value of 0 for both enrollment and graduates.

	Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
			59	10			59	10
					66	15	218	45
			134	24			134	24
			6	1			6	1
					84	9	84	9
			59	14			59	14
			73	18			73	18
			3	1			3	1
			131	26			131	26
			608	84	74	17	682	101
			31	1			31	1
			106	15			106	15
					153	22	153	22
			70	10			70	10
			58	21			58	21
			1	1			1	1
							0	51
			35	9			35	9
			138	30			138	30
			6,122	580			7,301	735
			55	15			106	18
	324	94	131	11			455	105
							445	106
			5	1			5	1
			55	4			55	4
							1,722	420
			471	48	69	5	540	53
			53	5			53	5
			204	36	291	54	495	90
	531	166					1,065	326
			48	11			48	11
			54	14			54	14
			89	25	85	9	174	34

Table 6: Need for Selected Professions in Michigan

Selected Professions	Michigan Employment (2018)[1]	Grand Rapids Employment (2018)[2]	Michigan Annual Growth Rate[3]	Grand Rapids Annual Growth Rate[4]
Dental Assistants	9,960	1,060	0.004	0.008
Dental Hygienists	9,510	1,010	0.004	0.008
Diagnostic Medical Sonographers	2,670	330	0.018	0.029
Dietitians and Nutritionists	2,010	260	0.001	0.019
EMTs and Paramedics	7,100	520	0.016	0.018
Family and General Practitioners	3,320	NA	0.004	0.006
Home Health Aides	26,580	1,840	0.024	0.028
Nurses, RN	96,680	12,550	0.012	0.022
Nurses, LPN or LVN	14,840	2,030	0.005	0.009
Medical Assistants	23,680	2,440	0.001	0.016
Nurse Practitioners	4,490	350	0.021	0.029
Nursing Assistants	49,760	7,280	0.009	0.015
Occupational Therapy Assistants	1,140	260	0.023	0.032
Occupational Therapists	4,580	580	0.015	0.024
Optometrists	1,590	260	0.012	0.017
Physician Assistants	4,490	610	0.018	0.024
Physical Therapists	7,970	980	0.02	0.028
Respiratory Therapists	4,580	650	0.01	0.022
Speech-language Pathologists	3,950	620	0.007	0.014
Surgical Technologists	4,240	730	0.009	0.02

Notes:
[1]Source: https://www.bls.gov/oes/2018/may/oes_mi.htm.
[2]Source: https://www.bls.gov/oes/2018/may/oes_24340.htm.
[3]Source: http://milmi.mt.gov/datasearch/projections-excel (Statewide Long-Term Projections 2014-2024, Occupational Projections).
[4]Source: http://milmi.mt.gov/datasearch/projections-excel (Michigan Regional Long-Term Employment Projections 2014-2024, West Michigan Prosperity Region Occupational Projections).

Replacement rates = (Replacement/Employment 2014)

NA = Not Available

	Michigan Projected Employment (2024)	Grand Rapids Projected Employment (2024)	Michigan Annual Job Growth	Grand Rapids Annual Job Growth	Michigan Annual Replacement Rate	Grand Rapids Annual Replacement Rate	Average Annual Job Openings in Michigan[1]	Average Annual Job Openings in Grand Rapids[1]
	10,201	1,112	34	7	0.025	0.024	283	33
	9,741	1,059	33	7	0.016	0.017	185	24
	2,972	392	43	9	0.019	0.018	94	15
	2,022	291	2	4	0.008	0.006	18	6
	7,809	579	101	8	0.016	0.016	215	17
	3,400	NA	11	NA	0.027	0.027	101	N/A
	30,645	2,172	581	47	0.023	0.023	1,192	90
	103,853	14,300	1,025	250	0.024	0.024	3,345	551
	15,291	2,142	64	16	0.028	0.028	480	73
	23,822	2,684	20	35	0.021	0.021	518	86
	5,086	415	85	9	0.024	0.023	193	17
	52,508	7,960	393	97	0.023	0.023	1,537	265
	1,307	314	24	8	0.029	0.029	57	15
	5,008	669	61	13	0.019	0.019	148	24
	1,708	288	17	4	0.035	0.037	73	14
	4,997	703	72	13	0.023	0.023	176	27
	8,976	1,157	144	25	0.027	0.027	359	52
	4,862	741	40	13	0.023	0.024	146	29
	4,119	674	24	8	0.025	0.025	123	23
	4,474	822	33	13	0.01	0.01	76	20

Table 7: Average Annual Earnings for Select Health Care Professions

Selected Professions Color Key: Above Seven Percent Below Negative Seven Percent (-7%)	2005 Mean Annual Earnings*			2017 Mean Annual Earnings*		
	Grand Rapids**	Michigan	U.S.	Grand Rapids	Michigan	U.S.
Dental Assistant	$41,582	$39,845	$38,534	$43,016	$37,371	$39,635
Dental Hygienist	$65,910	$71,192	$77,942	$66,127	$63,893	$76,504
Diagnostic Medical Sonographer	$64,878	$66,795	$71,269	$60,933	$61,886	$74,988
Dietitian and Nutritionist	$59,348	$60,263	$59,080	$58,925	$56,671	$61,619
EMT and Paramedic	$38,892	$35,898	$36,567	$36,439	$33,150	$37,596
Family and General Practitioner	$203,612	$179,426	$180,481	$180,073	$195,931	$213,654
Home Health Aide	$26,600	$24,661	$24,969	$24,392	$23,992	$24,873
LPN	$47,172	$48,473	$46,557	$42,923	$48,824	$46,826
Medical Assistant	$34,999	$33,970	$33,635	$34,052	$32,034	$34,400
Nurse Practitioner	NA	NA	NA	$99,533	$104,747	$110,105
Nursing Assistant	$29,186	$30,421	$28,544	$29,411	$29,913	$29,237
Occupational Therapy Assistant	$43,389	$50,736	$51,173	$47,728	$54,663	$60,923
Occupational Therapist	$82,942	$71,012	$75,988	$70,388	$82,067	$86,707
Optometrist	$109,657	$123,921	$122,789	$114,469	$116,661	$122,009
Physician Assistant	$96,379	$92,304	$91,378	$111,877	$106,007	$107,319
Physical Therapist	$81,189	$85,014	$84,024	$85,714	$91,235	$90,231
Respiratory Therapist	$71,743	$59,209	$59,492	$56,466	$57,194	$63,320
RN	$67,117	$73,532	$73,133	$65,594	$70,808	$75,346
Speech-language Pathologist	$104,387	$83,098	$74,574	$73,195	$80,069	$81,718
Surgical Technologist	$45,943	$47,148	$46,184	$42,053	$43,446	$49,234

Source: https://www.bls.gov/oes/tables.htm.

Notes:
*2005 and 2017 Mean Annual Wages are inflated to 2018 dollars.
**2005 Mean Annual Wages for Grand Rapids were approximated using hourly wage data.

	2018 Mean Annual Earnings			Percent Change in Real Annual Earnings Since 2005			Percent Change in Real Annual Earnings Since 2017		
	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.
	$42,720	$37,140	$39,770	2.74	-6.79	3.21	-0.69	-0.62	0.34
	$65,680	$64,130	$75,500	-0.35	-9.92	-3.13	-0.68	0.37	-1.31
	$60,010	$61,130	$73,860	-7.50	-8.48	3.64	-1.51	-1.22	-1.50
	$57,530	$57,000	$61,210	-3.06	-5.41	3.60	-2.37	0.58	-0.66
	$36,470	$33,720	$37,760	-6.23	-6.07	3.26	0.09	1.72	0.44
	$227,780	$207,110	$211,780	11.87	15.43	17.34	26.49	5.71	-0.88
	$26,900	$24,770	$25,330	1.13	0.44	1.44	10.28	3.24	1.84
	$43,520	$49,040	$47,050	-7.74	1.17	1.06	1.39	0.44	0.48
	$34,320	$32,540	$34,540	-1.94	-4.21	2.69	0.79	1.58	0.41
	$99,120	$106,880	$110,030	NA	NA	NA	-0.42	2.04	-0.07
	$28,760	$30,130	$29,580	-1.46	-0.96	3.63	-2.21	0.72	1.17
	$47,840	$52,410	$60,410	10.26	3.30	18.05	0.23	-4.12	-0.84
	$70,890	$77,940	$85,350	-14.53	9.76	12.32	0.71	-5.03	-1.57
	$122,500	$112,440	$119,980	11.71	-9.26	-2.29	7.02	-3.62	-1.66
	$114,260	$110,240	$108,430	18.55	19.43	18.66	2.13	3.99	1.04
	$85,640	$91,160	$88,880	5.48	7.23	5.78	-0.09	-0.08	-1.50
	$56,490	$57,040	$62,500	-21.26	-3.66	5.06	0.04	-0.27	-1.29
	$65,930	$71,330	$75,510	-1.77	-2.99	3.25	0.51	0.74	0.22
	$72,420	$78,220	$80,700	-30.62	-5.87	8.22	-1.06	-2.31	-1.25
	$40,970	$43,280	$49,040	-10.83	-8.20	6.18	-2.57	-0.38	-0.39

Medical Patents

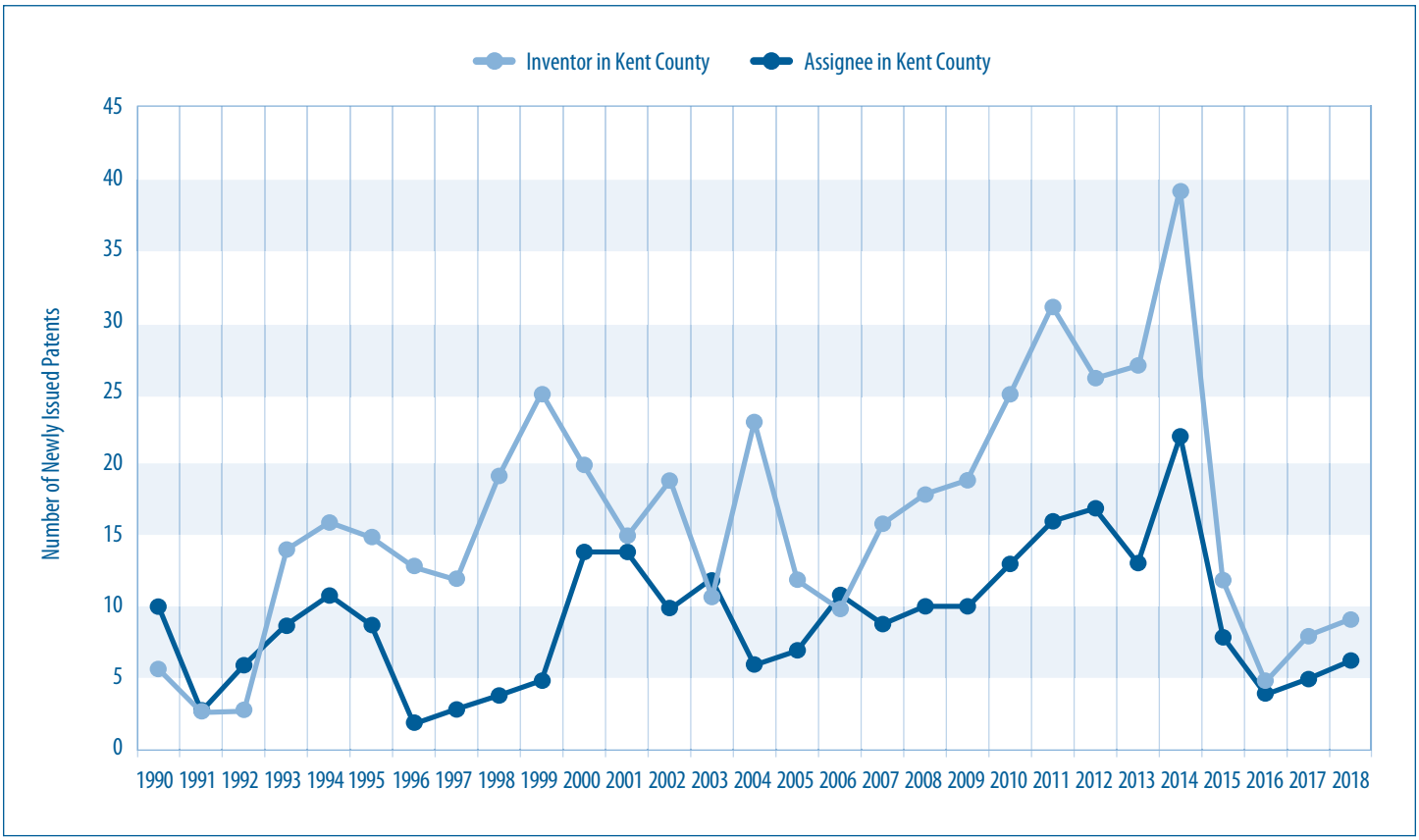
A patent is the property right granted to an inventor or assignee for a new or improved product, process, or piece of equipment. Patents are used as indicators of economic growth because of the investment that went into creating the innovations as well as the investment opportunities that result from the innovations.

There are drawbacks, however, to relying on patent data to measure innovative activity. Some inventors and assignees choose not to register patents for their innovations because doing so will require them to divulge details to competitors. In addition, not all patents have a substantial impact on economic progress. On the whole, though, patents are seen as reflecting significant contributions to society and the economy in general. The use of patents is particularly relevant in the medical field due to the large amount of spending for medical research and development (R&D).

The database of the U.S. Patent and Trademark Office (USPTO) indicates the name and location of both a patent's inventor and its assignee (owner). In some cases, the inventor owns the patent. But in corporate settings, the business itself is usually the assignee while an individual researcher is the inventor. This differentiation can then result in location differences, for example, the inventor lives in Kent County, but the company that owns the patent is located in China or perhaps the inventor lives in Germany, but the assignee is a company in West Michigan. To evaluate the economic significance of innovative activities, considering inventors and assignees separately is useful.

Figure 1 shows the number of new medical patents granted by the USPTO to inventors residing in Kent County and, separately, patents with assignees in Kent County, from the year 1990 through 2018. For those with inventors living in Kent County, the average annual number of patents increased from 12.6 (during 1990 to 1999) to 16.3 (during 2000 to 2009), with a further increase to an average of 20.2 (during 2010 to 2018). For those with assignees in Kent County, the average annual number of patents increased from 6.2 (during 1990 to 1999) to 10.3 (during 2000 to 2009) and to 11.6 (during 2010 to 2018). This growth in medical patents owned by entities in Kent County or invented by innovators in Kent County is an indicator of economic progress, as new discoveries and improvements can result in technological advancements. Over time, such innovations could encourage greater investment and lead to additional job opportunities in the regional economy.

Figure 1: Medical Patenting in Kent County, 1990–2018

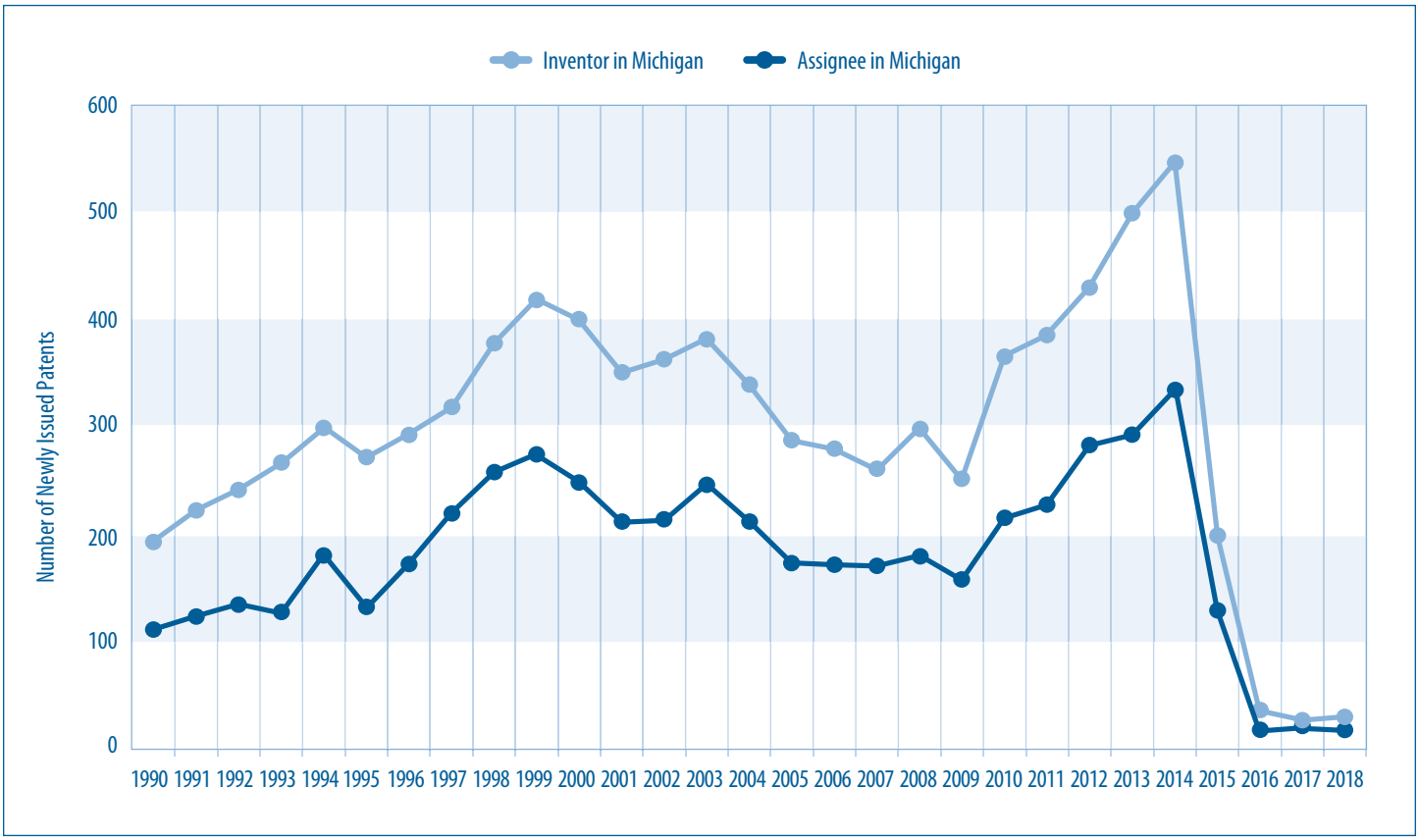


Source: United States Patent and Trademark Office.
www.uspto.gov

Although the average annual number of patents has increased over time, **Figure 1** clearly shows that there has been a significant decrease in patenting since 2014, with the annual number of new patents with inventors living in Kent County falling by 76.9 percent from 2014 to 2018 and the annual number of new patents with assignees located in Kent County falling by 72.7 percent over the same period.

To determine if this recent change in medical patenting is specific to Kent County, we compared **Figure 1** with **Figure 2**, which shows the parallel data for the State of Michigan as a whole. The two figures have similar patterns, with generally upward trends followed by stark declines since 2014. Furthermore, rather than a regional aberration, the decline in medical patenting appears to be a national phenomenon, as can be seen in **Table 1**, which displays the percentage change in the annual number of new medical patents for Kent County, Michigan, and the entire U.S., from 2014 to 2018.

Figure 2: Medical Patenting in Michigan, 1990–2018



Source: United States Patent and Trademark Office.
www.uspto.gov

Table 1: Percentage Change in Newly Issued Medical Patents by Location of Inventor and Assignee, 2014-2018

	Location of Inventor			Location of Assignee		
	Kent County	Michigan	U.S.	Kent County	Michigan	U.S.
Percent Change 2014-2018	-77	-95	-96	-73	-95	-96

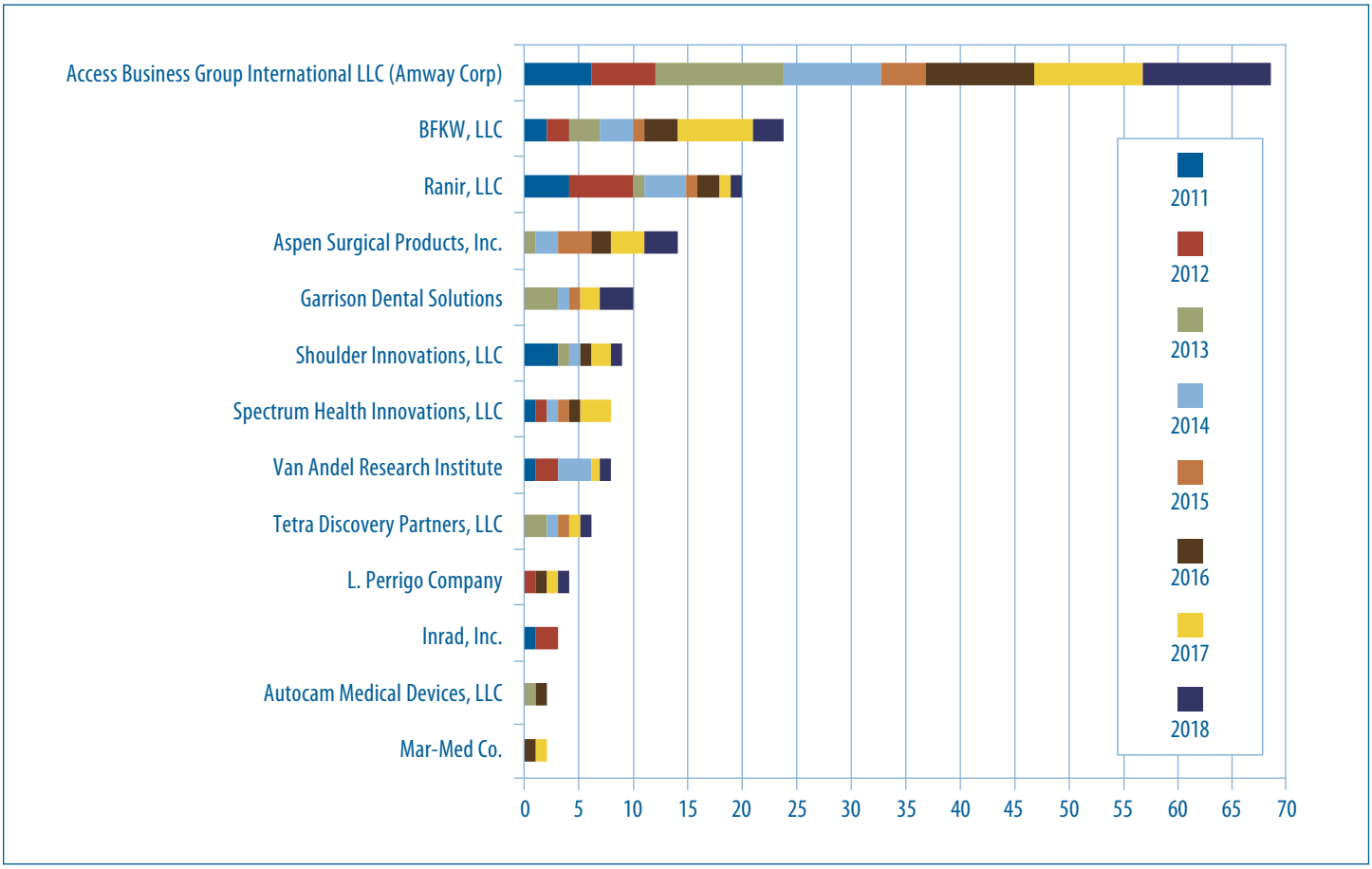
Source: United States Patent and Trademark Office.
www.uspto.gov

Comparing the national, state, and local patent data is revealing. In 2014, 2.3 percent of all of the new medical patents with a U.S. inventor had an inventor from Michigan. Although the overall number of new medical patents fell in the following years for both the state and the nation as a whole, this percentage did not change significantly. In 2018, 2.5 percent of new medical patents with a U.S. inventor had an inventor from Michigan. However, out of the new Michigan medical patents, 7.2 percent had an inventor from Kent County in 2014, while in 2018 this percentage increased more than four-fold to 32 percent. Thus, although the quantity of medical patenting has decreased in recent years, the relative output of inventors in Kent County has grown.

A patent obtained through the USPTO only gives property right protection in the U.S. While this protection is sufficient for some inventors and assignees, others choose to apply for patents in other countries to receive property rights elsewhere. One way to do this is through the World Intellectual Property Organization (WIPO). Filing an international patent application with the WIPO allows an inventor to then pursue patent rights in up to 150 countries simultaneously.

The number of nonduplicate medical patent applications filed by West Michigan companies at the WIPO and at the USPTO from 2011 through 2018 is shown in **Figure 3**. Since the year 2011, there have been 179 medical patent filings from 13 West Michigan companies. However, the majority of these filings come from only three companies, which together are responsible for approximately 63 percent of the total number of filings. Although the most prolific companies consistently apply for medical patents over time, the same is not true for all of the others, as 31 percent of the listed companies did not apply for any medical patents in 2018.

Figure 3: Medical Patent Applications in West Michigan, KOMA Region*



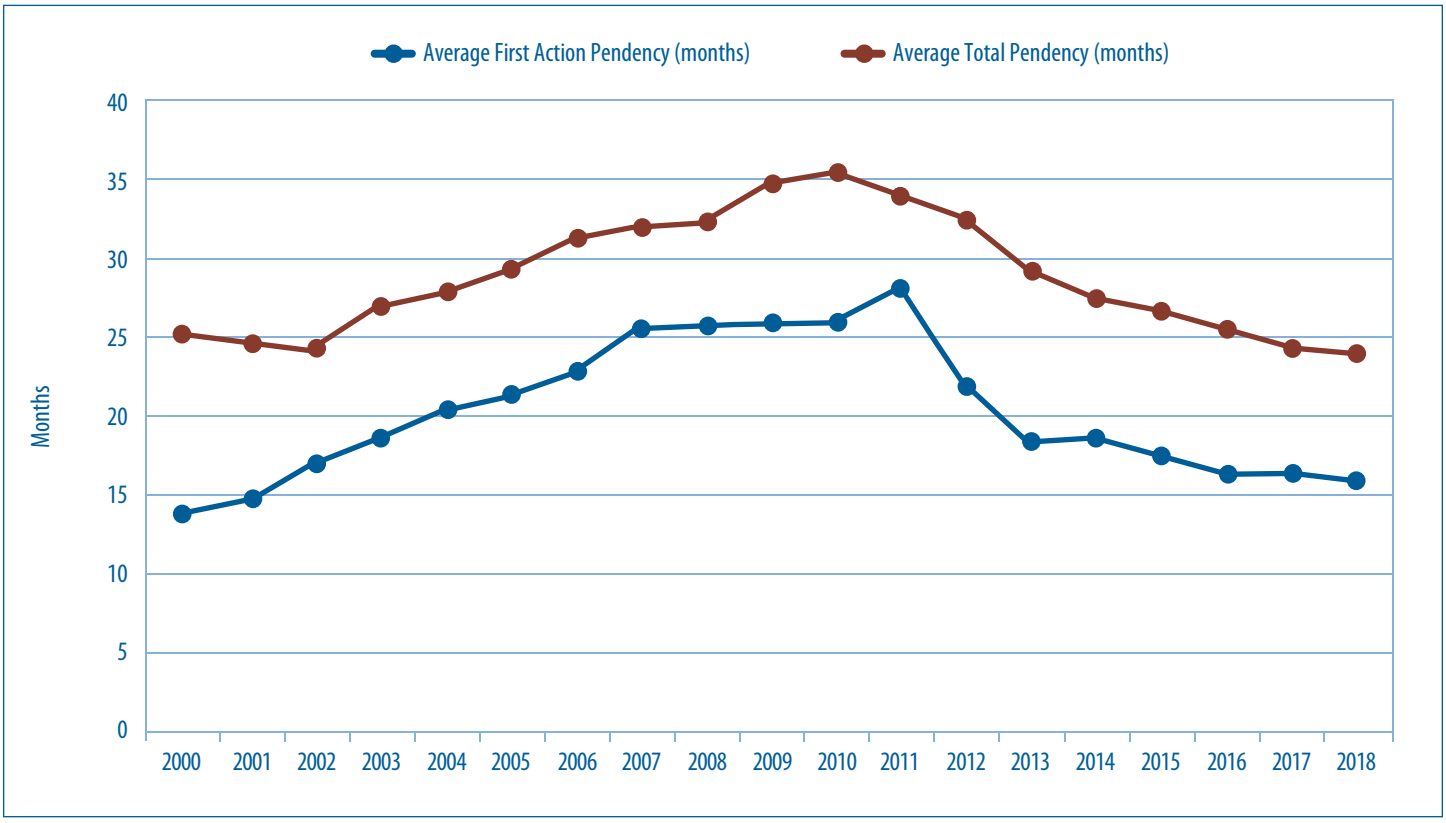
*Kent, Ottawa, Muskegon, and Allegan Counties.
Sources: United States Patent and Trademark Office and World Intellectual Property Organization.
www.uspto.gov and www.wipo.int

What could cause the relatively modest volume of medical patenting in West Michigan in recent years? The patenting process involves time delays between application and approval. If the processing time has increased since 2014, then that could help explain the recent declines in approved medical patents. Data on patent wait times ("pendency") is not available for medical patents specifically, but is available for USPTO patent applications as a whole. **Figure 4** shows the average wait times for the first action made by the USPTO on patent applications and for the entire "start to finish" time, from fiscal years 2000 through 2018. Rather than increasing in recent years, the average wait time has been decreasing since 2010 for Average Total Pendency and 2011 for Average First Action Pendency, though it is possible that this pattern does not hold for medical patents.

One possible explanation for the recent decrease in medical patents rests on a change in the patenting process itself and the resulting incentive structure. The Leahy-Smith America Invents Act (AIA) of 2011 switched U.S. patenting from a "first-to-invent" to a "first-to-file" system for patent applications filed on or after March 16, 2013. The act also made changes to patenting fees and the definition of "prior art" for patent reviews. Although the AIA was intended to encourage patenting, some have argued that aspects of the law might be particularly disadvantageous to small businesses and independent inventors.

Other explanations not examined here might be at the root of the patenting changes illustrated in this section. Whatever the cause or causes, the recent decreases in patenting are concerning, as patented medical innovation has the potential to become a significant driver of economic growth in West Michigan.

Figure 4: USPTO Patent Wait Times*, 2000–2018



*By fiscal year. First action pendency is the estimated time in months from filing to the date a first action is filed by the USPTO, as well as any time awaiting a reply from an applicant to submit all parts of their application. Total pendency is the estimated time in months from filing to issue or abandonment of the patent application.

Source: United States Patent and Trademark Office.
www.uspto.gov

Health Care Trends

GRAND VALLEY STATE UNIVERSITY
www.gvsu.edu

Demographic Changes

Demographic changes have significant effects on the utilization of health care services. We continue to monitor two key trends: continued population growth on the west side of the state and an increase in the average age of the population. Because older individuals tend to have more health care needs than younger individuals, an aging population can result in increased health care utilization and, as a result, increased expenditures. Additionally, previously noted geographic shifts in population distribution from east to west can affect demand for care and resource allocation in particular regions.

Population Growth

Figure 1 displays population growth rates for Kent, Ottawa, Muskegon, and Allegan counties (KOMA), the Detroit region (Oakland, Macomb, and Wayne counties), the entire State of Michigan, and the U.S. Throughout the 1990s, KOMA's population growth rate was greater than both the growth rate for the State of Michigan and the growth rate for the U.S. However, during the recession in the mid 2000s, growth rates for both KOMA and the Detroit region fell drastically. Though KOMA maintained positive population growth throughout the 2000s, the Detroit region experienced population loss beginning in the early 2000s that lasted for more than a decade. The Detroit region achieved positive population growth in the early part of this decade before dipping into a negative growth rate in 2015. Since 2016, however, the Detroit region has experienced low, but positive, growth, and from 2017 to 2018, the population in the Detroit region grew at a rate of 0.09 percent.

KOMA's population growth rate began growing rapidly in 2010 and exceeded the national growth rate in 2012. Over recent years, the positive population growth in West Michigan has continued, but at a slower pace, with growth rates falling from 1.26 percent in 2013 to 0.73 percent in 2018. While the western population growth rate appears to be slowing, the KOMA region population growth in 2018 continued to surpass that in the Detroit region, illustrating a continued shift in population density to the western part of the state. As this trend continues, demand for health care resources and health care infrastructures could be affected. For example, while the share of total state Medicare expenditures fell for both KOMA and the Detroit region from 2010 to 2014, the relative decline was more than 20 times larger for the Detroit region (Centers for Medicare and Medicaid Services, 2017).

In summary, we note declining population growth rates across both the KOMA and Detroit regions, across the State of Michigan as a whole, and furthermore for the U.S. at large, where the rate fell sharply from 0.72 percent in 2017 to 0.44 percent in 2018.

Age Distribution

An important development in demographic trends in the U.S. continues to be the aging of the baby boomers, those born between 1946 and 1964. **Figures 2 through 4** depict population distributions by age for KOMA, the Detroit region, and the U.S. as a whole. The clear trend in all three figures is the steady aging of the population. Persons between the ages of 45 and 64 continue to outnumber all other age groups despite being only the third largest age group in 1990. As noted previously, since 2010, the percentage of the population over the age of 65 has experienced the largest growth of any of the age categories. As a result, the populations between the ages of 5 and 19, 20 and 34, and 35 and 44 all account for a smaller percentage of the total population today than they did in 1990. These trends are important for several reasons.

First, health care expenditures are closely related to age, with more than 50 percent of lifetime spending on medical care occurring after the age of 65 (Alemayehu & Warner, 2004). Due to the demographic shifts (see **Figures 2 through 4**), the Centers for Medicare and Medicaid Services (2017) project total Medicare spending to nearly double between 2015 and 2026. In Michigan, the Detroit region has a higher proportion of its population in the 45 to 64 and 65 and over age categories, which could result in higher medical expenditures. The share of the population over the age of 65 in the Detroit region grew from approximately 12 percent in 1990 to more than 16 percent in 2018. By contrast, KOMA has a population distribution that is slightly younger than the U.S. as a whole. However, increasing medical expenditures associated with an aging population are likely to occur across the entire state.

Second, **Figures 2 through 4** show the proportion of those over the age of 65 in comparison to the population between the prime working ages of 35 and 44. Since the Medicare program is primarily funded through taxes on employment, the participants in the labor market, at any given time, effectively subsidize health insurance for the over 65 age demographic. The number of workers per Medicare beneficiary has fallen steadily since 1995. Whereas in 2000, four workers supported each Medicare enrollee, the number of workers per beneficiary is projected to fall to 2.8 by 2020 (Board of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds, 2012). The implications for the long-term sustainability of the Medicare Part A trust fund are grim, despite recent declines in Medicare expenditure growth rate projections. The most recent Congressional Budget Office projections of Medicare solvency suggest that the Part A trust fund will be exhausted by 2026 (Congressional Research Service, 2019).

Finally, the aging of the population has important implications for employer-sponsored health insurance premiums. As the share of the workforce over the age of 45 grows, the cost of private health insurance obtained through employment will likely continue to increase. From 2008 to 2018, average annual employer-sponsored health insurance premiums for family coverage increased 55 percent, which is more than twice as fast as the real annual wages have grown (26 percent), and three times as fast as the rate of inflation at 17 percent, over the same period (Kaiser Family Foundation, 2018).

References

Alemayehu, B., & Warner K.E., (2004). The lifetime distribution of health care costs. *Health services research, 39*(3), 627-642.

Board of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. (2012). *2012 annual report.* Retrieved August 25, 2018 from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/downloads/tr2012.pdf.

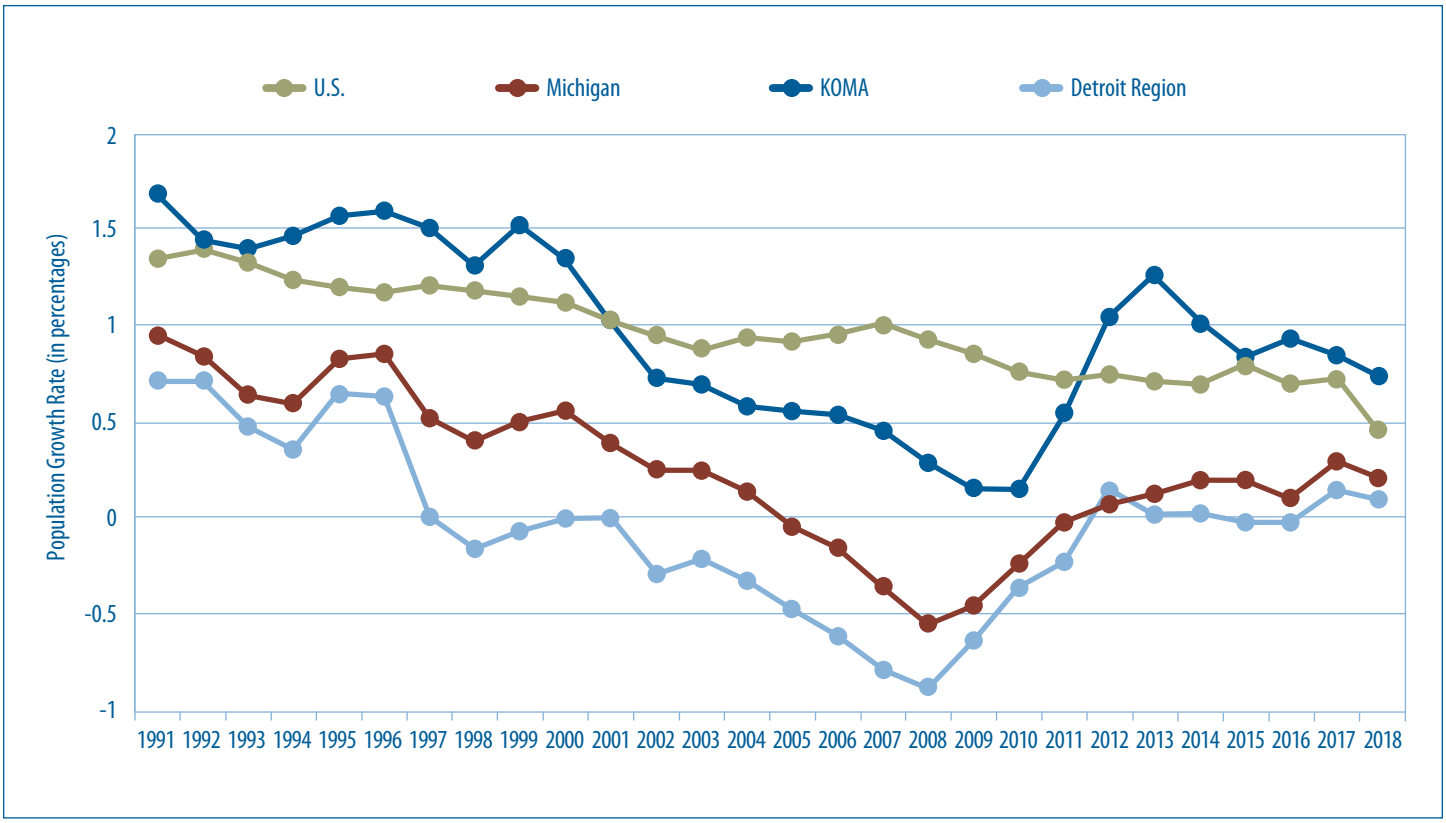
Centers for Medicare and Medicaid Services. (2017). *Medicare geographic variation public use files.* Retrieved August 25, 2018 from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/GV_PUF.html.

Congressional Research Service. (2019). *Medicare: Insolvency projections.* Retrieved September 14, 2019 from https://fas.org/sgp/crs/misc/RS20946.pdf.

Kaiser Family Foundation. (2018). *2018 Employer health benefits survey.* Retrieved August 6, 2019 from http://www.kff.org/health-costs/report/2018-employer- health-benefits-survey/.

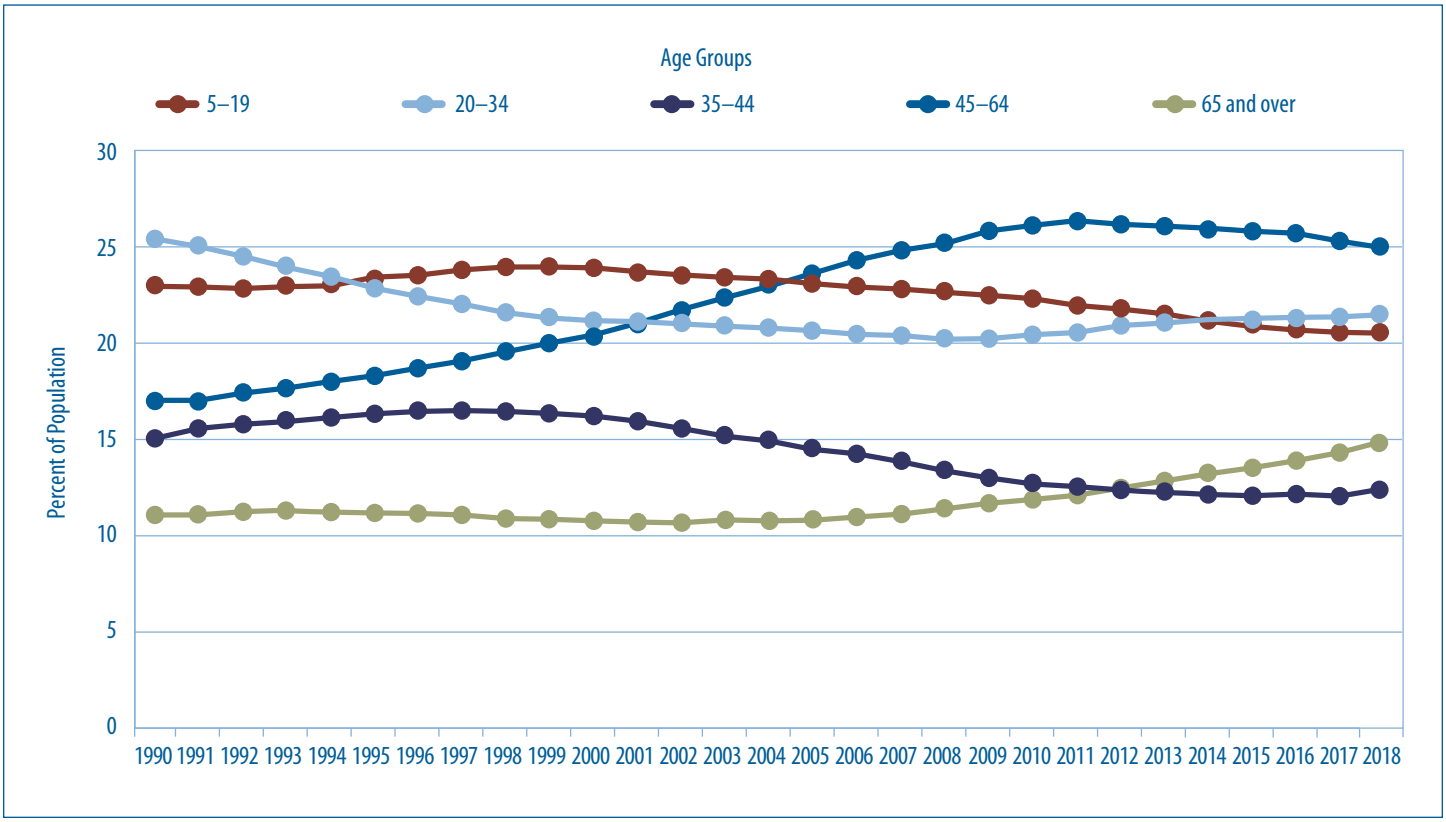
United States Census Bureau. (2018). *County population by characteristics datasets.* Retrieved August 25, 2018 from https://www.census.gov/data/datasets/2017/demo/popest/counties-detail.html.

Figure 1: Annual Population Growth Rate, 1991–2018



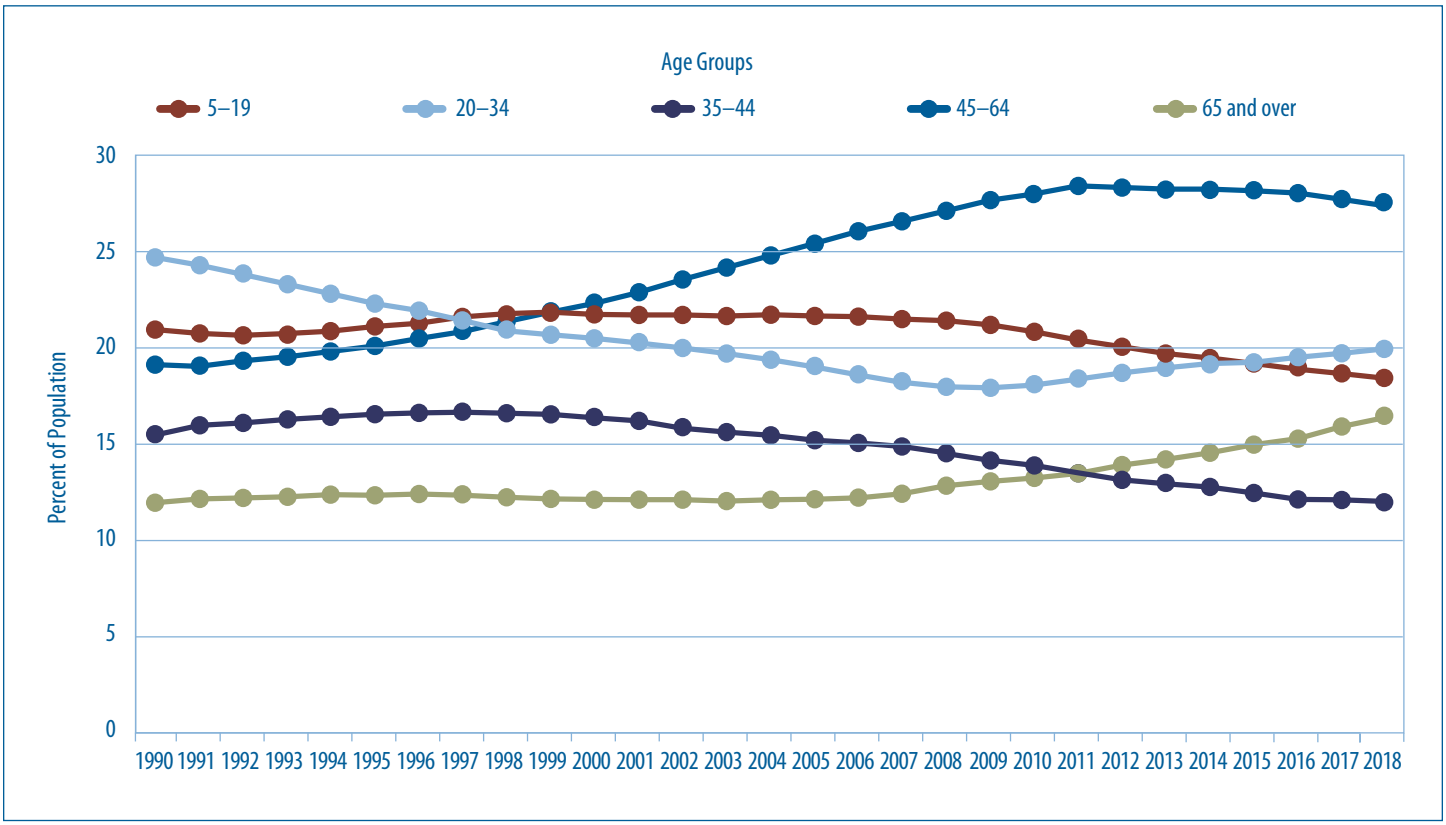
Source: U.S. Census. *Population and housing unit estimates.*

Figure 2: Population Distribution as a Percent of KOMA, 1990–2018



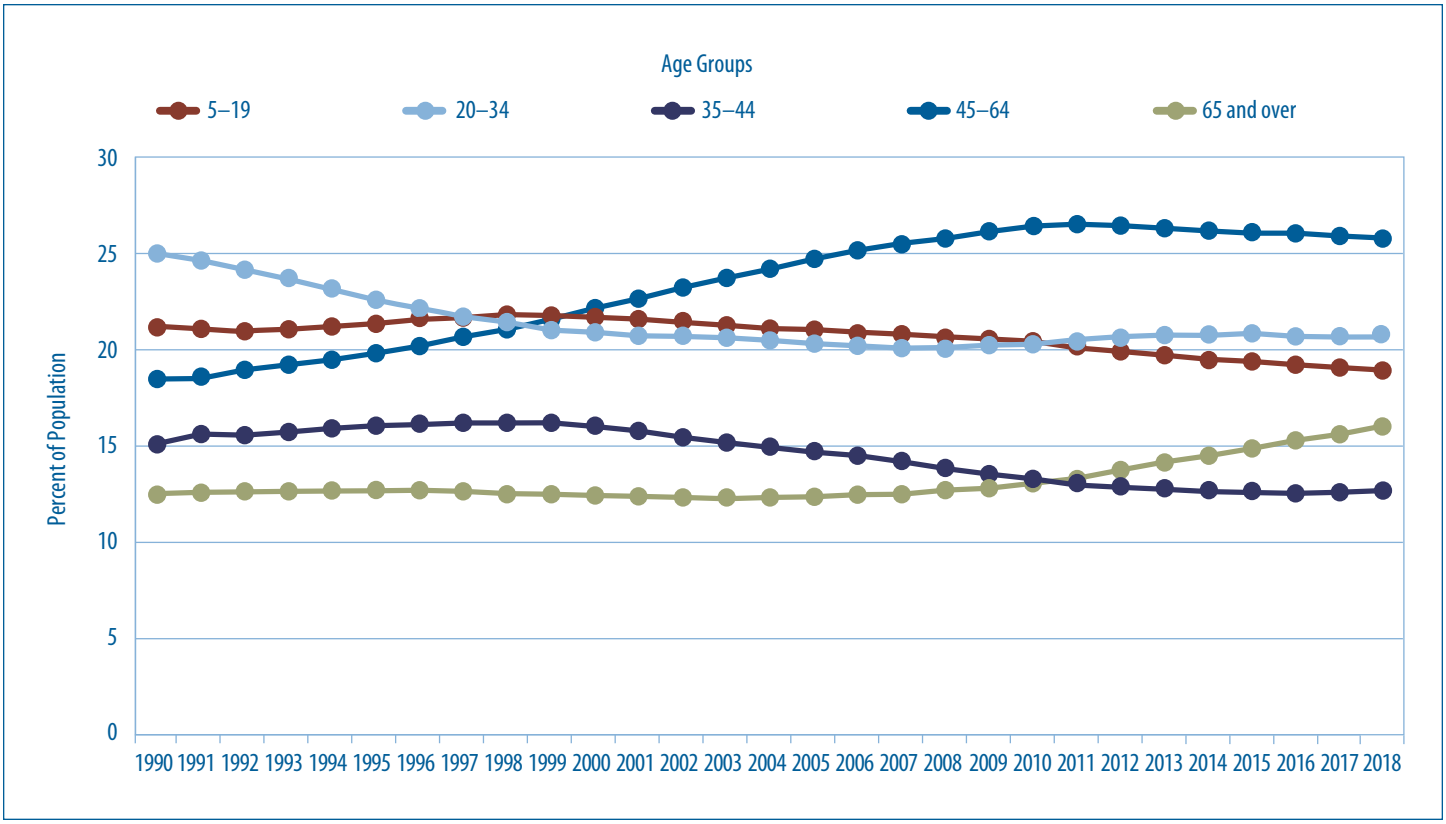
Source: U.S. Census. *Population and housing unit estimates.*

Figure 3: Population Distribution as a Percent of the Detroit Region, 1990–2018



Source: U.S. Census. *Population and housing unit estimates.*

Figure 4: Population Distribution as a Percent of Total United States, 1990–2018



Source: U.S. Census. *Population and housing unit estimates.*

Health Care Overview

In this section, we consider broad health care trends across opioid use and deaths, suicides, mental health, general health risk factors, and access to care, comparing the West Michigan KOMA counties (Kent, Ottawa, Muskegon, and Allegan counties) and the Detroit region (Macomb, Oakland, and Wayne counties). The data on opioids and suicides are sourced from the CDC's IQVIA Xponent and Wide-ranging Online Data for Epidemiologic Research (WONDER) data, while the mental health, risk factors, and access to care data is sourced from the Michigan Department of Health and Human Services, Behavioral Risk Factor Survey System (MiBRFSS). A caveat about the MiBRFSS data is that all estimates are based on self-reported surveys. Consequently, the actual incidence and prevalence rates for the factors examined using this data may differ from those reported by respondents.

Opioid Prescriptions and Overdoses

Figure 1 presents estimates of the number of opioid prescriptions dispensed per 100 persons per year from 2006 to 2017 for both the KOMA and Detroit regions. For the computation of prescribing rates, the numerators are the total number of opioid prescriptions dispensed within the given region, and the denominator is based on resident population estimates from the U.S. Census Bureau. Looking at the Detroit region first, we note a steady rise in the prescribing rate until 2012, when it peaked at just over one annual prescription per capita. Since 2012, the Detroit region has experienced a year-on-year decline in the prescribing rate down to about 0.76 prescriptions per capita in 2017. The trend for the KOMA region is more dramatic with rates remaining below those in the Detroit region prior to 2012, but then growing by roughly 72 percent between 2011 and 2013. After reaching a prescription dispense rate of close to 1.5 per capita in 2013, the KOMA region experienced a drop to 0.57 prescriptions per capita in 2015. This rate has remained largely stable in the KOMA region since 2015, with the rate being 0.64 prescriptions per capita in 2017. Overall, these trends suggest a reversal of opioid prescribing rates in the Detroit region to a level below that in 2006. Furthermore, the level in 2017 remains 38 percent higher (per capita) than what it was at its low in 2006.

Figure 2 tracks the rate for overdose deaths (per 100,000 individuals) for the 1999 to 2017 period, across both the KOMA and Detroit regions. In order to attain a sufficient sample size for analysis, we pooled two years of data for estimates between 1999 and 2012, and then use single year data for 2013 through 2017. It is worth noting that adjusting for age differences between the regions does little to change the reported trends, and as such, we report the unadjusted raw overdose deaths here. The cause of death within the data is determined using death certificates for U.S. residents, and **Figure 2** reports the overdose deaths (per 100,000 individuals) resulting for all drug-induced causes. Here, the trends appear fairly similar for both the Detroit and KOMA regions between the years 1999 and 2014, where both regions experienced growth in their overdose death rate of about 260 percent (for the Detroit region) and 320 percent (for KOMA). Since 2014, the trends remain upward, however, there is a visible divergence between KOMA, which has remained steady at around 18 deaths (per 100,000 individuals), while the Detroit region has seen a concerning continued growth within its drug overdose death rate from about 22 (per 100,000) in 2014 up to 34 (per 100,000) in 2017. This trend represents a 57 percent growth in the drug overdose rate in the Detroit region since 2014.

Taken together, **Figures 1 and 2** highlight that, while the volume of legal opioid dispensing has reverted down since 2012, the trend in deaths has continued to grow, particularly so in the Detroit region. As such, negative health consequences associated with drug usage and overdose must continue to remain a critical focus of intervention and policy initiatives.

Suicides and Mental Health Problems

This year, we also examine trends pertaining to suicides and mental health problems. **Figure 3** shows suicides which are reported as deaths per 100,000 individuals within the given region whose underlying cause of death was classified as a suicide. Similar to the overdose death data, the suicide data is sourced from the CDC WONDER database. Looking first at the trend for KOMA, we see an overall upward trend for the sample period of 1999 to 2017, and we further note a spike in the death rate from about 10.9 (per 100,000) in 2013/2014 up to 15.4 (per 100,000) in 2015 (an overall rate increase of 41 percent). Most recently, however, this rate did come down to 11.8 and 13 deaths per year in 2016 and 2017, respectively. Looking next at the suicide rates within the Detroit region, we note a similarly increasing trend. Overall, the Detroit region saw a growth in the suicide rate by 38.4 percent, where most of the increase has resulted since 2005 to 2006. However, since 2015, the Detroit suicide rate has begun to level slightly below the 2015 rate high.

Figure 4 reports the fraction of survey respondents (to the MiBRFSS survey) that report experiencing more than 14 days of poor mental health. Here, the numerator consists of the number of people reporting 14 days or more to the question "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" The denominator is based on the total number of respondents in a given county. Looking at both the KOMA and Detroit regions across the period of 2011 to 2017, we see that the rate of self-reported mental health issues has remained fairly stable across time, with 12.4 percent of KOMA and 13.6 percent of Detroit region individuals reporting 14 or more poor mental health days in the last month.[1]

[1] Data for 2016 was not available and as such we use a weighted average for the years 2015 and 2017 to proxy for the 2016 missing values.

Risk Factors

Figure 5 presents estimates of the prevalence of heavy drinking for KOMA and the Detroit region. Heavy drinking is defined as the proportion of adults in each region who reported consuming an average of more than one alcoholic drink per day for women or more than two per day for men. The data suggest that 7.5 percent of the West Michigan population and 6.5 percent of the population in the Detroit region were classified as heavy drinkers in 2017. Rates of heavy drinking have remained largely stable from 2011 through 2017.

Figure 6 also focuses on alcohol consumption, but shifts from heavy drinking to binge drinking. Binge drinking is defined as consuming four or more drinks on a single occasion for women and five or more drinks on a single occasion for men. Rates of binge drinking on both the west and east sides of the state are similar and remained steady over the time period included in the analysis. Approximately 19.8 percent of the population of West Michigan and 18.6 percent of the Detroit region reported a binge drinking episode in the past 30 days in 2017.

Figure 7 displays estimates of the proportion of the adult population who currently smoke cigarettes. As of 2017, nearly 16 percent of the KOMA population and 19 percent of residents in the Detroit region were current smokers. Using 2017 county population estimates, this equates to approximately 132,082 smokers in West Michigan and 545,271 smokers in the Detroit region. For the Detroit region in 2017, this marks a reduction of 77,243 smokers from 2016. In 2014, the Centers for Disease Control estimated that 15.5 percent of the U.S. population currently smoked cigarettes and cigarette smoking was responsible for 480,000 annual deaths (CDC, 2018). Treatment for illnesses related to smoking and tobacco use can be costly and resource-intensive. Reductions in the prevalence of smoking and tobacco use could lead to increased worker productivity and provide some relief for rising health care expenditures (Berman et al., 2014).

Using data from 2017 for Kent and Wayne counties, **Figure 8** shows that the number of current smokers who report having attempted to quit smoking for at least one day in the past 12 months is fairly similar across the two counties. More specifically, we find that 63.1 percent of the smoking population in Kent county has attempted to quit smoking in the past year, while 66.7 percent of Wayne county residents report the same. These figures suggest that close to two thirds of the smoking population appear motivated to quit smoking, which is a finding that may be of interest to public health officials and medical care providers who could consider supporting these smokers to help them in their efforts.

While **Figure 7** suggests a downward trend in percentage of current smokers, one might be concerned with whether this trend is driven by people giving up their smoking habits or simply substituting alternative products such as e-cigarettes. While our data does not allow us to look at these potential substitution patterns directly, **Figure 9** provides data on current e-cigarette use for two counties, Kent and Wayne, in 2017. Overall, the use rates for e-cigarettes appear considerably lower than the cigarette use rates, with 5.6 percent of Kent county residents and 3.8 percent of Wayne county residents reporting being current users.

Beyond asking about whether a person is an e-cigarette user, the MiBRFSS survey also asks about frequency of use for current users and whether a person is a former e-cigarette user. In order to get a large enough sample for reporting, we combine responses from an increased number of West Michigan (Allegan, Ionia, Kent, Montcalm, Muskegon, Ottawa) and East Michigan (Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, Wayne) counties into a combined sample for 2017. The results for this sample are reported in **Figure 10**, where we see that, overall, 1.3 percent of current users report smoking e-cigarettes every day, 3.4 percent report smoking some days, and 15.3 percent of all respondents report being former e-cigarette smokers. Combined, this adds up to about 214,000 individuals across these counties that are either daily or occasional users of e-cigarettes. It is important to note that MiBRFSS data only covers the noninstitutionalized adult population (aged 18 or older), and as such, it cannot speak to recent trends in increased e-cigarette use among youth below the age of 18. The CDC and the FDA have, however, recently released figures showing that one in five high school students and one in 20 middle school students were past month e-cigarette users, and that use of any tobacco product grew by close to 40 percent among high school students between 2017 and 2018 (CDC, 2019).

Next, **Figures 11 and 12** track the share of the West Michigan and Detroit populations that are overweight and obese, respectively. An individual is considered to be overweight if their body mass index (BMI) is greater than or equal to 25 and less than 30 and considered obese if their (BMI) is above 30. In 2017, approximately one-third of the population in each region was considered to be overweight and nearly another third was obese. In sum, 65 percent of adults in the KOMA region and 60.7 percent of adults in the Detroit region were either overweight or obese in 2017. These estimates are similar to the share of the overall U.S. population who is overweight or obese (Ogden et al., 2014). Studies place the health care costs associated with obesity at between 10 percent and 20 percent of total U.S. health-related spending (Cawley & Meyerhoefer, 2012; Finkelstein et al., 2009).

Finally, **Figure 13** plots the share of the population in each region reporting that their general health was either “fair” or “poor”. Nearly one in five residents in the Detroit region reported themselves to be in fair or poor health in 2017, while that number was close to 15 percent in the KOMA region. The gap between self-reported health on the west and east sides of the state has remained relatively consistent over time.

Access to Care

In addition to an examination of the risk factors associated with poor health outcomes, we are also interested in measures involving access to health care services. **Figure 14** plots the percentage of the population in the KOMA and Detroit regions that reports having no health insurance. Uninsured rates in both regions have fallen since 2013 because of the improving economy and the expanded health insurance options available under the Affordable Care Act. For example, as of August 2018, more than 670,000 people have enrolled in the Healthy Michigan expansion of the state's Medicaid program (MDHHS, 2018). In 2011, the first year of our data, nearly 16 percent of the adult population in the Detroit region was uninsured. By 2017, that figure had fallen to 6.7 percent. Because West Michigan has a lower initial uninsured rate, the reduction in the share of the population with no health insurance coverage has been less pronounced. However, the west side of the state still experienced a decrease in the uninsured rate of 3.7 percentage points from 2011 to 2017 (12.3 percent to 8.6 percent). Worth noting here is that while the trend has been continuously downward for the Detroit region, the KOMA region observed a 1.3 percentage points uptick in the fraction of the population reporting no insurance coverage between 2016 and 2017.

The next three figures represent measures of health care access that we would expect to be impacted by the increase in insurance coverage that was observed in **Figure 14**. **Figure 15** displays estimates of the share of the population who report being unable to access health care at some point in the past 12 months due to cost. Though fewer people report lacking access to care because of cost in 2017 compared to 2011, rates remain above 10 percent of the population in both regions. Furthermore, while trending downward since 2014 in West Michigan, the share of those with no access to care rose from 2016 to 2017 in the KOMA region.

Figure 16 continues the examination of access to care by tracking the share of the population who report having a usual source of care when ill. In both regions, this share has increased slightly since 2011 but has trended downward from 2015 to 2016. For the period of 2016 to 2017, however, we observe a reversal of this downward trend with rates increasing by 0.3 percentage points in the KOMA region and by 0.9 percentage points in the Detroit region.

Lastly, **Figure 17** plots the share of the population in West Michigan and the Detroit region who received a routine checkup in the past year. Here we note a positive development with both regions moving from about two-thirds of the population reporting having had a routine checkup in 2011, to about three-fourths reporting the same in 2017. As such, approximately 25 percent of respondents in both regions went without an annual routine checkup in 2017. Forgoing an annual checkup may act to lower health care expenditures in the short-run, but could lead to higher spending in the long-run through reduced early-detection and prevention efforts. Additionally, given the trends noted previously with respect to individuals' self-reported fair or poor health remaining stable over time, along with stable rates of smoking and obesity, continued stress on the importance of preventative care through an annual exam may be warranted as a means to help promote education and monitoring of these high health risk related behaviors.

References

Berman, M., Crane, R., Seiber, E., & Munur. M. (2014). Estimating the cost of a smoking employee. *Tobacco Control*, *23*(5), 428-433.

Cawley, J., & Meyerhoefer, C. (2012). The medical care costs of obesity: An instrumental variables approach. *Journal of Health Economics*, *31*(1): 219-230.

Centers for Disease Control (CDC). (2018). *Current cigarette smoking among adults in the United States*. Retrieved August 26, 2018 from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm.

Centers for Disease Control (CDC). (2019). *E-cigarettes and Youth: What Educators and Coaches Need to Know*. Retrieved September 12, 2019 from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/OSH-E-Cigarettes-and-Youth-What-Educators-and-Coaches-Need-to-Know-20190327-508.pdf?s_cid=osh-stu-feature-b2s-2019-002.

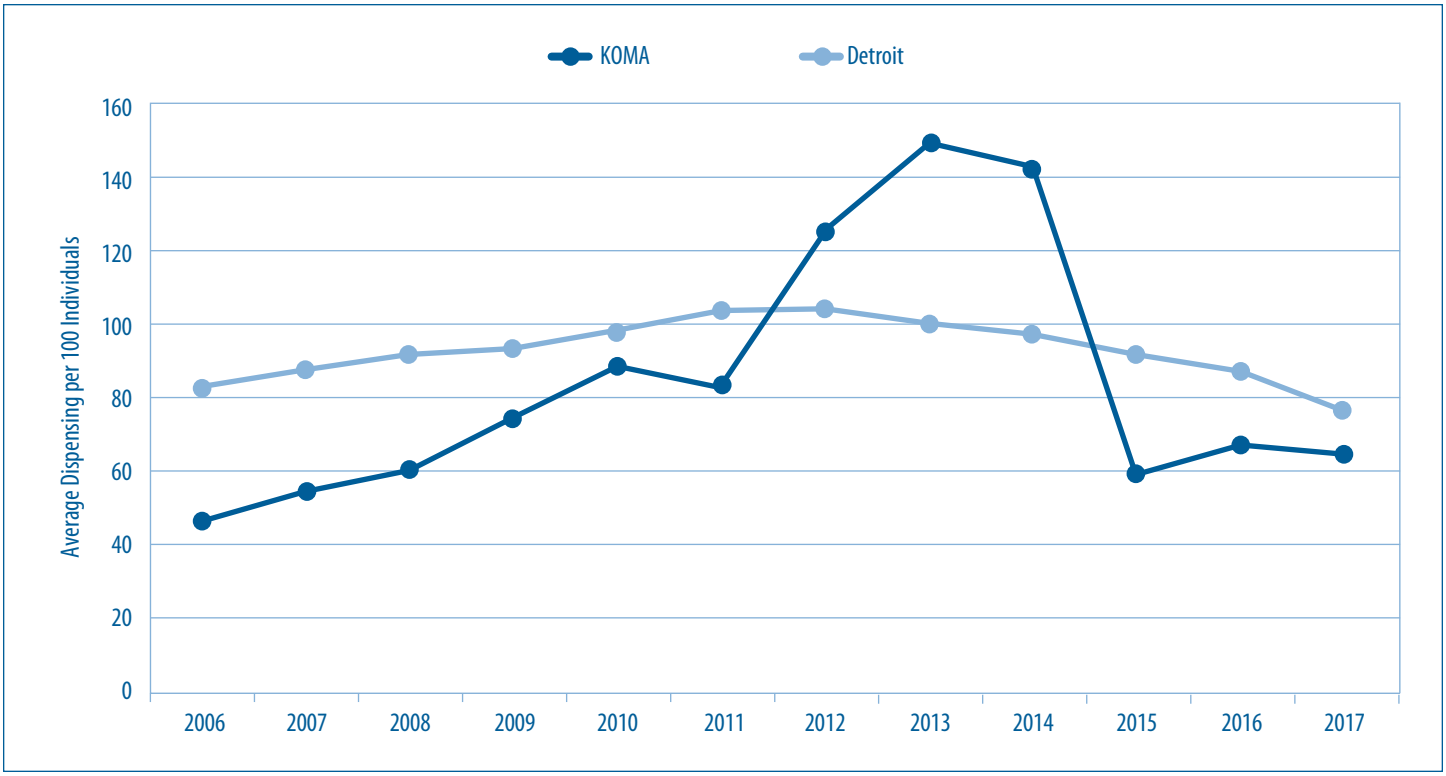
Centers for Disease Control (CDC). (2019). *National Center for Health Statistics. Compressed Mortality File data.* Retrieved September 12, 2019 at http://wonder.cdc.gov/cmf-icd10.html.

Finkelstein, E.A., Trogdon, J. G, J. Cohen, W., & Dietz. W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. *Health Affairs*, Web Exclusive July 27, 2009.

Michigan Department of Health and Human Services (MDHHS). (2018). *Healthy Michigan Plan enrollment statistics.* Retrieved August 26, 2018 from: https://www.michigan.gov/ mdhhs/0,5885,7-339-71547_2943_66797---,00.htmlMiBRFS_Standard_Tables_FINAL_599753_7.pdf.

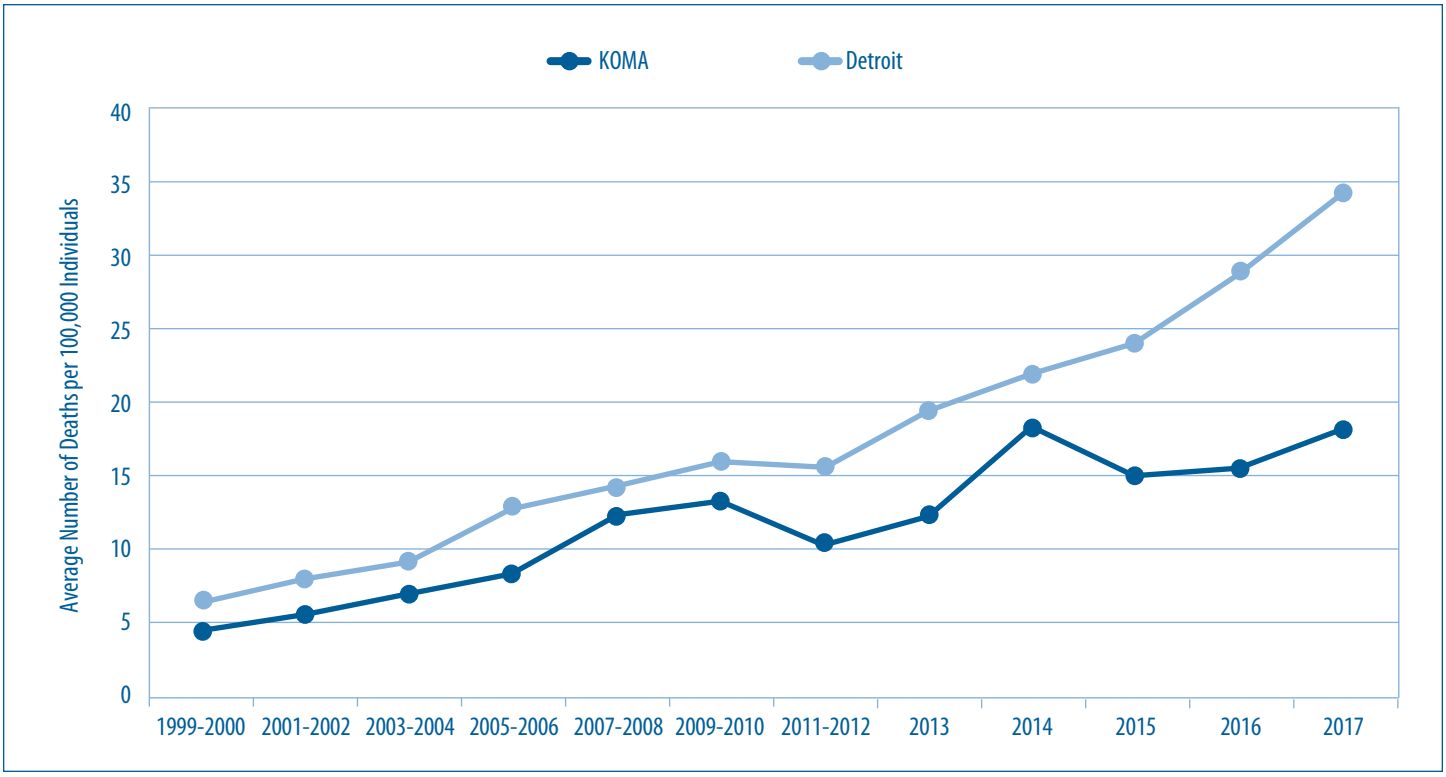
Ogden, C.L., Carroll, M.D., Kit, B.K., & Flegal, K.M. (2014). Prevalence of childhood and adult obesity in the United States. *Journal of the American Medical Association*, *311*(8): 806-814.

Figure 1: Opioid Prescription Dispensing, 2006–2017



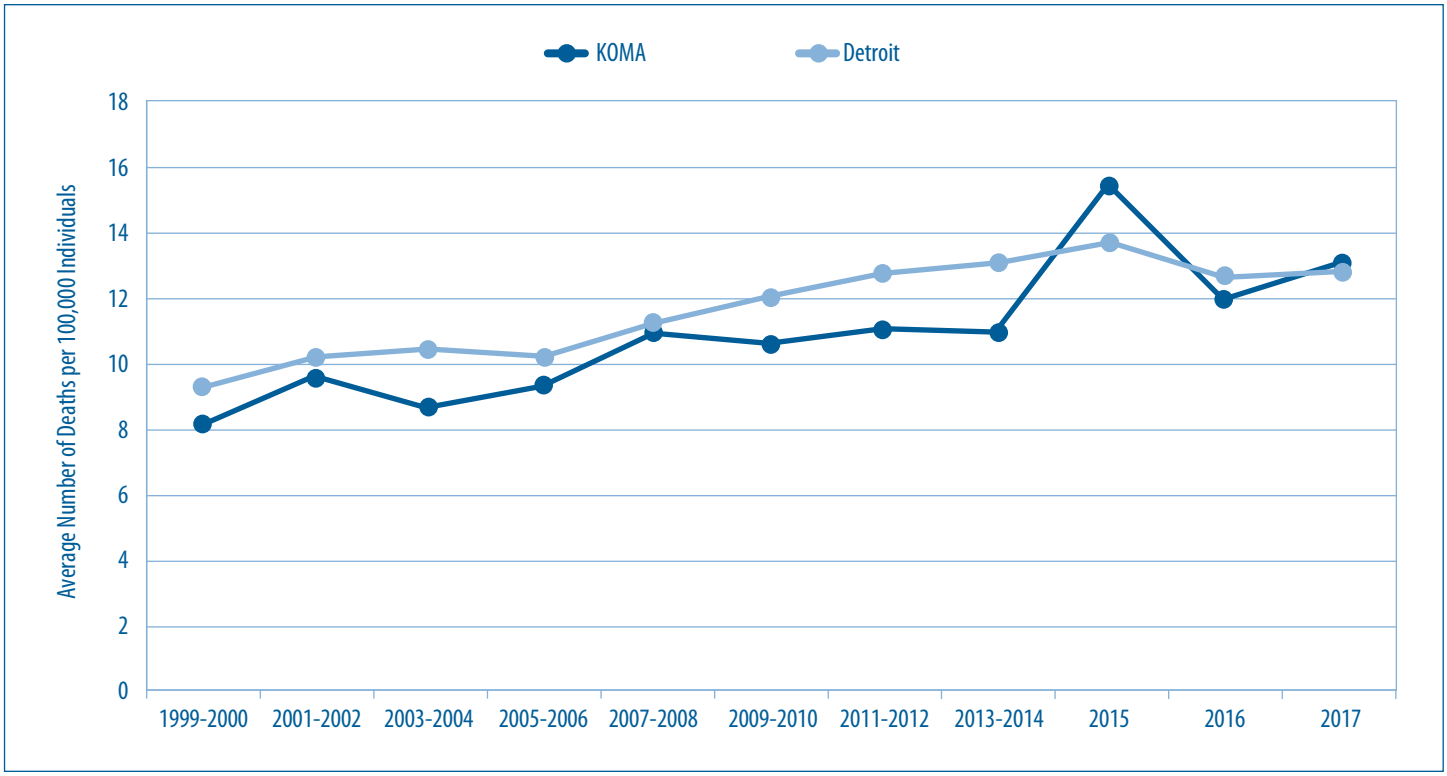
Source: CDC's IQVIA Xponent and Wide-ranging Online Data for Epidemiologic Research data, 2018.

Figure 2: Drug Overdose Deaths, 1999–2017



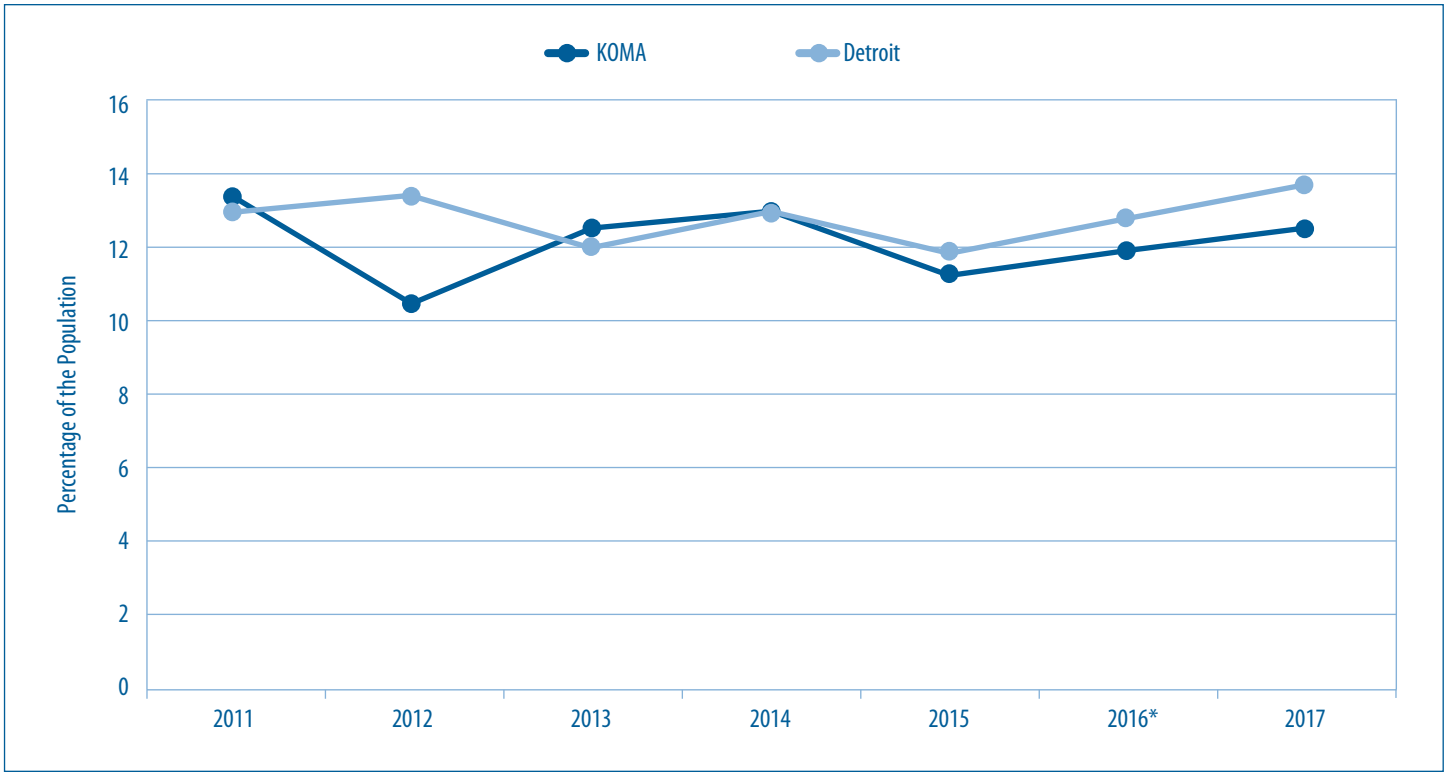
Source: Centers for Disease Control Compressed Mortality File data, 2018.

Figure 3: Deaths from Suicide, 1999–2017



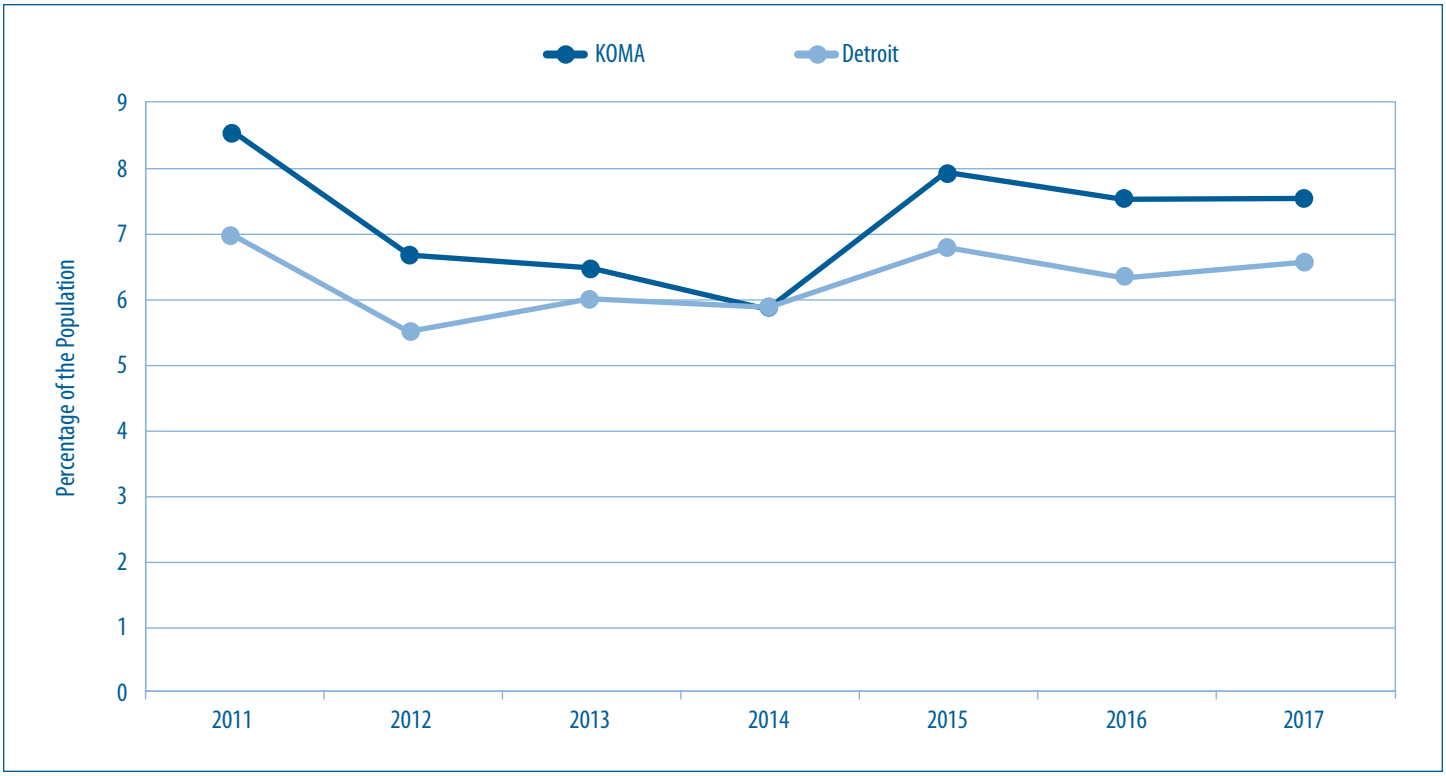
Source: Centers for Disease Control Compressed Mortality File data, 2018.

Figure 4: Poor Mental Health Days, 2011–2017



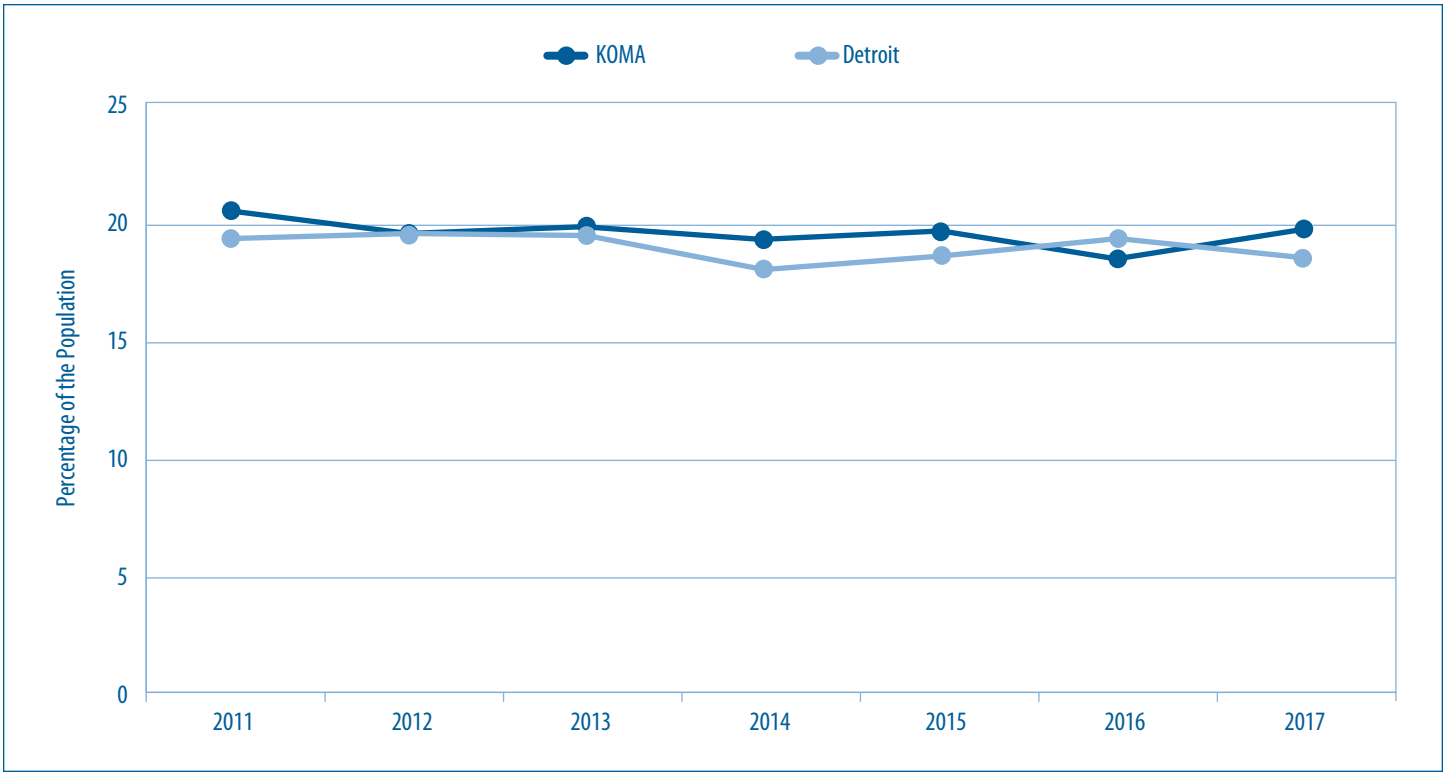
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents reporting 14 or more poor mental health days in the last month.

Figure 5: Heavy Drinking, 2011–2017



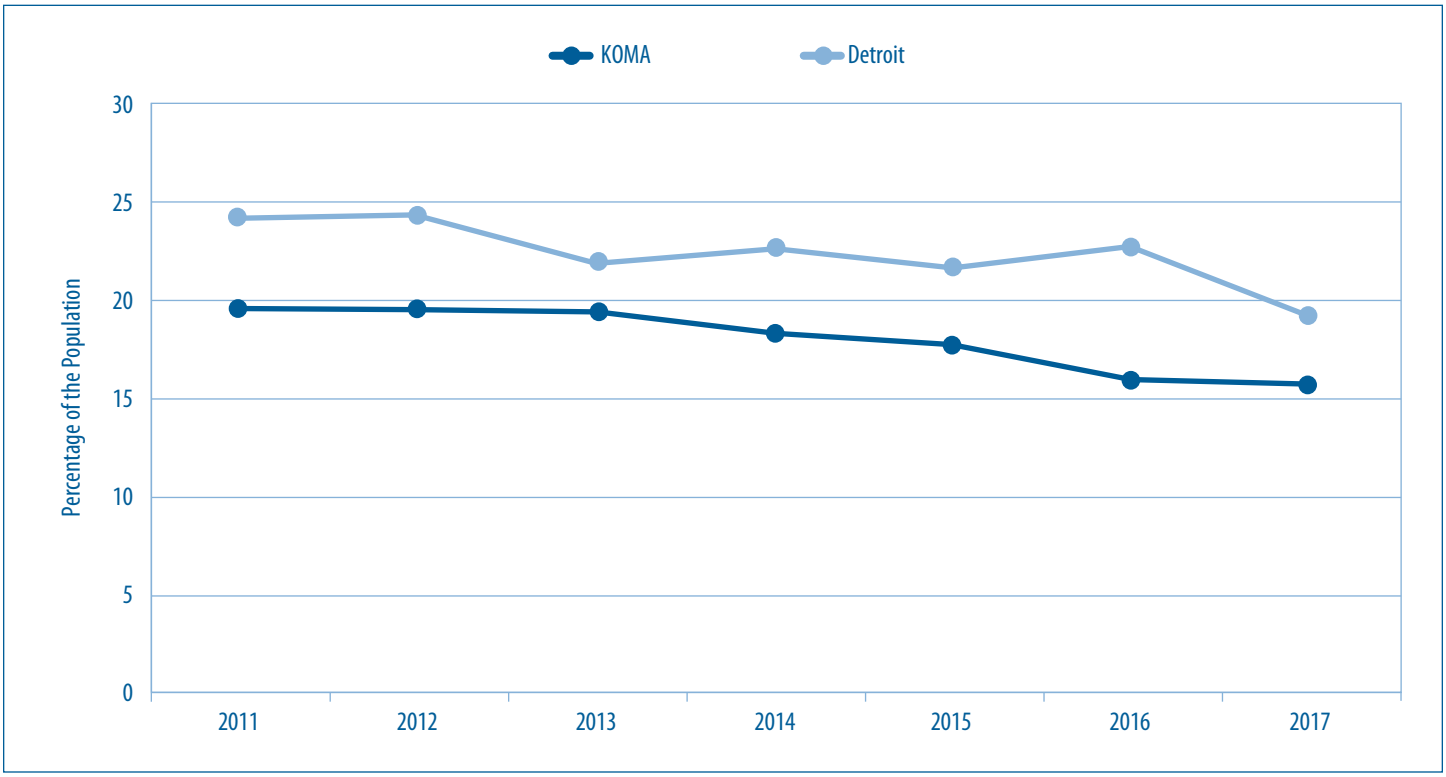
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents who reported consuming an average of more than two alcoholic drinks per day for men or more than one per day for women.

Figure 6: Binge Drinking, 2011–2017



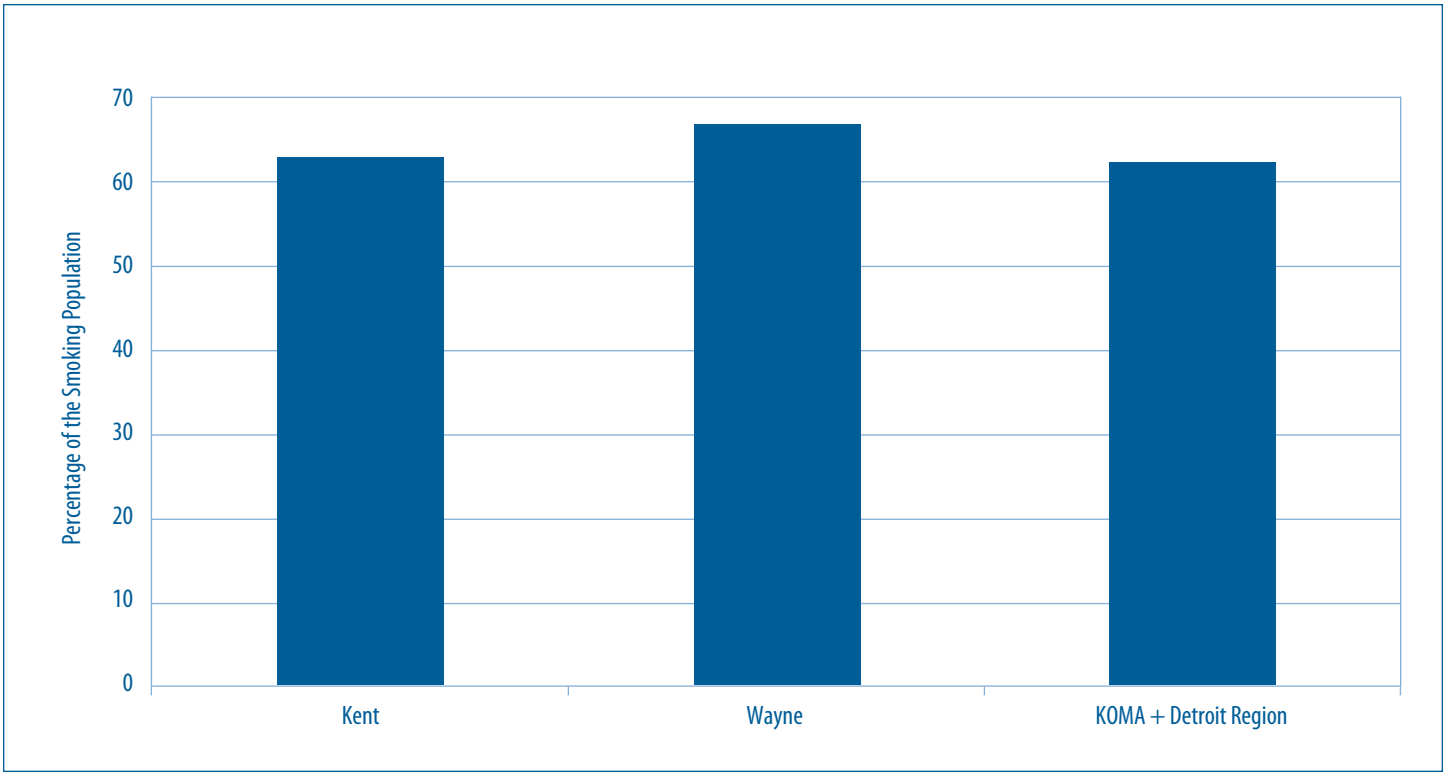
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents who reported consuming five or more drinks on a single occasion for men or four or more drinks on a single occasion for women.

Figure 7: Current Cigarette Smokers, 2011–2017



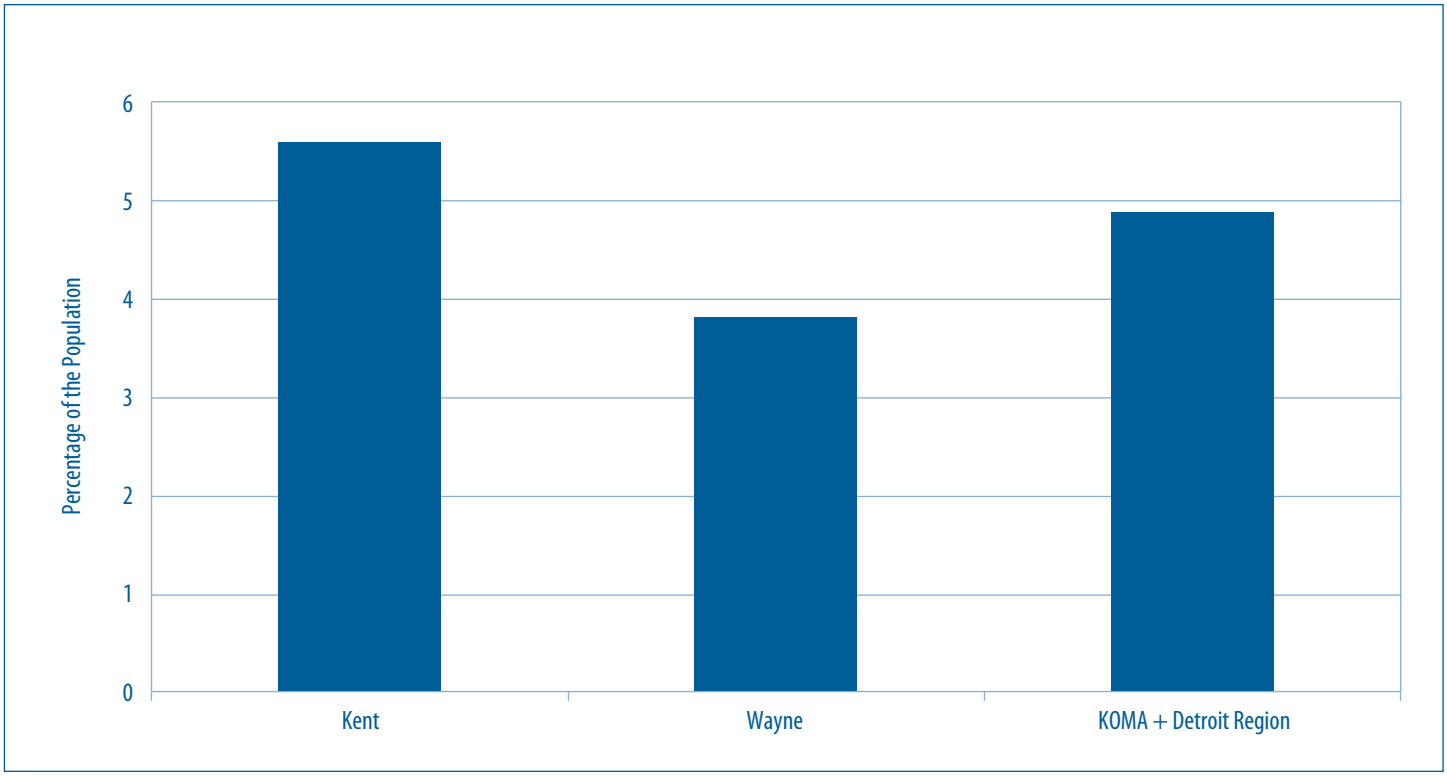
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported that they had ever smoked at least 100 cigarettes in their life and who now smoke cigarettes, either every day or some days.

Figure 8: Quit Smoking for at Least One Day in the Past 12 Months in 2017



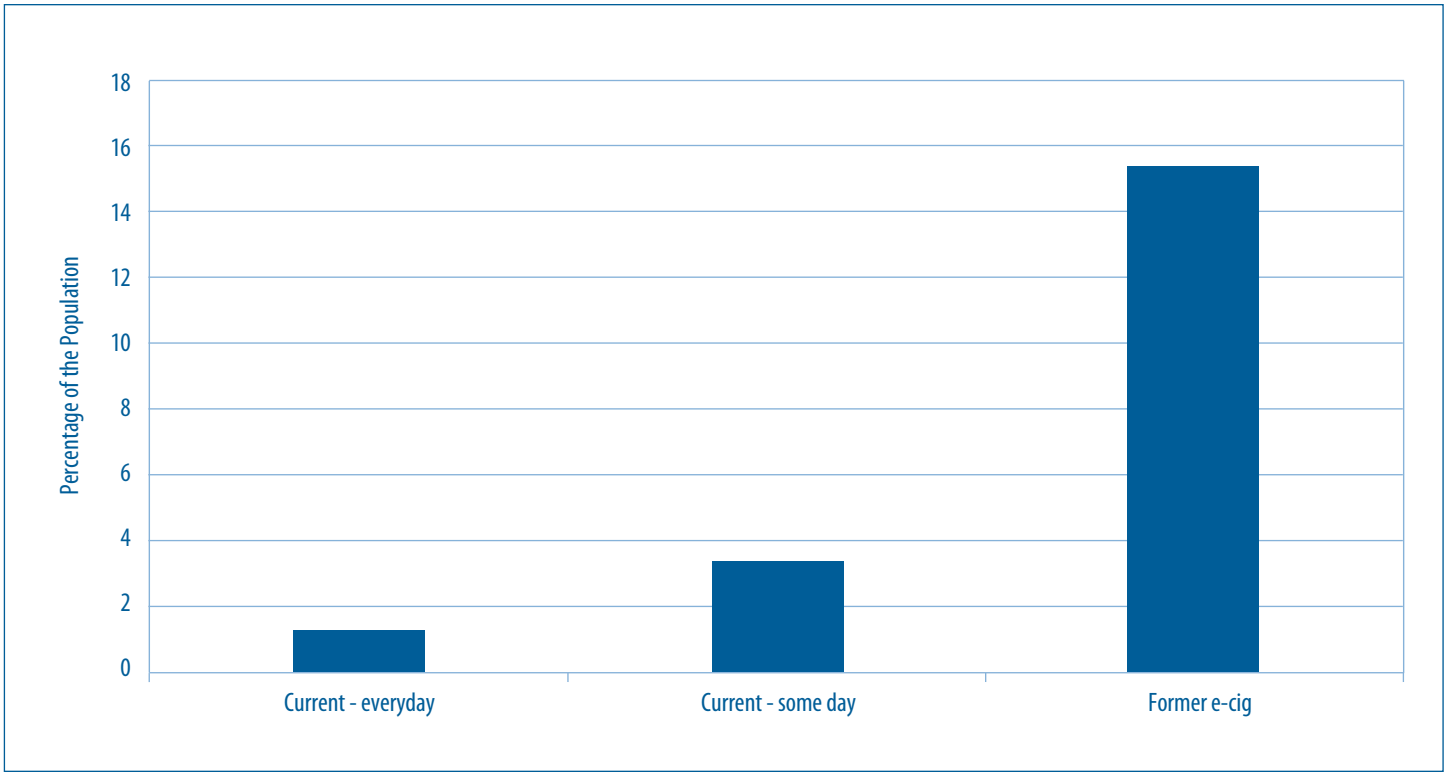
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all current smoking adults, the proportion who reported having quit smoking for at least one day in the past 12 months.

Figure 9: Current E-cigarette Users in 2017



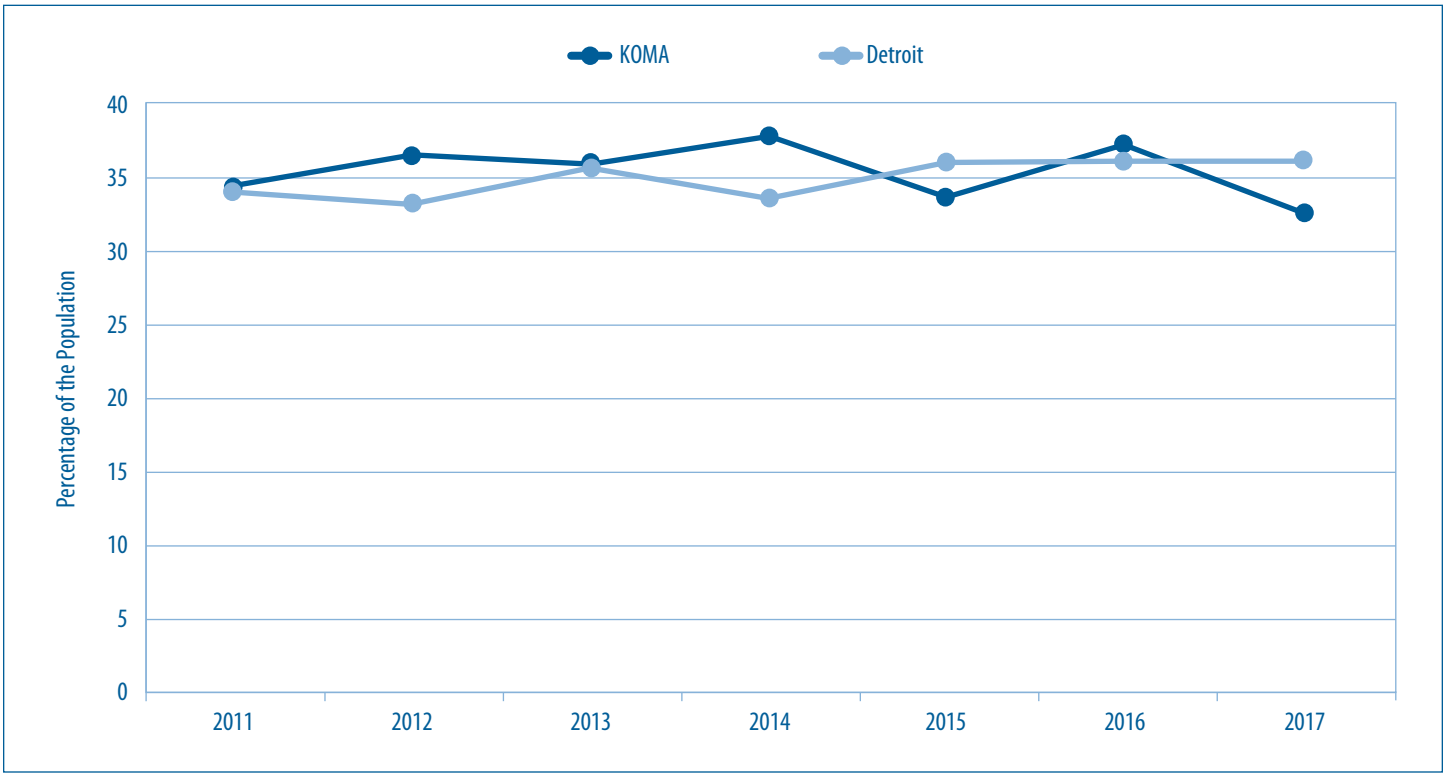
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported being current e-cigarette users.

Figure 10: Current vs. Former E-cigarette User Status in 2017



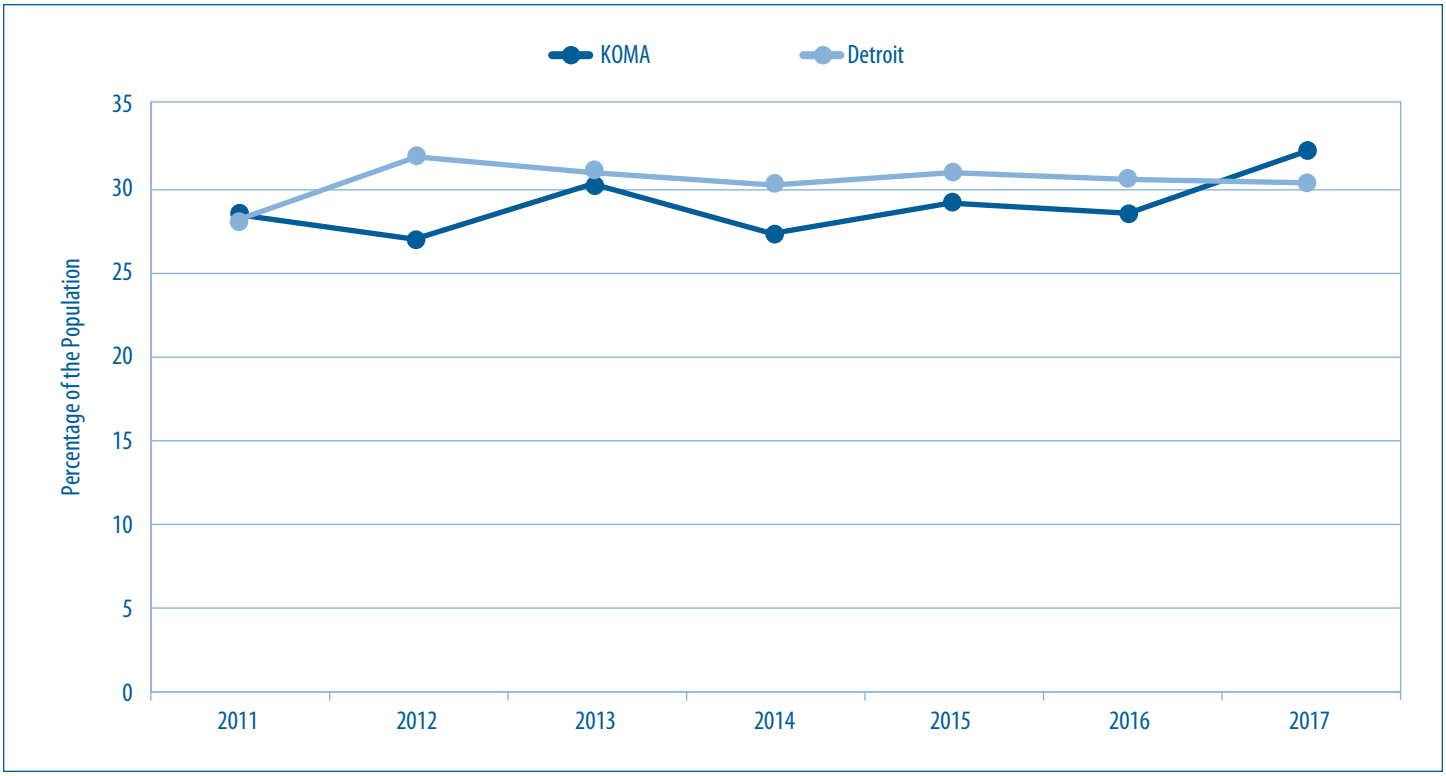
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported that they are current or former e-cigarette users.
Note: This figure uses combined responses for greater west and east Michigan counties.

Figure 11: Overweight, 2011–2017



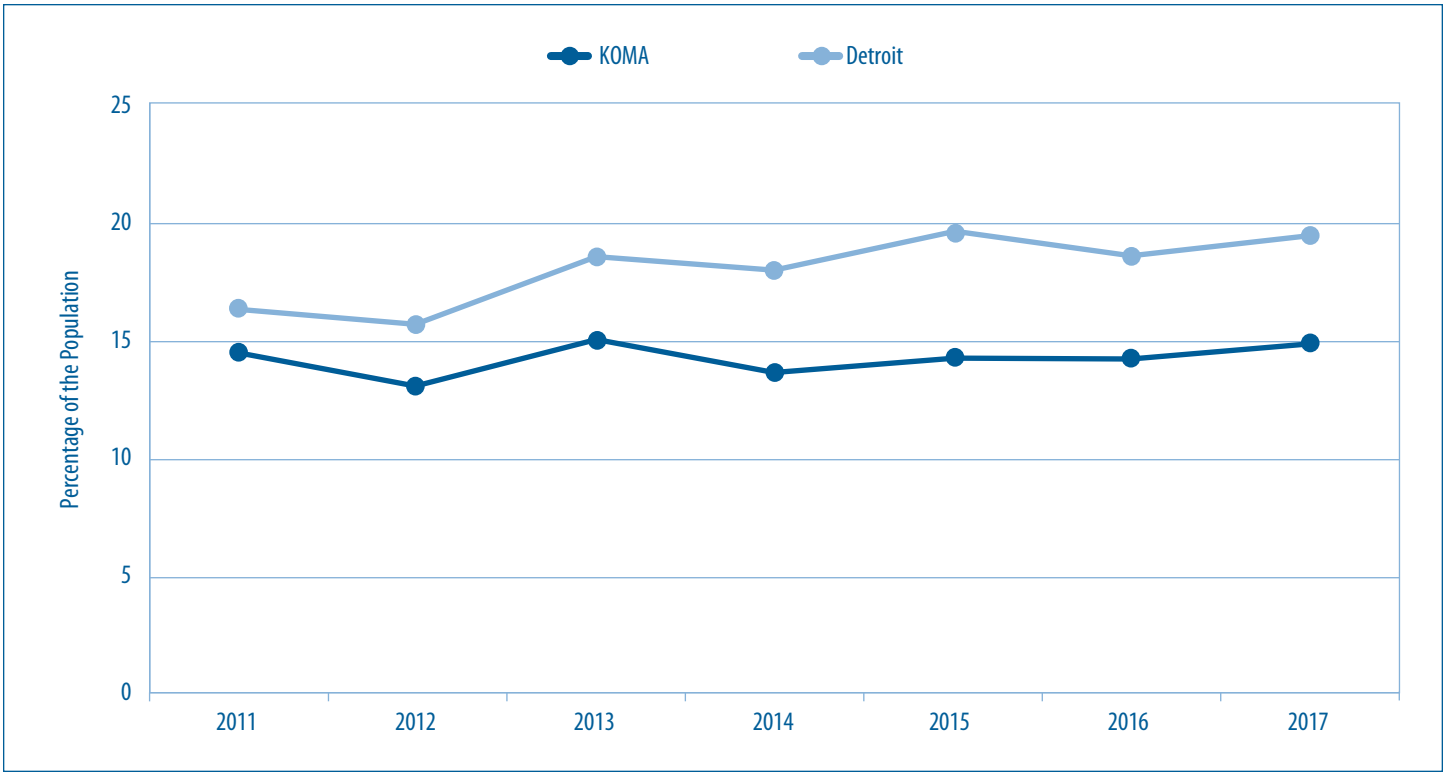
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents whose Body Mass Index (BMI) was greater than or equal to 25 and less than 30.

Figure 12: Obesity, 2011–2017



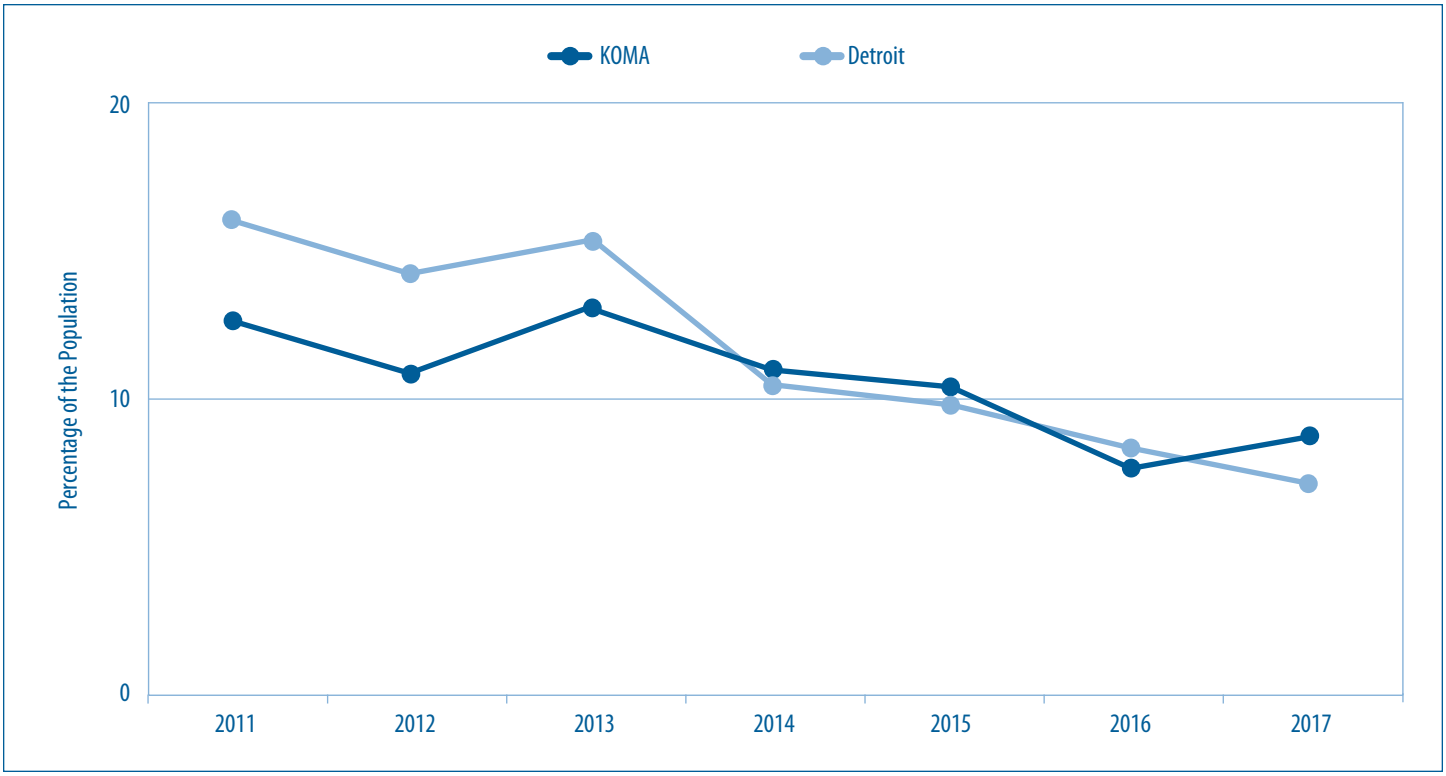
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents whose Body Mass Index (BMI) was greater than or equal to 30.

Figure 13: Health Status - Fair or Poor Health, 2011–2017



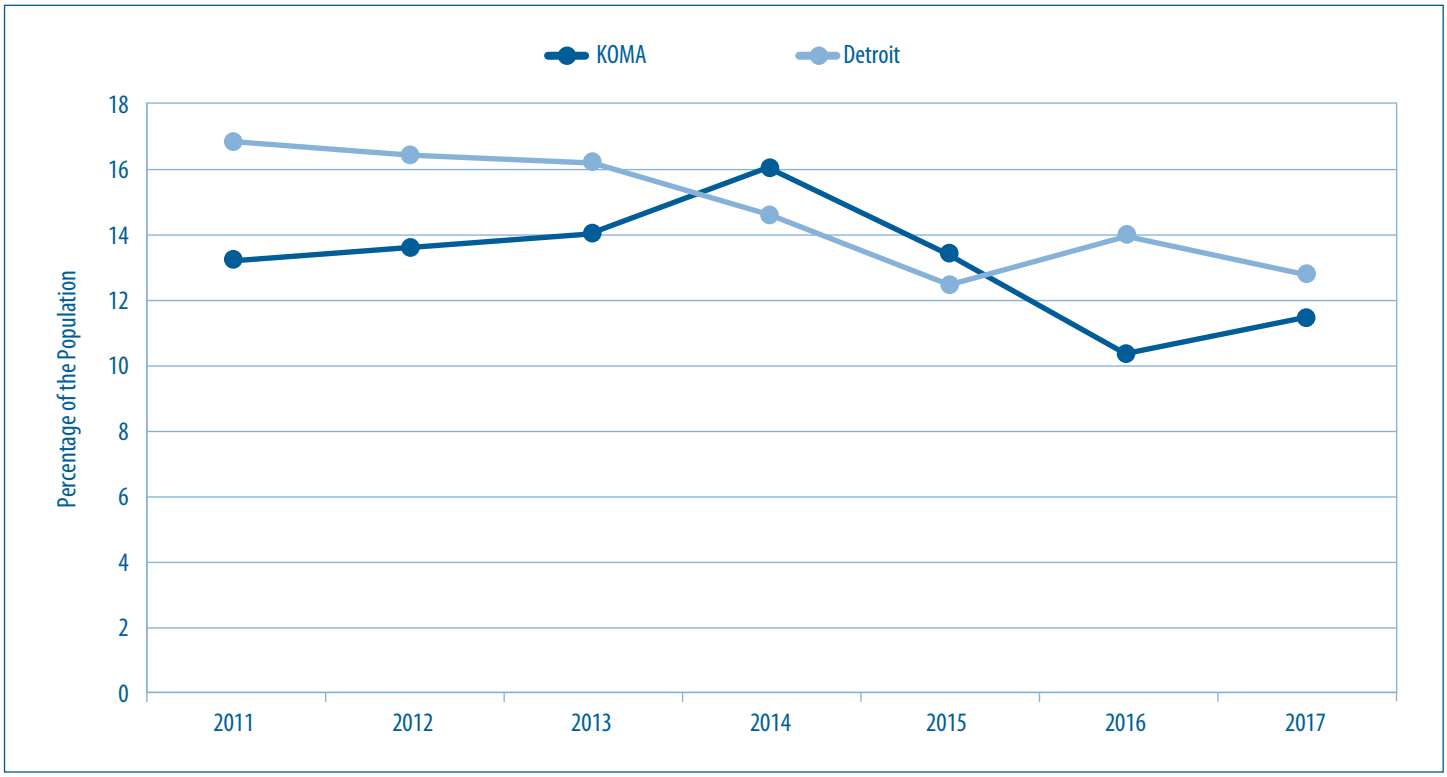
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion of respondents who reported that their health, in general, was either fair or poor.

Figure 14: No Health Insurance, 2011–2017



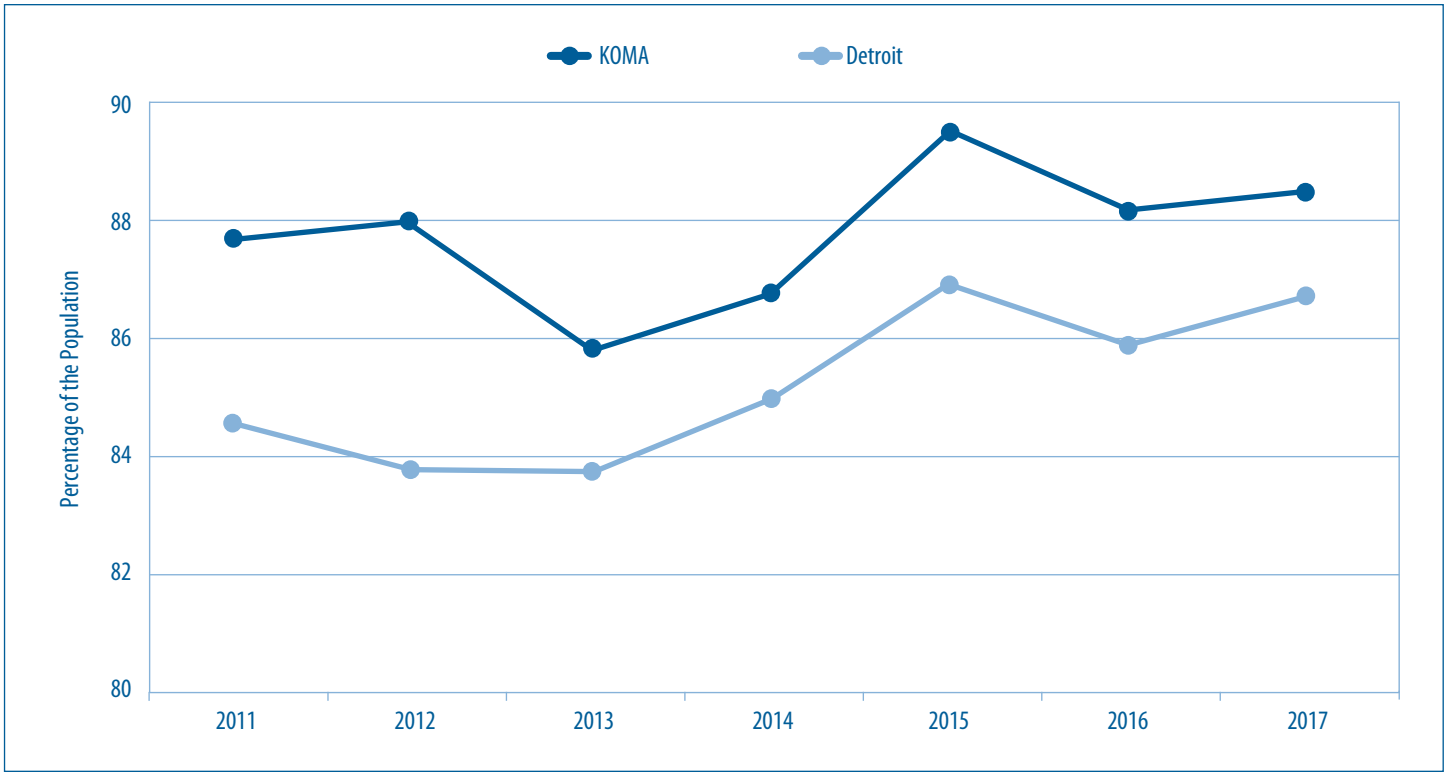
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among adults age 18-64 years, the proportion who reported having no health care coverage, including health insurance or prepaid plans such as HMOs.

Figure 15: No Health Care Access Due to Cost, 2011–2017



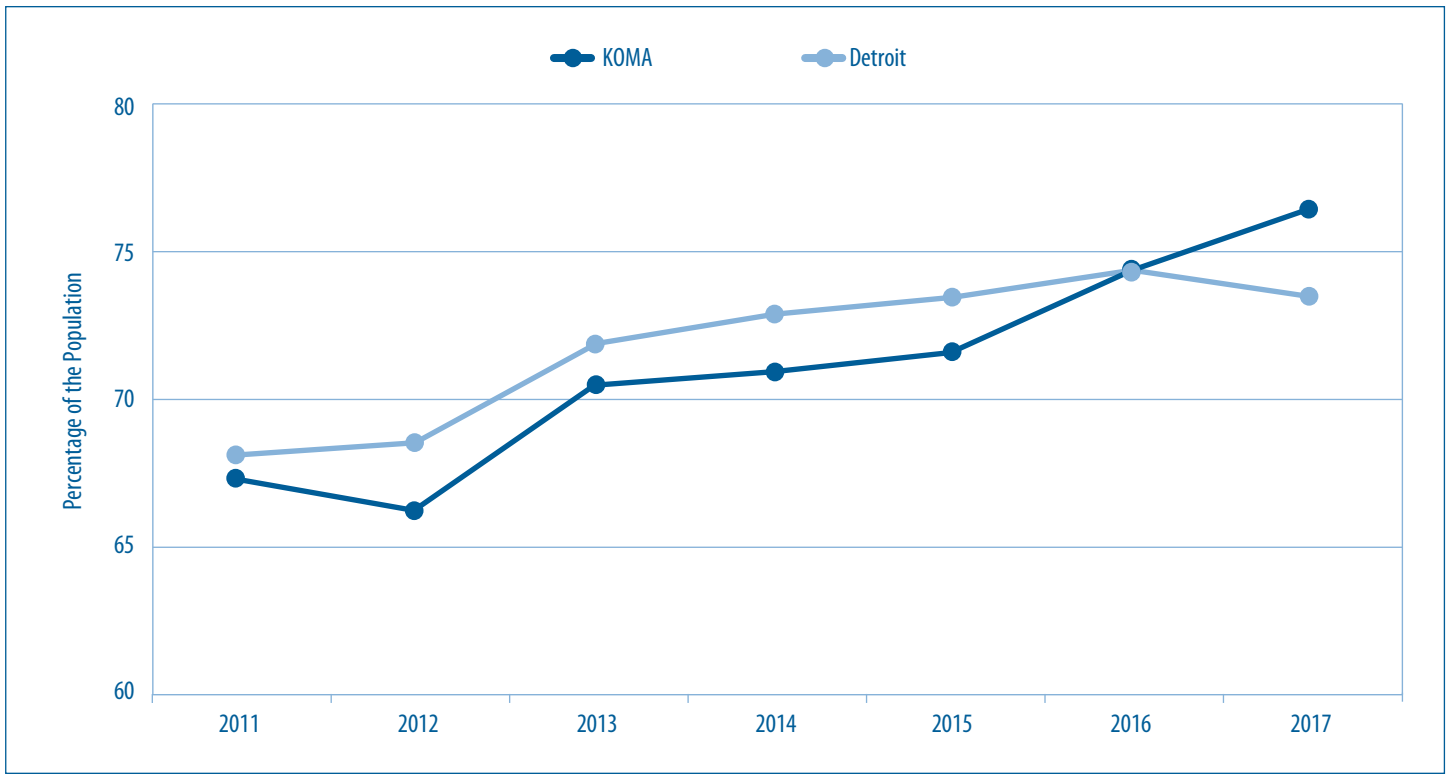
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported that in the past 12 months, they could not see a doctor when they needed to due to the cost.

Figure 16: Has a Usual Source of Care, 2011–2017



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported that they have a usual source of care when ill.

Figure 17: Had Routine Checkup in Past Year, 2011–2017



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2018.
Definition: Among all adults, the proportion who reported that they had a routine checkup in the past year.

Economic Analysis

GRAND VALLEY STATE UNIVERSITY

www.gvsu.edu

Benchmarking Communities

In this section, we compare the Grand Rapids combined statistical area to a select group of metropolitan areas to examine differences in the supply of hospital services, hospital expenses, and Medicare expenditures.[1] We compare changes in hospital utilization and expenditures for the Grand Rapids region to changes for a benchmark region calculated as the population weighted outcome average for Louisville, KY; Buffalo, NY; Rochester, NY; and Milwaukee, WI. These regions were selected as benchmark communities based on similarities to Grand Rapids in a variety of regional metrics, including population density, earnings estimates, unemployment rates, and population age and race distributions. We also include data for the Detroit region and for the entire U.S.

The Supply and Utilization of Hospital Services

Figures 1-7 focus on both hospital capacity and utilization across Grand Rapids and the benchmark comparison regions. Utilization measures such as admissions, outpatient hospital visits, and emergency department visits are measured as per capita rates using the number of residents in each region as the denominator. As noted previously, a downside to the use of these per capita utilization rates is that they do not account for the inflow of patients from outside the region or the outflow of patients to other regions. As such, if individuals are traveling to a region to receive care despite living outside of that region, those individuals will contribute to the numerator in the utilization calculation, but not to the denominator. In cases where patient inflow is particularly high, utilization measures will be overstated. We provide evidence in this section that approximately 21 percent of hospitalized patients in Grand Rapids come from outside the immediate region. Unfortunately, we are unable to measure patient inflow for the other regions we examine.

Figure 1 includes data on the number of hospital beds per 1,000 residents in each region from 2005 to 2017. This measure serves as a proxy for hospital capacity. For Grand Rapids, the benchmark communities, and the U.S., per capita hospital inpatient capacity has declined over the past decade. Detroit, however, continued to see a steady increase in per capita hospital beds since 2005. As noted previously, Detroit's increase is likely due to the region's population losses rather than the construction of new beds. Grand Rapids continues to present with fewer beds per capita than the national average, with a decrease from 1.97 to 1.90 from 2016 to 2017. This trend is positive, as smaller hospital capacity should lead to lower overhead costs and less expensive hospital care.

Figure 2 displays the number of hospital admissions per 1,000 residents. While **Figure 1** focuses on inpatient capacity, **Figure 2** provides data on inpatient utilization. Grand Rapids has consistently shown significantly fewer admissions per capita than the benchmark regions, as well as the national average over time. This could be an indication of a relatively healthy population in West Michigan or a stronger reliance on outpatient rather than inpatient care. Because inpatient care is typically associated with high costs, finding fewer hospital admissions reflects a positive trend for the Grand Rapids region. While hospital admissions have generally been falling over time throughout the U.S. as a whole, as well as in the benchmark regions, Detroit has seen increasing admission rates beginning in 2007, although the trend seems to have leveled off since 2015.

Figure 3 plots per capita outpatient visits from 2005 to 2017. When we compare trends in outpatient visits to inpatient admissions, we see that, for Grand Rapids, the decrease in inpatient admissions is contrasted by an increase in outpatient visits. Additionally, as noted last year, Grand Rapids and Detroit in particular differ from the benchmark communities and the U.S. as a whole, with a much steeper slope of increased outpatient visits. In fact, the benchmark regions demonstrated a decrease in outpatient visits from 2016 to 2017.

One explanation for the growth in outpatient visits to hospitals in both Grand Rapids and Detroit involves the transition to increased numbers of independent physician practices aligning with hospital systems (Medicare Payment Advisory Commission, 2012). Provider-based billing allows qualified hospital-affiliated physician practices to charge an additional "facility fee" for patient care (American College of Physicians, 2013). Importantly, the data source for **Figure 3**, the American Hospital Association (AHA) Hospital Statistics publication, instructs reporting hospitals that "visits to satellite clinics and primary group practices should be included if revenue is received by the hospital" (AHA, 2018, p. 235), meaning that patient visits to nonhospital settings are often categorized as hospital outpatient visits under a provider-based billing system. As such, what appears to be a doubling of per capita outpatient visits to hospitals in Grand Rapids from 2005 to 2017 likely reflects a change in billing practices.[2] Of interest, in July 2018, Centers for Medicare & Medicaid Services (CMS) announced a policy proposal to move to "site neutral payments" beginning in 2019 (CMS, 2018a). The proposal was later finalized by CMS, and in November of 2018, the CMS announced that the "policy would result in lower copayments for beneficiaries and savings for the Medicare program in an estimated amount of $380 million for 2019" (CMS, 2018c). While it is still too early to determine the influence of these policy initiatives on the number of outpatient hospital visits in the regions examined here, the trend noted in **Figure 3** may be impacted by these efforts in the future.

[1] Because the Grand Rapids metropolitan statistical area (MSA) definition has recently changed, we use the more consistent definition of the core-based statistical area. The Detroit region is defined using the smaller metropolitan division categorization. All other regions are defined using the MSA.

[2] According to the 2012 MedPac Report to Congress, "Growth in the percentage of [evaluation and management] office visits that are provided in [hospital outpatient departments] has accelerated, increasing at an annual rate of 3.5 percent from 2004 through 2008, by 9.9 percent in 2009, and by 12.9 percent in 2010" (MedPAC, 2012 pg. 73).

Another factor to consider is that since values in **Figure 3** are calculated as the ratio of outpatient visits to the number of area residents, those coming from outside the Grand Rapids or Detroit areas to receive treatment are included in the numerator, but not in the denominator of the calculation. Therefore, the large increases in outpatient hospital visits from 2005 to 2017 could be driven, in part, by changes in the inflow of patients to the area. **Figure 4** plots the KOMA resident share of local hospital admissions for years 2006, 2008, 2010, 2012, 2014, 2016, and 2017. In 2006, 82 percent of admissions to KOMA hospitals were from people living in a KOMA zip code. By 2017, that figure had fallen to 78.7 percent. So while we have seen an increase in the percentage of patients from outside the KOMA region using local hospitals, the magnitude of this change, as noted in prior years, has been rather small.

Figure 5 examines an additional component of hospital utilization by plotting per capita emergency department (ED) visits for Grand Rapids and each of the comparison regions. Notably, Detroit continues to experience far greater ED use than either Grand Rapids or the national average. Because of the high cost of care typically associated with ED visits, this likely contributes to a higher cost of care on the east side of the state. The Grand Rapids region has seen considerable growth in ED utilization over the past decade. In 2005, Grand Rapids ED use was below both the benchmark communities and the national average with 363 ED visits per 1,000 residents. By 2017, ED visits in Grand Rapids had increased to 464 per 1,000 residents. Overall, this trend of increasing ED use in Grand Rapids appears to have begun to reverse since 2015, resulting in Grand Rapids having slightly lower ED use per capita in 2017 than the benchmark. This is the first time since 2012 that Grand Rapids outperforms the benchmark in this dimension, something that marks a positive development as ED use is generally more expensive than care provided in alternative settings, and many visits to the ED are for nonemergent conditions (Honigman et al., 2013; Weinick, Burns, & Mehrotra, 2010). One clear way to address rising costs of health care provision would be to continue to reduce the ED use. A way to potentially help reduce ED utilization may be to direct more people to use telehealth for nonemergent needs.

Figure 2 suggests that Grand Rapids residents are relatively less likely to be admitted to the hospital than those in the benchmark communities, and **Figure 6** indicates that our average hospital length of stay, conditional on admission, tends to be shorter as well. The average length of hospital stays in Grand Rapids has remained below the national average and the benchmark average since 2006. Because of the high cost associated with each day in the hospital, minimizing the average length of stay can have a substantial impact on hospital costs, however, this will not necessarily translate into reduced payer costs as hospitals are commonly paid on the basis of diagnostic related groupings for inpatient care.

Finally, **Figure 7** highlights the number of hospital-based personnel per 1,000 residents in each region. These personnel counts are based on the total number of full-time equivalent (FTE) hospital employees, excluding medical and dental residents, interns, and other trainees. As noted in the Education and Job Growth section of this publication, the rate of employment growth in the health care sector in West Michigan has been positive and is reflected in the increase in hospital-based personnel for Grand Rapids since 2011. While Grand Rapids continues to remain close to the national average, it continues to remain below both the benchmark communities and the Detroit region.

Hospital and Medical Expenditures

Figure 8 examines payroll and benefits expenses per hospital employee, which is inflation-adjusted to 2017 dollars using the consumer price index. Average compensation for hospital workers in Grand Rapids is below the national average, below the benchmark level, and has remained fairly flat since 2005. On the other hand, Detroit has relatively high levels of compensation for hospital employees. While that level had recently fallen from its high in 2008, we note a return to pre-2014 levels for Detroit in 2017.

Figure 9 displays total hospital expenses per admission. It is important to recognize that **Figure 9** is measuring the expenses reported by the hospital to provide treatment for the average admission, but does not reflect patient or insurer expenditures on hospital care. Even after adjusting for inflation, the growth in hospital expenses per admission for all of the comparison regions has been substantial over the past decade. From 2016 to 2017, expenses per admission continued to rise for all regions, except Detroit which had a slight decrease. Despite the relatively low hospital employee compensation noted in **Figure 8**, we see that hospital expenses per admission in Grand Rapids are significantly higher than the national average and are approximately $4,700 greater per admission than Detroit in 2017. This marks a $2,000 increase in the Grand Rapids and Detroit expenditure gap since 2015, when the difference was approximately $2,700. On average, inflation-adjusted expenses per hospital admission in Grand Rapids have grown from approximately $19,700 in 2005 to $31,000 in 2017.

There are two key factors that could be driving this increase in hospital expenses per admission: 1) increasing utilization of new technology; and 2) increases in the overall illness severity of hospitalized patients. Newer and more advanced health care technologies often tend to be cost-increasing rather than cost-reducing (Kumar, 2011). While technological advancements may lead to improved health care outcomes, they still reflect a costly investment by hospitals. Additionally, as noted previously, changes in the payment incentives for inpatient care have led to certain types of care migrating to outpatient settings (Berenson, Ginsburg, & May, 2011). As a result, the health of the average patient admitted to the hospital today is likely to be worse than the health of the average patient admitted in 2005. Ultimately, the effect of this shift in treatment settings has been to reduce the hospital share of total health expenditures, but increase per admission expenses (Moses et al., 2013). Estimates in **Figure 9** provide another area of focus for residents and local stakeholders who have an interest in understanding the growth in health care expenditures. More work is needed to identify the contributors to the high cost of hospital admissions in Grand Rapids and to determine whether this expenditure growth can be addressed without negatively impacting patient health.

Figure 10 plots per capita Medicare expenditures for both Fee-for-Service (FFS) and Medicare Advantage (MA) enrollees from 2007 through 2017. These figures represent the average, annual, per capita government expenditure for a Medicare beneficiary in each of the comparison communities. Data on FFS Medicare enrollment and expenditures and MA enrollment were obtained through the CMS Geographic Variation Public Use File (CMS, 2018b). Measures of MA expenditures were calculated using year-specific benchmark payment rates, which provide an approximate estimate of county-level MA spending. Due to the nature of the data used to construct **Figure 10**, geographic regions are defined as the primary county in the MSA (e.g. estimates for Grand Rapids are specific to Kent County). Expenditures in **Figure 10** are adjusted for regional differences in prices, population age, gender, and race. These figures include expenditures for physician and hospital care, but exclude expenditures on prescription medications. Additionally, in cases where treatment was received in a county outside of where the patient resides, CMS assigns expenditures to the county in which the patient lived and not the county where the treatment was performed. Notably, Medicare expenditures for nearly all regions and the U.S. as a whole fell from 2010 through 2015. This unprecedented string of year-over-year reductions in per-member Medicare expenditures received a good deal of attention, but the downward trend appears to have leveled off in recent years, and in 2017 we now note a reversal of this trend for Grand Rapids, our benchmark cities, and the U.S. as a whole. In fact, the adjusted Medicare expenditures per enrollee increased by about $374 in Grand Rapids between 2016 and 2017. With that noted, Medicare expenditures in Grand Rapids are still below the national average and in line with expenditures in the benchmark communities, while expenditures in Detroit have moved closer toward the national average, but remain substantially higher than in the other regions.

Care Coordination

Lastly, **Figure 11** provides evidence on the quality of care received in each region using hospital discharges for ambulatory care-sensitive conditions as a proxy for care coordination. This measure is often equated to preventable hospitalizations and can be used as an indicator of care efficiency. In this case, a lower number is preferable, so Grand Rapids performs particularly well. Overall, it appears that Grand Rapids and West Michigan Medicare FFS residents receive a higher level of care coordination than those in many of the comparison regions. However, in 2015, we note a reversal in the downward trend for Grand Rapids and its benchmark communities for the first time since 2011, with an 8.3-percent increase from its 2014 level.

Data for **Figure 11** were collected from the Dartmouth Atlas of Health Care (2018) and exhibit two primary differences from the previous figures. First, **Figure 11** focuses solely on Medicare FFS beneficiaries and does not include data on Medicare Advantage enrollees. Claims data for Medicare Advantage enrollees are typically not made available to researchers. Nationally, slightly more than one-third of Medicare beneficiaries are enrolled in a Medicare Advantage plan. However, Medicare Advantage enrollment in Grand Rapids is now above 50 percent. This should be kept in mind when evaluating **Figure 11**. Additionally, the Dartmouth Atlas of Health Care defines geographic regions at the hospital referral region (HRR) level and not the MSA.[3]

In conclusion, while Grand Rapids compares favorably to the other regions on metrics associated with care coordination and efficiency, there are several areas of concern and opportunities for potential improvement. For example, rates of outpatient visits to hospitals and ED visits in Grand Rapids are above the national average and have grown substantially over the past decade. Total hospital expenses per admission in Grand Rapids are above the national average and benchmark communities and grew at a relatively steep rate since 2005. While per capita Medicare expenditures in the Grand Rapids area remain below the national average and are similar to other comparable regions, we do note a rather steep increase in these expenditures between 2016 and 2017 with real expenditures growing by close to four percent. Further examination of the underlying reasons for these increases in expenses is needed to help provide direction for decisions pertaining to cost containment without sacrificing improved patient outcomes and high-quality care.

[3] The Dartmouth Atlas of Health Care defines HRRs as "regional health care markets for tertiary medical care that generally require the services of a major referral center. The regions were defined by determining where patients were referred for major cardiovascular surgical procedures and for neurosurgery."

References

American College of Physicians. (2013). *American College of Physicians Policy on Provider-Based Billing*. Retrieved September 10, 2016 from https://www.acponline.org/acp_policy/policies/provider_based_billing_2013.pdf.

American Hospital Association (AHA). (2018). *AHA hospital statistics 2018 edition*. Health Forum LLC, an affiliate of the American Hospital Association, Washington, D.C.

Berenson, R.A., Ginsburg, P.B., & May, J.H. (2011). Hospital-physicians relations: Cooperation, competition, or separation? *Health Affairs*, *26*(1), w31-w43.

Centers for Medicare & Medicaid Services. (2018a). *CMS Empowers patients and ensures site-neutral payment in proposed rule.* Retrieved August 26, 2018 from: https://www.cms.gov/newsroom/press-releases/cms-empowers-patients-and-ensures-site-neutral-payment- proposed-rule.

Centers for Medicare & Medicaid Services. (2018b). *Geographic variation public use file.* Retrieved August 26, 2018 from https://www.cms.gov/Research-Statistics-Data-and- Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/GV_PUF.html.

Centers for Medicare & Medicaid Services. (2018c). *CMS Finalizes Rule that Encourages More Choices and Lower Costs for Seniors. Retrieved September 16, 2019 from https://www.cms.gov/newsroom/press-releases/cms-finalizes-rule-encourages-more-choices-and-lower-costs-seniors.*

Dartmouth Atlas of Health Care. (2017). *Discharges for ambulatory care-sensitive conditions per 1,000 Medicare enrollees.* Retrieved October 18, 2018 from http://www.dartmouthatlas.org/data/table.aspx?ind=164.

Honigman, L.S., Wiler, J.L., Rooks, S., & Ginde, A.A. (2013). National study of non-urgent emergency department visits and associated resource utilization. *West J Emerg Med*, *14*(6), 609-616.

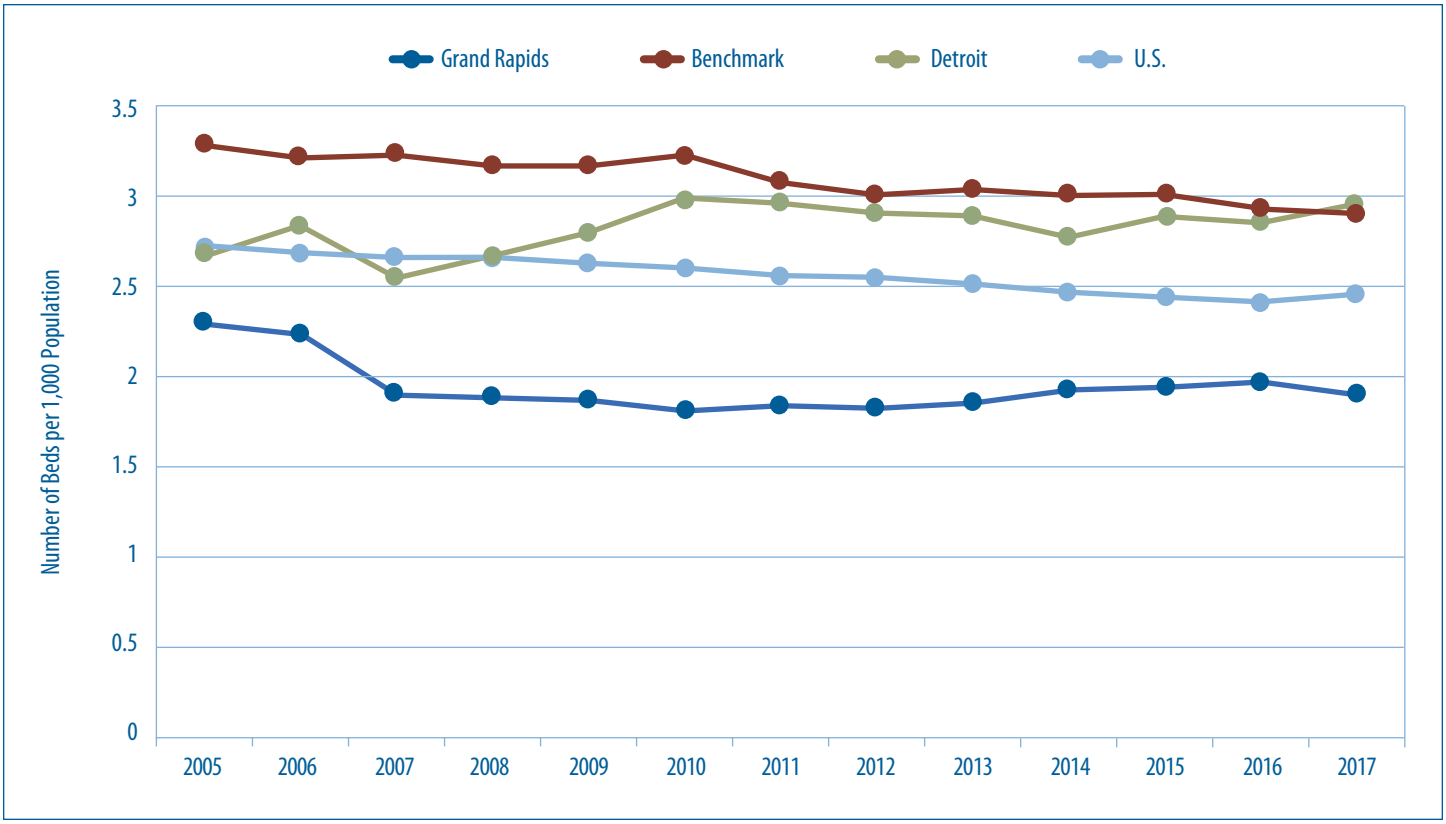
Kumar, R.K. (2011). Technology and healthcare costs. *Annals of Pediatric Cardiology*, *4*(1), 84-86.

Medicare Payment Advisory Commission (MedPAC). (2012). *Report to the Congress Medicare Payment Policy*. Retrieved September 10, 2016 from http://www.medpac.gov/docs/default-source/reports/march-2012-report-to-the-congress-medicare-payment-policy.pdf?sfvrsn=0.

Moses III, H., Matheson, D.H.M., Dorsey, E.R., George, B.P., Sadoff, D., & Yoshimura, S. (2013). The Anatomy of health care in the United States. *Journal of the American Medical Association*, *310*(18), 1947-1963.

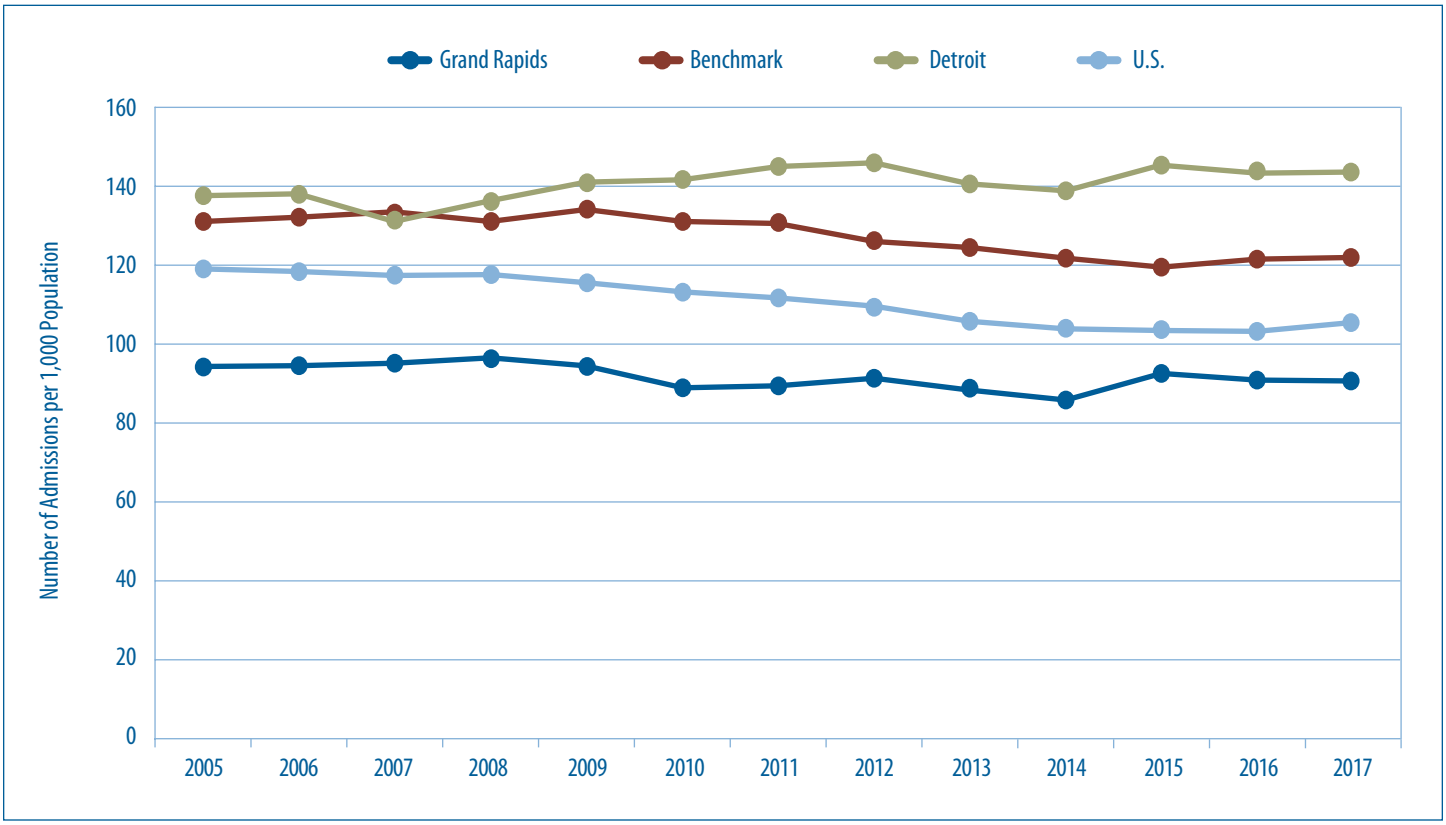
Weinick, R.M., Burns, R.M., & Mehrotra, A. (2010). Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Affairs*, *29*(9), 1630-1636.

Figure 1: Hospital Beds, 2005–2017



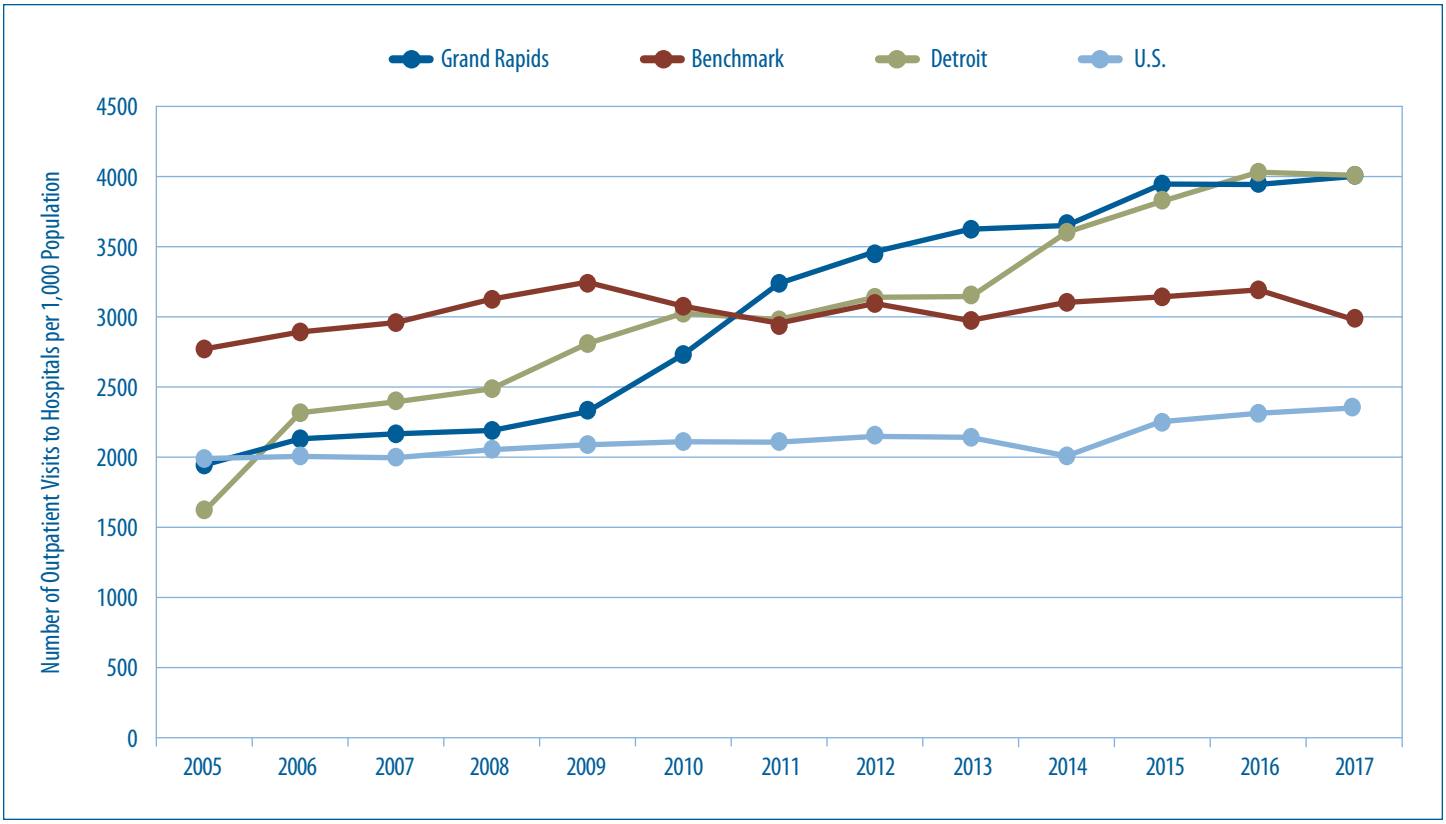
Source: American Hospital Association. *AHA hospital statistics,* 2018.

Figure 2: Hospital Admissions, 2005–2017



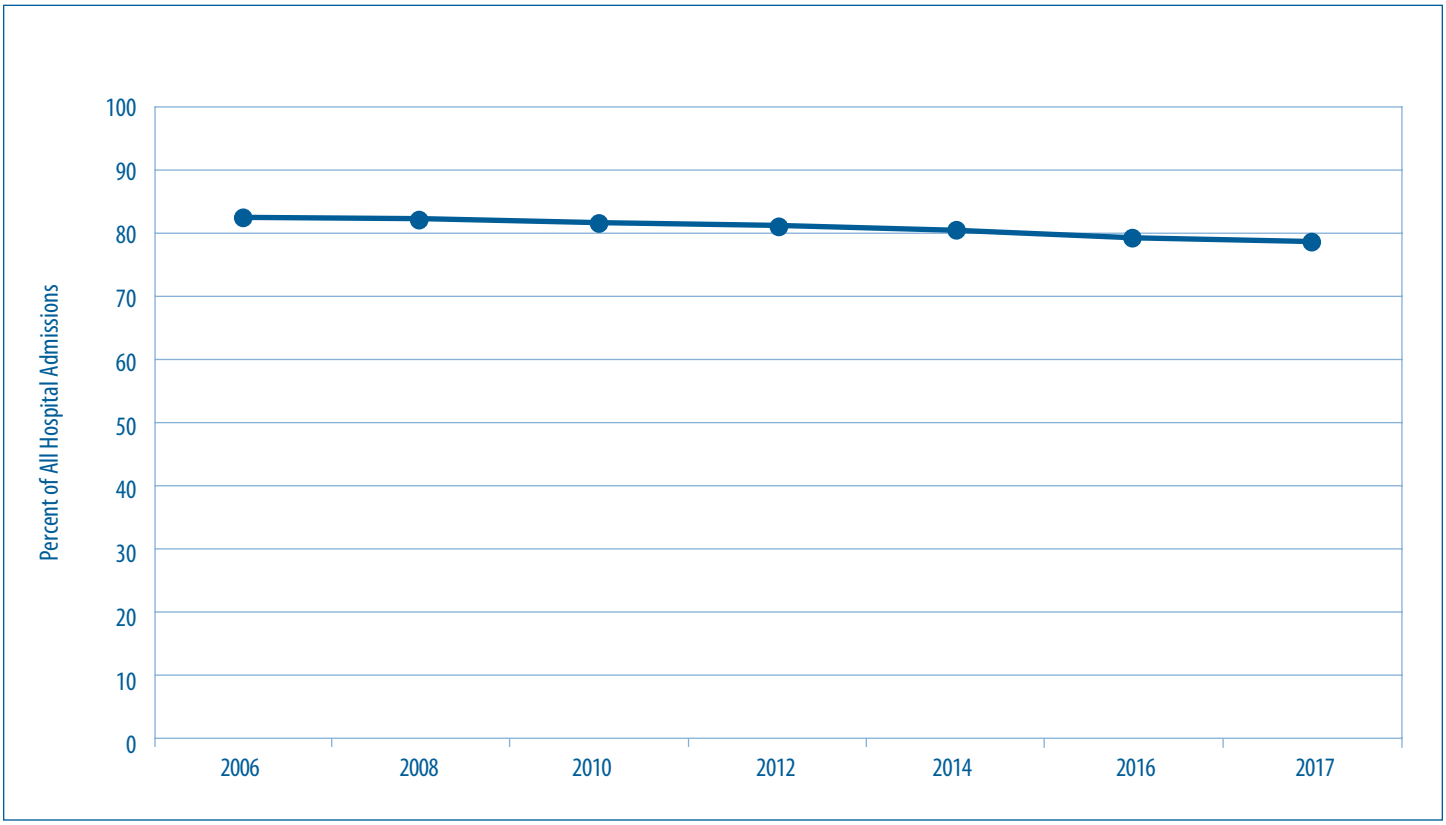
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 3: Outpatient Visits to Hospitals, 2005–2017



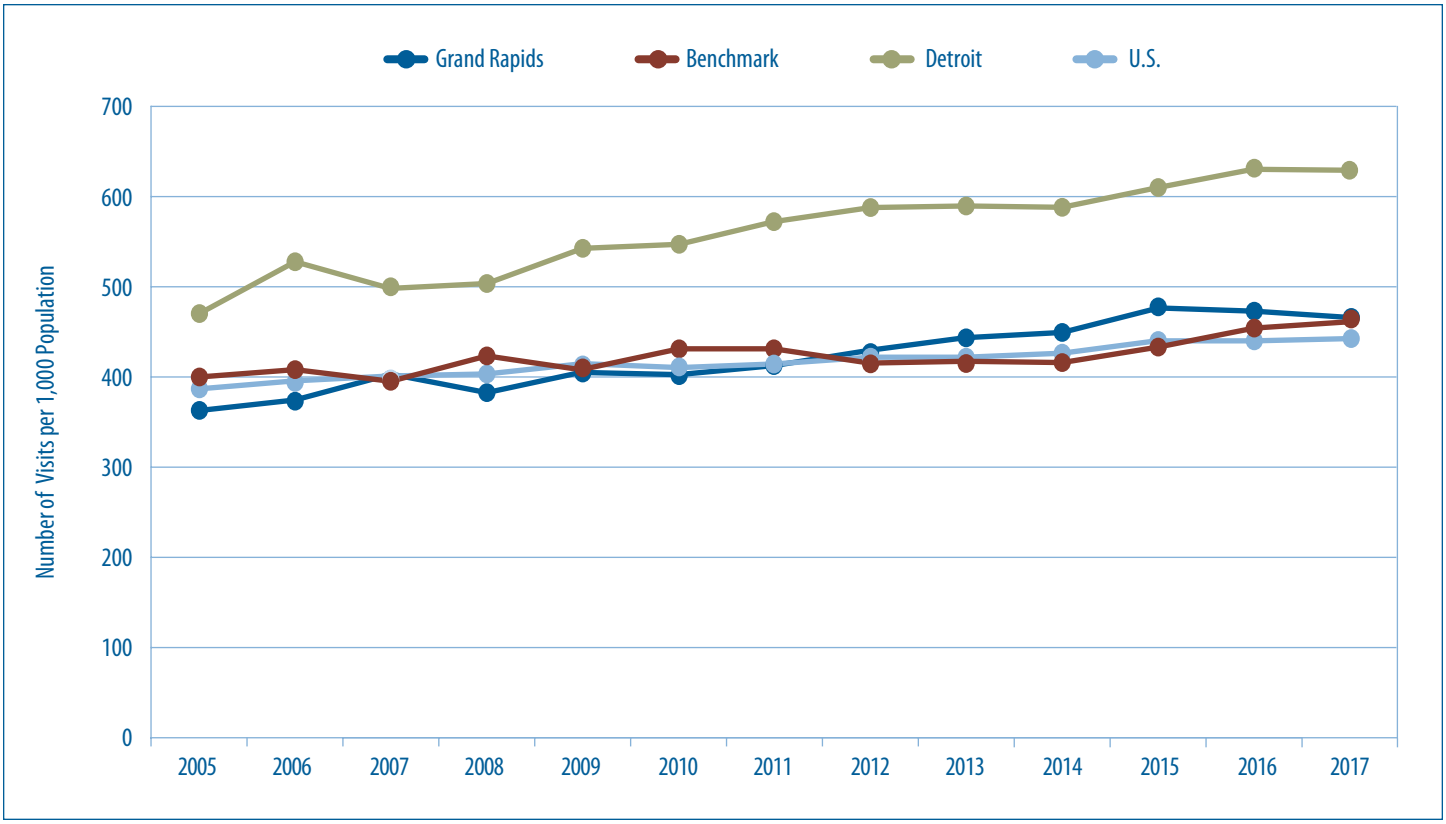
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 4: KOMA Resident Share of Local Hospital Admissions, 2006–2017



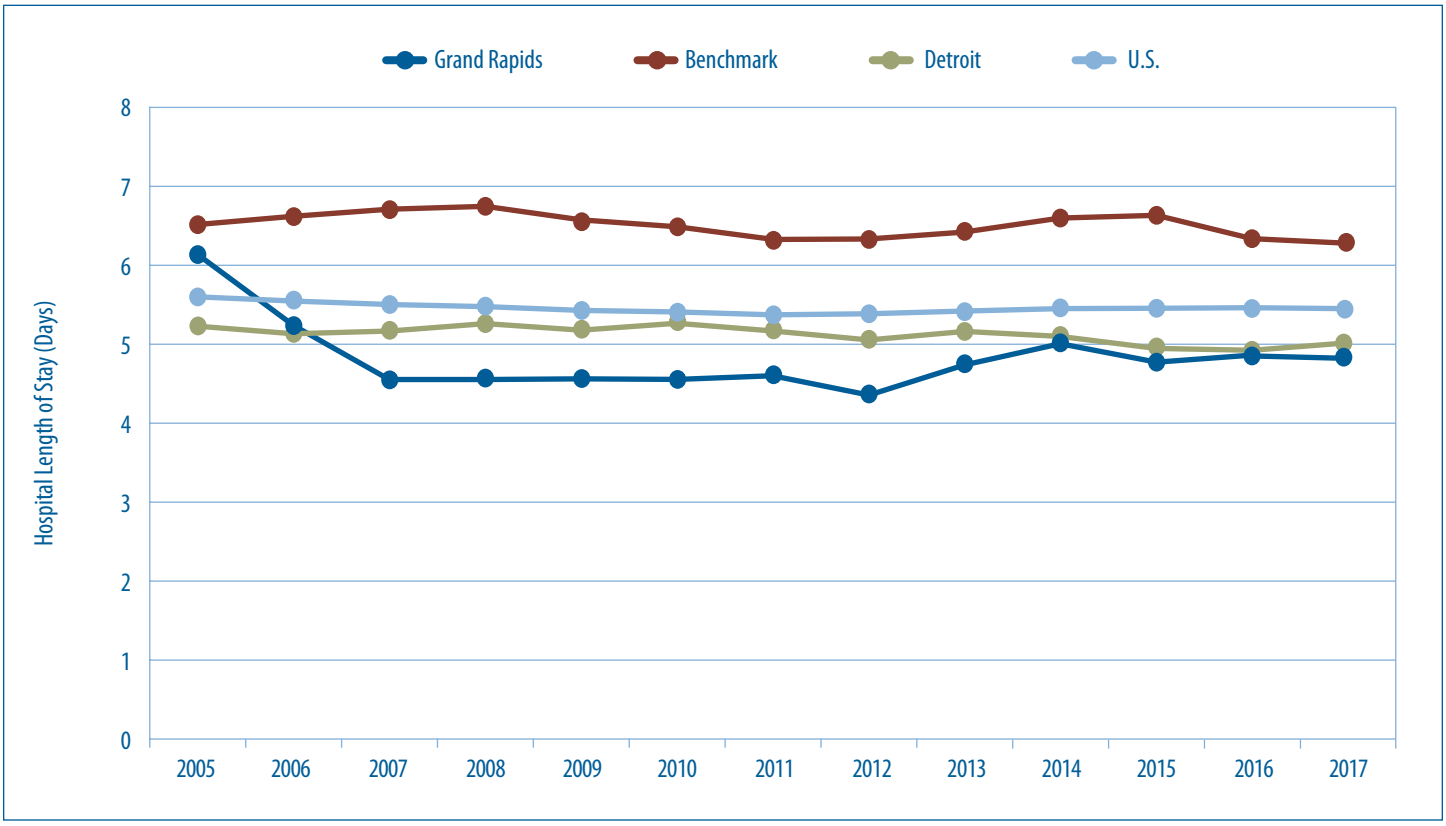
Source: Health Care Utilization Project's State Inpatient Databases.

Figure 5: Emergency Department Visits, 2005–2017



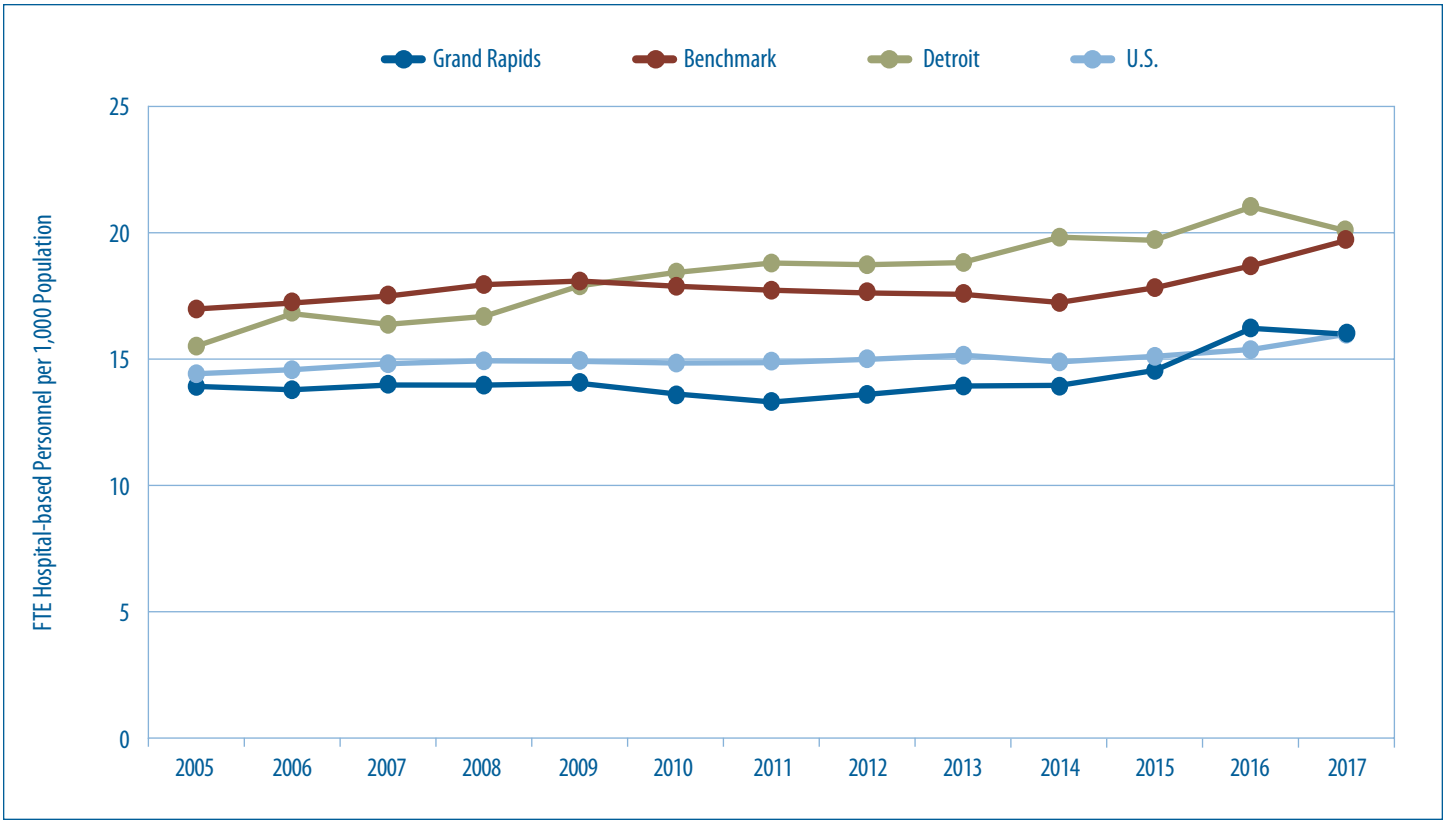
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 6: Average Hospital Length of Stay, 2005–2017



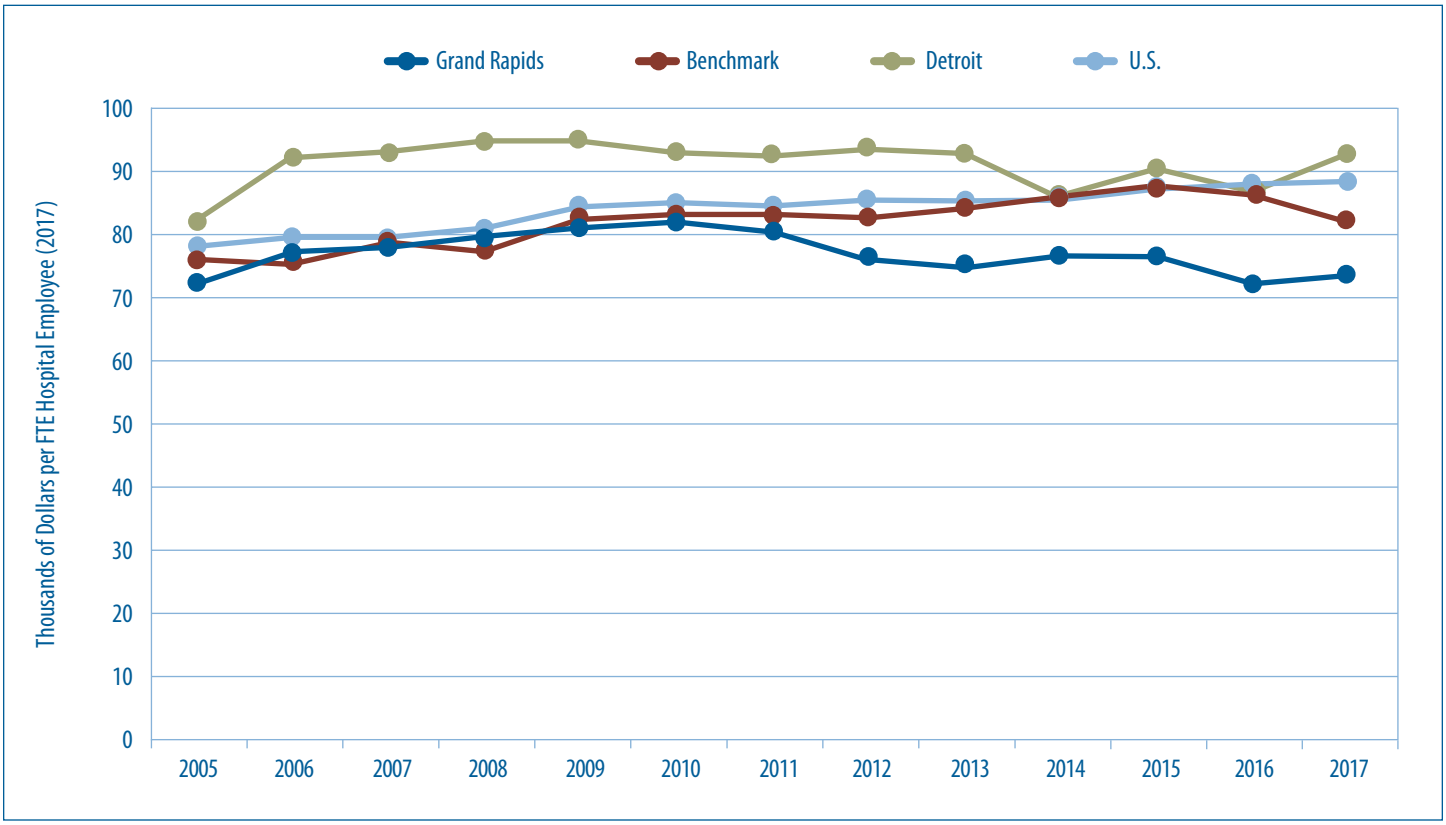
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 7: FTE Hospital-based Personnel, 2005–2017



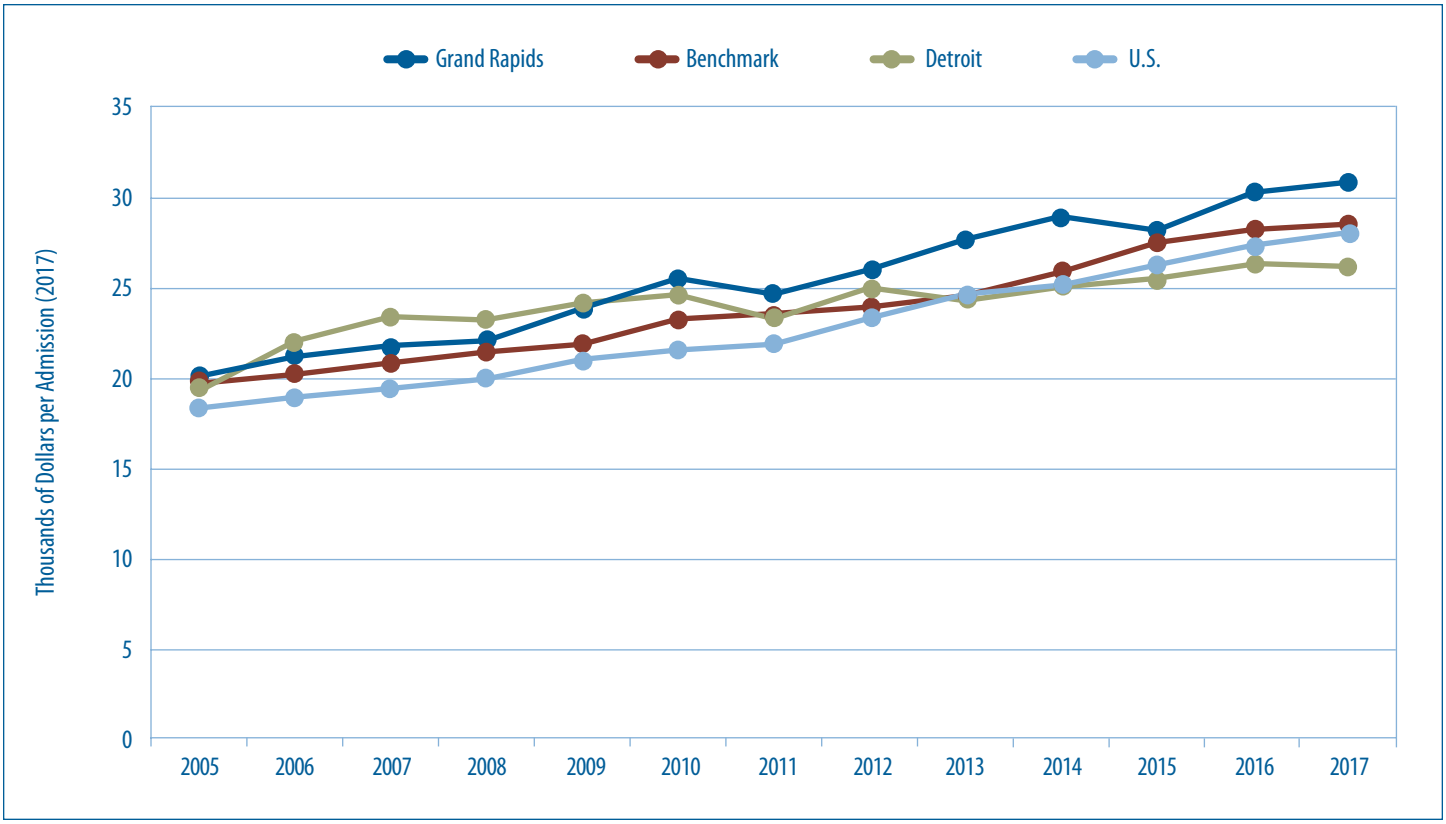
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 8: Average Payroll and Benefit Expenses, 2005–2017



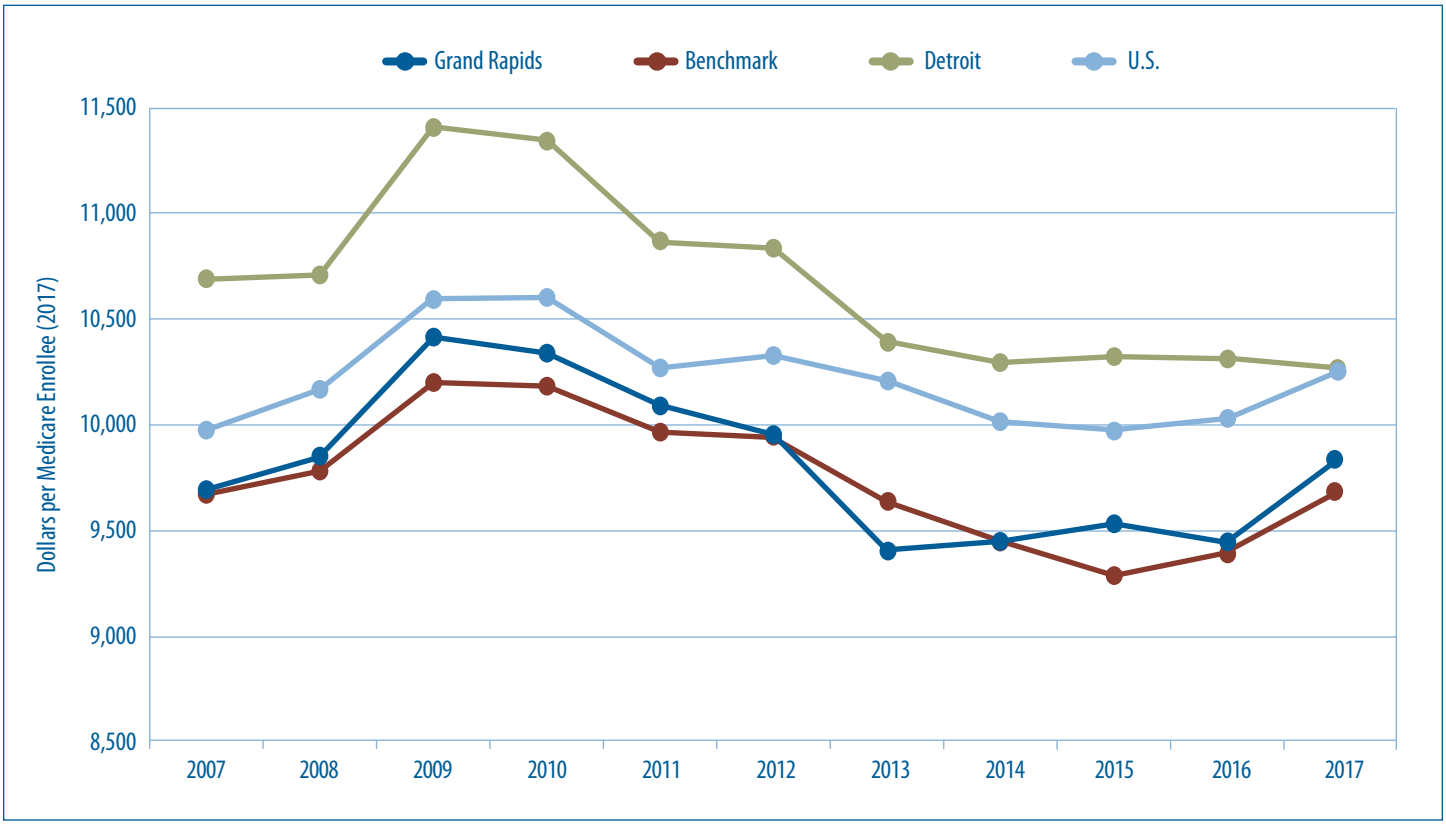
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 9: Total Hospital Expenses, 2005–2017



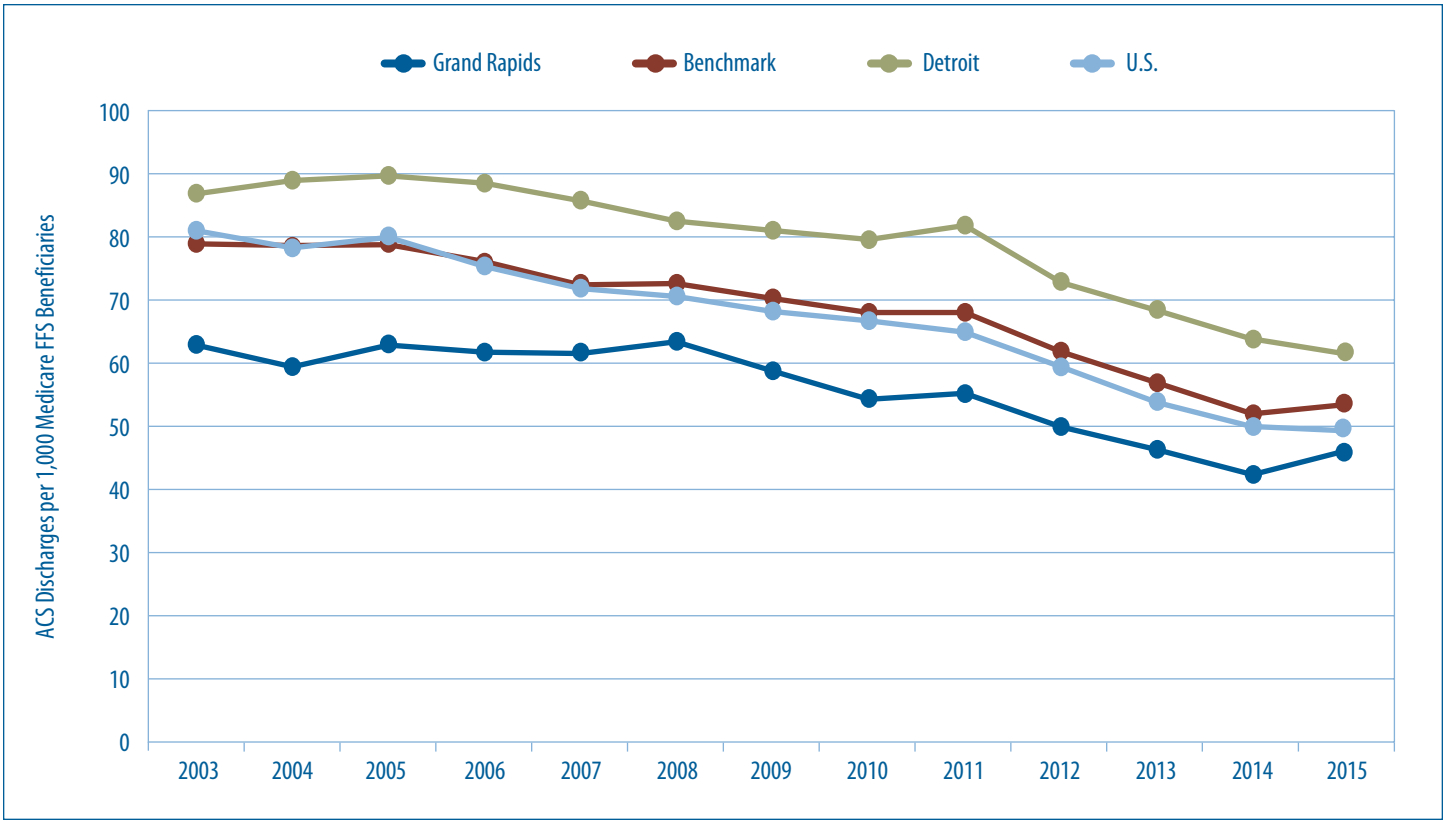
Source: American Hospital Association. *AHA hospital statistics, 2018.*

Figure 10: Adjusted Average Medicare Expenditures, 2005–2017



Sources: CMS Geographic Variation Public Use File; CMS Monthly Enrollment by Contract/Plan/State/County Files; CMS Plan Payment Data Files, 2018.

Figure 11: Discharges for Ambulatory Care-Sensitive Conditions, 2003–2017



Source: Dartmouth Atlas of Health Care. *Discharges for ambulatory care-sensitive conditions.*

Major Medical Conditions: Expenditure and Utilization Analysis

This analysis provides general cost information about some of the most prevalent and expensive medical conditions to identify and track trends in health care expenditures for select chronic health conditions and to examine geographic differences in the cost of care. The data presented in this section are average annual member expenditures, including prescription medication expenditures, for those enrolled in private health insurance plans administered by Blue Care Network (BCN), Blue Cross Blue Shield of Michigan (BCBSM), and Priority Health (PH) for the years 2017 though 2018. The following factors should be considered when interpreting analyses in this section:

- **Differences in benefit structures and enrollment.** Both BCN and PH offer primarily HMO products while BCBSM members are predominantly enrolled in PPO plans. HMOs tend to operate through selective contracting and provider referrals, utilizing networks to achieve cost savings. PPOs tend to have fewer restrictions on members seeking care, and, therefore, usually require additional member cost-sharing in the form of higher premiums, higher coinsurance rates, or higher co-pays. Because of these differences in benefit structures, evidence suggests that HMO plans are more attractive to enrollees who are healthier, who have less complex medical needs, or who have no longstanding ties to particular providers (Ji & Liu, 2007; Nicholson et al., 2004; Tchernis et al., 2006). However, some research has failed to find a substantial difference in health status for those enrolling in HMO plans (Schaefer & Reschovsky, 2002). Furthermore, enrollment changes can alter the underlying disease burden of the payer mix resulting in changes in utilization and expenditures.

- **Disease selection.** The health status, and thus the expenditures, for members with specific conditions might vary due to differences in demographics and health behaviors. For example, patients in some counties insured by one payer may be sicker than patients in other counties who are insured by a different payer.

- **Expenditures beyond disease.** In each case, the average patient expenditure data is for services not only related to the specific disease in question, but also for other unrelated medical costs the member may have incurred during the year. Differences in expenditures or treatment intensity for the unrelated health issues can result in additional variation in average patient expenditure estimates.

Expenditure estimates from each insurer can vary considerably because of these factors. Thus we average the data for all three insurers to arrive at a more robust estimate of member expenditures. Moreover, this year we also provide risk-adjusted expenditure data for 2018, when comparing KOMA and Detroit region expenditures to better determine the expenses associated with specific disease treatment and minimize the impact of health risk factors that may inherently affect health care expenditures.

KOMA Expenditures

As we have done in previous versions of this publication, we chose to focus on six chronic conditions that are associated with high prevalence rates and high levels of resource utilization: asthma, coronary artery disease (CAD), depression, diabetes, hyperlipidemia, and low back pain.[1] For comparison, we also included "healthy members", which we defined as those between the ages of 30 and 39 who had not been diagnosed with any of the six chronic conditions previously listed and who have total annual expenditures below $450,000. **Figure 1a** provides the average annual expenditures per member for each of the conditions in Kent, Ottawa, Muskegon, and Allegan (KOMA) counties in 2017 and 2018.[2] In most cases, we identified members in each disease category according to specifications defined by the Healthcare Effectiveness Data and Information Set (HEDIS). We excluded Medicaid and Medicare enrollees from our expenditure estimates. Finally, all expenditure estimates in **Figure 1a** are reported in 2018 dollars.

[1] Specific definitions for each of these conditions can be found in the online Disease Population Specs Appendix accessible at https://www.gvsu.edu/vphealth/health-check-65.htm.

[2] It should be noted that our 2017 estimates will deviate in some cases from those reported in our 2019 report. This deviation is due to a correction to an error in the algorithm used to prepare the expenditure data by one of our data suppliers. After investigating the effect of this error, we note that it might have understated the level of expenditures in prior years, however, the magnitude of the understatement when looking at 2017 was under four percent in all but one case, where CAD expenditures were understated by 5.97 percent. Figures in this year's report have fully corrected for this issue.

We note that, even after adjusting for inflation, **Figure 1a** indicates that expenditures for most of the conditions we consider increased from 2017 through 2018. **Figure 1b** further highlights the percentage change to average member costs. Here we note that expenditures increased for asthma (5.1 percent), CAD (19.4 percent), diabetes (3.2 percent), hyperlipidemia (10.7 percent), and also for healthy members (14.3 percent). Expenditures decreased slightly for low back pain (-0.9 percent) and depression (-1 percent). In dollar terms, the most dramatic change was seen in CAD expenditures, which increased by $5,343 on average per member and in hyperlipidemia, which saw a $1,157 increase on average per member.

Unfortunately, we are unable to identify the cause of these increases for CAD and hyperlipidemia expenditures. However, possible causes include a change in the composition of the non-Medicare/Medicaid patient group diagnosed with CAD and hyperlipidemia and insured by BCN, BCBSM, and PH; an increase in treatment intensity for members with CAD and hyperlipidemia; or an increase in the price of treatments commonly received by members with CAD and hyperlipidemia.

Tables 1 and 2 examine inpatient admissions for KOMA residents with a primary diagnosis of CAD to further investigate changes in CAD spending over time. The data source for these figures is the Healthcare Cost and Utilization Project's State Inpatient Database (HCUP), which includes the universe of admissions to hospitals in the State of Michigan in 2006, 2008, 2010, 2012, 2014, 2016, and 2017. While the data include detailed information about an individual's hospital experience, it is important to note two limitations: 1) these data only capture treatment in an inpatient setting and 2) individuals included in the data have various sources of insurance, including Medicare, Medicaid, and private insurance and are not directly comparable to our sample of the privately insured.[3]

Table 1 displays characteristics of KOMA residents admitted to the hospital with a primary diagnosis of CAD. Interestingly, admissions for this population have fallen steeply from 2006 to 2014 despite maintaining a consistent definition of diagnosis codes for CAD, which could reflect a local shift in CAD treatment from inpatient to outpatient settings, consistent with national trends (Truven, 2016). However, we note a reversal of this trend with a slight increase in CAD inpatient admissions between 2014 and 2017. The average age of a patient with CAD is approximately 66 years and has remained fairly constant over the sample period, while the share of admissions of women with CAD has fallen from about 35 percent in 2006 to 33 percent in 2017. The share of uninsured patients has fallen from more than four percent per year prior to the ACA and Medicaid expansion to less than one percent in 2017. The last two columns provide some indication that those diagnosed with CAD who are hospitalized may have more complex medical needs in recent years. For example, while 2.23 percent of CAD admissions in 2006 resulted in an in-hospital death, that number rose to 3.44 percent in 2016, but did fall somewhat to 3.26 percent in 2017. Additionally, the average number of recorded diagnoses for these patients increased from 8.22 in 2006 to 15.32 in 2017. Looking at the change between 2016 and 2017, we note that the average number of diagnoses per patient increased by about five percent. These figures indicate that some of the recent increases in CAD expenditures leading up to 2017 could have been the result of a growing disease burden among those diagnosed with CAD.

Table 2 uses the same data that was used in **Table 1**, but focuses on outcomes and treatment for KOMA residents hospitalized with a primary diagnosis of CAD. The average number of procedures remained largely stable until 2014. However, between 2014 and 2017 we have seen a reduction by 18.8 percent (down to about 4.46 procedures) while the average length of stay has increased from 3.46 days in 2006 to 4.54 days in 2017. Length of stay along with other outcomes in **Table 2** are potentially associated with both the severity of the patient's illness and with treatment decisions made by clinicians in the hospital. Notably, the share of patients with CAD who were discharged to a skilled nursing facility, an intermediate care facility, or an inpatient rehabilitation facility increased sharply from 2006 to 2014 before declining slightly in 2016 and 2017.

The next two columns include the share of patients receiving any of the two most commonly used inpatient treatments for CAD that signify varying degrees of treatment intensity: percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass graft (CABG). PTCA involves the unclogging of a coronary artery by inserting a catheter, inflating a balloon at the blockage site, and sometimes implanting a stent, while CABG is a more intensive procedure for reperfusion in which arteries or veins from the leg or forearm are used to bypass the coronary blockage (Pocock et al., 1995). From 2006 to 2017, the share of patients with CAD receiving PTCA fell by more than 20 percentage points from 54 percent to 32 percent, while the share of patients receiving CABG rose from slightly less than 14 percent to more than 20 percent. This pattern could be indicative of worsening health of patients diagnosed with CAD, a shift in treatment style toward more intensive interventions, or a shift in the share of PTCA procedures performed in an inpatient vs. outpatient setting.

Finally, the last column displays average total charges per CAD admission in 2017 dollars. Before interpreting changes over time in this measure, there is a critical distinction to be made between charges and payments. Charges represent the "list price" for a hospital stay and do not reflect negotiated discounts with private insurers or administratively set rates under the Medicare and Medicaid programs. Therefore, actual payments tend to be below charges, but charges can still provide an indication of changes in treatment intensity or rising prices associated with CAD hospital care. Average total charges for a CAD hospital admission increased from $36,557 in 2006 to $61,158 in 2017.

[3] We have limited the analyses in Tables 2 and 3 to those under the age of 65 who are privately insured.

These increases in charges for CAD hospital admissions seem to follow trends observed in national data where charges were reported to have been increasing for some time (Bai & Anderson, 2015). Moving forward, as part of the ACA since January 2019, hospitals are required to make their chargemaster list prices transparent (CMS, 2018). As part of our Health Check tracking, it will be interesting to see if these transparency efforts have any effect on the reported trends in charges.

Next, we return to reporting our insurer data. **Figure 2** separates the disease-specific expenditure figures for 2017 and 2018 in **Figure 1a** into medical and prescription drug components. The prescription drug share of total spending ranges from 14 percent for members with CAD to 34 to 35 percent for those diagnosed with diabetes and asthma. We note that the prescription drug expenditure share of overall disease-specific expenditures has been reduced by about one to two percent across all conditions between 2017 and 2018. However, this does not mean that real (in 2018 dollars) prescription drug expenditures have decreased on average per member. In fact, we note increased average prescription drug expenditures for members with asthma ($110 increase), CAD ($75), diabetes ($66), and hyperlipidemia ($185). It is only for depression (-$94) and low back pain (-$72) that we observe a real drop in average member drug expenditures.

Differences in Average Annual Expenditures Between KOMA and the Detroit Region

Figure 3a compares average annual per member expenditures in both the KOMA and Detroit regions. We define the Detroit region as Oakland, Macomb, and Wayne counties. **Figure 3a** indicates that expenditures for all conditions except for CAD are higher in the Detroit region than in KOMA. Notably, the CAD expenditures per-member, per-year are $5,706 (or 21 percent) higher in the KOMA region than in the Detroit region. Higher spending for the same condition on one side of the state compared to the other could be a function of higher prices for care, greater use of medical services/technologies, or geographic differences in the underlying health of the population.

Figure 3b plots the percentage change in expenditures for each condition from 2017 to 2018. So, while **Figure 3a** provides differences in spending levels between the two regions, **Figure 3b** presents a more dynamic look at how those spending levels changed in the past year. Growth in expenditures was higher in the Detroit region for healthy members and members with an asthma diagnosis than in KOMA. The expenditure growth for healthy members and those with asthma was more than five percent across both regions. Expenditure growth rates were higher in KOMA for diabetes and hyperlipidemia. Meanwhile, expenditures for low back pain and depression declined across both regions, but with a relatively larger decline observed in the Detroit region than in KOMA.

This year, we also have access to average member risk scores (in 2018), which allows us to adjust for expenditure differences between the KOMA and Detroit regions due to geographic differences in the underlying health of the population. To this end, **Figure 3c** reports two average member expenditures for KOMA members across all conditions; the first of these is the actual (raw) expenditures reported within **Figure 1a**, while the second is the predicted average KOMA region member expenditures if we set the KOMA member's risk score to be the same (on average) as that observed within the Detroit region member population.

Figure 3c shows us that for members with asthma, depression, or hyperlipidemia, the risk score adjusted KOMA expenditures move to within two to three percent of those in the Detroit region. The same expenditure convergence is observed for the healthy members who move within 2.6 percent. While the KOMA region and Detroit region average member expenditure gap is also decreased for members with low back pain, the expenditures in KOMA remain about 7.4 percent lower than in the Detroit region, even after the risk score adjustment. This suggests differences across the two regions that go beyond geographic differences in the underlying health of the populations, such as possible regional differences in treatment approaches to managing low back pain. For average CAD expenditures, we note that, while adjusting for risk score differences reduces the across region expenditure differences by $1,337, the adjusted, average member expenditures in the KOMA region are still 16.1 percent higher than in the Detroit region, again, suggesting that structural differences across these regions persist after adjusting for differences in population risk scores.

As previously noted, these differences in CAD expenditures may result from local differences in provider practice styles, service intensity, or price across the two regions. Lastly, we note risk score adjusted expenditures for KOMA members with a diagnosis of diabetes increase by $2,913, resulting in the adjusted expenditures for the KOMA region being higher than those observed in the Detroit region. This, in effect, flips the relationship we observed in **Figure 3a**, where average member expenditures are seen to be higher in the Detroit region than in the KOMA region for members with diabetes. This change suggests that risk scores are higher on average in the Detroit region than the KOMA region for members with a diabetes diagnosis, but adjusting the patient populations to have the risk score profile of the Detroit region would have us expect expenditures to be higher in KOMA than in the Detroit region by close to 8.5 percent (or $1,524). As with low back pain and CAD treatment, this finding suggests that there may be differences in the treatment costs associated with diabetes between the two regions.

Health Services Use

Figures 4a through 4c examine regional differences in health care utilization for each of the six conditions discussed in this report. This is the third year that we have been able to include utilization data in our analysis, and this brings us closer to identifying the causes behind the documented expenditure growth.

Figure 4a displays the average number of annual inpatient visits for a member in KOMA or the Detroit region in 2018. It is clear from this figure that hospitalization rates tend to be higher on the east side of the state than the west. For example, CAD members in KOMA experience an average of 0.46 inpatient admissions per year, while those with CAD in Detroit have an average of 0.56 hospital visits per year. Even more striking is the hospitalization rate differences for those diagnosed with either asthma, depression, or diabetes. Compared to individuals with these conditions in KOMA, those in Detroit experience more than 50 percent more hospitalizations per year.

Figure 4b extends the utilization analysis to emergency department (ED) use. Once again, ED use is higher in the Detroit region than in KOMA for all six of the conditions. For example, those with a low back pain diagnosis averaged 0.71 ED visits per year in Detroit compared to 0.43 ED visits per year in KOMA (indicating that we observe close to 65 percent more ED visits per member in Detroit for low back pain than in KOMA). While not as stark, the ED use differences for both depression and diabetes are more than 30 percent higher per member in the Detroit region than in KOMA. We further note that data on ED use in the Benchmarking Communities section of this book suggests that ED use has been increasing in both the Detroit and Grand Rapids regions throughout the past decade.

Next, utilization in terms of prescription drug fills are presented in **Figure 4c**. Again, we find evidence of higher use rates in the Detroit region than in the KOMA region. For example, the average member with diabetes in KOMA had 59 prescription fills in 2018 compared to 71 for individuals with diabetes in the Detroit region. Assuming that each member filled a prescription 12 times throughout the year, then this would represent an average of about five distinct prescriptions for a person with diabetes in KOMA and close to six distinct prescriptions in Detroit. Beyond diabetes, we note an average of 24 percent more prescription fills in Detroit than in KOMA for members with a depression diagnosis and, similarly, 29 percent more prescription fills in Detroit for members with a low back pain diagnosis.

Our last utilization metric, annual telehealth visits per member, are reported within **Figure 4d**. Here, we find that telehealth visits are more common within KOMA than within the Detroit region across all six of the conditions, with utilization differences ranging from 45 to 89 percent across the conditions. The highest differences are found for hyperlipidemia and CAD patients, where the former have 89 percent more telehealth visits in KOMA than in the Detroit region and the latter have 75 percent greater utilization in KOMA than in the Detroit region.

A notable development from last year's reporting on telehealth visits is that they have become more common for patients across all six of the tracked conditions. **Figure 4e** tracks the 2017 to 2018 percentage change in average telehealth visits per member and indicates growth in telehealth use across both the KOMA and Detroit region. A relative growth advantage is observed for the Detroit region, where three conditions — hyperlipidemia, diabetes, and depression — all saw growth by more than 800 percent. Looking at the KOMA region, we observe growth rates higher than 100 percent for the same conditions.

Comorbidities

In this section, we take a closer look at expenditures associated with diabetes and depression by examining the impact of additional diagnoses. Joint diagnoses and the presence of multiple comorbidities can lead to higher resource utilization and higher levels of spending. Importantly, we are not examining clinical linkages between these conditions, but rather only focusing on expenditure differences associated with multiple diagnoses. **Figure 5a** plots average annual member expenditures for those with only a diagnosis of diabetes, those with diagnoses of diabetes and asthma, diabetes and hypertension, diabetes and depression, and diabetes and CAD. According to **Figure 5a**, the addition of comorbidities greatly impacts the average expenditures associated with a diagnosis of diabetes. For example, expenditures in KOMA for a member diagnosed with diabetes and depression compared to a diagnosis of diabetes alone adds about $14,410 to the annual expenditure estimate, while a diagnosis of diabetes and CAD (instead of diabetes alone) adds close to $28,670 to the expenditure estimate.

Figure 5b displays the results of a similar analysis that focuses on depression. Results are similar to those in **Figure 5a**: the presence of multiple conditions greatly increases average annual expenditures for members with depression. For example, expenditures in Detroit for a member diagnosed with depression and CAD compared to a diagnosis of depression alone adds about $45,440 to the expenditure estimate.

Lastly, looking across **Figures 5a and 5b** we further note that expenditures for comorbidities do not appear to be additive. That is, average expenditures for members who suffer from both diabetes and depression are higher than if we simply added the average expenditure of a member who suffers only from diabetes with the average expenditure of a member diagnosed only with depression. Looking at KOMA, the expenditure difference adds up to $4,977, while the same difference is considerably higher in the Detroit region, adding up to a $15,708 difference.

Geographic Variation in Expenditures and Health Care Use

In **Figures 6 through 7**, we plot estimates of expenditures and health care use by zip code to examine the degree to which spending and use for those with chronic conditions vary over relatively small geographic areas. For each condition analyzed in this section, we limit our analysis to zip codes with at least 30 members distributed across at least two of the three payers supplying member data. We also adjusted our expenditure estimates for differences in zip code level population age, income, and education. Therefore, estimates can be interpreted as comparisons for individuals at the same age, with the same income, and the same level of education across different zip codes. On average, over the conditions that we examined, age, income, and education can explain approximately 15 percent of the variation in expenditures at the zip code level. The remaining variation could be attributed to some combination of underlying differences in population health, physician practice styles, or prices for health care services. We chose to focus on the two most expensive conditions in these figures: CAD and diabetes.

Expenditures for CAD are divided into five quantiles and mapped by zip code in **Figure 6a**. Those in the lowest quantile have average annual expenditures between $9,564 and $23,673, while those in the highest quantile have average annual expenditures between $33,518 and $47,453. Overall, having adjusted for differences in population characteristics due to age, income, and education, we note a fairly even distribution of low and high expenditure zip codes across both the west and east side of the state. However, there appears to be some clustering of high expenditure zip codes within the Ottawa and Allegan counties, while we see some clustering of low expenditure counties in Macomb county on the east side.

Figure 6b follows the same methodology in order to map the average number of inpatient admissions in 2018 for members with CAD. Those in the lowest quantile of the distribution experienced between 0.14 and 0.42 inpatient admissions, while those in the highest quantile had between 0.65 and 1.11 inpatient admissions. As we noted earlier, the Detroit region tends to have a greater reliance on inpatient care than West Michigan, and that is evident in **Figure 6b**. Zip codes in the City of Grand Rapids tend to be on the higher side of the distribution, but are generally not included in the top quantile. However, several zip codes within Ottawa and Allegan counties appear again within the top two quantiles.

Figure 6c repeats the analysis with the average number of ED visits in 2018 for those diagnosed with CAD by zip code. The lowest quantile of the distribution represents between 0 and 0.61 ED visits on average, while the highest quantile includes 0.97 to 2.29 visits on average. On the west side of the state, ED use is particularly high for members with CAD living in zip codes within the counties of Allegan, Ottawa, and Ionia, while zip codes farther to the north of Grand Rapids experienced relatively lower ED use. Those in the City of Detroit have significantly higher rates of ED use than those living in suburban Detroit.

Average prescription drug fills for members with CAD in 2017 are mapped in **Figure 6d**. Here, an interesting pattern emerges that will be repeated for members with diabetes (presented as follows): West Michigan has far fewer prescription fills, on average, than the Detroit region. Seven zip codes on the west side of the state are included in the top quantile of the distribution and many of the zip codes in the region are in the lowest two quantiles of prescription fills. On the east side of the state, we note several zip codes within Wayne county that are within the top prescription fill quantile.

This year, we continue our reporting of telehealth visits, which were first reported last year. Telehealth visits are a relatively new treatment option that some patients may find more convenient than traditional office visits. As noted in **Figures 4d and 4e**, we have seen considerable growth in telehealth use across both regions in 2018 when compared to 2017. However, overall use of telehealth visits for those with CAD on both the east and west sides of the state is still relatively low when compared to other types of visits. With that said, we further note that geographic differences in use are stark. **Figure 6e** suggests that use of telehealth visits for patients with CAD remains more common in West Michigan, with more intense use observed within the Grand Rapids region and in zip codes north east of Grand Rapids. Looking at the east side of the state, we observe rather low utilization of telehealth visits across zip codes within Wayne county, while we see a relatively high use within Oakland county. This is a pattern that will be repeated when we examine telehealth visits for diabetes as follows.

Figures 7a through 7e repeat the same analyses focusing on members with a diagnosis of diabetes. In this case, those in the lowest quantile have expenditures ranging from $8,065 to $15,185, while expenditures for those in the highest quantile are between $20,083 and $39,098. Here we see a fairly even distribution of both high and low expenditure zip codes across both regions, with some high expenditure clustering being visible within the north west zip codes of the Detroit region.

Figure 7b indicates that inpatient admissions for people with diabetes in West Michigan tend to be far lower, on average, than for those in the Detroit region. One exception on the west side of the state is Allegan county, where a number of zip codes are observed from the top two inpatient visit quantiles.

Figure 7c maps ED use by zip code and suggests that several West Michigan zip codes are in the bottom two quantiles of the ED visit distribution. Notably, we see more zip codes from the lowest two quantiles on the west side of the state than on the east side, however, we further note some high-use clusters on the west side (e.g. to the north east on the west side).

Figure 7d presents data on the number of prescription fills for a member diagnosed with diabetes by zip code. As was the case with CAD medications, we find a much lower reliance on prescription medication for people with diabetes on the west side of the state than on the east side. Every zip code in the immediate vicinity of Grand Rapids is in the lowest two quantiles of the prescription fill distribution, while much of the Detroit suburbs have relatively high levels of prescription drug use.

Finally, **Figure 7e** includes estimates of average annual telehealth visits for those with a diabetes diagnosis. As we saw with CAD telehealth visits, members on the west side of the state are more likely to use telehealth services than those on the east side of the state.

References

Bai, G., & Anderson, G.F. (2015). Extreme markup: The fifty U.S. hospitals with the highest charge-to-cost ratios. *Health Affairs, 34*(6), 922–928.

Centers for Medicare and Medicaid Services. (2018). *Fiscal Year (FY) 2019 Medicare Hospital Inpatient Prospective Payment System (IPPS) and Long-Term Acute Care Hospital (LTCH) Prospective Payment System Final Rule (CMS-1694-F).* Retrieved September 23, 2019 from https://www.cms.gov/newsroom/fact-sheets/fiscal-year-fy-2019-medicare-hospital-inpatient-prospective-payment-system-ipps-and-long-term-acute-0.

Express Scripts. (2014). *Exchange Pulse Public Exchanges Report – Public exchange medication utilization: Preliminary insights and implications*. Retrieved September 10, 2016 from http://lab.express-scripts.com/lab/insights/government- programs/first-look-health-exchange-medication-utilization.

Healthcare Utilization Project (HCUP) State Inpatient Databases (SID). 2006, 2008, 2010, 2012, 2014, 2016, and 2017. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/sidoverview.jsp.

Ji, L., & Liu. F. (2007). HMO versus non-HMO private managed care plans: An investigation on pre-switch consumption. *Health Care Management Science*, *10*(1), 67-80.

Nicholson, S., Bundorf, K., Stein, R.M., & Polsky, D. (2004). The magnitude and nature of risk selection in employer-sponsored health plans. *Health Services Research*, *39*(6 pt. 1), 1817-1838.

Pockock, S.J., Henderson, R.A., Rickards, A.F., Hampton, J.R., King, S.B., Hamm, C.W., Puel, J., Hueb, W., Goy, J.J., & Rodriguez, A. (1995). Meta-analysis of randomized trials comparing coronary angioplasty with bypass surgery. *Lancet*, *346*(8984): 1184-1189.

Schaefer, E., & Reschovsky. J.D. (2002). Are HMO enrollees healthier than others? Results from the Community Tracking Study. *Health Affairs*, *21*(3), 249-258.

Tchernis, R., Normand, S.T., Pakes, J., Gaccione, P., & Newhouse. J.P. (2006). Selection and plan switching behavior. *Inquiry*, *43*(1), 10-22.

Truven Health Analytics. (2016). *Shifts in cardiology treatment: Cardiac procedures move from inpatient to outpatient care*. Retrieved November 21, 2018 from http://truvenhealth.com/Portals/0/Assets/fact-files/Shifts_Cardiology_Treatment_May_Fact_File_2016.pdf.

Truven Health Analytics. (2015). *Understanding the exchange population: A statistical snapshot*. Retrieved September 10, 2016 from http://images.info.truvenhealth.biz/ Web/TruvenHealthAnalytics/%7Bd0d0e35d-3106-469e-b787-7371b83df0a1%7D_HP_15434_0315_UnderstandingExchangePopulation_RB_WEB.pdf.

Table 1: Characteristics of KOMA CAD Inpatients, 2006–2017

Year	Number of CAD Admissions	Average Age	Share Female	Share Uninsured	Died During Hospitalization	Average Number of Diagnoses
2006	4,928	65.78	35.45%	4.52%	2.23%	8.22
2008	3,717	65.66	35.63%	4.47%	2.15%	9.97
2010	3,341	66.65	35.83%	4.76%	2.96%	11.18
2012	3,328	66.35	33.98%	4.09%	2.67%	12.42
2014	2,785	66.67	33.39%	1.70%	3.30%	14.62
2016	2,937	66.60	32.24%	0.68%	3.44%	14.63
2017	3,160	66.84	33.13%	0.89%	3.26%	15.32

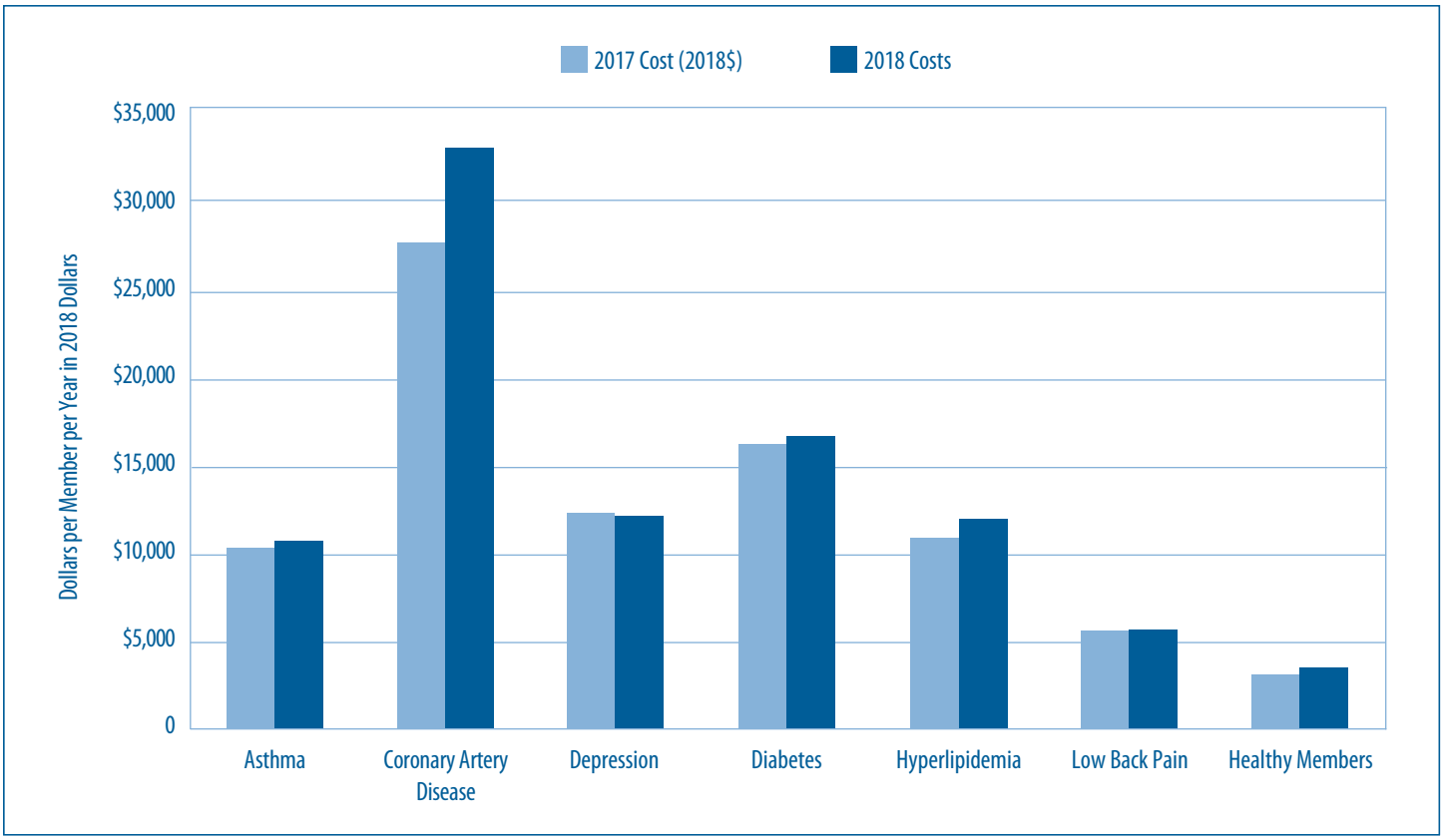
Source: Healthcare Utilization Project's State Inpatient Databases.

Table 2: Outcomes for KOMA CAD Inpatients, 2006–2017

Year	Number of CAD Admissions	Average Number of Procedures	Average Length of Stay	Share of Survivors Discharged to Facility	PTCA Rate	CABG Rate	Average Total Charges ($2017)
2006	4,928	5.27	3.46	6.71%	53.94%	13.78%	$37,335.81
2008	3,717	5.16	3.83	7.09%	45.90%	15.39%	$38,970.46
2010	3,341	5.15	3.89	10.95%	44.15%	15.18%	$42,635.43
2012	3,328	5.29	4.07	11.36%	43.09%	15.78%	$47,329.90
2014	2,785	5.49	4.58	12.33%	40.39%	20.65%	$55,356.39
2016	2,937	4.50	4.46	10.93%	36.36%	20.39%	$59,586.93
2017	3,160	4.46	4.54	10.34%	32.34%	20.44%	$61,158.00

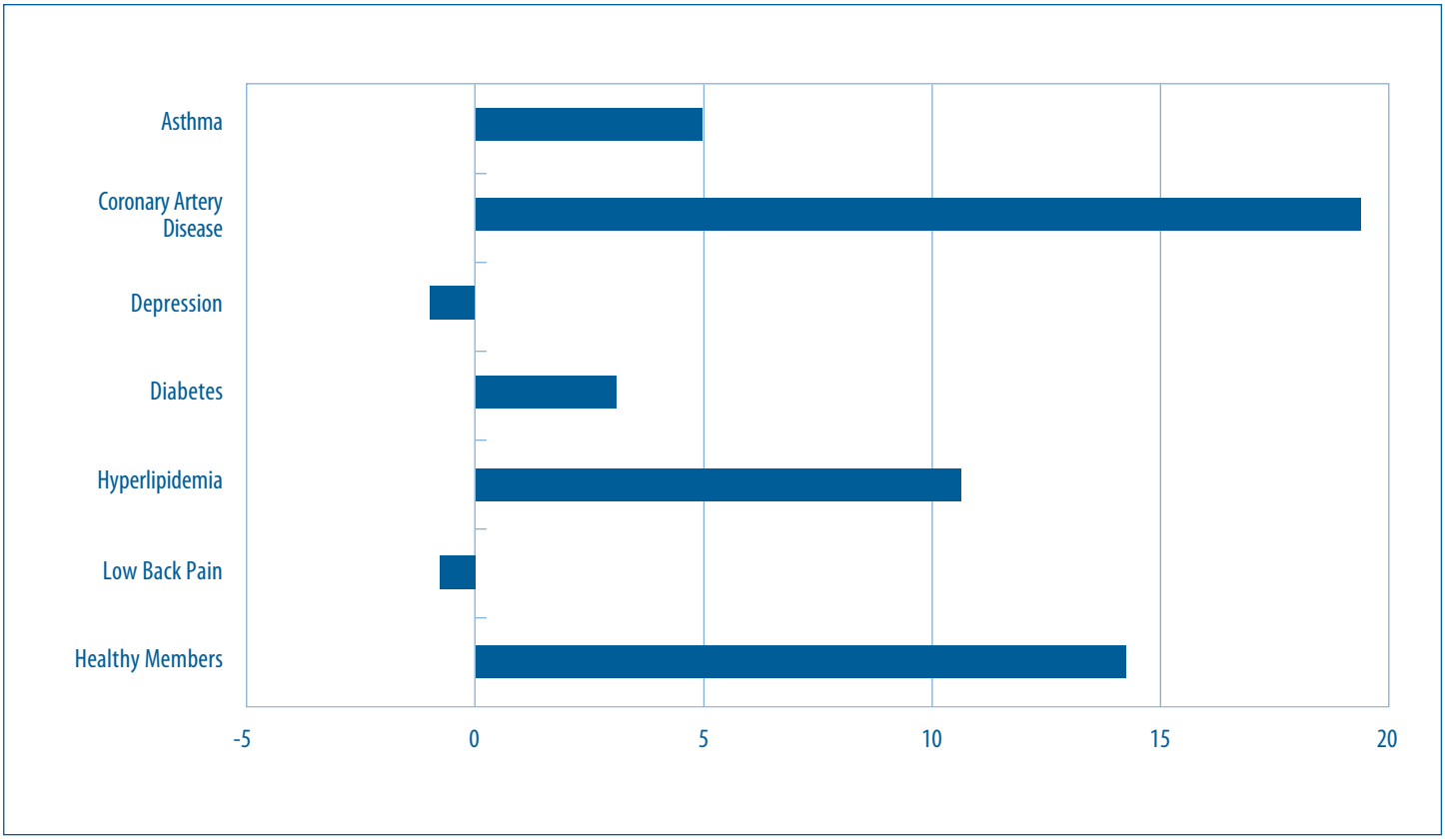
Source: Healthcare Utilization Project's State Inpatient Databases.

Figure 1a: Average Expenditures per Member in KOMA, 2017-2018



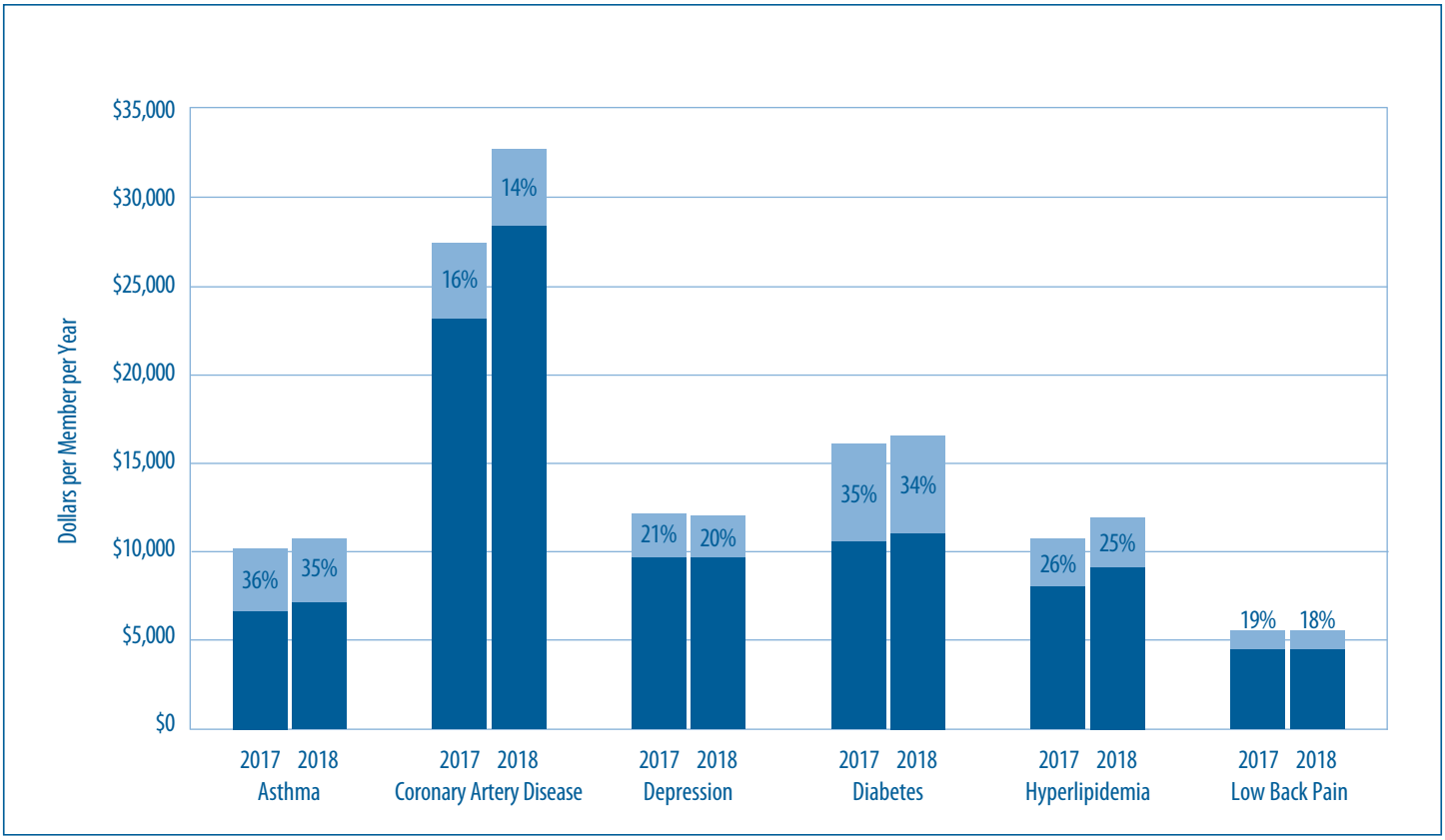
Source: BCBSM, BCN, and Priority Health member data.

Figure 1b: Percentage Change in Average Member Costs in KOMA, 2017-2018



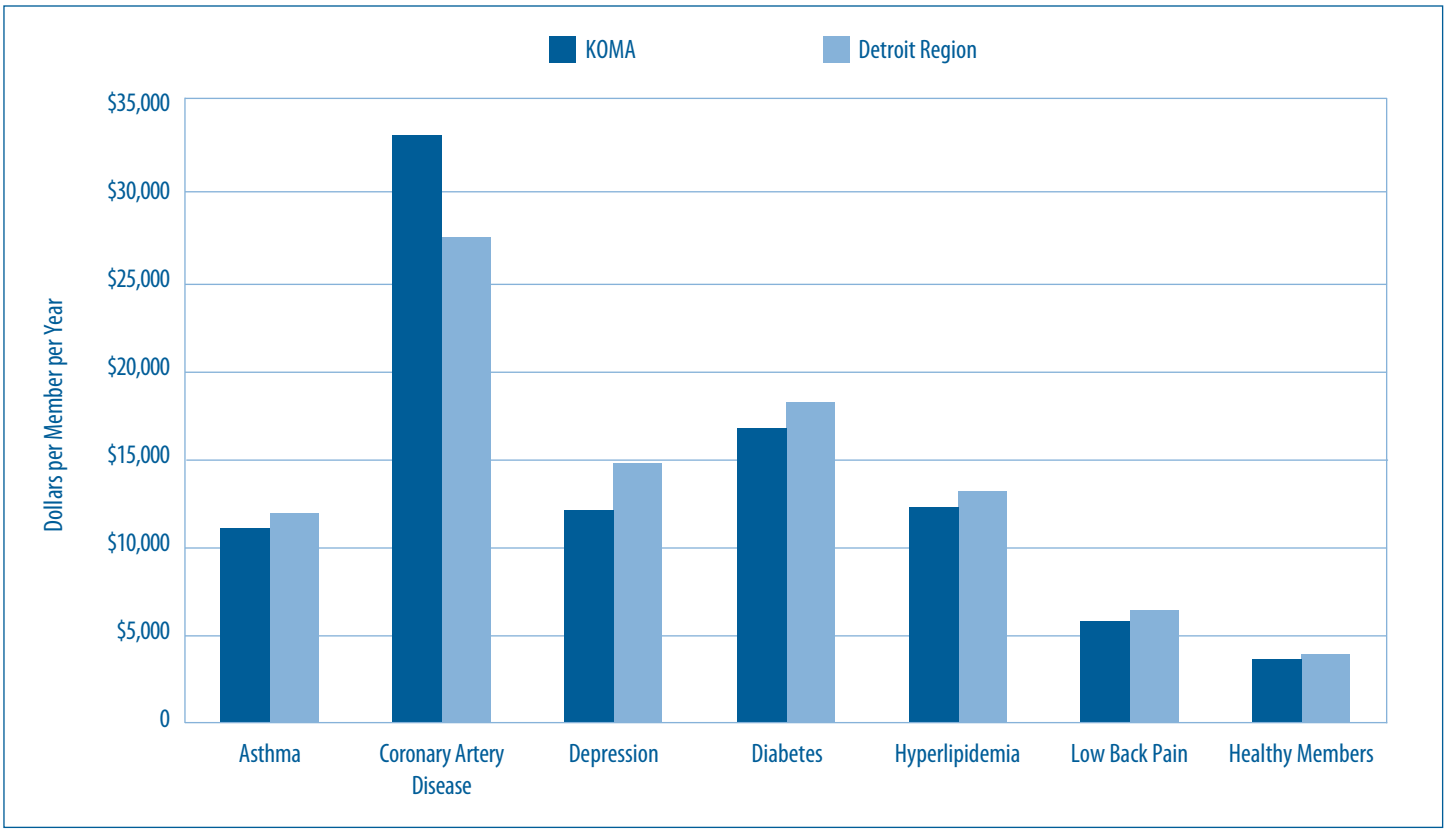
Source: BCBSM, BCN, and Priority Health member data.

Figure 2: Rx Share of Average Expenditures per Member in KOMA, 2017 and 2018



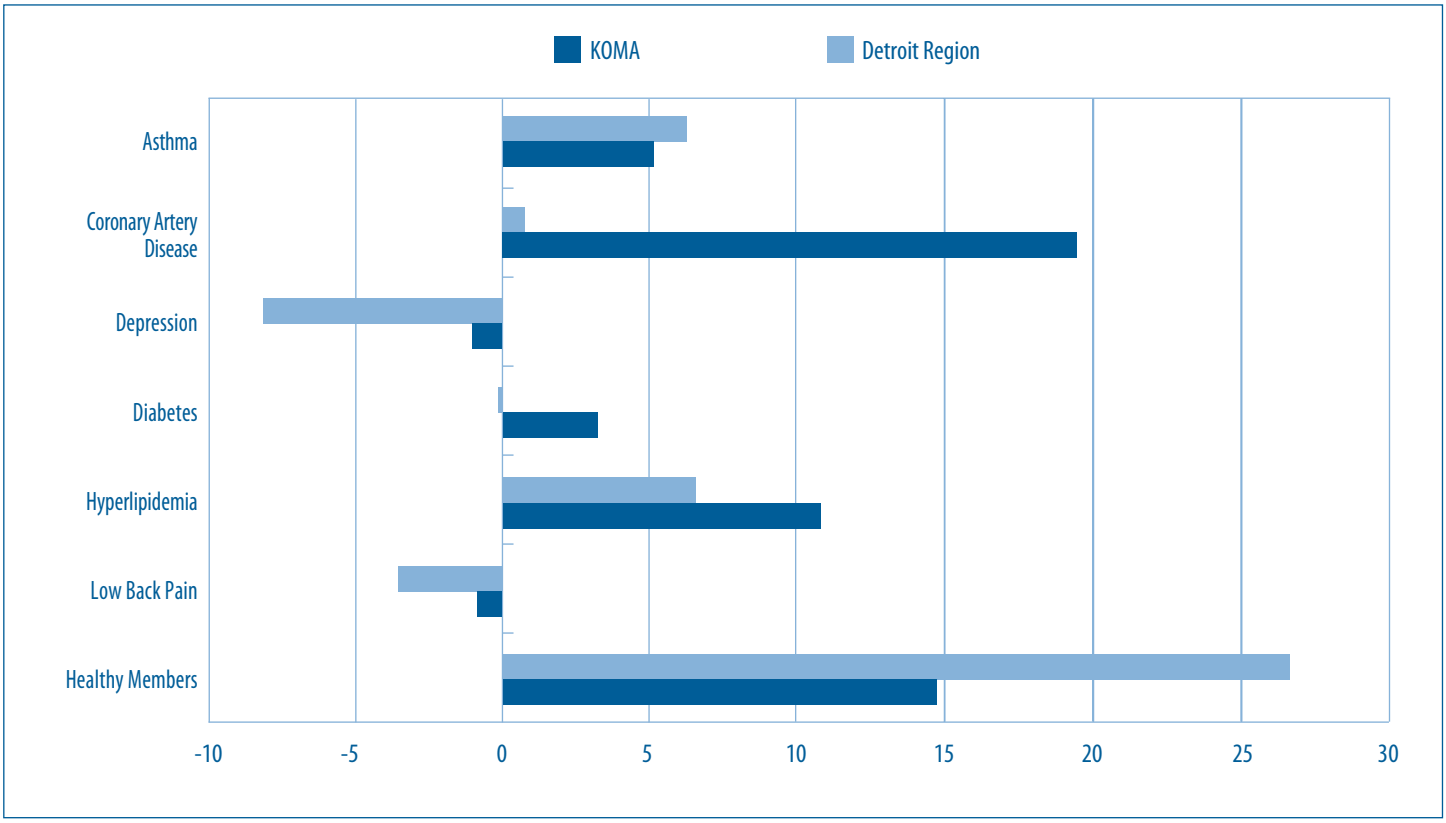
Source: BCBSM, BCN, and Priority Health member data.

Figure 3a: Average Expenditures per Member, 2018



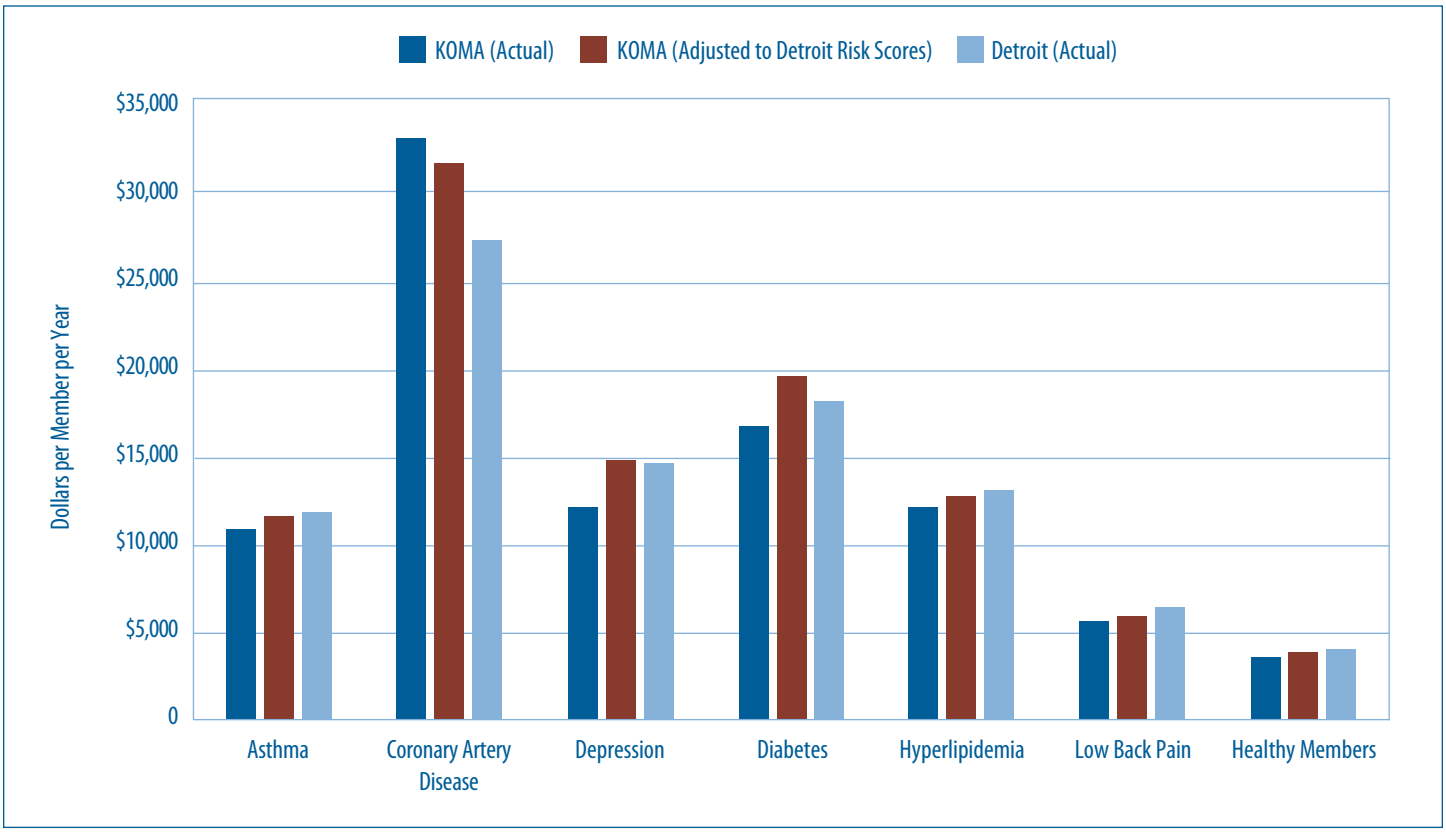
Source: BCBSM, BCN, and Priority Health member data.
Note: Not risk score adjusted.

Figure 3b: 2017-2018 Percentage Change in Average Expenditures per Member



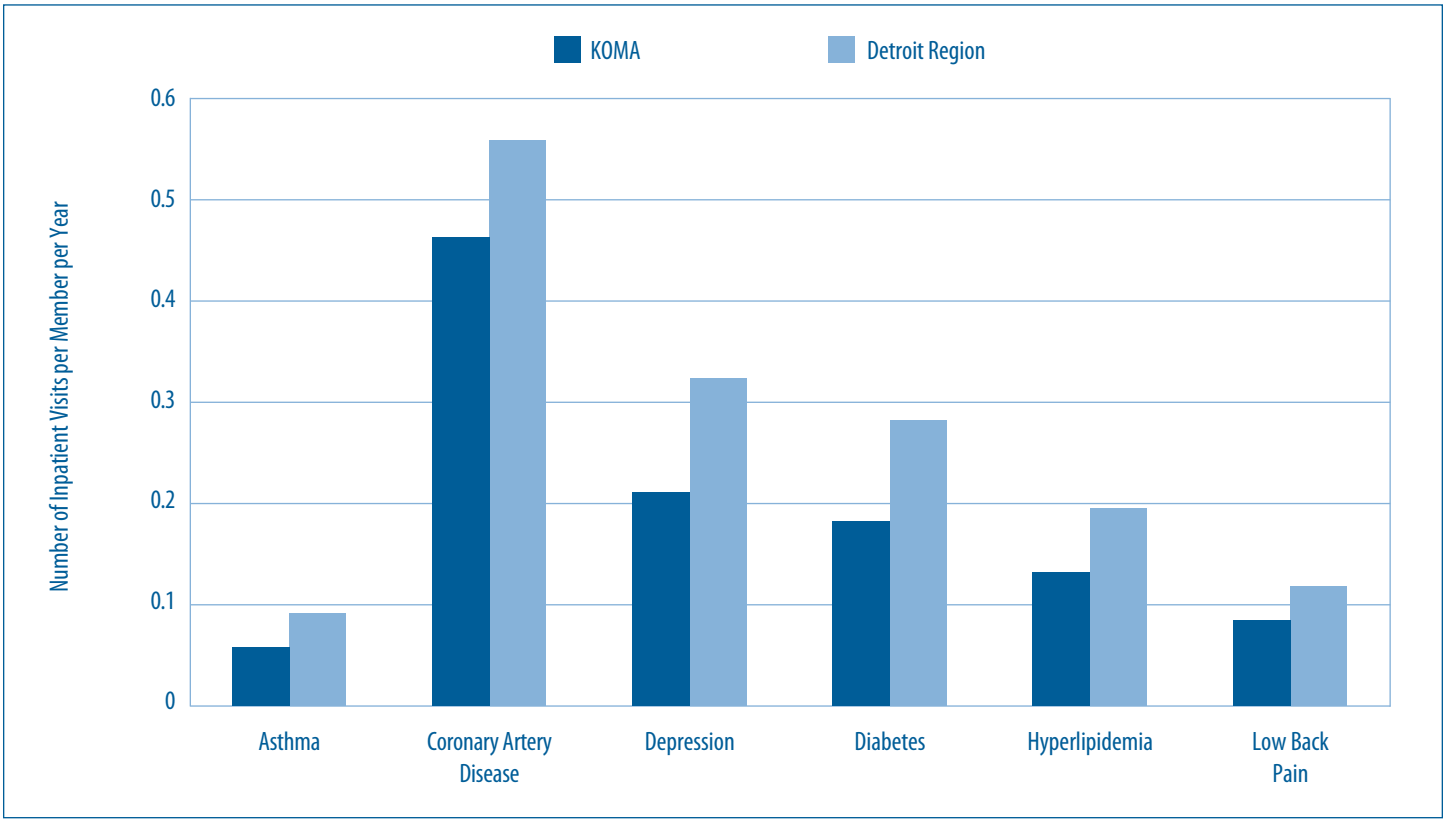
Source: BCBSM, BCN, and Priority Health member data.

Figure 3c: Average Expenditures per Member with Risk Score Adjusted KOMA Values, 2018



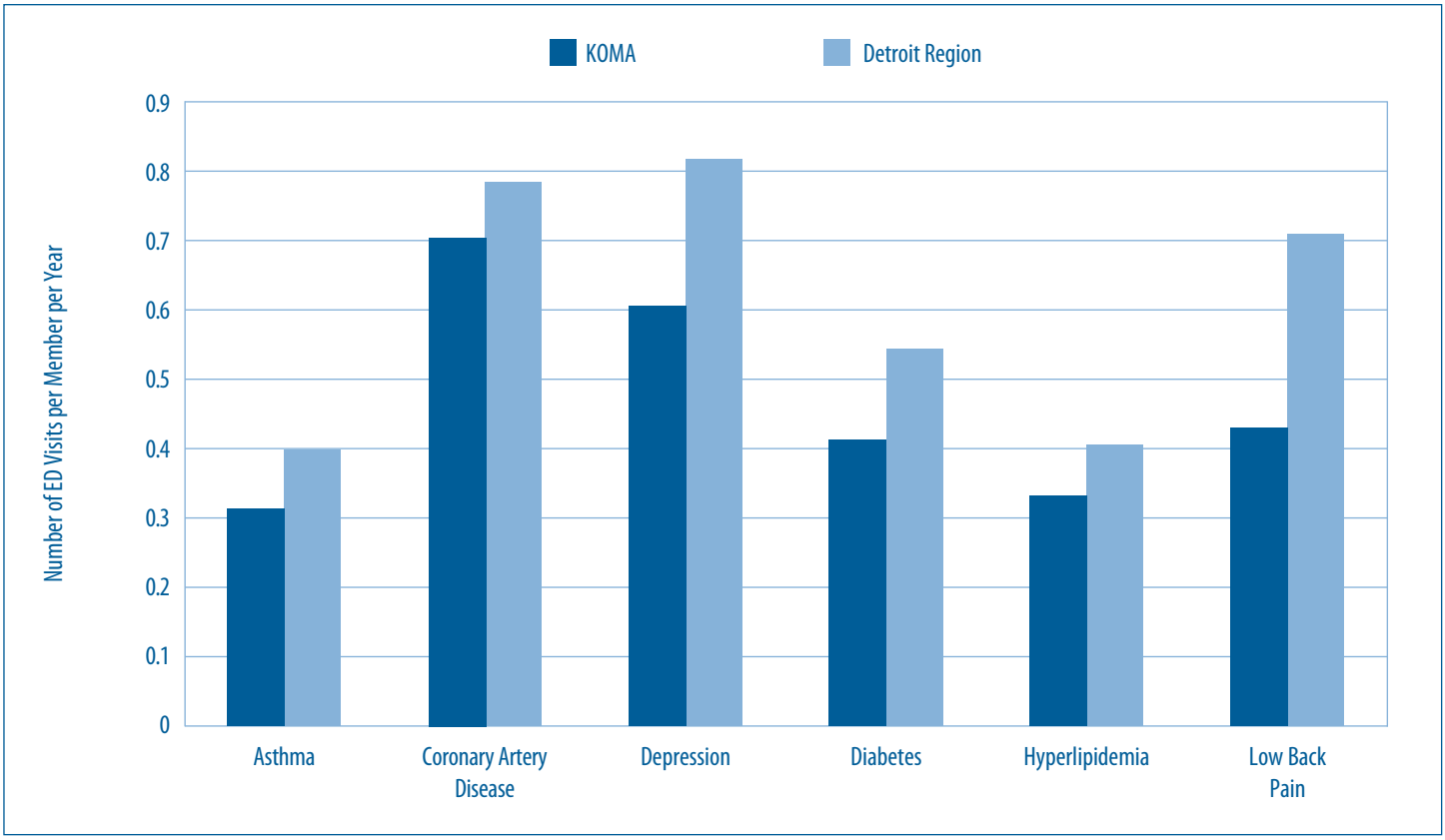
Source: BCBSM, BCN, and Priority Health member data.

Figure 4a: Average Annual Inpatient Visits per Member, 2018



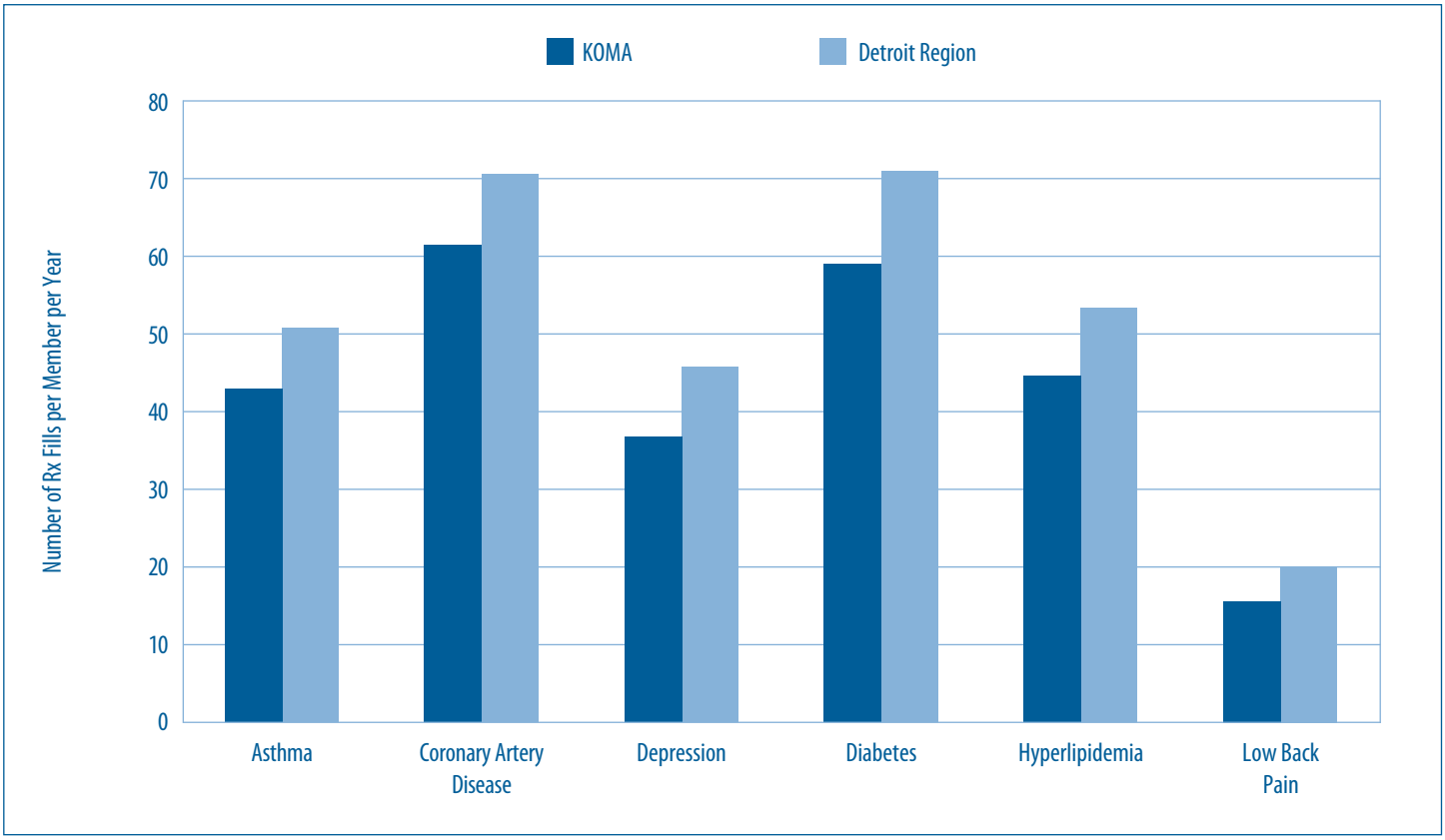
Source: BCBSM, BCN, and Priority Health member data.
Note: Not risk score adjusted.

Figure 4b: Average Annual Emergency Department Visits per Member, 2018



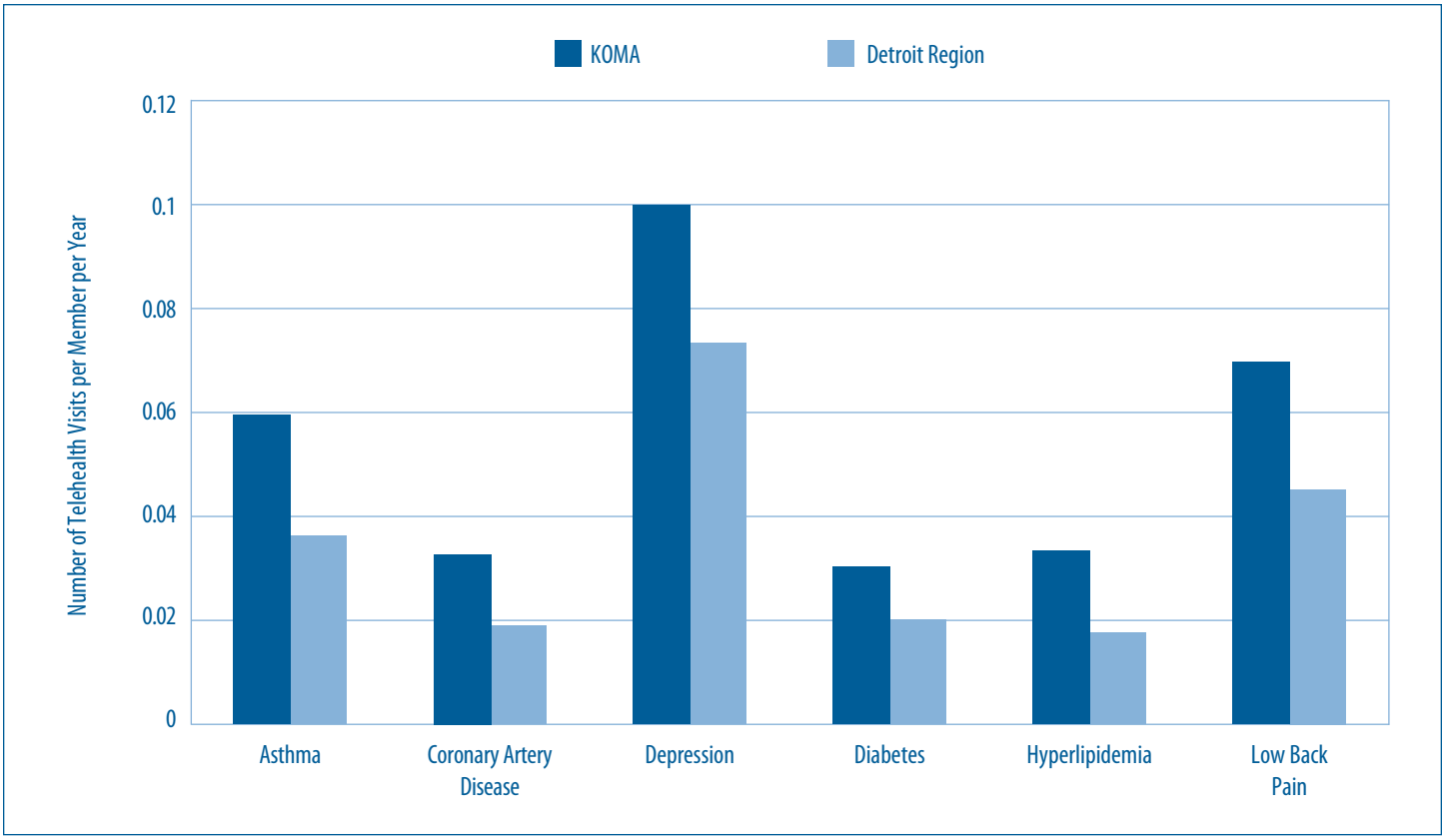
Source: BCBSM, BCN, and Priority Health member data.
Note: Not risk score adjusted.

Figure 4c: Average Annual Prescription Fills per Member, 2018



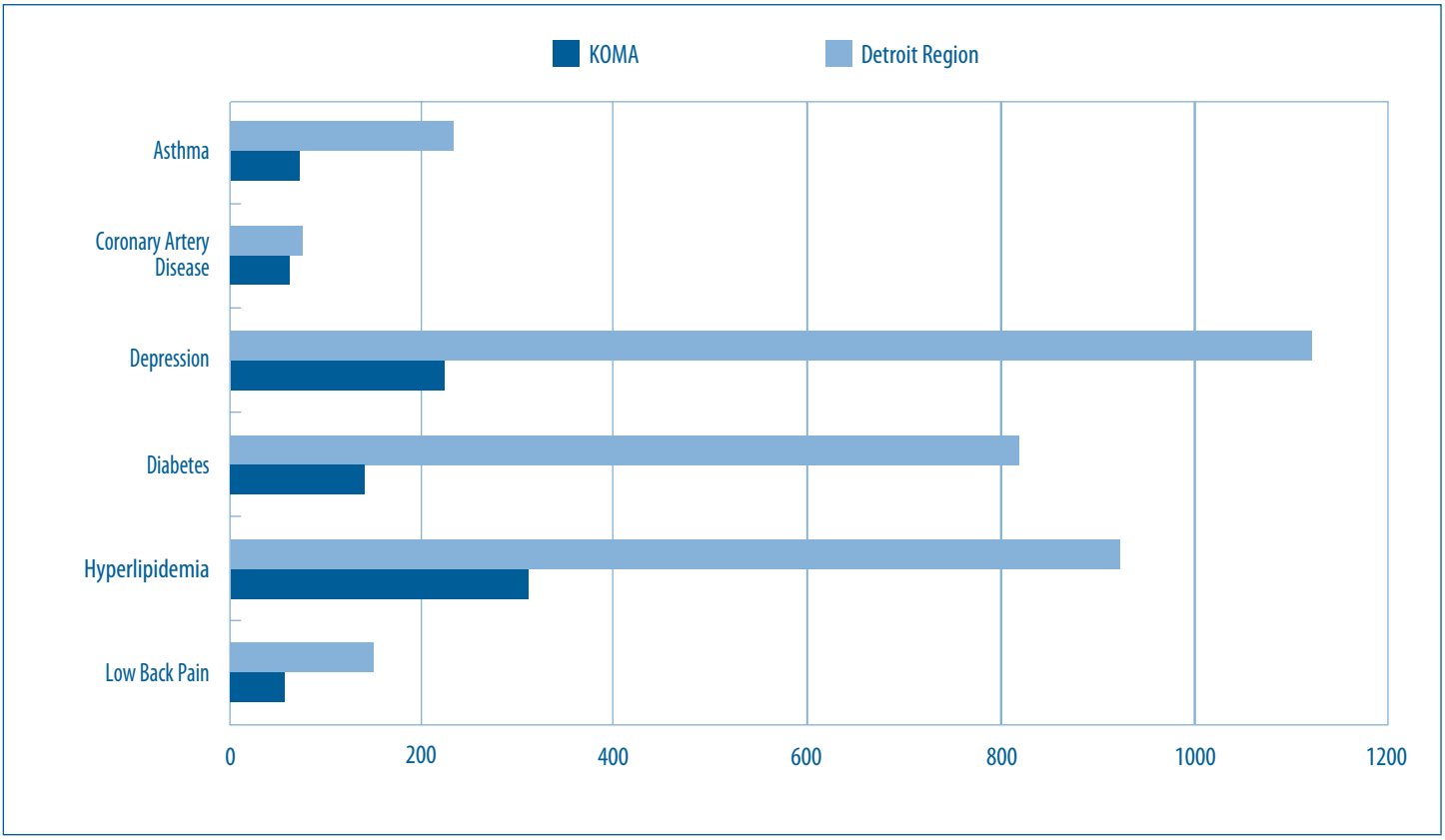
Source: BCBSM, BCN, and Priority Health member data.

Figure 4d: Average Annual Telehealth Visits per Member, 2018



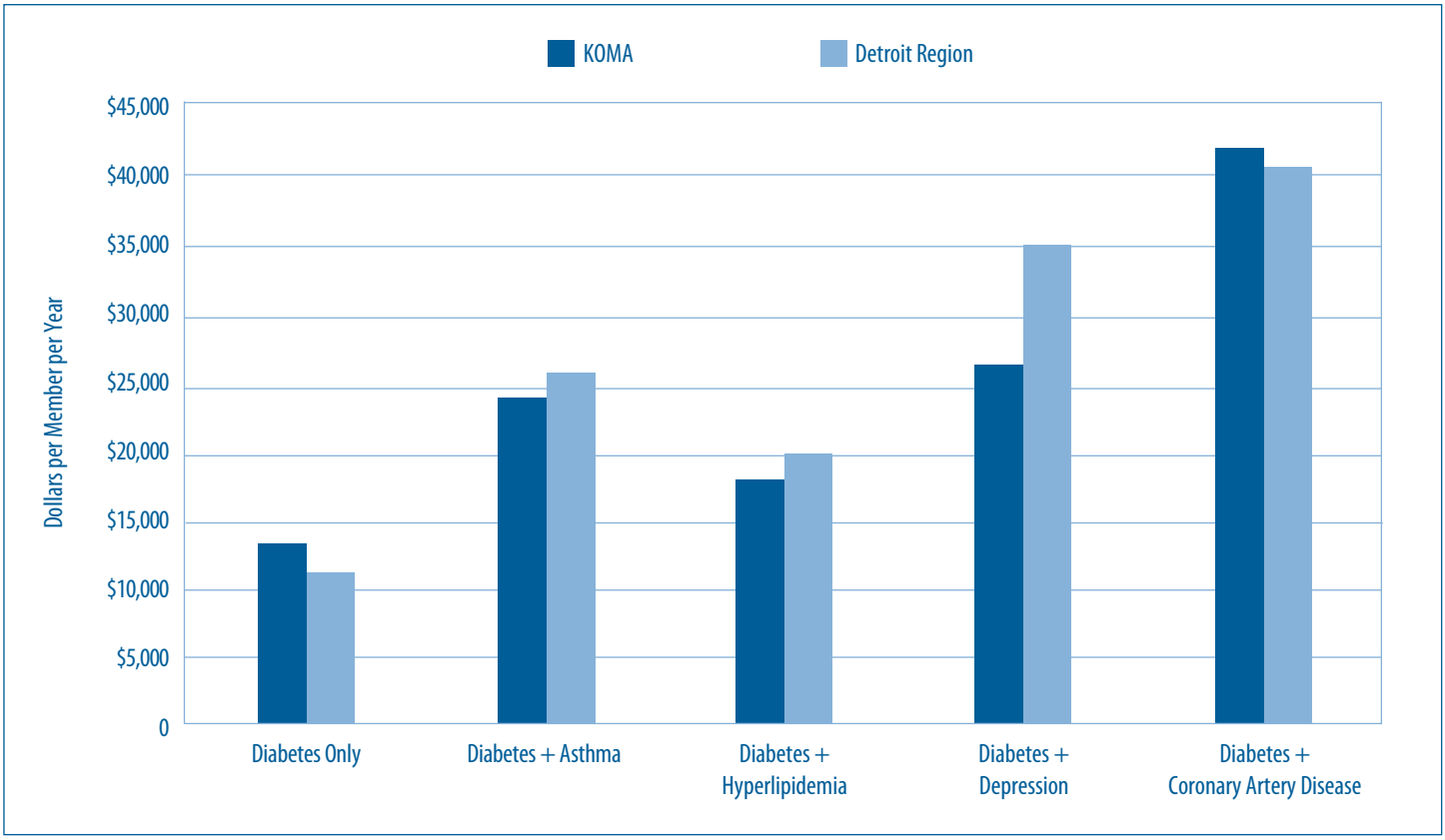
Source: BCBSM, BCN, and Priority Health member data.

Figure 4e: 2017-2018 Percentage Change in Average Telehealth Visits per Member



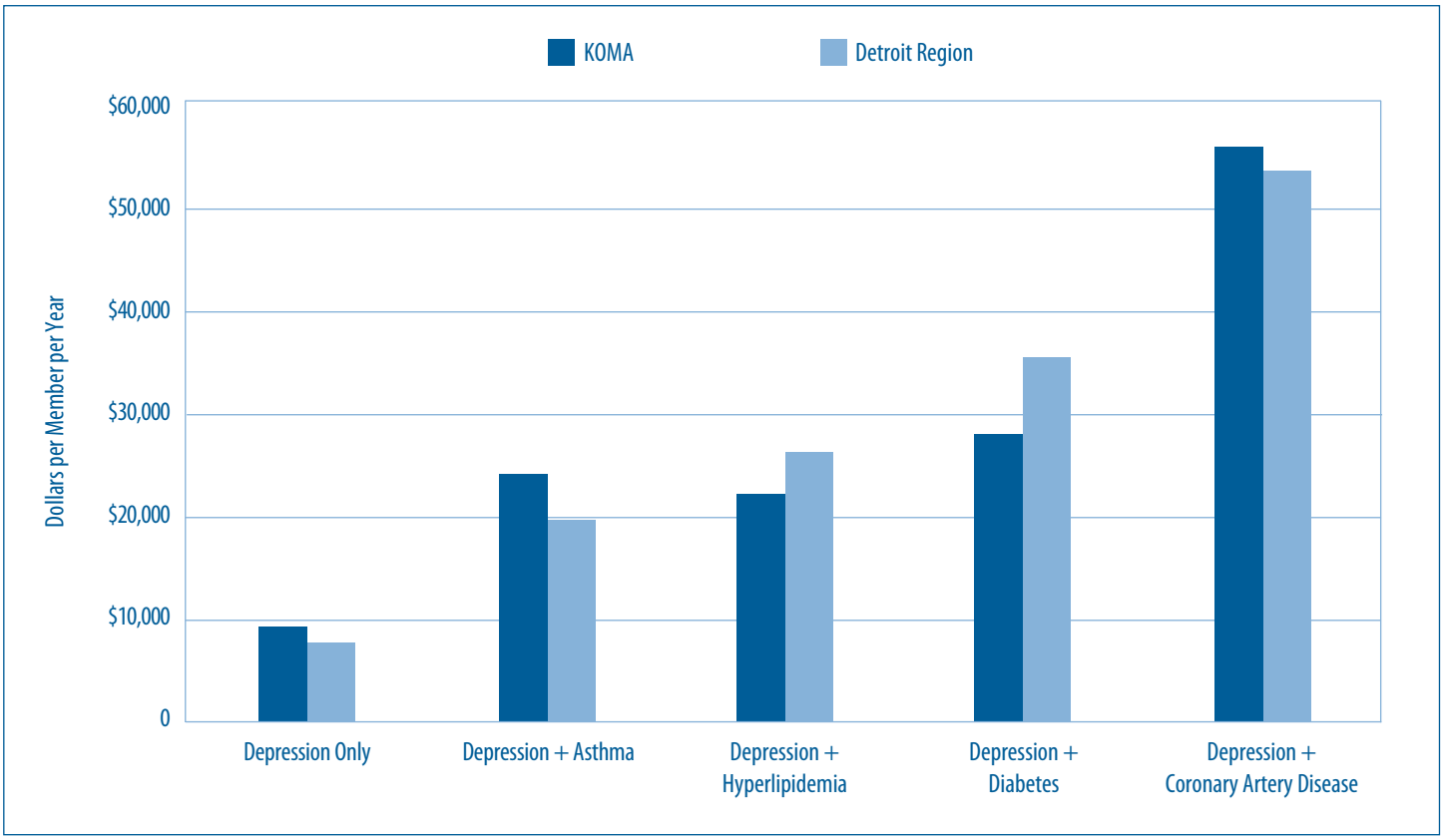
Source: BCBSM, BCN, and Priority Health member data.

Figure 5a: Expenditures for Members with Diabetes and Comorbidities, 2018



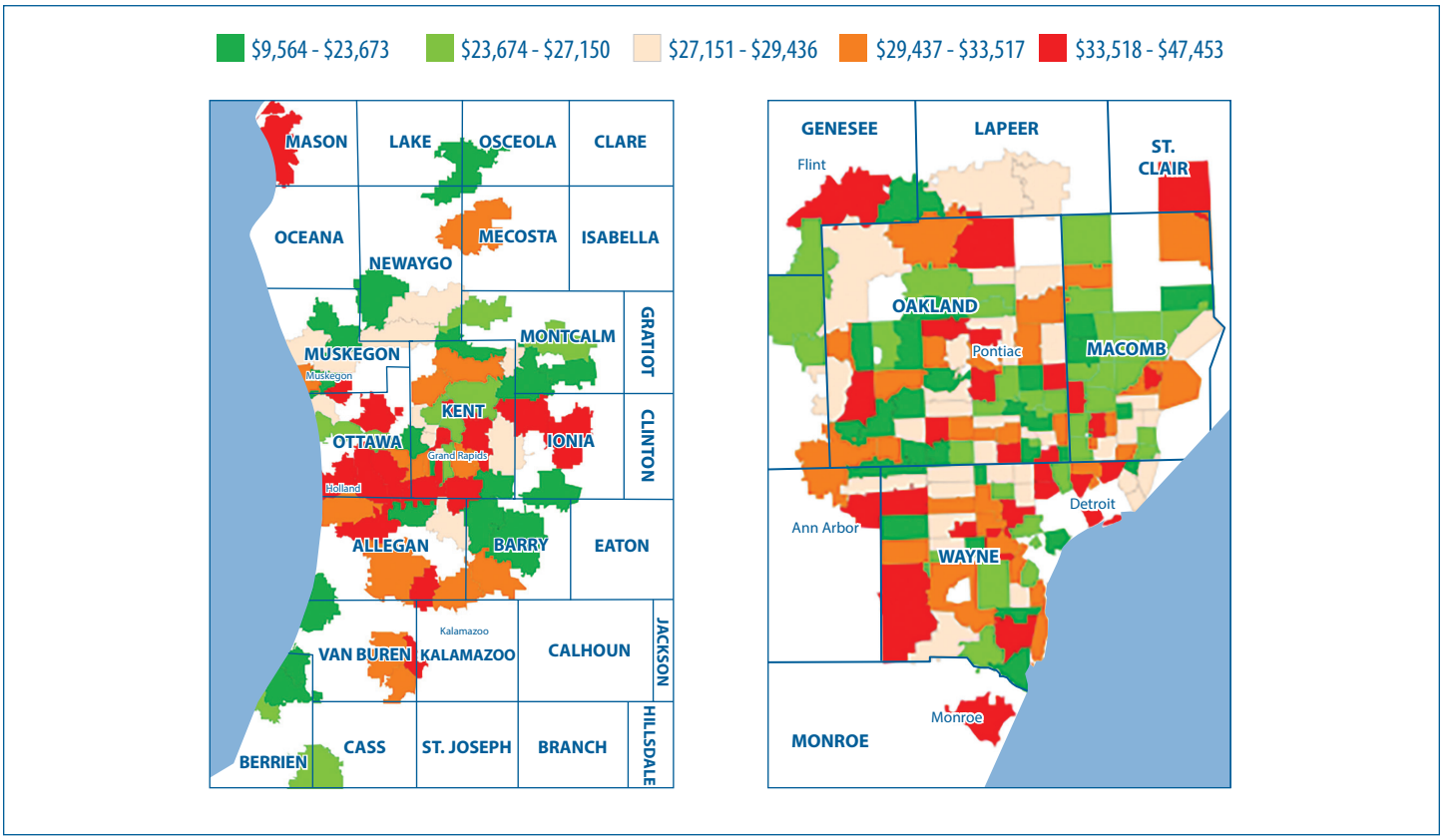
Source: BCBSM, BCN, and Priority Health member data.

Figure 5b: Expenditures on Members with Depression and Comorbidities, 2018



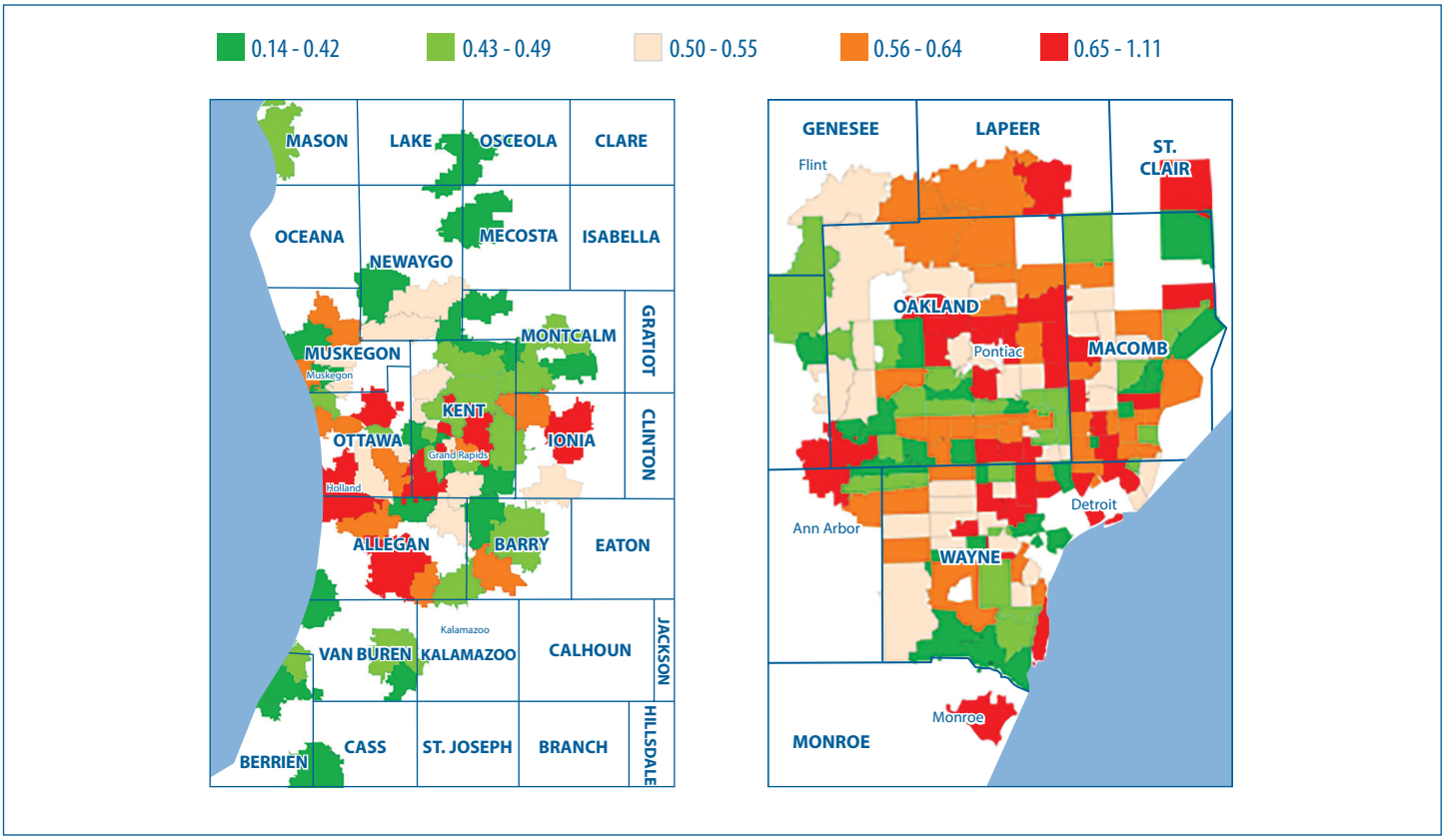
Source: BCBSM, BCN, and Priority Health member data.

Figure 6a: Distribution of Average Annual Expenditures per Member with CAD by Zip Code, 2018



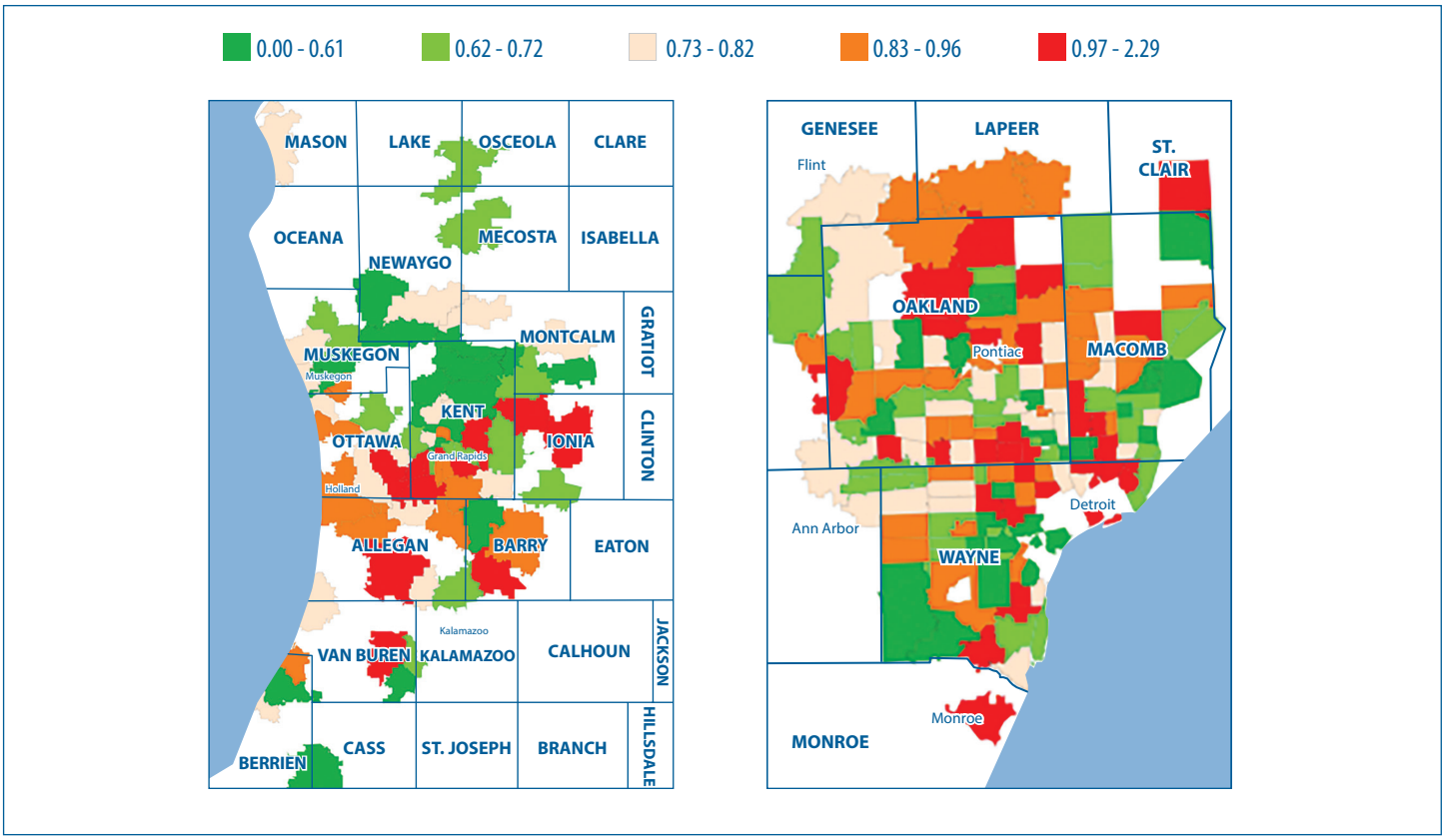
Source: BCBSM, BCN, and Priority Health member data.

Figure 6b: Distribution of Average Annual Inpatient Admissions per Member with CAD by Zip Code, 2018



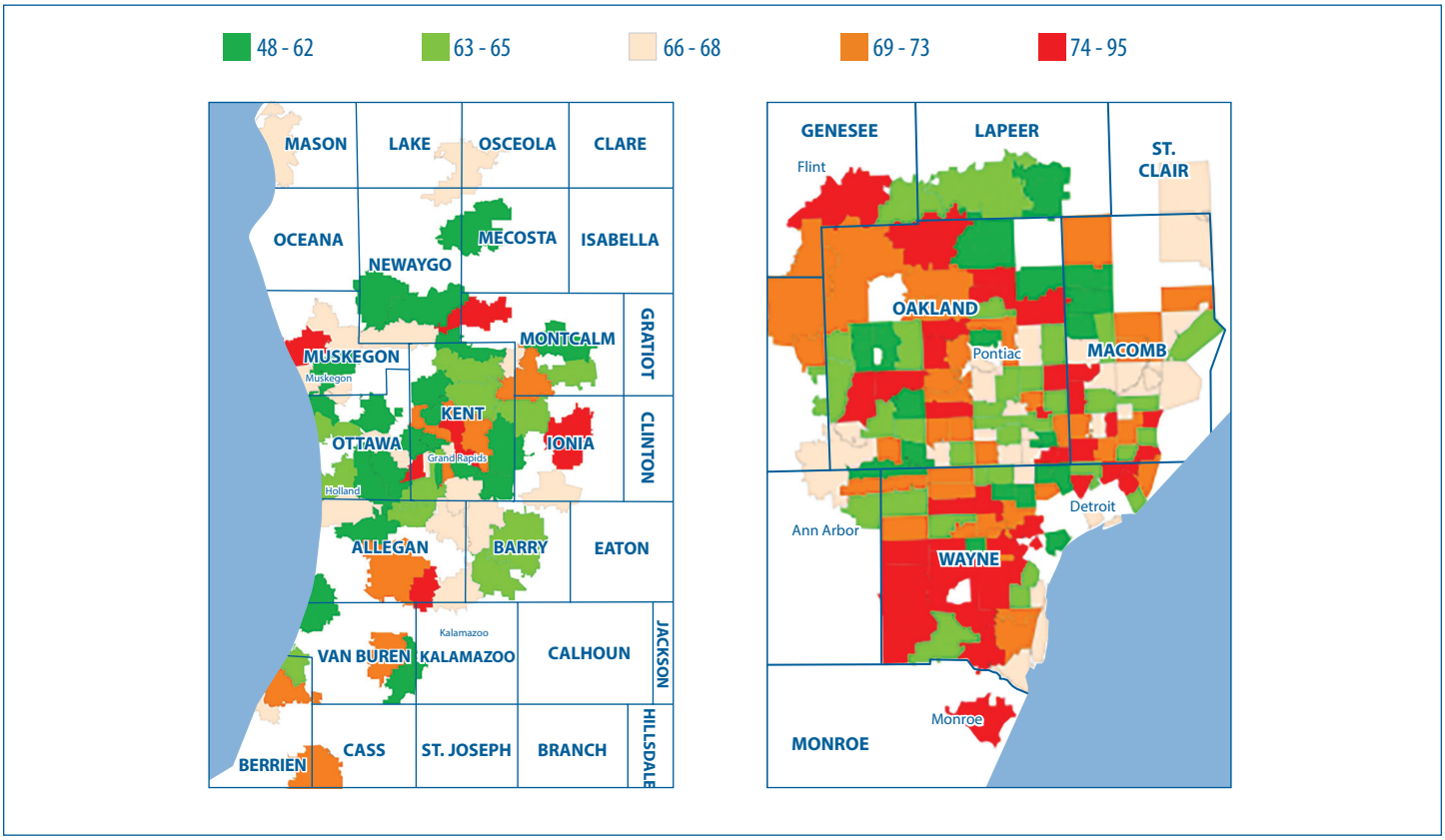
Source: BCBSM, BCN, and Priority Health member data.

Figure 6c: Distribution of Average Annual Emergency Department Visits per Member with CAD by Zip Code, 2018



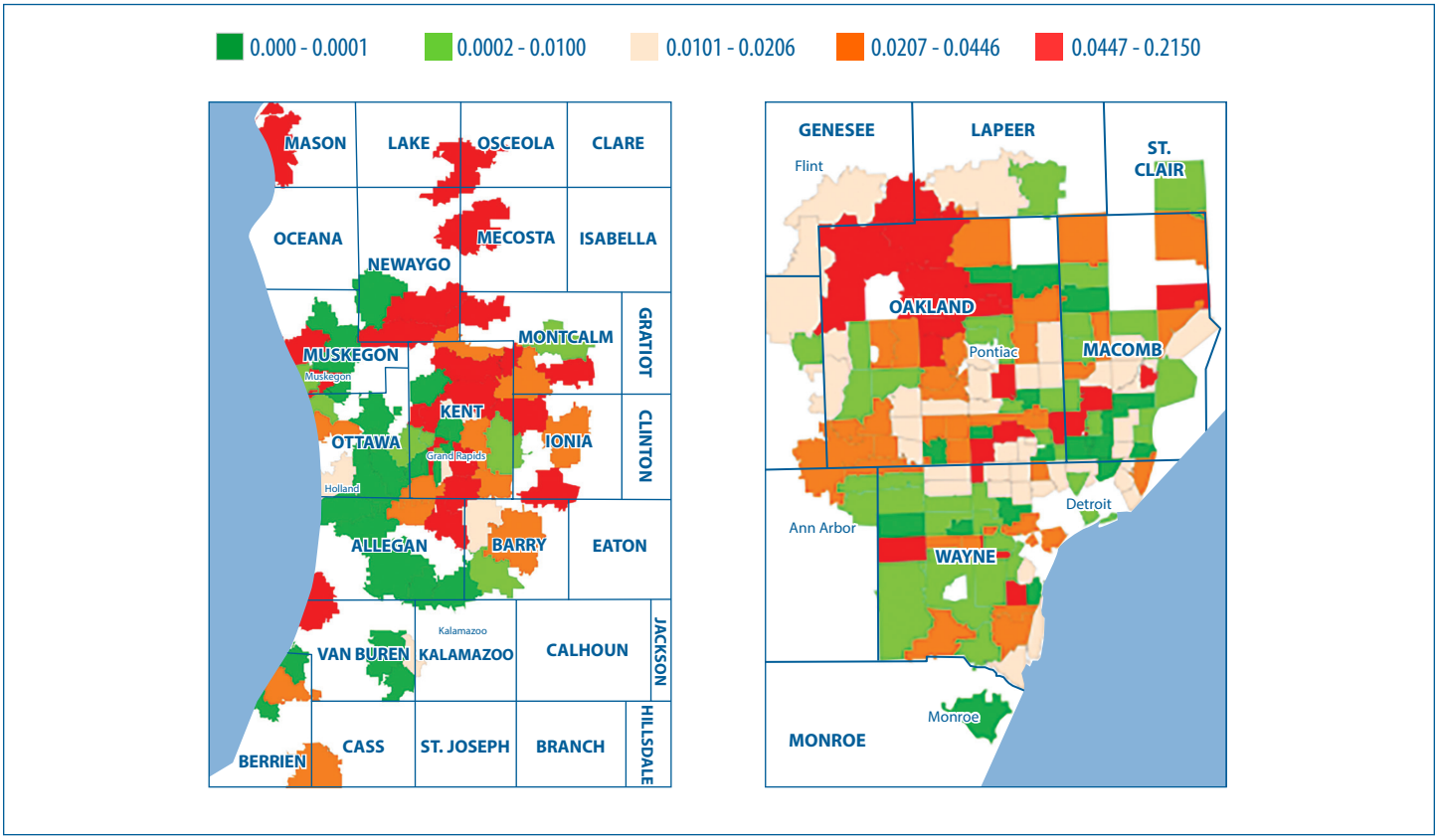
Source: BCBSM, BCN, and Priority Health member data.

Figure 6d: Distribution of Average Annual Prescription Fills per Member with CAD by Zip Code, 2018



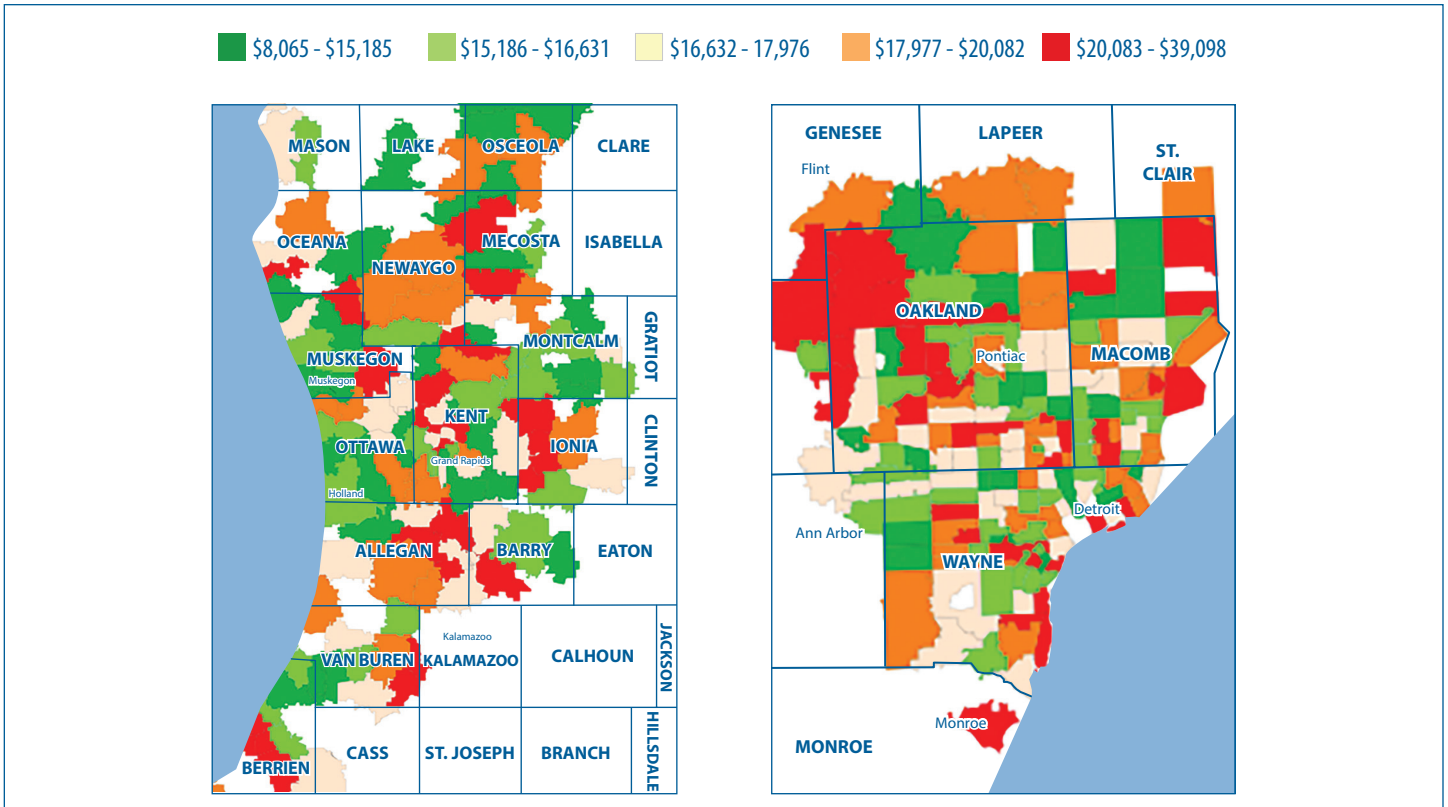
Source: BCBSM, BCN, and Priority Health member data.

Figure 6e: Distribution of Average Annual Telehealth Visits per Member with CAD by Zip Code, 2018



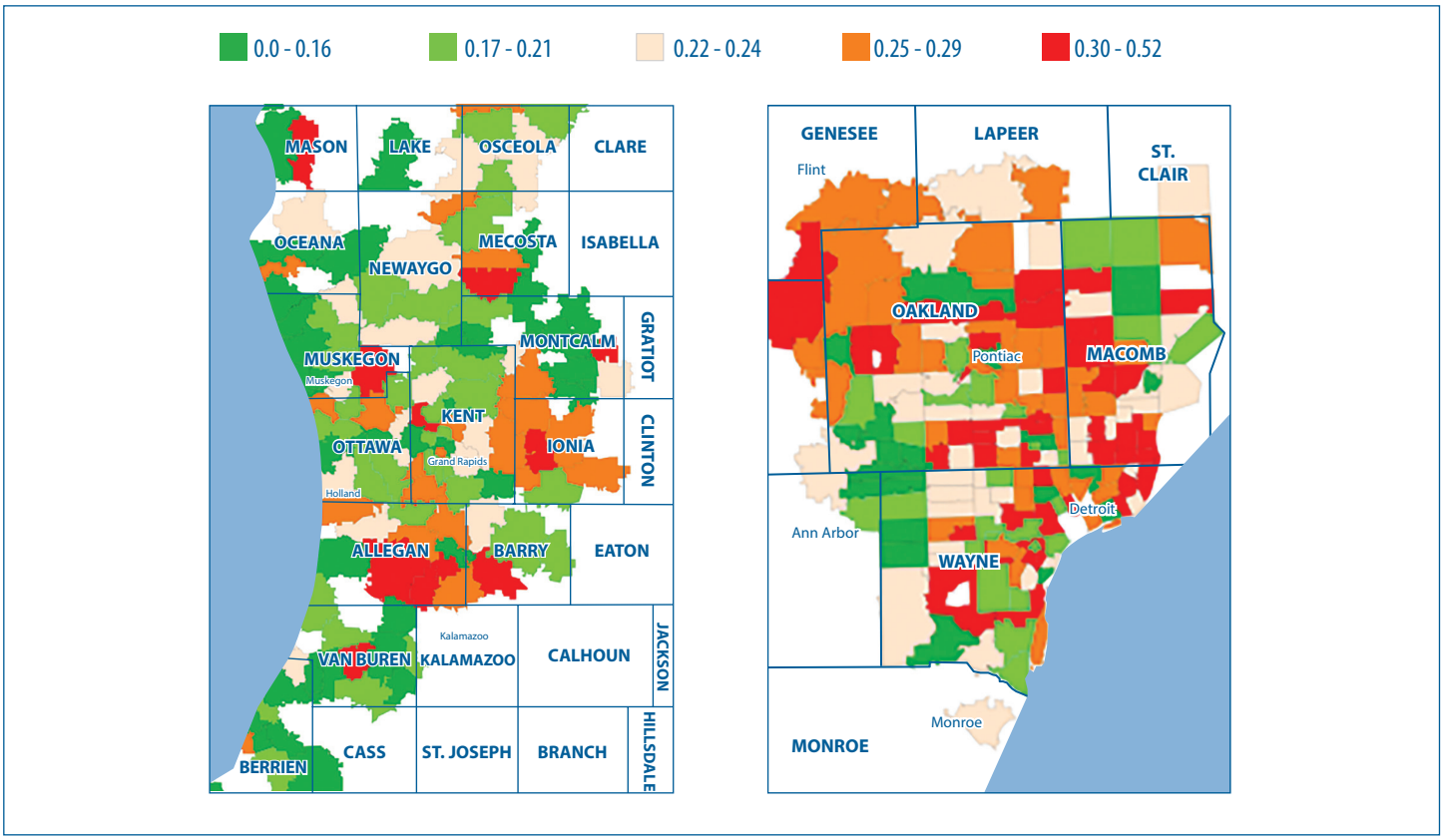
Source: BCBSM, BCN, and Priority Health member data.

Figure 7a: Distribution of Average Annual Expenditures per Member with Diabetes by Zip Code, 2018



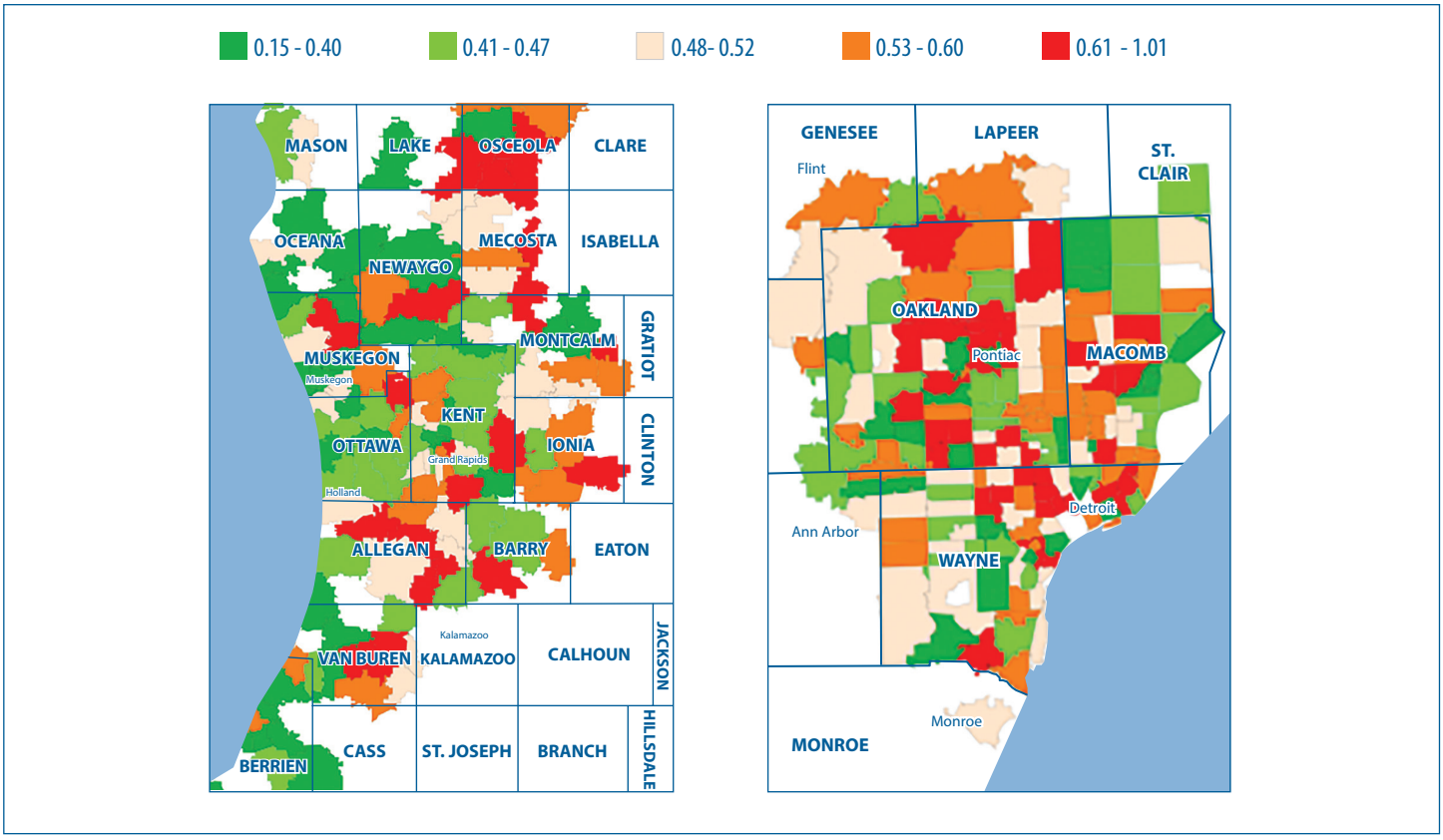
Source: BCBSM, BCN, and Priority Health member data.

Figure 7b: Distribution of Average Annual Inpatient Admissions per Member with Diabetes by Zip Code, 2018



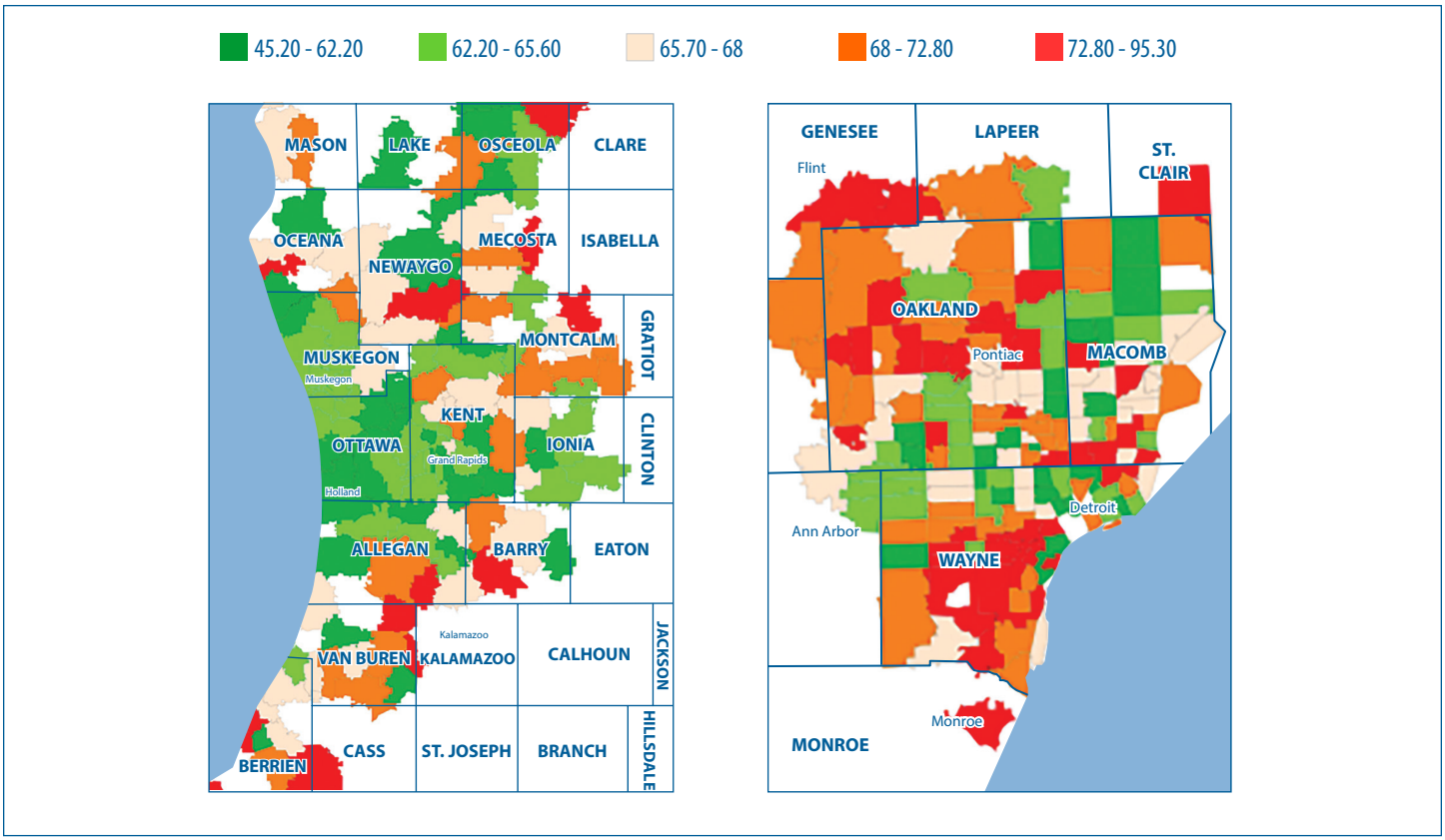
Source: BCBSM, BCN, and Priority Health member data.

Figure 7c: Distribution of Average Annual Emergency Department Visits per Member with Diabetes by Zip Code, 2018



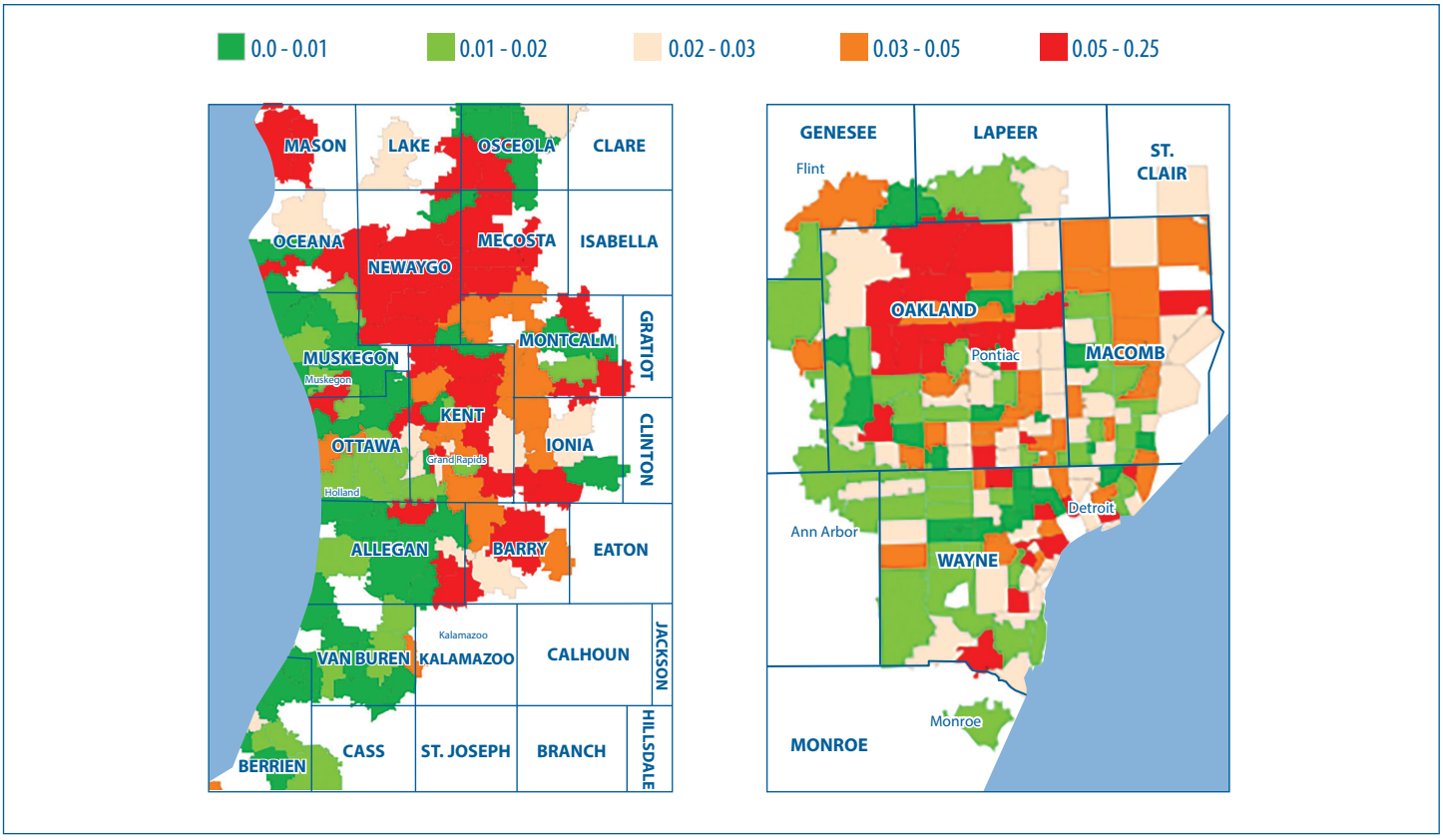
Source: BCBSM, BCN, and Priority Health member data.

Figure 7d: Distribution of Average Annual Prescription Fills per Member with Diabetes by Zip Code, 2018



Source: BCBSM, BCN, and Priority Health member data.

Figure 7e: Distribution of Average Annual Telehealth Visits per Member with Diabetes by Zip Code, 2018



Source: BCBSM, BCN, and Priority Health member data.

Grants provided by

Blue Cross Blue Shield Blue Care Network of Michigan

Nonprofit corporations and independent licensees of the Blue Cross and Blue Shield Association

PriorityHealth

MIX Paper from responsible sources FSC® C112819

This paper contains fiber from certified well-managed forests, was produced using certified renewable energy, and was printed locally.

Please recycle me or pass me on.

Grand Valley State University is an affirmative action, equal opportunity institution. It encourages diversity and provides equal opportunity in education, employment, all of its programs, and the use of its facilities. It is committed to protecting the constitutional and statutory civil rights of persons connected with the university. 1/20.

© 2020 Grand Valley State University. 18-1062

Grand Valley State University
www.gvsu.edu