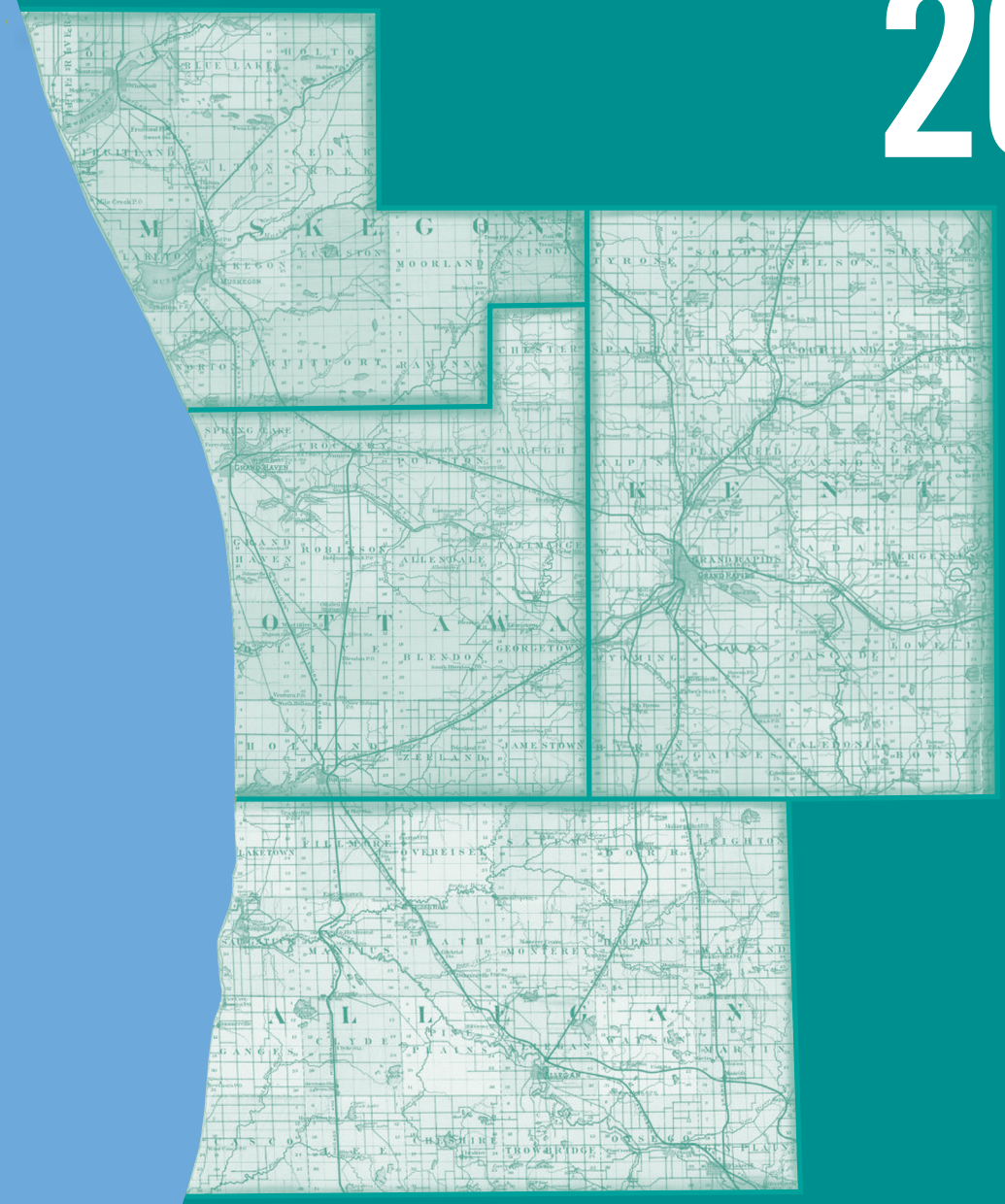
KENT COUNTY OTTAWA COUNTY MUSKEGON COUNTY ALLEGAN COUNTY

Health Check

ANALYZING TRENDS IN WEST MICHIGAN

2021



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Grand Valley State University

Health Check:
Analyzing Trends in West Michigan 2021

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GRAND VALLEY STATE UNIVERSITY
OFFICE OF THE VICE PROVOST FOR HEALTH

January 8, 2021

Dear Colleagues,

We are pleased to present *Health Check 2021: Analyzing Trends in West Michigan*. This report represents the collaborative efforts of Grand Valley State University's Office of the Vice Provost for Health, Seidman College of Business, Blue Cross Blue Shield of Michigan, Blue Care Network, and Priority Health.

This is the 12th year of Health Check and its analysis of data relevant to health and health care in Kent, Ottawa, Muskegon, and Allegan (KOMA) counties. The ongoing and consistent examination of this health-related data over time continues to serve as an important tool to inform the decision-making processes and policies of government, health care systems, education, and business, especially now as we move through and beyond the COVID-19 pandemic.

While the data in this publication is focused on primarily prepandemic data, authors have also made observations of some initial impacts of COVID-19 on job growth and consumer spending related to health care. You will find more detail about these COVID influences in the report.

Health Check is rich in data detail and comparative analyses that can serve as a major resource for planning during the upcoming year. This year's report includes these highlights:

- Demographically, the proportion of the population over 65 is continuing to rise in the KOMA and comparative regions.
- Drug usage and overdose deaths continue to be a major problem despite the decrease in legal opioid prescriptions.
- Actual and comparative (with benchmarking communities) rise in emergency department visits, expenses per hospital admission, and Medicare expenditures per capita have been documented in the Grand Rapids region.
- The percentage of individuals receiving routine health checkups has increased.

Economic analysis is provided through benchmarking with other peer communities. The report also utilizes average cost data provided by our insurance provider partners to look more closely at the expenditures for several conditions including asthma, coronary artery disease (CAD), depression, diabetes, hyperlipidemia, and low back pain and to compare KOMA to the Detroit area.

As we move forward in a stressed and uncertain environment due to COVID-19, we will continue to study and bring forward data that will help our communities address major issues in health care. We are pleased to play a role in contributing to relevant decision-making in our local and state partner organizations to ensure safe, high quality, and cost-effective health care planning for our community.

Respectfully,

Jean Nagelkerk, Ph.D., FNP, FNAP
Vice Provost for Health
Grand Valley State University

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

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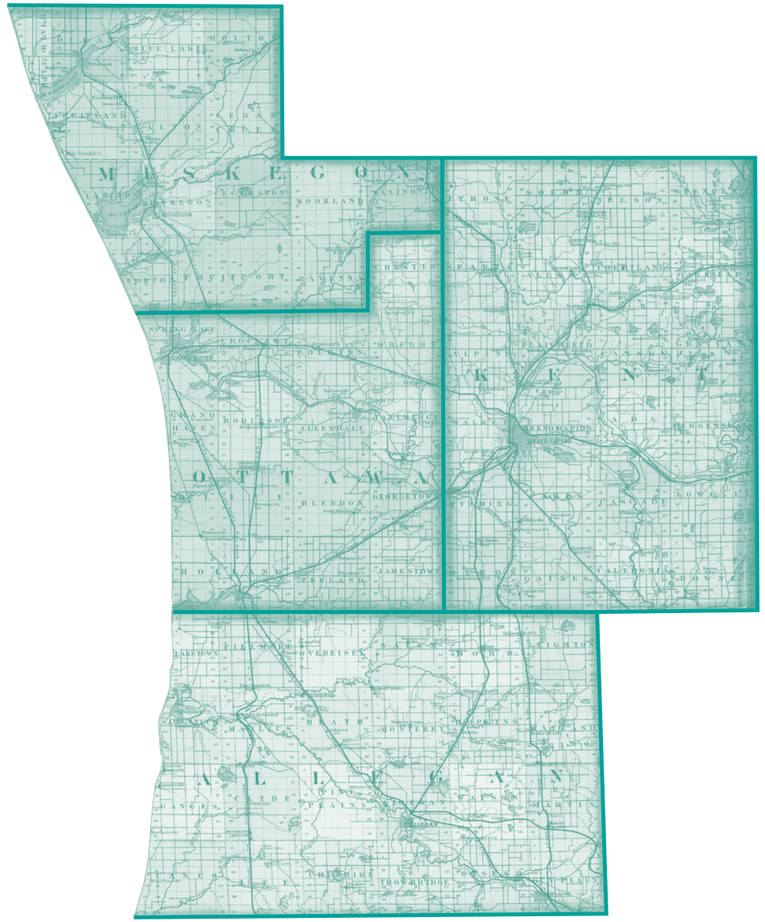
All the data used in this project are based on primary and secondary sources. We acknowledge our data sources in each section by listing source information; these sources are not duplicated or specifically cited in text discussions to preserve readability.

We are particularly indebted to the following organizations for use of their data:
American Hospital Association
Behavioral Risk Factor Surveillance System (BRFSS), based on CDC protocol and the Michigan BRFSS
Bureau of Labor Statistics
Center for Disease Control
Institute of Medicine of the Academies
Michigan Department of Community Health
Michigan Department of Health and Human Services
Michigan Health and Hospital Association
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
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
Aquinas College
Calvin University
Central Michigan University
Cornerstone University
Davenport University
Ferris State University
Grand Rapids Community College
Grand Valley State University
Hope College
Kellogg Community College
Kuyper College
Lansing Community College
Michigan State University
Montcalm Community College
Muskegon Community College
Southwestern Michigan College
West Shore Community College
Western Michigan University



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Executive Summary

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Education and Job Growth

This year's job growth numbers look very different than previous years due to the global outbreak of novel coronavirus (COVID-19). In the aftermath of the COVID-19 pandemic, there was a sharp decline in job growth by about 2 percent in April 2020 when compared to the 2005 baseline. In the following two months, however, the U.S. job growth showed positive signs of recovery, with 3.8 percent growth in June 2020. A similar trend was also observed in Michigan. However, the job losses due to the pandemic were much more pronounced in Michigan, where the sharp negative dip in April 2020 corresponded to a 22-percent drop in job growth from the 2005 benchmark. The upshot is that the growth gap between Michigan and the entire U.S. continued to widen from a gap of 13.2 percentage points in January 2020 to 20.7 percentage points in April of 2020.

Although we currently do not have enough information about how jobs in the health care industry were affected by the pandemic, we present data on job growth in 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 Grand Rapids health care industry jobs. 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 aides, medical assistants, and home health and personal care aides at both the city and state levels. Different from Grand Rapids, the State of Michigan is also likely to have more job openings for dental assistants. 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, registered nurses, respiratory therapists, speech-language pathologists, and surgical technologists increased nationally, but have declined in both Michigan and Grand Rapids. Between 2018 and 2019, we further observed real annual earnings gains above 7 percent for only optometrists in both Grand Rapids and Michigan.

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 from 1990 to 1999, to 16.3 from 2000 to 2009, and to 18.9 patents from 2010 to 2019. 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 in West Michigan and the Detroit region (Oakland, Macomb, and Wayne counties) and compare changes in these trends to national averages. We continue to note a shift in population density from East Michigan to West Michigan, with the Detroit region demonstrating -0.08 percent growth rate in 2019, compared to 0.53 percent growth in the Kent, Ottawa, Muskegon, and Allegan (KOMA) counties. While the 2019 growth rate in West Michigan is below the 1.25 percent growth rate noted in 2013, population growth still surpasses the 2019 national average of 0.48 percent. 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 2019, the 65 and older population made up 15.22 percent of the KOMA region population and 16.66 percent of the Detroit region population.

Health Care Overview

In this year's report, we continue to examine opioid use, drug overdose deaths, suicide deaths, self-reported mental health, as well as health risk behaviors and access to health care. For the Detroit region, we see an increase in opioid prescriptions from 2006 until 2012, which peaked at 103 prescriptions per 100,000 individuals. There was an annual decrease year-after-year from 2012 onward, suggesting a 38-percent decline in prescriptions in 2018 relative to the 2012 baseline. However, the Detroit area has experienced an ongoing increase in the rate of overdose deaths despite the drop in legal prescriptions of opioids. On a positive note, we observe a reversal in Detroit's trend of overdose deaths in 2018, plummeting from 18 deaths per 100,000 in 2017 to about 15 deaths per 100,000 in 2018. While the KOMA region had a lower prescription rate than the Detroit region in 2018, the number of overdose deaths in the KOMA region has increased drastically from about 4 to 15 deaths (per 100,000 individuals) 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 2018. Additionally, risk factors related to alcohol consumption, smoking, and obesity have all remained stable. We find a lower rate of e-cigarette usage, however, when compared to cigarettes, with 2 percent of respondents reporting smoking e-cigarettes every day, 3.9 percent reporting smoking some days, and 19.6 percent reporting being former e-cigarette smokers in 2018. This year, in addition to smoking measures, we also examined physician referrals to cessation resources. We find that 63.1 percent of smokers were referred to cessation resources in Wayne county in 2018, whereas this number was 58.8 percent in Kent county.

We continue to monitor access to health care with respect to individual health insurance status and utilization of routine and preventative care. Despite a slight increase in the percent of uninsured within the KOMA region from 2016 to 2017, we find that the percentage of individuals lacking health insurance decreased from 12.3 percent in 2011 to 6.6 percent in 2018. 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 67 percent of the KOMA population in 2011 up to 79 percent in 2018.

Health Care Spending During COVID-19

We use data from Opportunity Insights to track consumer spending at a daily frequency during COVID-19. This data tracks aggregate credit card and debit card spending collected by Affinity Solutions Inc. Our focus is specifically on consumer spending on health care and social assistance. Health care and social assistance spending includes, among others, expenditures on physician's office visits; medical, diagnostic, and treatment services; and family services. We find a 60-percent decline in health care and social spending in Michigan followed by the implementation of social distancing and mitigation policies such as public school closures, nonessential business closures, as well as the stay-at-home order. However, we observe a positive sign of recovery in consumer spending right after the stimulus payment on April 15.

Economic Analysis

Benchmarking Communities

Compared to a group of peer communities, we find that hospital admission rates in the Grand Rapids region are relatively low (89.24 admissions per 1,000 residents in Grand Rapids vs. an average of 121.82 in the peer communities). Outpatient visits to hospitals are high, however, and have grown significantly over the past decade. We suspect that the primary reason for the growth in outpatient visits to hospitals is related to provider-based billing arrangements, which represent a shift in the categorization of the care setting rather than an actual increase in the number of visits. Emergency department (ED) visits in Grand Rapids numbered 461 per 1,000 residents in 2018, compared to a national average of 438 visits per 1,000 individuals. Similarly, total hospital expenses per admission averaged $32,180 in Grand Rapids in 2018 compared to a national average of $28,790. Unlike the previous 11 years in the study, we find Medicare expenditures in Grand Rapids rose above the national average ($10,550 per capita in Grand Rapids vs. $10,448 per capita nationally) and are also above expenditures for Medicare beneficiaries in the Detroit region ($10,212 per capita) and in the set of peer communities ($10,064 per capita). These findings on ED visits, hospital expenses per admission, and Medicare spending show the potential for higher levels of health spending in the region moving forward.

Major Medical Conditions: Expenditure and Utilization Analysis

We used member data provided by Blue Care Network, Blue Cross Blue Shield of Michigan, and Priority Health to examine average annual expenditures and health care use for those diagnosed with at least one of the following six chronic conditions: asthma, coronary artery disease (CAD), depression, diabetes, hyperlipidemia, and low back pain. Understanding that, from year to year, small coding changes may affect the composition of the diagnosis categories, we find that changes in expenditures between 2018 and 2019 across all conditions were mixed in KOMA counties. The largest dollar increase is for diabetes ($1,000 or 17.6 percent) and largest dollar decrease is for asthma (-$726 or -6.7 percent).

While average annual expenditures for each of the seven studied diagnoses have historically been higher in the Detroit region than in West Michigan, the opposite is true for CAD, hyperlipidemia, and healthy members in 2019. We find that average annual inpatient admissions, visits to emergency departments, and the average number of prescription fills tend to be greater in the Detroit region than in KOMA for the chronic conditions studied. It is also true, however, that the percentage gaps in all three utilization categories narrowed between 2018 and 2019, with few exceptions.

While the Detroit region has lagged KOMA in the adoption and utilization of telehealth, it has since caught up and now telehealth utilization is roughly the same on both sides of the state. We continue to map variations in health expenditures and utilization for select conditions at the ZIP code level. In general, there remains a greater reliance on inpatient care and prescription fills in the Detroit region than in West Michigan. While overall use of telehealth remains low over the entire state relative to other services examined, it is clear that ZIP codes in the eastern part of the state have caught up to the western side in the adoption and utilization of telehealth services.

Knowledge Foundations

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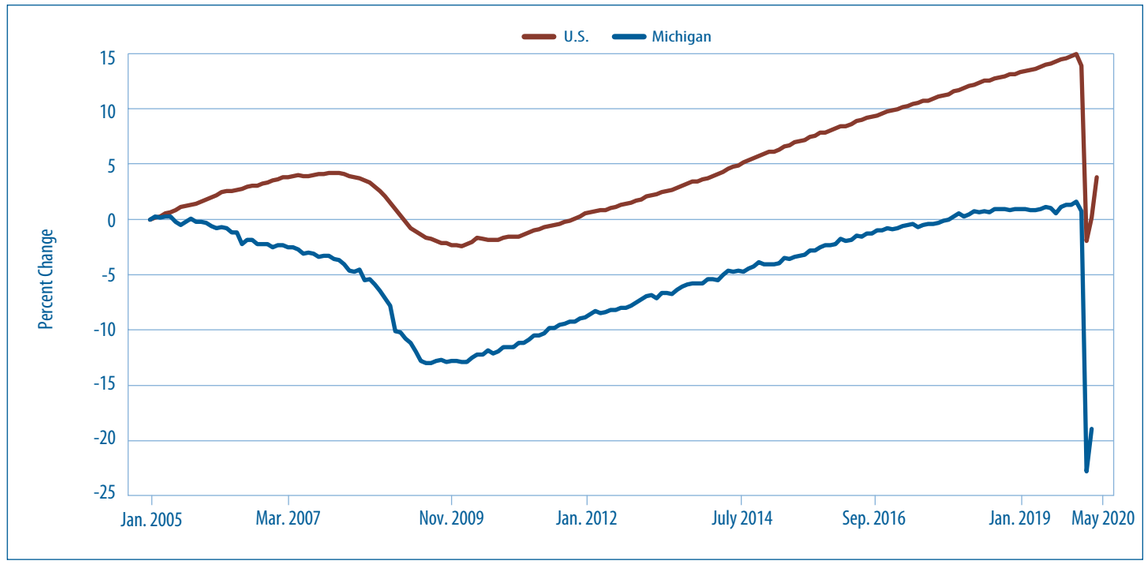
Education and Job Growth

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 May 2020. After the 2008 recession, the focus was on the dramatic decline of jobs for both Michigan and the U.S. At the height of the recession, jobs had fallen by more than 2 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 (i.e. about 4.2 percent in December 2007) and has continued to increase. However, Michigan did not recover to prerecession job levels until January 2018, meaning the state has experienced only a small net gain in payroll jobs for more than a decade. The positive economic outlook in Michigan and the U.S. for the past two years has been disrupted in the first quarter of 2020 by an unprecedented outbreak of the novel coronavirus (COVID-19) in Wuhan, China, that spread rapidly around the world causing a global pandemic. The pandemic response policies such as business closures combined with a large negative health shock hit a record toll on the job growth rate. In April 2020, job growth declined from a 14 percent annual rate in 2019 to about -2 percent in the U.S., while surpassing that in Michigan. Specifically, Michigan and the U.S. experienced, respectively, a decline in nonfarm payroll jobs by about 23 percent and 2 percent. Moreover, the discrepancy between the U.S. job growth and that of Michigan has begun to further increase from a gap of 11 percentage points in January 2018 to a gap of 21 percentage points in April 2020. We observed positive signs of recovery in May 2020, albeit a gap of 19 percentage points existed between the U.S. and Michigan job growth.

Figure 1: Nonfarm Payroll Jobs Percent Change, January 2005 – May 2020

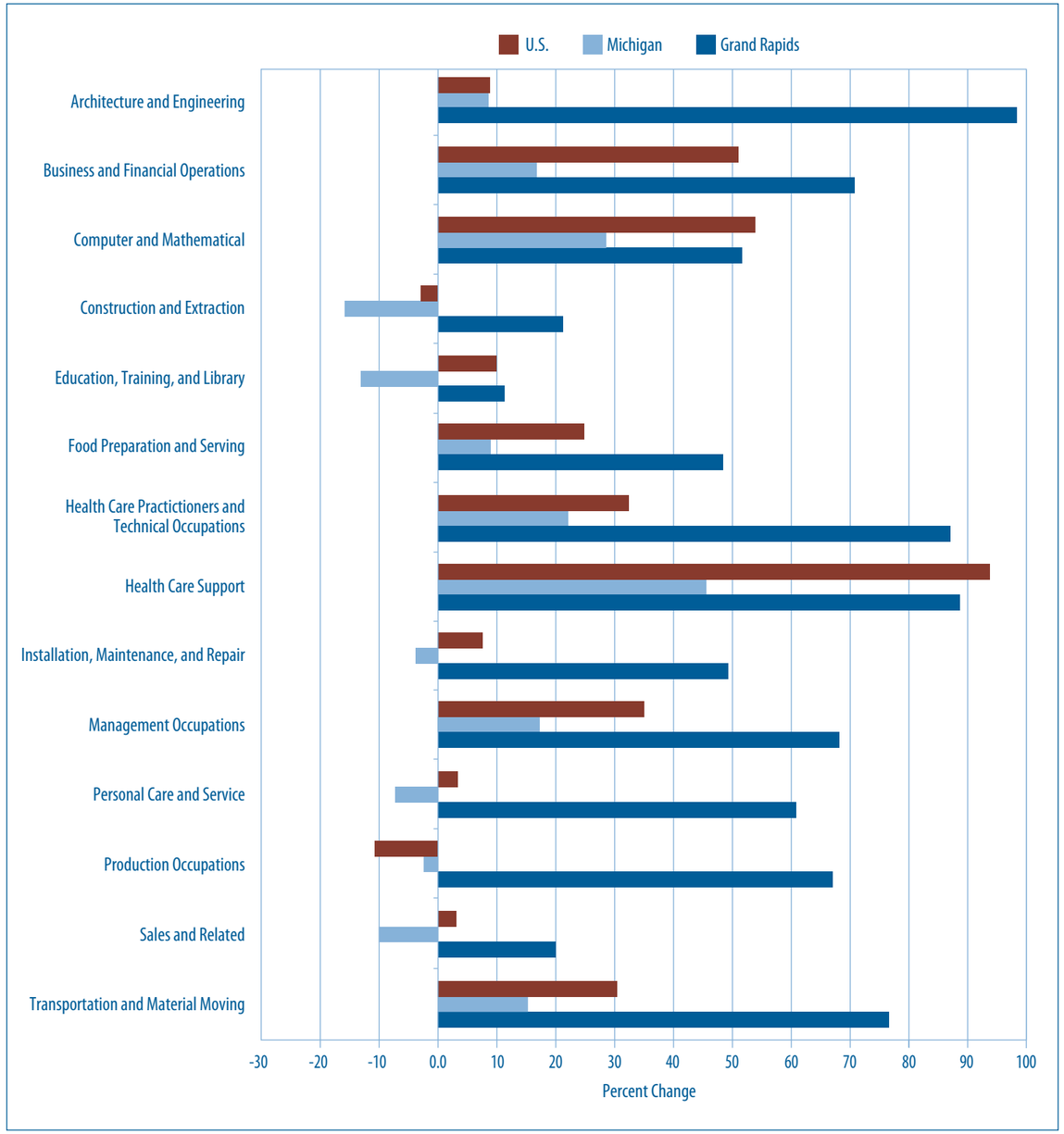


Source: Bureau of Labor Statistics, www.bls.gov

Figure 2 provides a more detailed analysis of employment changes by examining job growth or job losses at the industry level from 2005 to 2019. 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 50 percent) over this period in nine occupational categories: architecture and engineering (99 percent), health care support (89 percent), health care practitioners and technical occupations (87 percent), transportation and material moving (77 percent), business and financial operations (71 percent), management occupations (68 percent), production operations (67 percent), personal care and service (61 percent), and computer and mathematical occupations (51 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 four times the state and triple 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.

Figure 2: Job Growth for Select Major Occupational Groups, 2005–2019



Source: Bureau of Labor Statistics, www.bls.gov

We observe a further decline in job growth for construction and extraction by about 16 percent in Michigan. Moreover, there is an increasing negative growth rate within education, training, and library occupations across the state as a whole, where we observe close to a 13-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 in employment, 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 both since 2005 and since 2018 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 (RNs), occupational and physical therapists, occupational and physical therapy assistants, physician assistants, pediatricians, surgeons, recreational therapists, and surgical technicians. Only a few occupations experienced job losses in Grand Rapids since 2005; those include medical transcriptionists, nuclear medicine technologists, nursing aides and assistants, and family and general practitioners. Grand Rapids also experienced a significant decline in optometrists from 2018 to 2019. The State of Michigan saw significant job growth among diagnostic medical sonographers, medical assistants, pharmacy technicians, physician assistants, and pediatricians and job losses among audiologists, dentists, medical transcriptionists, nuclear medicine technologists, and licensed practical or licensed vocational nurses (LPNs or LVNs).

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 the Grand Rapids metro area 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 2019, the corresponding annualized average growth rates, and projected employment in 2028. 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 dental assistants (130 in Grand Rapids and 1,052 for the state), home health and personal care aides (1,057 in Grand Rapids and 10,132 for the state), medical assistants (354 in Grand Rapids and 3,043 for the state), licensed practical or licensed vocational nurses (152 in Grand Rapids and 1,064 for the state), and nursing aides and assistants (1,034 in Grand Rapids and 5,883 for the state).

Finally, **Table 7** presents inflation-adjusted growth in annual earnings for health professions in Grand Rapids, Michigan, and the United States. Once again, data for wage estimates came from the Bureau of Labor Statistics, and we compared changes in these estimates for the long term (from 2005 to 2019) and the shorter term (2018 to 2019). We specifically focused on fields in which real earnings have increased or decreased by more than 7 percent over the 2005 to 2019 period. In Grand Rapids, the occupations with the largest decline in real earnings include diagnostic medical sonographers, emergency medical technicians (EMTs) and paramedics, occupational therapists, respiratory therapists, speech-language pathologists, and surgical technologists.

Dental hygienists, diagnostic medical sonographers, dietitians and nutritionists, EMTs and paramedics, and surgical technologists all experienced real earnings losses beyond 7 percent for the State of Michigan. Occupations experiencing the largest real earnings gains in the Grand Rapids region from 2005 to 2019 include family and general practitioners, occupational therapy assistants, optometrists, and physician assistants. Family and general practitioners, occupational therapists, and physician assistants all saw wage growth in excess of 7 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, 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 2018 and 2019 in Grand Rapids, we further note one occupation with more than 7 percent growth in real annual earnings: optometrists. The growth for optometrists is considerably higher in Grand Rapids than in both Michigan and the U.S. at large. In the short-term, we also observe a substantial decline in earnings for EMTs and paramedics, as well as physician assistants.

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 in the last few years, 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 4, 2020 from static1.squarespace.com/static/57f269e19de4bb8a69b470ae/t/58d2eb93bf629a4a3878ef3e/1490217882794/Knocking2016FINALFORWEB-revised021717.pdf.

Table 1: Health Care Job Growth for Selected Occupations, 2005-2019

Occupation	Grand Rapids						Michigan				
	Employment (2005)	Employment (2018)	Employment (2019)	Employment Growth (%) Since 2005	Employment Growth (%) Since 2018		Employment (2005)	Employment (2018)	Employment (2019)	Employment Growth (%) Since 2005	Employment Growth (%) Since 2018
Anesthesiologists	NA	NA	NA	NA	NA		NA	NA	990	NA	NA
Audiologists	NA	30	40	NA	33.3		690	450	450	-34.8	0.0
Cardiovascular Technologists/Technicians	NA	400	400	NA	0.0		1,940	2,510	2,340	20.6	-6.8
Dental Assistants	860	1,060	1,000	16.3	-5.7		9,650	9,960	9,610	-0.4	-3.5
Dental Hygienists	690	1,010	1,070	55.1	5.9		7,850	9,510	9,140	16.4	-3.9
Dentists, General	350	420	380	8.6	-9.5		4,570	3,810	3,720	-18.6	-2.4
Diagnostic Medical Sonographers	130	330	360	176.9	9.1		1,510	2,670	2,660	76.2	-0.4
Dietitians and Nutritionists	140	260	280	100.0	7.7		1,410	2,010	2,040	44.7	1.5
EMT and Paramedics	450	520	NA	NA	NA		6,670	7,100	7,160	7.3	0.8
Home Health and Personal Care Aides	NA	NA	6,060	NA	NA		NA	NA	68,860	NA	NA
Medical Assistants	1,540	2,440	2,500	62.3	2.5		14,490	23,680	24,580	69.6	3.8
Medical Records/Health Info Technicians	510	630	870	70.6	38.1		4,820	6,050	8,380	73.9	38.5
Medical Transcriptionists	290	90	90	-69.0	0.0		3,080	1,810	1,450	-52.9	-19.9
Nuclear Medicine Technologists	110	70	70	-36.4	0.0		960	630	610	-36.5	-3.2
Nurse Practitioners	NA	350	530	NA	51.4		NA	4,490	4,840	NA	7.8
Nurses, RN	6,310	12,550	12,820	103.2	2.2		81,370	96,680	96,900	19.1	0.2
Nurses, LPN or LVN	1,870	2,030	1,780	-4.8	-12.3		17,850	14,840	14,140	-20.8	-4.7
Nursing Aides and Assistants	4,950	7,280	7,970	61.0	9.5		48,960	49,760	51,270	4.7	3.0
Occupational Therapists	230	580	570	147.8	-1.7		3,510	4,580	4,620	31.6	0.9
Occupational Therapy Assistants	50	260	250	400.0	-3.8		890	1,140	1,230	38.2	7.9
Opticians, Dispensing	320	400	340	6.3	-15.0		3,550	3,580	3,590	1.1	0.3
Optometrists	80	260	130	62.5	-50.0		1,290	1,590	1,370	6.2	-13.8
Pharmacists	560	930	850	51.8	-8.6		8,110	9,140	8,650	6.7	-5.4
Pharmacy Technicians	700	1,370	1,260	80.0	-8.0		8,560	15,580	15,040	75.7	-3.5
Physical Therapists	330	980	980	197.0	0.0		5,170	7,970	8,060	55.9	1.1
Physical Therapist Assistants	100	560	520	420.0	-7.1		2,550	3,800	3,540	38.8	-6.8
Physician Assistants	180	610	680	277.8	11.5		2,320	4,490	4,840	108.6	7.8
Physicians, Family and General Practitioners	270	NA	180	-33.3	NA		3,030	3,320	3,270	7.9	-1.5
Physicians, Obstetricians and Gynecologists	NA	130	120	NA	-7.7		750	730	930	24.0	27.4
Physicians, Pediatricians	30	150	130	333.3	-13.3		370	930	1,150	210.8	23.7
Physicians, Psychiatrists	NA	80	70	NA	-12.5		400	630	700	75.0	11.1
Physicians, Surgeons	100	210	NA	NA	NA		1,640	1,320	1,670	1.8	26.5
Physicians and Surgeons, All Other	380	1,260	1,070	181.6	-15.1		10,220	16,480	15,810	54.7	-4.1
Radiologic Technologists and Technicians	380	820	850	123.7	3.7		6,020	6,710	6,750	12.1	0.6
Recreational Therapists	60	110	140	133.3	27.3		700	710	780	11.4	9.9
Respiratory Therapists	240	650	730	204.2	12.3		3,390	4,580	4,520	33.3	-1.3
Speech-language Pathologists	390	620	610	56.4	-1.6		3,340	3,950	4,300	28.7	8.9
Surgical Technologists	220	730	720	227.3	-1.4		2,610	4,240	4,240	62.5	0.0

Source: Bureau of Labor Statistics, www.bls.gov

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		Lansing Community College		Montcalm Community College		Muskegon Community College		Southwestern Michigan University		West Shore Community College		TOTAL ENROLLMENT	TOTAL GRADUATES
Allied Health Sciences			1,629	85															1,629	85
Biology									1,396	42									1,396	42
Chemistry									181	18									181	18
Dental Assistant/Assisting					90	46													90	46
Dental Hygiene/Hygienist			191	118	185	94	149	54	136	66									661	332
Diagnostic Medical Sonography			99	52					82	79									181	131
Dietary and Food Service Management			1	6															1	6
Electrocardiogram (ECG) Technician															4	0			4	0
Emergency Medical Services							72	16											72	16
Emergency Medical Technician [1]							64	80							18	1			82	81
Fire Science									180	45					6	6			186	51
Gerontology			0*	140	11	0													11	140
Health Information Technology	283	130	105	79											59	22			447	231
Kinesiology									658	43									658	43
Magnetic Resonance Imaging (MRI) [2]							12	0											12	0
Medical Assistant [3]	313	179					21	22			78	26					100	5	512	232
Medical Billing																	15	9	15	9
Medical Laboratory Technology			3	8															3	8
Medical Office Administration											109	26							109	26
Nursing Assistant (CNA)															7	0	36	3	43	3
Nursing [4]	88	73			667	434	1,023	821	1,089	1,389	669	144	794	432	437	154	163	160	4,930	3,607
Occupational Therapy Assistant					154	58													154	58
Phlebotomy															9	0			9	0
Physical Therapist Assistant							139	68											139	68
Psychology			103	17															103	17
Radiography [5]			195	117	140	60	80	55	137	116									552	348
Respiratory Care			92	61									224	59					316	120
Surgical Technology									66	63									66	63

Note: Tables do not include programs with no information readily available and programs with a value of 0 for both enrollment and graduates.
[1]Combined Emergency Medical Technician (SWMU) & EMT-Basic and EMT-Paramedic (KCC)
[2]The MRI program is part of the MiRIS Consortium; KCC is allotted five seats.
[3]Includes Medical Administrative Assistance (KCC), Medical Assistant (Davenport & Montcalm), Medical Assistant Office and Clinical (SWMU)
[4]Includes Practical Nursing (Davenport), Practical Nurse (GRCC), Nursing (LMC), Nursing LPN (Muskegon CC) and Nursing-Practical (KCC)
Nursing (RN, Practical Nursing LPN, Paramedic to RN, LPN to RN) (SWMU)
[5]Includes Radiologic Technology (GRCC)
*Data as reported by the respective college or university

Table 3: College and University Programs — Bachelor's Degree (Continued Next Spread)

Color Key: Students Enrolled Over Last Three Years; Graduates Over Last Three Years

	Albion College		Aquinas College		Calvin University		Central Michigan University		Cornerstone University			Davenport University		Ferris State University		Grand Valley State University		Hope College		Kuyper College		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
Allied Health Sciences														436	184	2,750	778									3,186	962
Animal Science/Pre-Vet																						1,708	370			1,708	370
Athletic Training	12	16	43	27			250	65								335	60	31	16			276	67	67	39	1,014	290
Biochemistry	87	23			427	106	183	60						10	5	369	60							213	30	1,289	284
Biochemistry and Molecular Biology																		114	33			890	175			1,004	208
Biochemistry and Molecular Biology/Biotechnology														97	30							326	66			423	96
Biology	326	110	173	85	608	125	447	690	66	4				130	297	1,537	320	441	125			38	5	600	112	4,366	1,873
Biomedical Laboratory Science																						934	200			934	200
Biomedical Sciences																3,595	720							1,863	308	5,458	1,028
Biopsychology																6	5									6	5
Biosystems Engineering																						664	141			664	141
Cardiac Rehabilitation									33	0																33	0
Cell and Molecular Biology																286	53									286	53
Chemistry	42	15	23	5	146	28	87	32								298	52					728	184	176	23	1,500	339
Clinical Laboratory Sciences																						53	55			53	55
Communication Disorders							574	233																		574	233
Community Health									4	0																4	0
Dental Hygiene														108	44											108	44
Diagnostic Medical Sonography																555	65									555	65
Dietetics							321	117														505	170	65	76	891	363
Environmental Biology/Microbiology																						62	8			62	8
Environmental Biology/Plant Biology																				2	1	81	17			83	18
Exercise Science	221	71	70	33			1,821	603	63	83						3,160	782	407	131	4	0			922	240	6,668	1,943
Genomics and Molecular Genetics																						657	159			657	159
Health Administration							411	170																		411	170
Health Care Systems Administration														358	199											358	199
Health Communication																284	94									284	94
Health Fitness in Preventive and Rehabilitative Programs							0*	185																		0	185
Health Information Management												346	66	158	65											504	131
Health Services Administration												456	137													456	137
Human Biology																						4,973	1,159			4,973	1,159
Kinesiology					483	108																3,534	1,013			4,017	1,121
Medical Case Management												493	0*													493	0
Medical Laboratory Sciences														107	58	307	63									414	121
Microbiology																						501	146			501	146
Molecular Diagnostics														36	22											36	22
Neuroscience	14	0					584	160														2,255	497			2,853	657
Nuclear Medicine Technology														108	73											108	73
Nursing[1]			557	0*	894	189						1,902	499	1,254	661	1,327	619	544	130			1,411	612	951	397	8,840	3,107
Nutritional Sciences																						600	163			600	163
Occupational Therapy																								287	136	287	136
Physics	19	9			77	11	46	9								112	21	49	11			766	146	125	17	1,194	224
Physiology																						1,058	231			1,058	231
Public Health														84	19											84	19
Psychology	284	87	218	72	569	144			210	112				395	105	2,918	798	883	219			3,872	1,010	823	429	10,172	2,976
Radiation Therapy																310	54									310	54
Radiologic and Imaging Sciences																11	11									11	11
Social Work					277	86	638	169	137	42				547	203	1,181	316	260	85	158	23	602	182	351	235	4,151	1,341
Sociology	87	29	53	19	107	43	148	172						25	11	253	86	278	63			273	119	238	98	1,462	640
Speech Pathology and Audiology					383	96																		213	89	596	185
Therapeutic Recreation					138	31										434	116									572	147

Note: 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.
*Data as reported by the respective college or university

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

Color Key: Students Enrolled Over Last Three Years / Graduates Over Last Three Years	Calvin University		Central Michigan University		Davenport University			Ferris State University		Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
Animal Science												42	14			42	14
Biochemistry and Molecular Biology												0*	1			0	1
Biology/Biological Sciences			60	128						124	29			108	45	292	202
Biomedical Laboratory Science/Operations												56	16			56	16
Biomedical Sciences										61	18					61	18
Biostatistics										106	44	33	21			139	65
Cell and Molecular Biology										112	35					112	35
Chemical Engineering												15	15	30	14	45	29
Chemistry			49	21										25	9	74	30
Communication Disorders			9	121								186	95			195	216
Comparative Medicine and Integrative Biology												43	10			43	10
Counseling Psychology														387	100	387	100
Dietetics			30	110												30	110
Epidemiology												28	18			28	18
Exercise Physiology														53	28	53	28
Health Administration			50	360						201	69					251	429
Health and Risk Communication												36	19			36	19
Integrative Pharmacology												18	5			18	5
Kinesiology												142	88			142	88
Medical and Bioinformatics					118	33				59	24					177	57
Neuroscience			13	20								1	2			14	22
Nursing					111	20		303	71	17	15	359	184	61	14	851	304
Occupational Therapy					250	77				418	164			532	280	1,200	521
Physician Assistant			231	99						419	137			231	108	881	344
Pharmacology and Toxicology												430	128			430	128
Physics			26	26								9	44	9	12	44	82
Physiology												16	5			16	5
Psychology												50	51	275	156	325	207
Public Health										282	128	289	208			571	336
Speech Language Pathology	102	92	239	121						243	90			176	88	760	391
Social Work								229	99	915	439			1,051	426	2,195	964
Sociology												1	8	26	9	27	17
Vision Rehabilitation Therapy														72	52	72	52

Note: Tables do not include programs with a value of 0 for both enrollment and graduates.
*Data as reported by the respective college or university

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			Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
Animal Science								58	13			58	13
Audiology	148	37								70	15	218	52
Biochemistry and Molecular Biology								130	23			130	23
Biochemistry and Molecular Biology-Environmental Toxicology								4	3			4	3
Biological Sciences										82	8	82	8
Biosystems Engineering								51	16			51	16
Cell and Molecular Biology								66	21			66	21
Cell and Molecular Biology - Environmental Toxicology								3	1			3	1
Chemical Engineering								122	24			122	24
Chemistry								610	105	67	15	677	120
Communicative Sciences and Disorders								35	1			35	1
Comparative Medicine and Integrative Biology								111	22			111	22
Counseling Psychology										147	22	147	22
Epidemiology								74	11			74	11
Genetics								47	20			47	20
Genetics – Environmental Toxicology								0*	1			0	1
Health Administration	0*	47										0	47
Human Nutrition								29	11			29	11
Kinesiology								141	22			141	22
Medicine	1,217	257						6,037	564			7,254	821
Neuroscience	49	10						53	14			102	24
Nursing						286	99	258	14			544	113
Optometry			443	106								443	106
Pathobiology								3	2			3	2
Pharmacology and Toxicology								71	4			71	4
Pharmacy			1,674	422								1,674	422
Physics								504	53	67	6	571	59
Physiology								50	10			50	10
Psychology								251	39	277	55	528	94
Physical Therapy	535	175				532	175					1,067	350
Rehabilitation Counseling								48	11			48	11
Social Work								53	9			53	9
Sociology								83	21	86	9	169	30

Note: Tables do not include programs with a value of 0 for both enrollment and graduates.
*Data as reported by the respective college or university

Table 6: Need for Selected Professions in Michigan

Selected Professions	Michigan Employment (2019)[1]	Grand Rapids Employment (2019)[1]	Michigan Annual Growth Rate[2]	Grand Rapids Annual Growth Rate[2]		Michigan Projected Employment (2028)	Grand Rapids Projected Employment (2028)	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]
Dental Assistants	9,610	1,000	-0.002	0.013		9,427	1,122	-20	14	0.112	0.116	1,052	130
Dental Hygienists	9,140	1,070	-0.003	0.013		8,922	1,200	-24	14	0.067	0.064	585	83
Diagnostic Medical Sonographers	2,660	360	0.008	0.018		2,851	422	21	7	0.058	0.065	177	30
Dietitians and Nutritionists	2,040	280	0.002	0.012		2,081	311	5	3	0.062	0.062	131	21
EMT and Paramedics	7,160	NA	-0.003	0.013		6,948	NA	-24	NA	0.066	0.061	446	NA
Home Health and Personal Care Aides	68,860	6,060	0.021	0.034		82,724	8,218	1,540	240	0.125	0.135	10,132	1,057
Medical Assistants	24,580	2,500	0.008	0.021		26,520	3,023	216	58	0.115	0.118	3,043	354
Nurse Practitioners	4,840	530	0.015	0.028		5,537	681	77	17	0.059	0.056	362	46
Nurses, LPN or LVN	14,140	1,780	-0.001	0.011		14,040	1,971	-11	21	0.076	0.073	1,064	152
Nurses, RN	96,900	12,820	0.009	0.014		105,426	14,515	947	188	0.056	0.054	6,381	881
Nursing Aides and Assistants	51,270	7,970	0.002	0.011		52,055	8,823	87	95	0.113	0.118	5,883	1,034
Occupational Therapists	4,620	570	0.008	0.020		4,948	680	36	12	0.058	0.054	306	43
Occupational Therapy Assistants	1,230	250	0.016	0.023		1,413	306	20	6	0.114	0.147	161	43
Optometrists	1,370	130	0.001	0.013		1,385	146	2	2	0.030	0.038	43	7
Physical Therapists	8,060	980	0.009	0.022		8,738	1,193	75	24	0.044	0.044	429	67
Physician Assistants	4,840	680	0.017	0.030		5,618	884	86	23	0.064	0.065	395	67
Physicians, Family and General Practitioners	3,270	180	-0.001	0.011		3,229	198	-5	2	0.031	0.025	96	6
Respiratory Therapists	4,520	730	0.012	0.023		5,045	894	58	18	0.057	0.049	318	54
Speech-language Pathologists	4,300	610	0.017	0.012		4,993	677	77	7	0.059	0.053	329	40
Surgical Technologists	4,240	720	-0.002	0.011		4,178	792	-7	8	0.078	0.082	325	67

Note: Job growth rate and annual change are based on rounded data.
Sources:
[1]Bureau of Labor Statistics, www.bls.gov
[2]Michigan Bureau of Labor Market Information and Strategic Initiatives, www.milmi.org
Michigan Annual Replacement Rate = (Replacement/Employment 2018)
Grand Rapids Annual Replacement Rate = (Replacement/Employment 2016)
NA = Not Available

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*			2018 Mean Annual Earnings*				2019 Mean Annual Earnings			Percent Change in Real Annual Earnings Since 2005			Percent Change in Real Annual Earnings Since 2018		
	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.		Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.
Dental Assistants	$42,348	$40,567	$39,232	$43,494	$37,813	$40,491		$44,600	$39,340	$41,170	5.32	-3.03	4.94	2.54	4.04	1.68
Dental Hygienists	$67,102	$72,482	$79,354	$66,870	$65,292	$76,868		$63,180	$65,610	$77,230	-5.84	-9.48	-2.68	-5.52	0.49	0.47
Diagnostic Medical Sonographers	$66,055	$68,005	$72,561	$61,097	$62,238	$75,198		$60,960	$62,990	$75,780	-7.71	-7.37	4.44	-0.22	1.21	0.77
Dietitians and Nutritionists	$60,426	$61,355	$60,151	$58,572	$58,033	$62,319		$56,380	$56,070	$62,330	-6.70	-8.61	3.62	-3.74	-3.38	0.02
EMT and Paramedics	$39,625	$36,549	$37,229	$37,131	$34,331	$38,444		$31,570	$33,760	$38,830	-20.33	-7.63	4.30	-14.98	-1.66	1.00
Home Health and Personal Care Aides	$27,097	$25,108	$25,422	$27,387	$25,219	$25,789		$26,150	$25,660	$26,440	-3.50	2.20	4.01	-4.52	1.75	2.52
Medical Assistants	$35,632	$34,585	$34,245	$34,942	$33,130	$35,166		$34,510	$33,760	$35,720	-3.15	-2.39	4.31	-1.24	1.90	1.58
Nurse Practitioners	NA	NA	NA	$100,916	$108,817	$112,024		$102,790	$108,660	$111,840	NA	NA	NA	1.86	-0.14	-0.16
Nurses, LPN or LVN	$48,016	$49,351	$47,401	$44,309	$49,929	$47,903		$46,780	$50,300	$48,500	-2.57	1.92	2.32	5.58	0.74	1.25
Nurses, RN	$68,345	$74,864	$74,459	$67,125	$72,622	$76,878		$68,220	$73,200	$77,460	-0.18	-2.22	4.03	1.63	0.80	0.76
Nursing Aides and Assistants	$29,715	$30,972	$29,061	$29,281	$30,676	$30,116		$29,470	$31,220	$30,720	-0.83	0.80	5.71	0.65	1.77	2.01
Occupational Therapists	$84,447	$72,299	$77,365	$72,175	$79,352	$86,897		$72,080	$78,010	$86,210	-14.64	7.90	11.43	-0.13	-1.69	-0.79
Occupational Therapy Assistants	$44,167	$51,655	$52,100	$48,707	$53,360	$61,505		$51,290	$53,040	$61,880	16.13	2.68	18.77	5.30	-0.60	0.61
Optometrists	$111,636	$126,166	$125,014	$124,720	$114,477	$122,154		$152,230	$125,550	$122,980	36.36	-0.49	-1.63	22.06	9.67	0.68
Physical Therapists	$82,653	$86,554	$85,546	$87,192	$92,812	$90,490		$86,830	$90,500	$90,170	5.05	4.56	5.40	-0.41	-2.49	-0.35
Physician Assistants	$98,113	$93,977	$93,034	$116,330	$112,238	$110,395		$107,710	$110,510	$112,410	9.78	17.59	20.83	-7.41	-1.54	1.83
Physicians, Family and General Practitioners	$207,327	$182,678	$183,751	$231,907	$210,863	$215,617		$236,790	$207,330	$213,270	14.21	13.50	16.06	2.11	-1.68	-1.09
Respiratory Therapists	$73,019	$60,282	$60,570	$57,514	$58,074	$63,632		$58,360	$58,870	$63,950	-20.08	-2.34	5.58	1.47	1.37	0.50
Speech-language Pathologists	$106,295	$84,604	$75,925	$73,732	$79,637	$82,162		$74,340	$80,870	$82,000	-30.06	-4.41	8.00	0.82	1.55	-0.20
Surgical Technologists	$46,772	$48,003	$47,021	$41,712	$44,064	$49,929		$42,140	$44,590	$50,110	-9.90	-7.11	6.57	1.03	1.19	0.36

Source: www.bls.gov/oes/tables.htm
*2005 and 2018 Mean Annual Wages are inflated to 2019 dollars.
NA = Not Available

Medical Patents

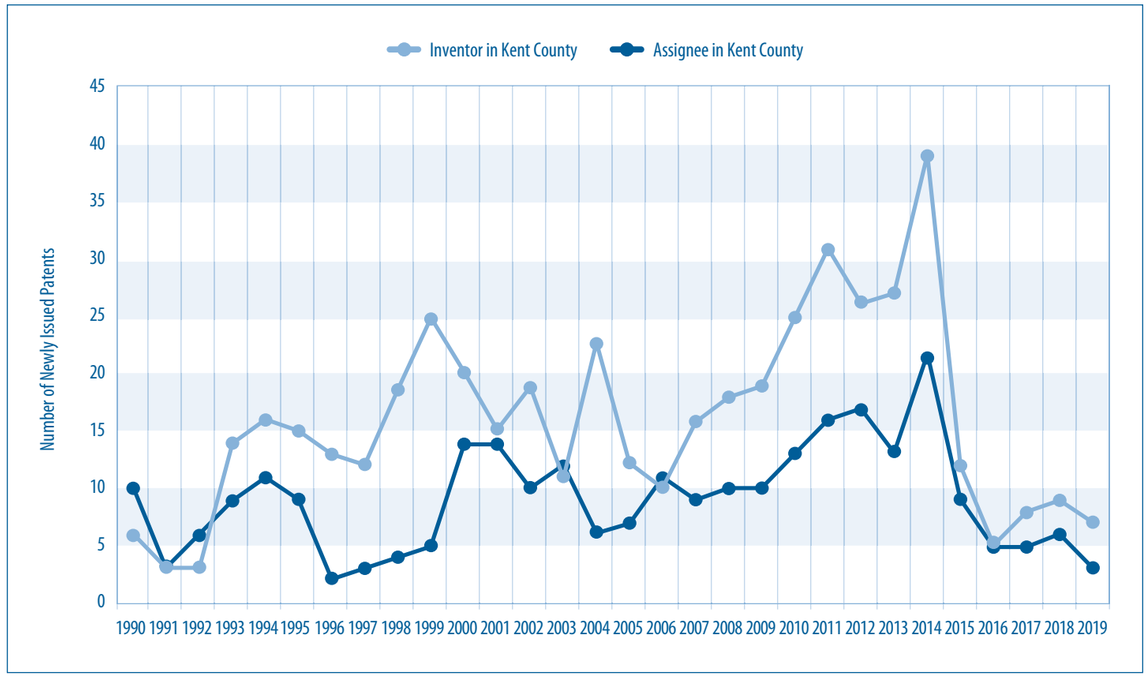
A patent is the property right granted to an inventor or assignee for a new or improved product, process, or piece of equipment. Patents are used as indicators of economic growth because of the investment that went into creating the innovations, as well as the investment opportunities that result from 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, where, for example, the inventor lives in Kent County, but the company that owns the patent is in China, or 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 2019. For those with inventors living in Kent County, the average annual number of patents increased from 12.6 in the years 1990 through 1999 to 16.3 in the years 2000 through 2009, with an additional increase to an average of 18.9 in the years 2010 through 2019. For those with assignees in Kent County, the average annual number of patents increased from 6.2 in the years 1990 through 1999 to 10.3 in the years 2000 through 2009 and to 10.9 patents in the years 2010 through 2019. 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, 1990–2019

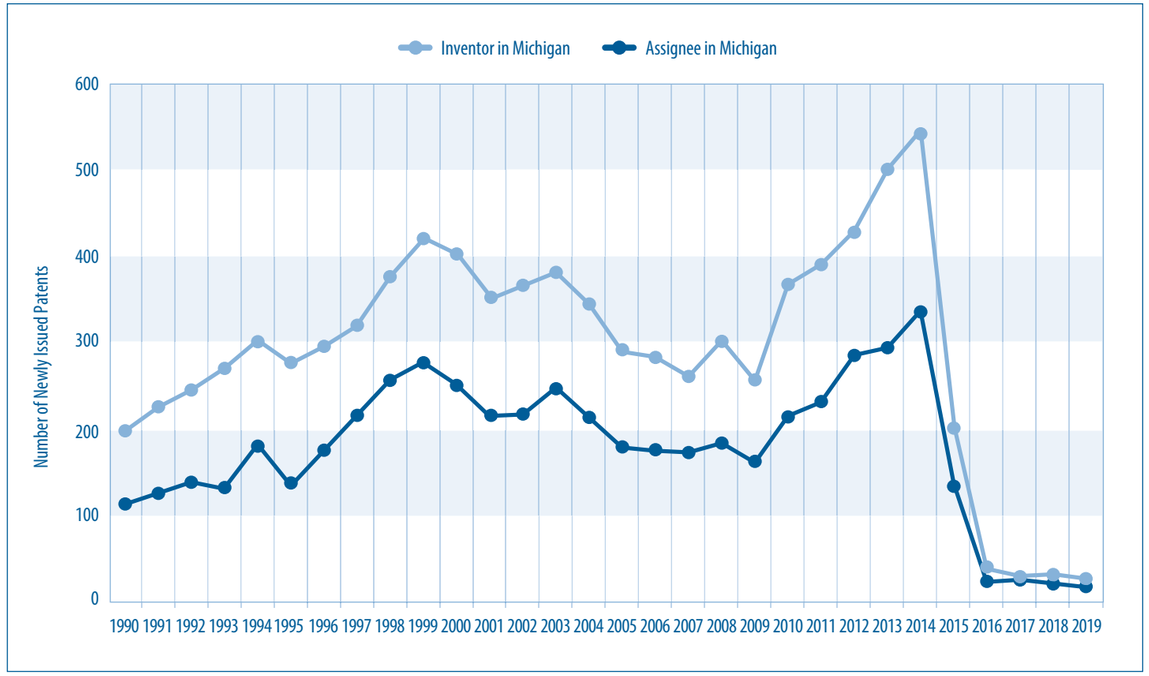


Source: United States Patent and Trademark Office, www.uspto.gov

Although the average, annual number of patents has increased over time as mentioned previously, **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 82.1 percent from 2014 through 2019, and the annual number of new patents with assignees located in Kent County falling by 86.4 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 through 2019.

Figure 2: Medical Patenting in Michigan, 1990–2019



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, 2014–2019

	Location of Inventor			Location of Assignee		
	Kent County	Michigan	U.S.	Kent County	Michigan	U.S.
Percent Change 2014-2019	-82.1	-95.8	-94.9	-86.4	-95.5	-95.5

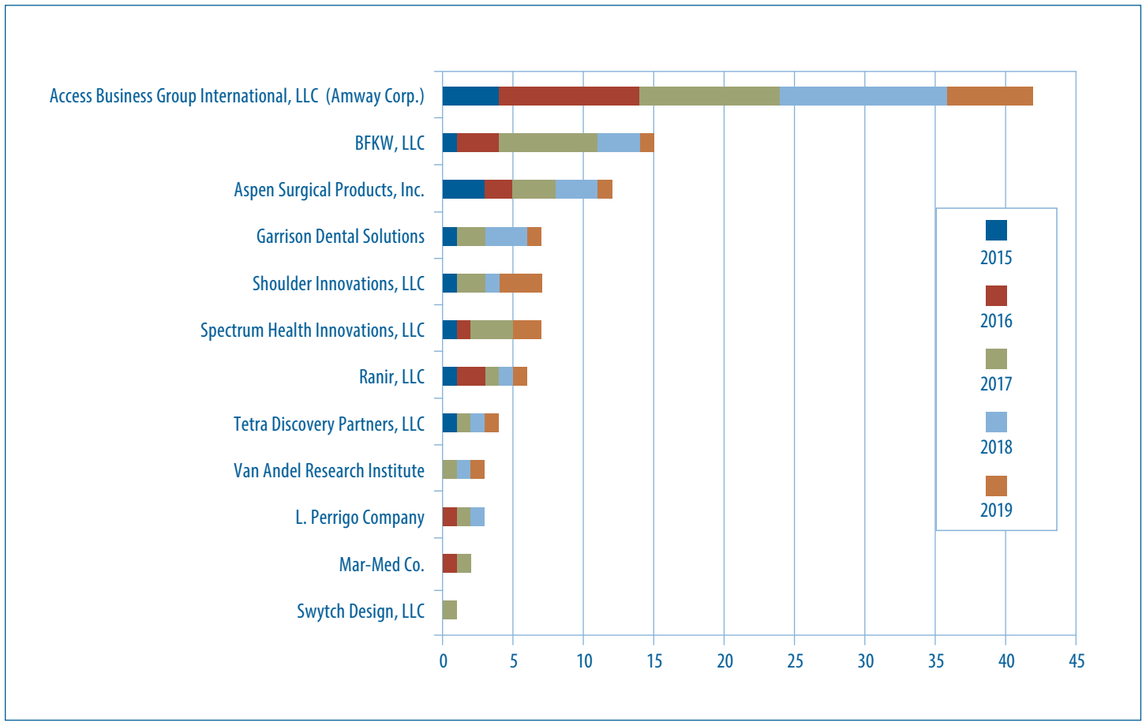
Source: United States Patent and Trademark Office, www.uspto.gov

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. The overall number of new medical patents fell in the following years for both the state and the nation as a whole, and this percentage dropped too. In 2019, 1.9 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 2019 this percentage increased more than four-fold to 30.4 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 in order 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 193 countries simultaneously.

The number of nonduplicate medical patent applications filed by West Michigan companies at the WIPO and at the USPTO from 2015 through 2019 is shown in **Figure 3**. Since the year 2015, there have been 109 medical patent filings from 12 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 25 percent of the listed companies did not apply for any medical patents in 2019.

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. Increases in processing time could possibly 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 2019. Rather than increasing in recent years, the average wait time has been decreasing since 2010 through 2011, 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.

There has also been a shift in global patenting, which could explain some of the decline in medical patents in the U.S. WIPO (2019) reports that the number of patent applications in the U.S. fell by 1.6 percent from 2017 through 2018, while the number of patent applications in many other locations grew: by 11.6 percent in China, 7.5 percent in India, 4.7 percent at the European Patent Office, and 5.2 percent worldwide.

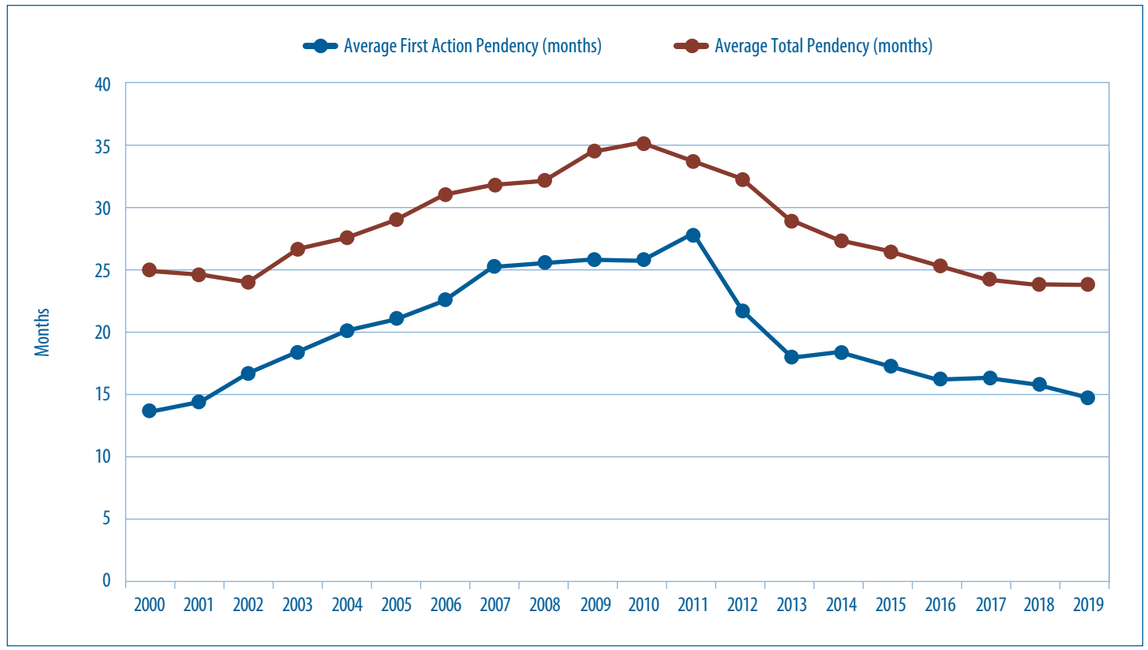
Recent court cases are probably the most substantial reason for the decline in medical patenting. In 2012, the U.S. Supreme Court struck down medical diagnostics patents in Mayo Collaborative Services v. Prometheus Laboratories, Inc., and in 2013, it struck down patents on gene sequences in Association for Molecular Pathology v. Myriad Genetics. These rulings have likely pushed companies to keep certain medical discoveries secret rather than pursue patents for them.

Other explanations not examined here might also contribute to the patenting changes illustrated previously. Whatever the 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.

References

WIPO (2019). *World Intellectual Property Indicators 2019*. Geneva: World Intellectual Property Organization.

Figure 4: USPTO Patent Wait Times*, 2000–2019



*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
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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, except for a negative dip in 2010, 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. Although the Detroit region has experienced low, but positive, growth between 2016 and 2017 (about 0.13 percent on average), this trend has been reversed since 2018, where the decline in the population growth rate reached a low of -0.08 percent in 2019.

KOMA's population growth rate began increasing rapidly after 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 1.25 percent in 2013 to 0.53 percent in 2019. While the western population growth rate appears to be slowing, the KOMA region population growth in 2019 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 2016 to 0.48 percent in 2019.

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 (about 3 percentage points between 2010 and 2019). 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 2019. 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, participants in the labor market effectively subsidize health insurance for the over 65 age demographics. 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 www.cms.gov/Research-Statistics- Data-and-Systems/ Statistics-Trends-and-Reports/ ReportsTrustFunds/ downloads/tr2012.pdf.

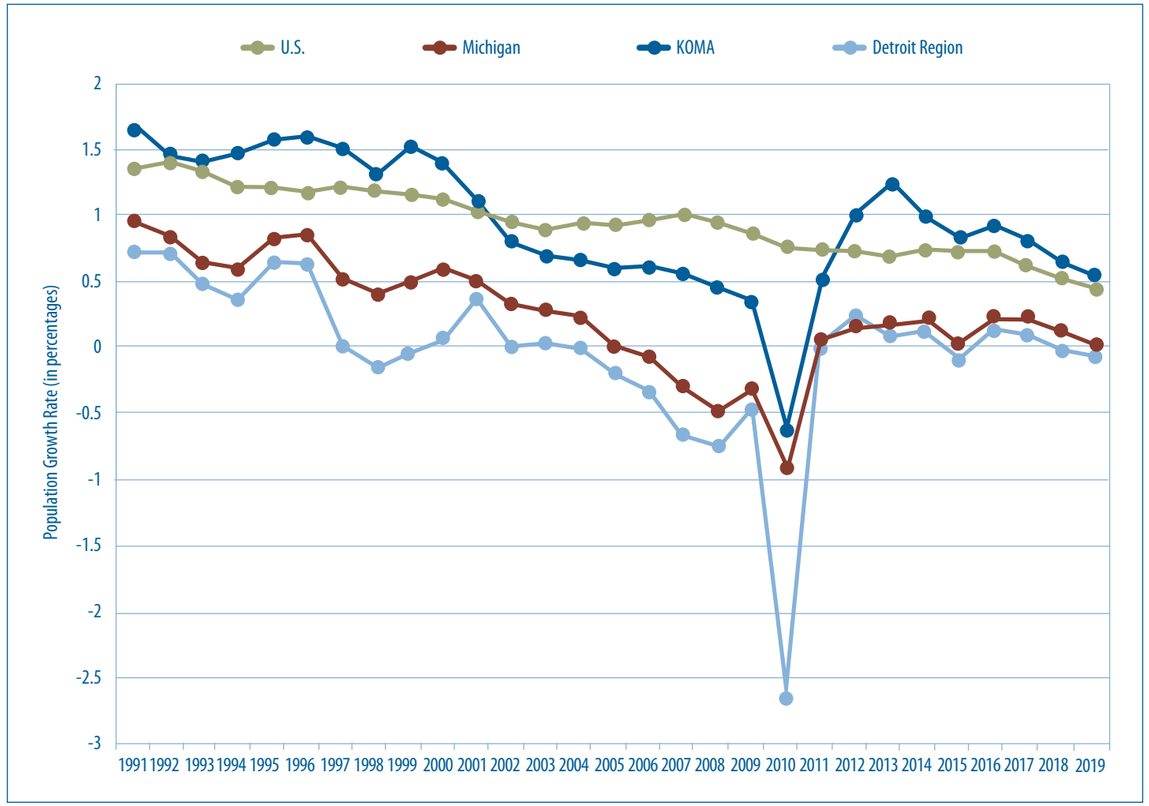
Centers for Medicare and Medicaid Services. (2017). *Medicare geographic variation public use files.* Retrieved August 25, 2018 from www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/GV_PUF.html.

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

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

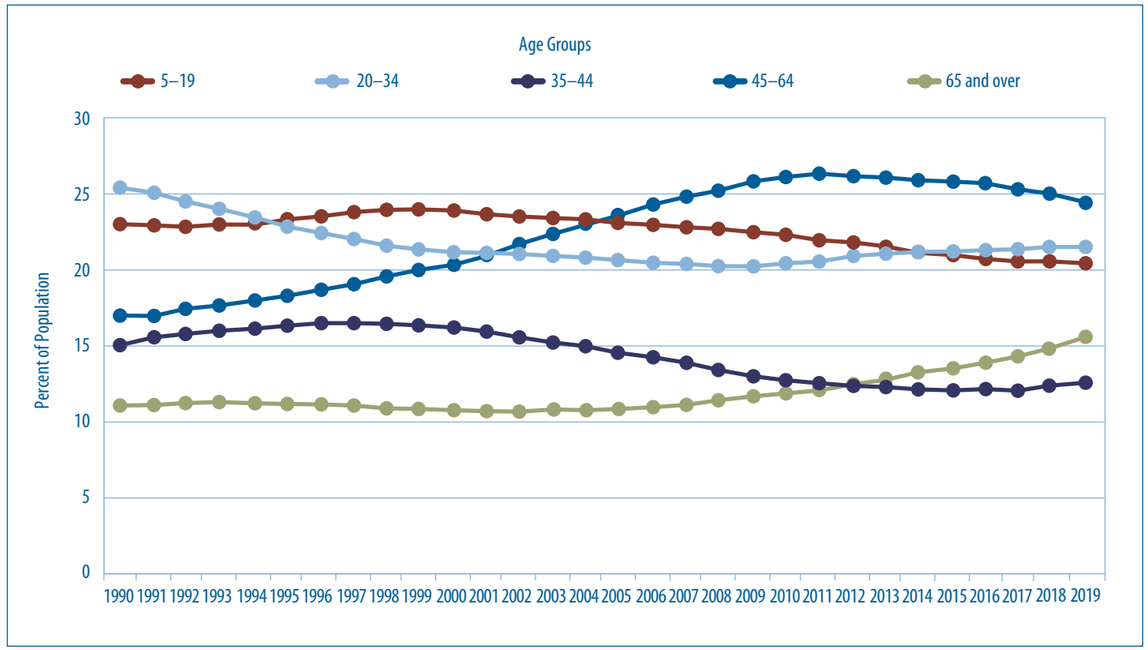
United States Census Bureau. (2018). *County population by characteristics datasets.* Retrieved August 25, 2018 from www.census.gov/data/datasets/2017/demo/popest/counties-detail.html.

Figure 1: Annual Population Growth Rate, 1991–2019



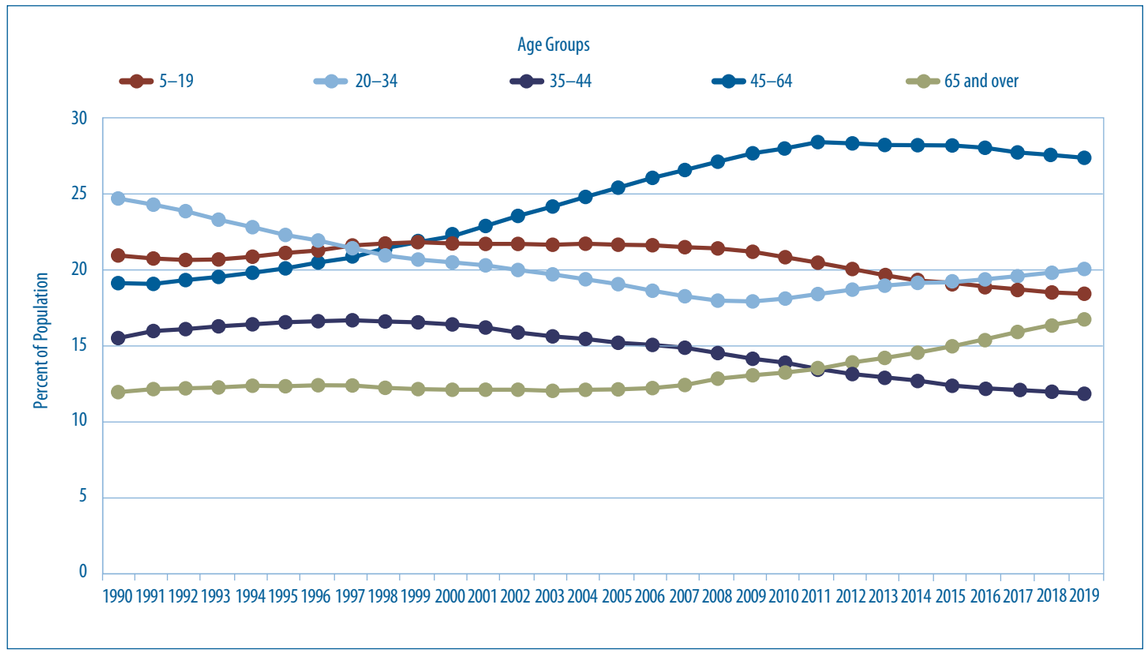
Source: U.S. Census, population and housing unit estimates
Differences compared to previous Health Check editions are due to revisions of U.S. Census Bureau data.

Figure 2: Population Distribution as a Percent of KOMA, 1990–2019



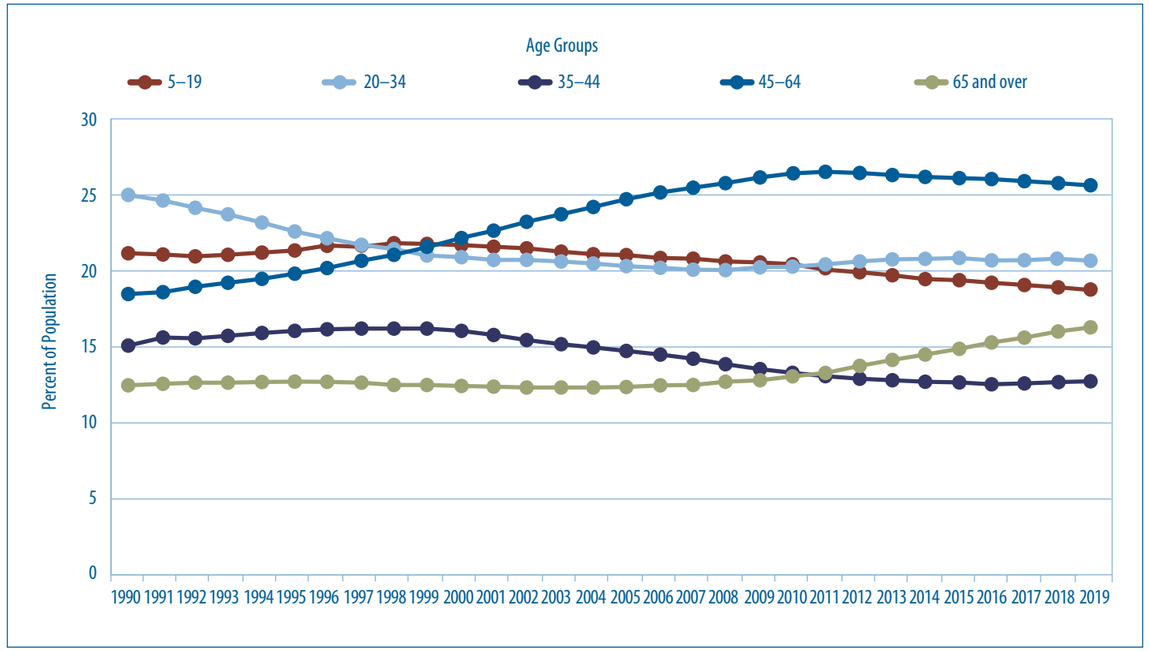
Source: U.S. Census, population and housing unit estimates

Figure 3: Population Distribution as a Percent of the Detroit Region, 1990–2019



Source: U.S. Census, population and housing unit estimates

Figure 4: Population Distribution as a Percent of Total United States, 1990–2019



Source: U.S. Census, population and housing unit estimates

Health Care Overview

In this section, we consider broad health care trends related to opioid use and deaths, suicides, mental health, general health risk factors, and access to care, comparing the West Michigan KOMA (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 Centers for Disease Control and Prevention's (CDC) IQVIA Xponent and Wide-ranging Online Data for Epidemiologic Research (WONDER). The mental health, risk factors, and access to care data are 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 may differ from those reported by respondents.

Opioid Prescriptions and Overdose Deaths

Figure 1 presents estimates of the number of opioid prescriptions dispensed per 100 persons per year from 2006–2018 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 denominators are 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 103 annual prescriptions per 100 individuals, which is more than one prescription per capita. Since 2012, the Detroit region has experienced a year-on-year decline in the prescribing rates; in 2018, the rate dropped to about 0.64 prescriptions per capita.

The trend for the KOMA region is more dramatic. Rates remained below that of the Detroit region prior to 2012, but then grew 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 in 2015. This rate has remained largely stable since 2015, with the rate being 0.59 prescriptions per capita in 2018. Overall, these trends suggest a reversal of opioid prescribing rates in the Detroit region to a level below that in 2006. While a similar trend is seen in KOMA from its peak in 2006, we also note a slight uptick in opioid prescriptions since 2015. Furthermore, the level in 2018 remains 27 percent higher than the low in 2006.

Figure 2 tracks the rate for overdose deaths per 100,000 individuals for the period 1999–2018, across both the KOMA and Detroit regions. To attain a sufficient sample size for analysis, we pooled two years' worth of data for estimates between 1999 and 2012, and then used single-year data for the remaining years from 2013 through 2018. It is worth noting that adjusting for age differences between the regions does little to change the reported trends, and, we report the unadjusted raw overdose deaths here. The cause of death is determined using death certificates for U.S. residents, and **Figure 2** reports the overdose deaths resulting for all drug-induced causes. The trends appear fairly similar for both the Detroit and KOMA regions during the years 1999–2014, 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 the regions: KOMA has remained steady at around an average of 17 deaths per 100,000 individuals; in the Detroit region, a continued growth from about 22 in 2014 to 34 per 100,000 in 2017 is concerning. Although the death rate still remains relatively high in 2018, we observe a decline in the trend between 2017 and 2018 in both the Detroit and KOMA regions. Specifically, the overdose death rate declined by 15 percent in KOMA and 6 percent in the Detroit region. The larger decline in the KOMA region, however, widens the gap between the trends by about 17 percentage points in 2018.

Taken together, **Figures 1 and 2** highlight that, while the volume of legal opioid dispensing has declined since 2012, the trend in deaths has continued to grow, particularly 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

This year, we continue to examine trends pertaining to suicides and mental health problems. **Figure 3** shows 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 1999–2018; we further note a spike in the death rate from 10.9 in 2013–2014 to 15.4 in 2015, suggesting an increase of 41 percent for the overall rate. Most recently, however, this rate fell to an average of about 13 deaths per 100,000 per year from 2016–2018. Looking at the suicide rates within the Detroit region, we note a similar increasing trend. Overall, the Detroit region saw a growth of 54.3 percent in the suicide rate, with most of the increase occurring since 2005–2006. In 2016 and 2017, the suicide rate in Detroit seemed to level slightly below the 2015 rate; however, there was a major uptick to 14 deaths per 100,000, per year in 2018.

Mental Health

Figure 4 reports the fraction of respondents to the BRFSS survey that report experiencing more than 14 days of poor mental health. Here, the numerator consists of the number of individuals who reported 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, on the other hand, is based on the total number of respondents in a given county. Looking at both the KOMA and Detroit regions from 2011–2018, we see that the rate of self-reported mental health issues has remained fairly stable across time. In 2018, KOMA experienced a slight uptick[1] in the rate to 14.1 percent; the Detroit region remained stable at 13.4 percent.

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 7.1 percent of the West Michigan population and 5.7 percent of the population in the Detroit region were classified as heavy drinkers in 2018. Rates of heavy drinking have remained largely stable from 2015–2018, though there is a slight decline in the heavy drinking trend in the Detroit region in 2018.

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 18.6 percent of the population of West Michigan and 18.3 percent of the Detroit region reported a binge-drinking episode in the past 30 days in 2018.

Figure 7 displays estimates of the proportion of the adult population who currently smoke cigarettes. As of 2018, about 18.5 percent of the KOMA population and 19.1 percent of residents in the Detroit region were current smokers. Using 2018 county population estimates, this equates to approximately 154,918 smokers in West Michigan and 522,518 smokers in the Detroit region. For the Detroit region, this marks a reduction of 22,753 smokers from 2017. In 2014, the CDC estimated that 15.5 percent of the U.S. population 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 2018 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. Specifically, we find that 64.6 percent of the smoking population in Kent county have attempted to quit smoking in the past year, while 64.7 percent of Wayne county residents report having done the same. These figures suggest that close to two thirds of the smoking population appear motivated to quit smoking. **Figure 9**, however, suggests that less than two-thirds of smokers report being referred to cessation resources by a physician in Kent county, whereas the referral to cessation resources are greater than two-thirds in Wayne county. This finding may be of interest to public health officials and medical care providers who could consider supporting smokers with smoking cessation.

Figure 7 suggests a downward trend in the 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 chewing tobacco and/or e-cigarettes. While our data does not allow us to look at these potential substitution patterns directly, **Figure 10** provides data on the use of chewing tobacco, snuff, or snus for two counties, Kent and Wayne, in 2018. Overall, the use rates for chewing tobacco, snuff, or snus appear considerably lower than cigarette rates at 3 percent of residents in Kent county and 1.3 percent in Wayne county.

Furthermore, the BRFSS survey asks about frequency of use for current e-cigarette users and whether a person is a former e-cigarette user. To get a large enough sample for reporting, we combined responses for 2018 from six counties in West Michigan (Allegan, Ionia, Kent, Montcalm, Montcalm, Ottawa) and seven counties in East Michigan (Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, Wayne). The results for this sample are reported in **Figure 11**, where we see that, overall, 2 percent of current users report smoking e-cigarettes every day, 3.9 percent report smoking some days, and 19.6 report being former e-cigarette smokers. Combined, this adds up to about 166,627 individuals across these counties who are either daily or occasional users of e-cigarettes. It is important to note that BRFSS data only covers the noninstitutionalized adult population (aged 18 or older) and cannot speak to recent trends in increased e-cigarette use among youth under 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).

Figures 12 and 13 track the share of the West Michigan and Detroit populations that are overweight or 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 2018, a little more than one-third of the population in each region was considered to be overweight and nearly another third was obese. In sum, 66 percent of adults in the KOMA region and 66.7 percent of adults in the Detroit region were either overweight or obese in 2018. These estimates are similar to the share of the overall U.S. population that is overweight or obese (Ogden et al., 2014). Studies place the health care costs associated with obesity at between 10 and 20 percent of total U.S. health-related spending (Cawley & Meyerhoefer, 2012; Finkelstein et al., 2009).

Finally, **Figure 14** plots the share of the population in each region reporting that their general health was either "fair" or "poor." About 19 percent of the residents in the Detroit region reported themselves to be in fair or poor health in 2018, while that number was close to 17 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, albeit a slight convergence shows up in 2018.

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

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 15** plots the percentage of the population in the KOMA and Detroit regions that report 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 September 2020, more than 790,000 people have enrolled in the Healthy Michigan expansion of the state's Medicaid program (MDHHS, 2020). In 2011, the first year of our data, nearly 16 percent of the adult population in the Detroit region was uninsured. By 2018, that figure had fallen to 5.8 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 5.7 percentage points from 2011 to 2017 (12.3 percent to 6.6 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 point uptick in the fraction of the population that reported having no insurance between 2016 and 2017, which then was followed by a 2 percentage point decline in 2018.

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 15. Figure 16** displays estimates of the share of the population that reported they were 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 2018 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 10.3 percent in 2016 to 11.3 percent in 2018 in the KOMA region.

Figure 17 continues the examination of access to care by tracking the share of the population that reports 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. In 2018, the uptick in the trend continued for the KOMA region, with a 1.5 percentage point increase from 2017 to 2018, surpassing the 2015 level. However, we observe a divergence in the trend for the Detroit region, where the share of individuals that reports a usual source of care plummeted by 1.6 percentage points in 2018.

Lastly, **Figure 18** plots the share of the population in West Michigan and the Detroit region with 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 four-fifths reporting the same in 2018. As such, approximately 20 percent of respondents in both regions went without an annual routine checkup in 2018. 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 www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm.

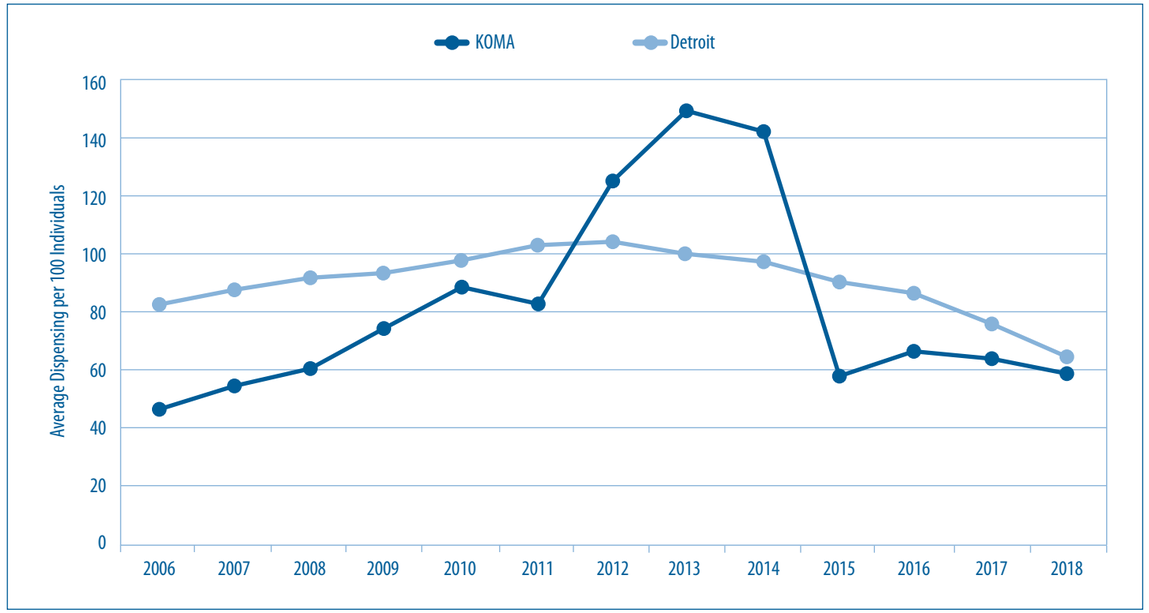
Centers for Disease Control (CDC). (2019). *E-cigarettes and Youth: What Educators and Coaches Need to Know.* Retrieved September 12, 2019 from www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/OSH-E-Cigarettes-and-Youth-What-Educators-and-Coaches-Need-to-Know-20190327-508.pdf?s_cid=osh-stu-feature-b2s-2019-002.

Finkelstein, E. A., Trogdon, J. G., Cohen, J.W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. *Health Affairs*, Web Exclusive. Retrieved September 16, 2020 from www.healthaffairs.org/doi/full/10.1377/hlthaff.28.5.w822.

Michigan Department of Health and Human Services (MDHHS). (2020). *Healthy Michigan Plan county enrollment.* Retrieved September 16, 2020 from www.michigan.gov/documents/mdch/HMP_County_Breakdown_Data_455353_7.pdf.

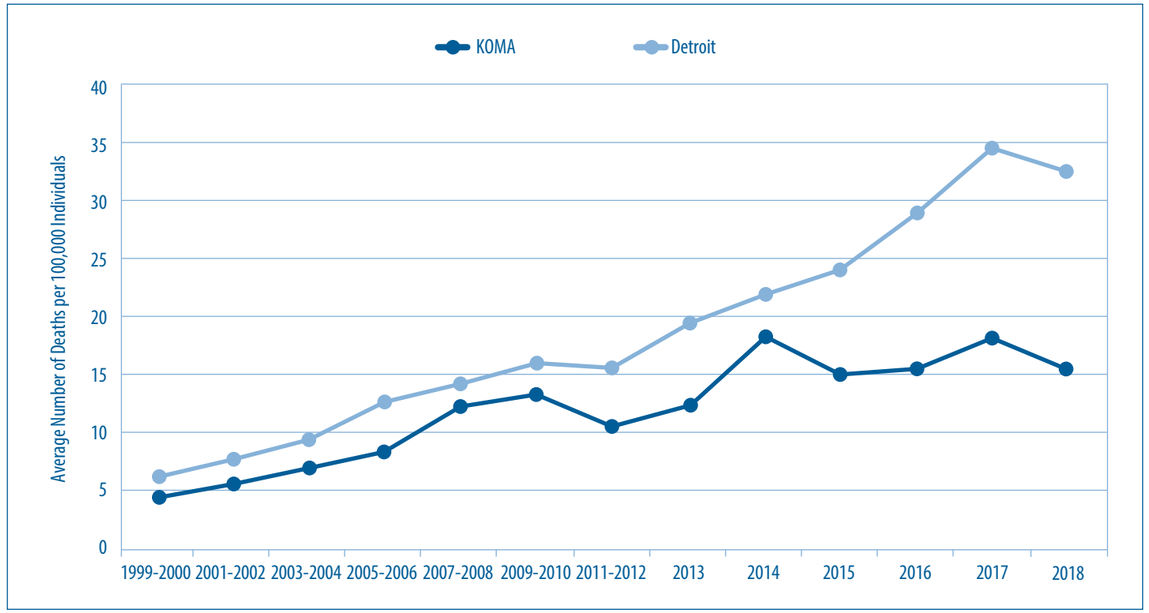
Ogden, C. L., Carroll, M.D., Kit, B. K., & Flegal, K.M. (2014). Prevalence of childhood and adult obesity in the United States. *Journal of the American Medical Association*, *311*(8): 806-814.

Figure 1: Opioid Prescription Dispensing, 2006–2018



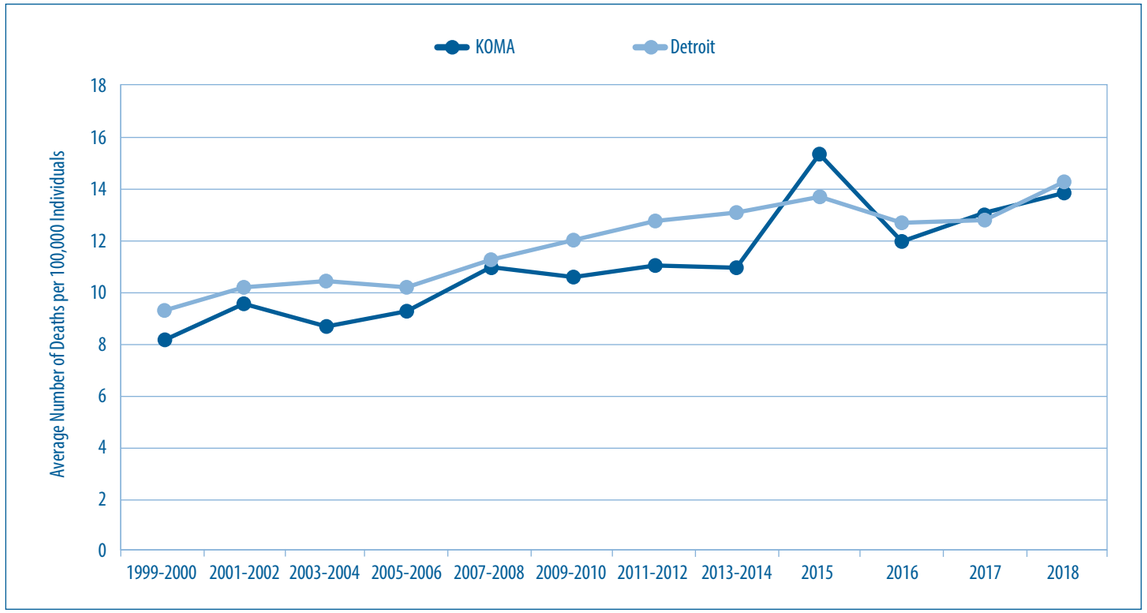
Source: CDC's IQVIA Xponent and Wide-ranging Online Data for Epidemiologic Research data, 2019

Figure 2: Drug Overdose Deaths, 1999–2018



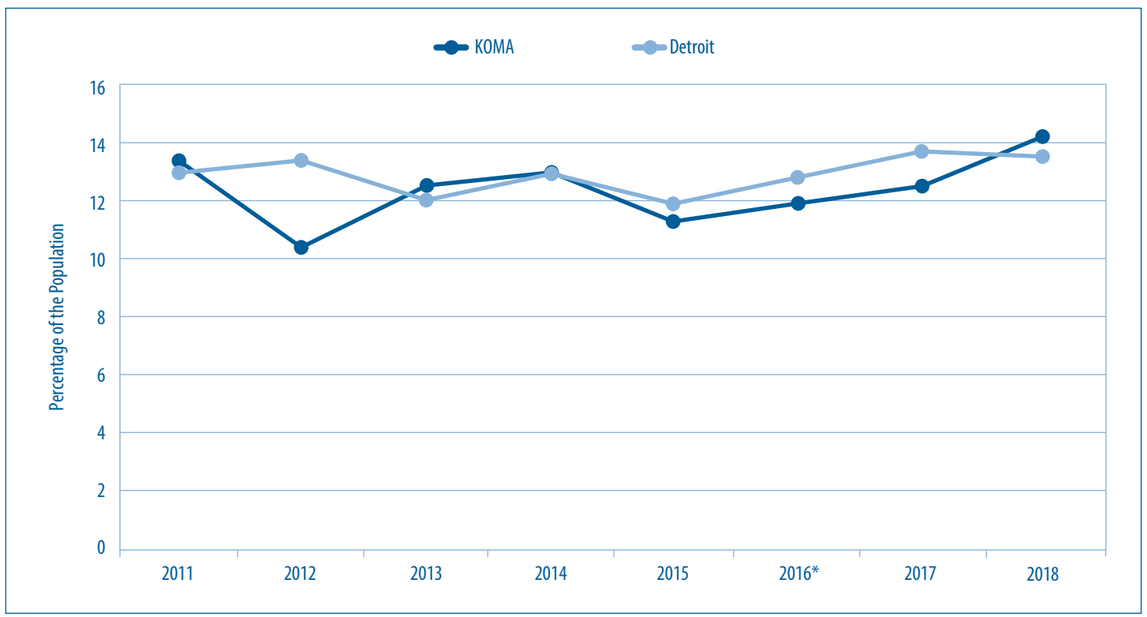
Source: Centers for Disease Control Compressed Mortality File data, 2019

Figure 3: Deaths from Suicide, 1999–2018



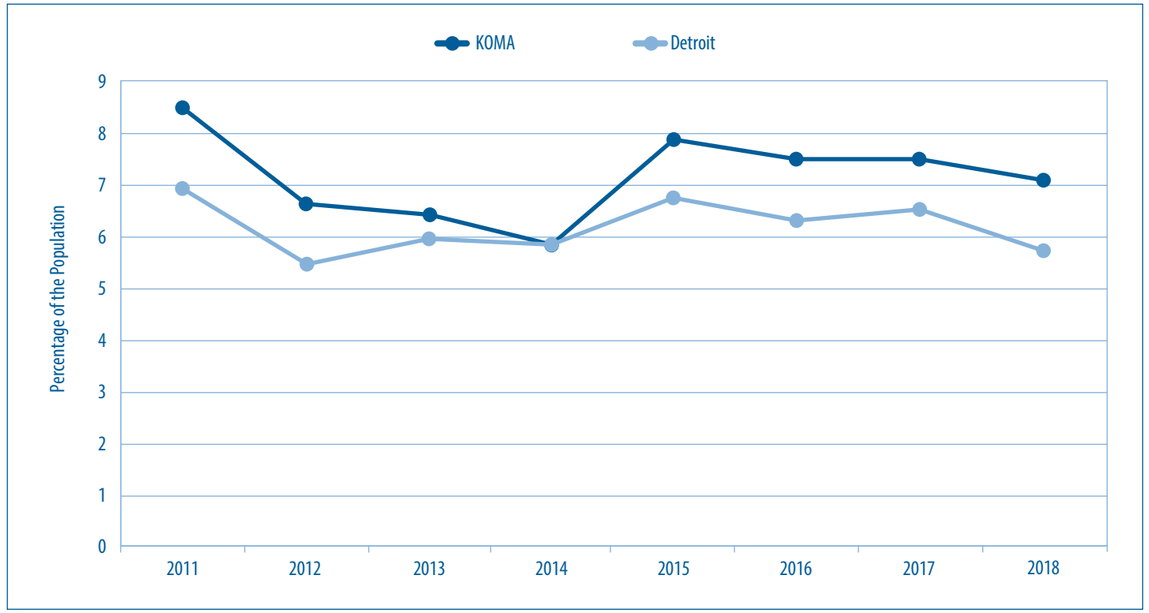
Source: Centers for Disease Control Compressed Mortality File data, 2019

Figure 4: Poor Mental Health Days, 2011–2018



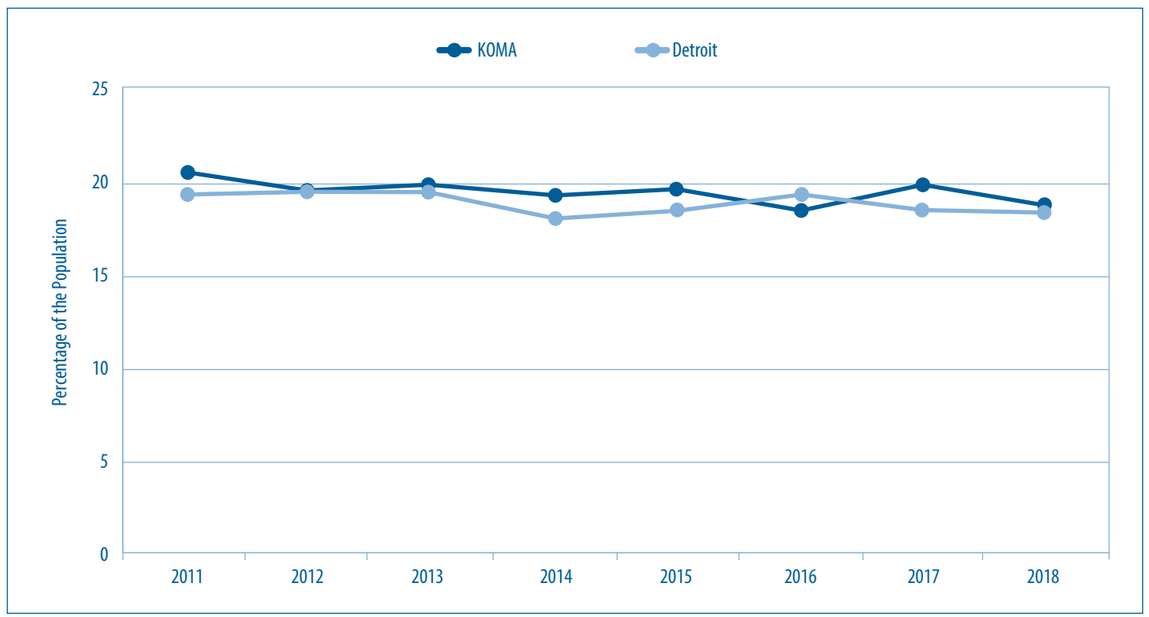
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents reporting 14 or more poor mental health days in the last month
*2016 data was missing and therefore we predicted using the weighted average of 2015 and 2017 data.

Figure 5: Heavy Drinking, 2011–2018



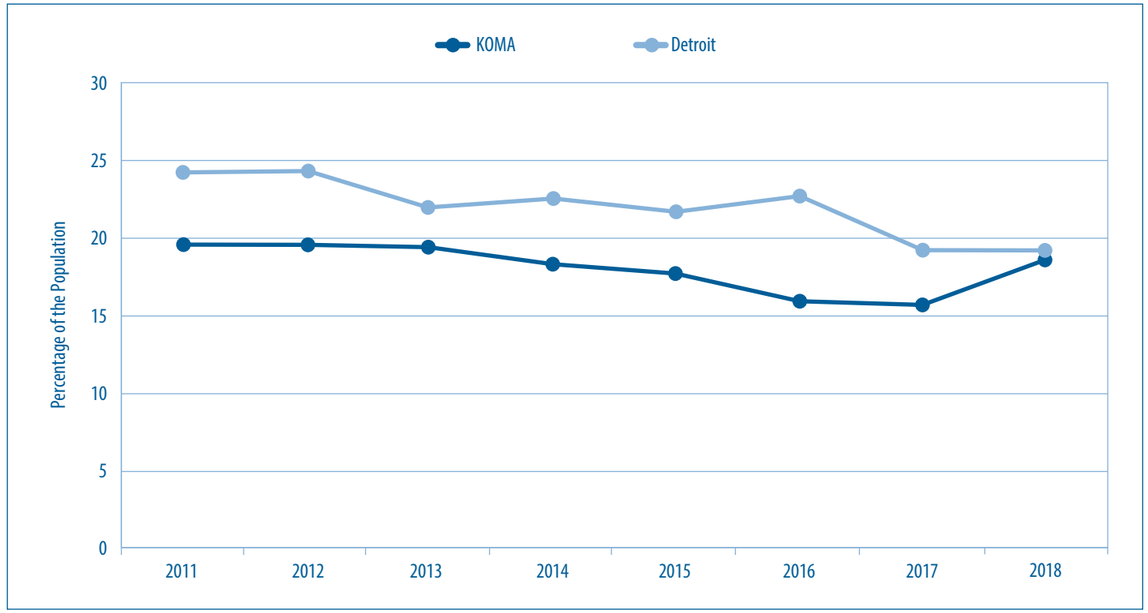
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents who reported consuming an average of more than two alcoholic drinks per day for men or more than one per day for women

Figure 6: Binge Drinking, 2011–2018



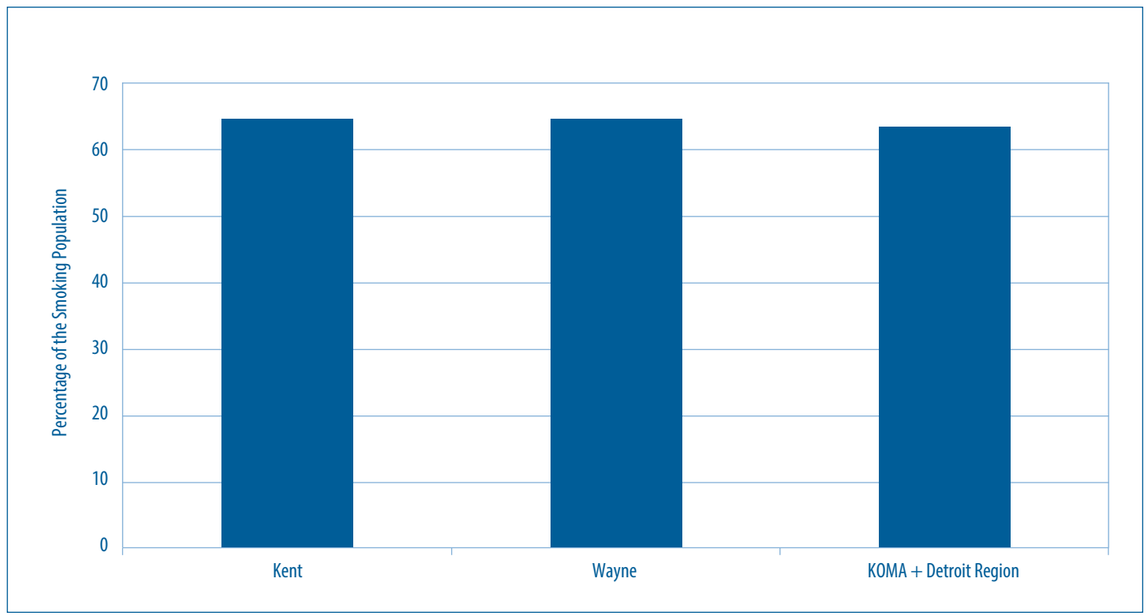
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents who reported consuming five or more drinks on a single occasion for men or four or more drinks on a single occasion for women

Figure 7: Current Cigarette Smokers, 2011–2018



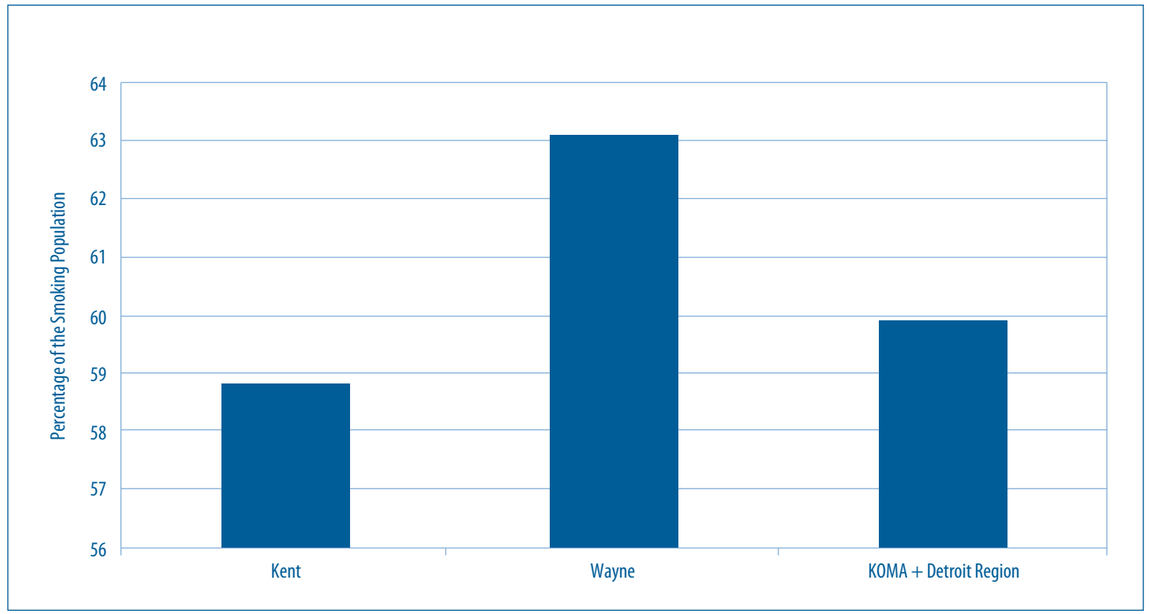
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion who reported that they had ever smoked at least 100 cigarettes in their life and who now smoke cigarettes, either every day or some days

Figure 8: Quit Smoking for at Least One Day in the Past 12 Months in 2018



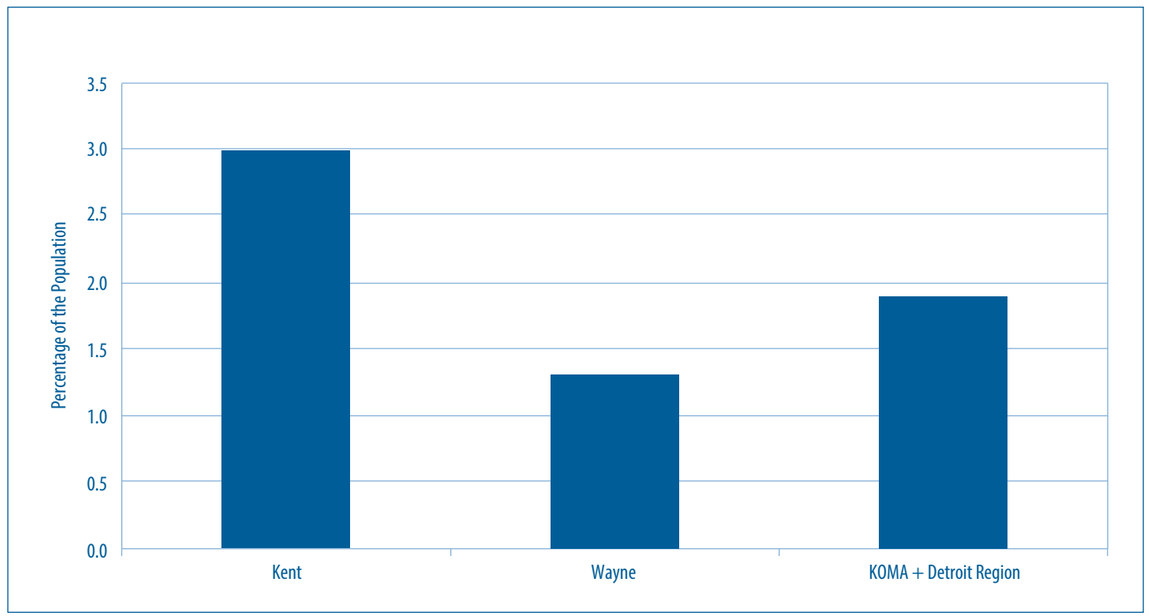
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all current smoking adults, the proportion who reported having quit smoking for at least one day in the past 12 months

Figure 9: Physician Referral of Smokers to Cessation Resources, 2018



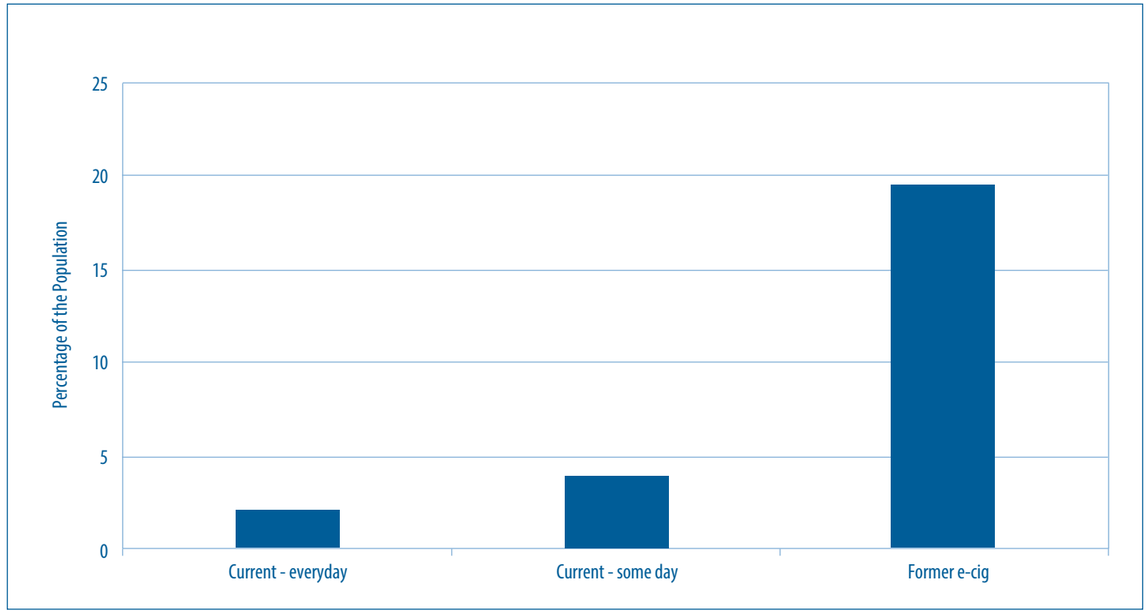
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019

Figure 10: Current Use of Chewing Tobacco, Snuff, or Snus in 2018



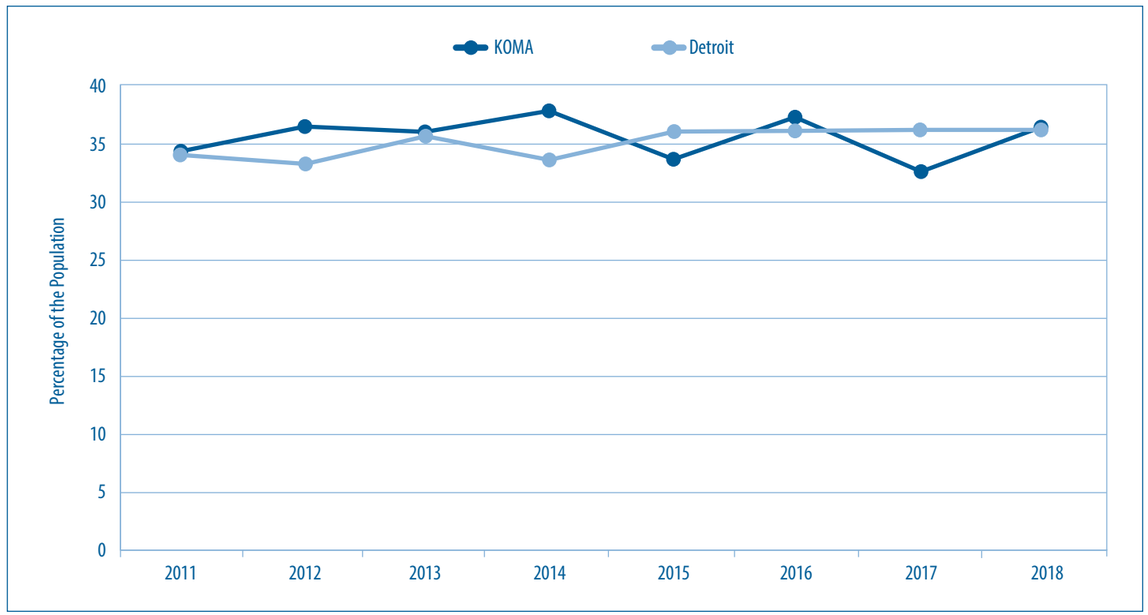
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019

Figure 11: Current vs. Former E-cigarette User Status in 2018



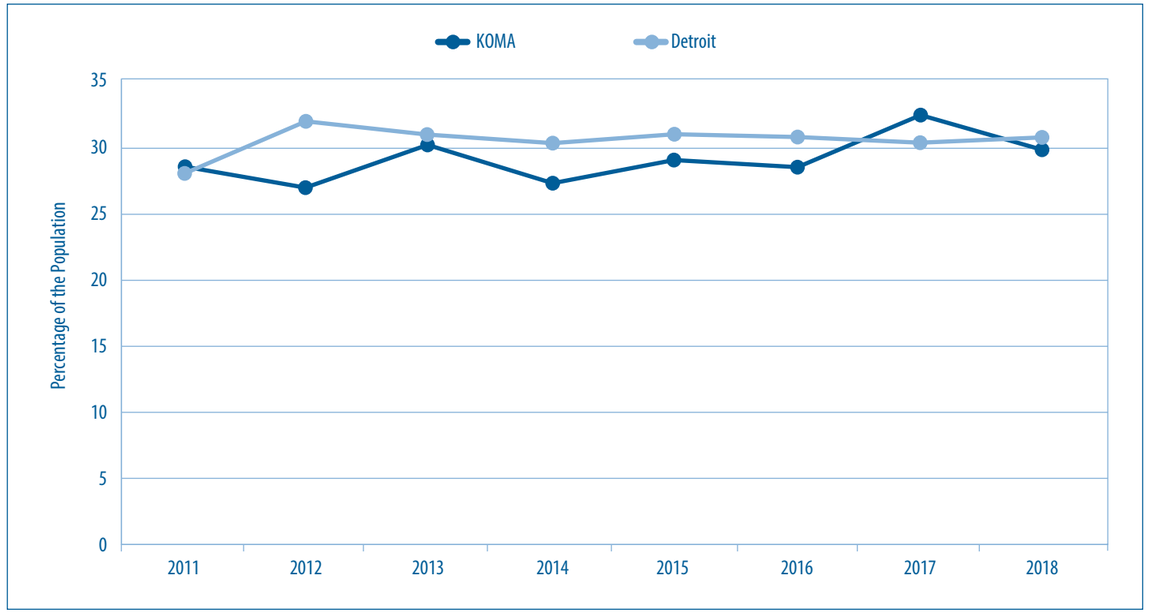
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion who reported that they are current or former e-cigarette users
Note: This figure uses combined responses for greater west and east Michigan counties.

Figure 12: Overweight, 2011-2018



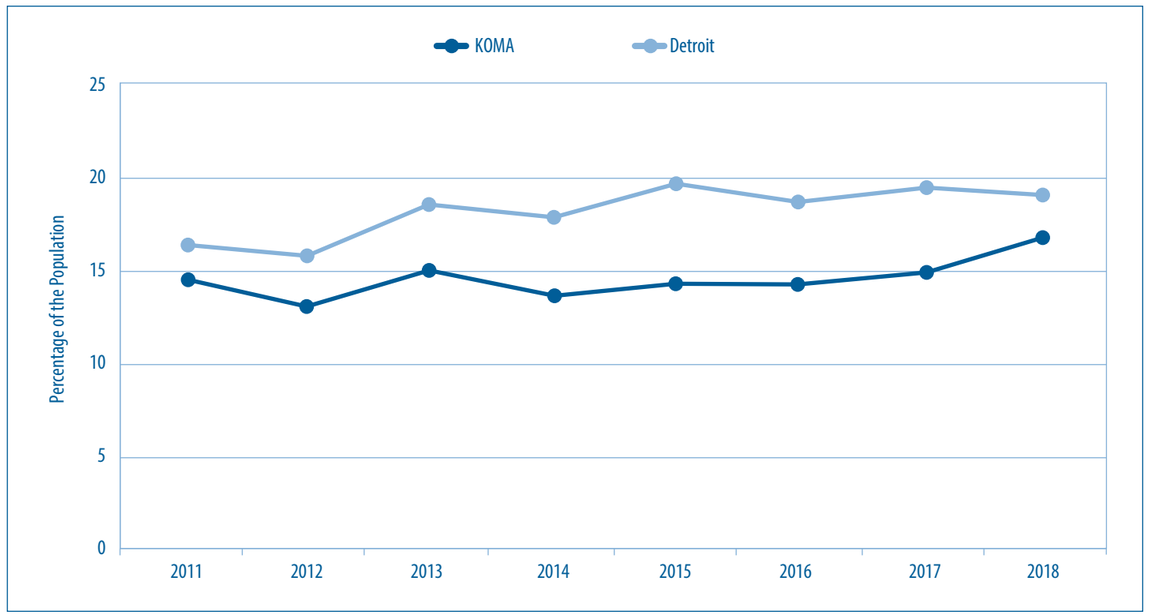
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents whose Body Mass Index (BMI) was greater than or equal to 25 and less than 30

Figure 13: Obesity, 2011–2018



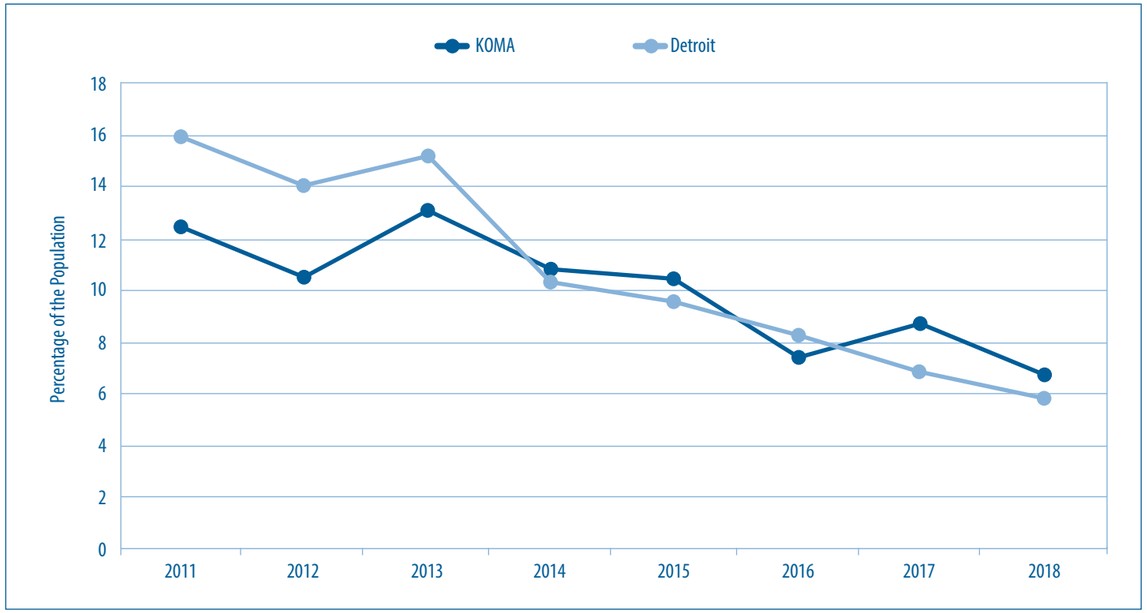
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents whose Body Mass Index (BMI) was greater than or equal to 30

Figure 14: Health Status - Fair or Poor Health, 2011–2018



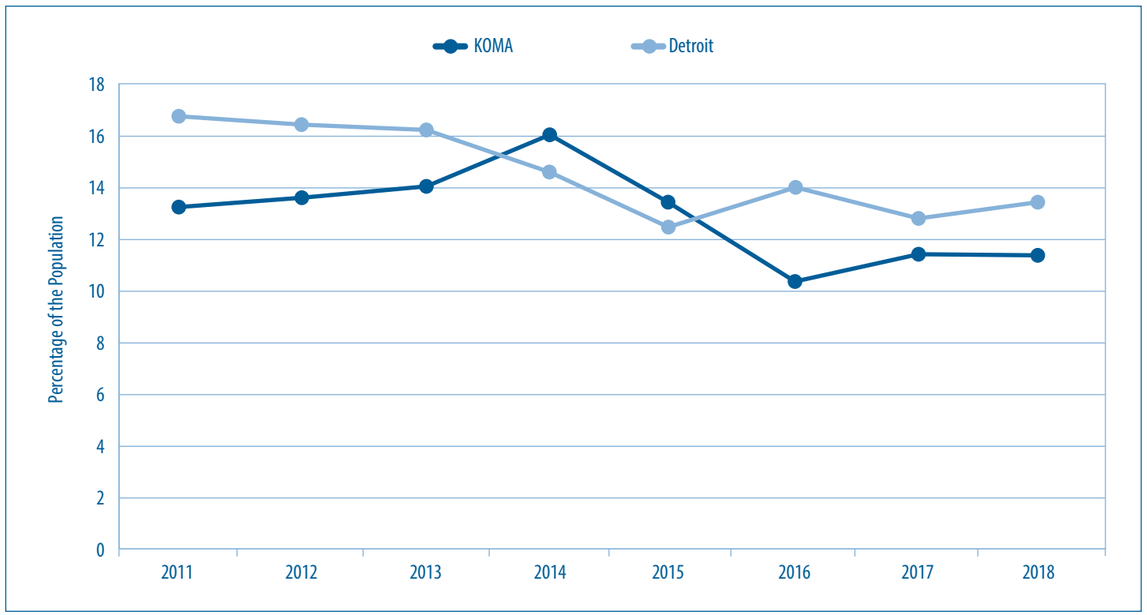
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion of respondents who reported that their health, in general, was either fair or poor

Figure 15: No Health Insurance, 2011–2018



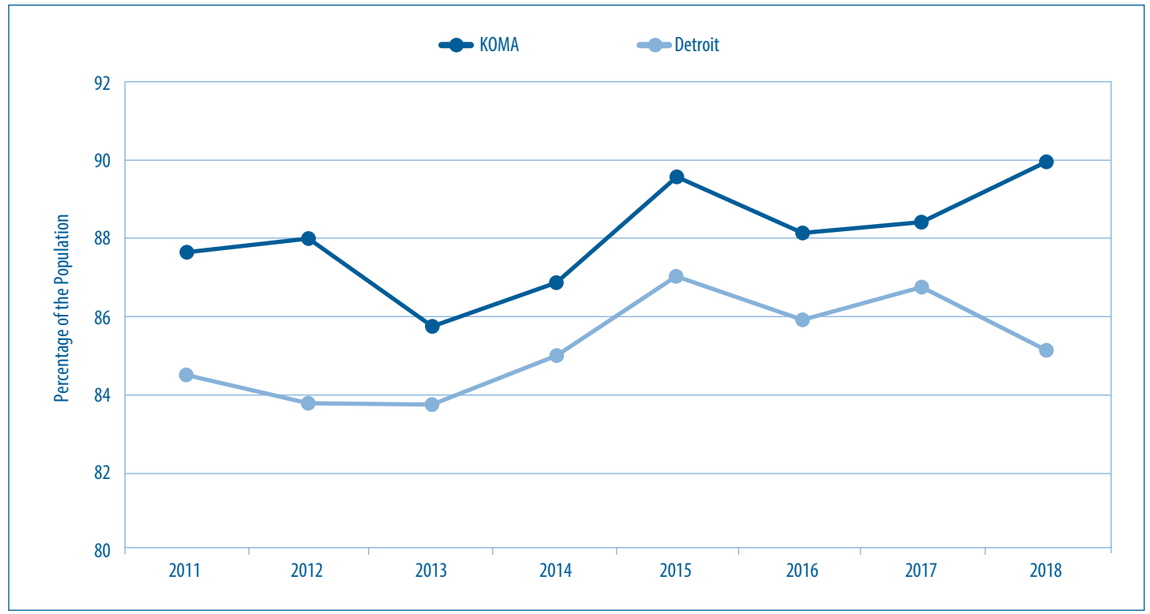
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among adults age 18-64 years, the proportion who reported having no health care coverage, including health insurance or prepaid plans such as HMOs

Figure 16: No Health Care Access Due to Cost, 2011–2018



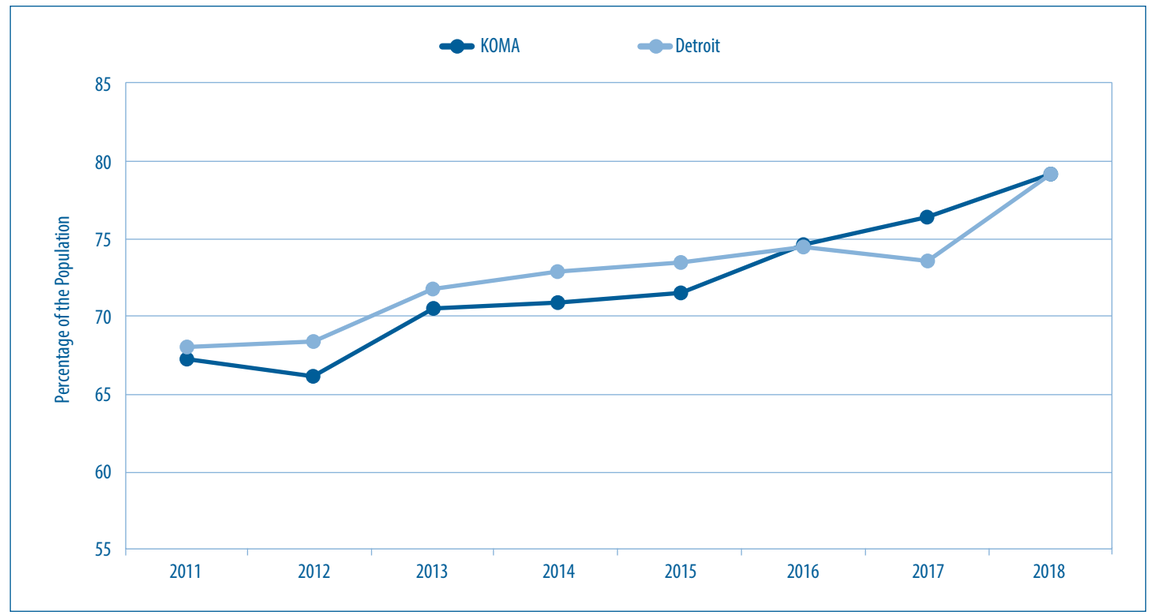
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion who reported that in the past 12 months, they could not see a doctor when they needed to due to the cost

Figure 17: Has a Usual Source of Care, 2011–2018



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion who reported that they have a usual source of care when ill

Figure 18: Had Routine Checkup in Past Year, 2011–2018



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2019
Definition: Among all adults, the proportion who reported that they had a routine checkup in the past year

Health Care Spending During COVID-19

In this year's report, we use novel data on consumer spending to obtain insights into the economic implications of the novel coronavirus (COVID-19) outbreak. The consumer spending data come from the Opportunity Insights Economic Tracker, which tracks aggregate credit and debit card spending collected by Affinity Solutions Inc. The ability to track consumer spending at a higher frequency (i.e., days) allows us to understand the immediate economic implications of COVID-19. The data are seasonally adjusted and show percentage changes relative to the mean of January 2020. Moreover, it closely tracks the historical benchmarks of retail spending and services (Chetty et al., 2020). A limitation of the data is that Affinity Solutions captures about 10 percent of debit and credit card spending in the U.S. Chetty and coauthors (2020) note that the Affinity data can be viewed as representative statistics of total card spending, but not total consumer spending. In this section, we are going to specifically focus on health care and social assistance spending by consumers during COVID-19.

Health care spending consists of expenditures associated with the following subsectors: ambulatory health care services (e.g., physician's offices or dentist's offices), hospitals (e.g., medical, diagnostic, and treatment services), and nursing and residential care facilities (e.g., mental health and substance abuse facilities). On the other hand, social assistance services include individual and family services, vocational rehabilitation services, child day care services, community food and housing, and emergency and other relief services. Note that these services are on a short-stay basis and do not require residential stay.

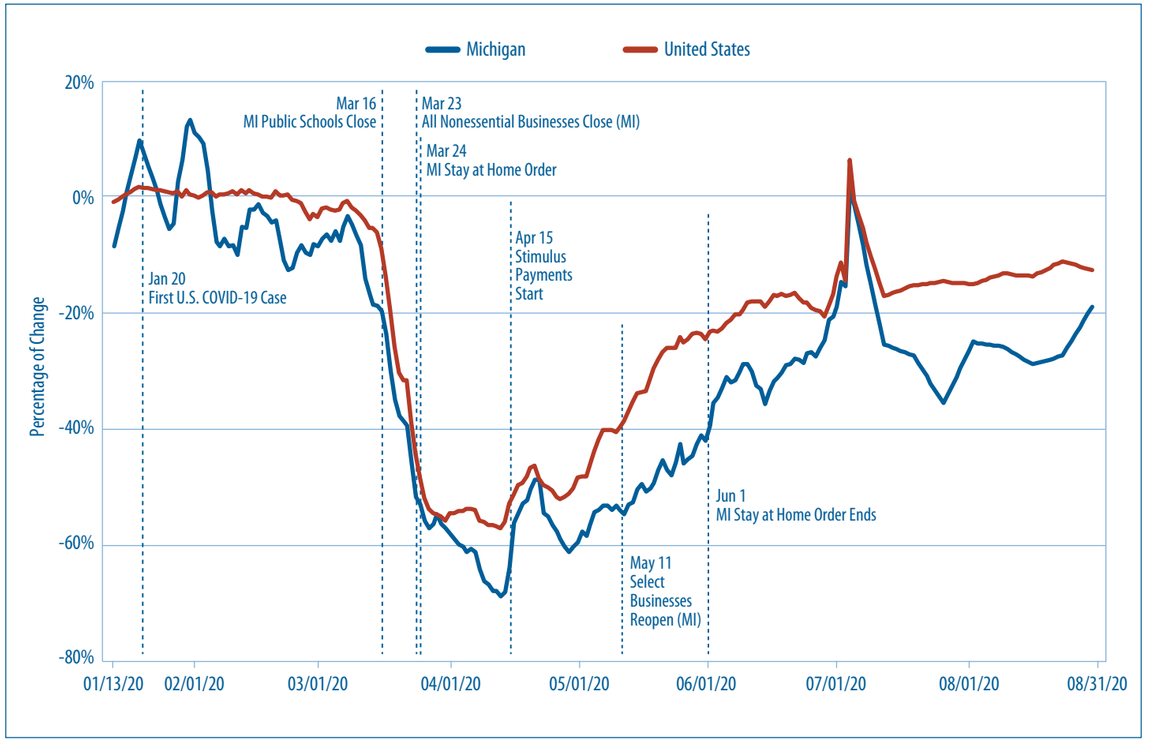
Figure 1 shows a large reduction in health care and social assistance spending following the mitigation measures implemented by the State of Michigan. Specifically, we observe a more than 60-percent reduction in health care and social assistance spending in Michigan followed by public school and nonessential business closures, respectively, on March 16 and March 23, and the stay-at-home order on March 24. We observe a recovery in consumer spending after the start of stimulus payments on April 15. This upward trend continues after select businesses opened and the stay-at-home order ended in Michigan. Despite the positive trend, health care and social assistance spending was down by about 19 percent in Michigan and 13 percent in the U.S. by the end of August. One of the reasons for reductions in health care spending may be the limitations in accessing health care. For example, Aslim and Mungan (2020) highlight these access problems among individuals seeking treatment for substance use disorders during COVID-19. If individuals cannot access health care for conditions that require treatment, we might expect an increase in non-COVID mortality amid the pandemic.

References

Chetty, R., Friedman, J., Hendren, N., & Stepner, M. (2020). The economic impacts of COVID-19: Evidence from a new public database built from private sector data. Working paper. opportunityinsights.org/wp-content/uploads/2020/05/tracker_paper.pdf.

Aslim, E.G., & Mungan, M.C. (2020). Access to substance use disorder treatment during COVID-19: Implications from reduced local jail populations. *Journal of Substance Abuse Treatment*, 119, 108147. www.sciencedirect.com/science/article/pii/S0740547220304049.

Figure 1: Percent Change in Health Care and Social Assistance Spending by Consumers During COVID-19



Source: Opportunity Insights Economic Tracker, tracktherecovery.org

Source: Opportunity Insights Economic Tracker, tracktherecovery.org

Economic Analysis

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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 1-6 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.

Figure 1 includes data on the number of hospital beds per 1,000 residents in each region from 2005 to 2018. This measure serves as a proxy for hospital capacity. For Grand Rapids, per capita hospital inpatient capacity has remained relatively flat over the past decade while it has declined in the U.S. and benchmark communities. 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. While Grand Rapids continues to present with fewer beds per capita than the national average, with an increase from 1.90 to 1.99 from 2017 to 2018, the gap has narrowed since 2010. As greater hospital capacity could lead to higher overhead costs and more expensive hospital care, Grand Rapids risks losing its comparative advantage if this trend continues.

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 saw increasing admission rates beginning in 2007 until 2015, when the trend seems to have leveled off or reversed.

Figure 3 plots per capita outpatient visits from 2005 to 2018. 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 in the previous two years, Grand Rapids and Detroit differ from the benchmark communities and the U.S. with a much steeper slope of increased outpatient visits.[2]

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 for 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 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 non-hospital settings are often categorized as hospital outpatient visits under a provider-based billing system. As such, what appears to be more than a doubling of per capita outpatient visits to hospitals in Grand Rapids from 2005 to 2018 likely reflects a change in billing practices.[3] Of interest, in July 2018, 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, they 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, 2018b). Even though this initiative was successfully challenged in court by hospital groups in 2019, the U.S. Court of Appeals ruled in 2020 that the Department of Health and Human Services may proceed with the action. This development may impact the trends shown in **Figure 3** in future Health Check reports.

[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] The values in **Figure 3** are calculated as the ratio of outpatient visits to the number of area residents, meaning the admissions of those living outside the Grand Rapids or Detroit areas are included in the numerator, but not in the denominator. Admissions of such individuals to KOMA hospitals remained steady at approximately 20 percent over the 2006–2016 period, however, this consideration is likely not responsible for any observed trends in outpatient visits.

[3] According to the 2012 Medicare Payment Advisory Commission 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." (Medicare Payment Advisory Commission, 2012, p. 73)

Figure 4 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, ED use in Grand Rapids was below both the benchmark communities and the national average with 363 ED visits per 1,000 residents. By 2015, ED visits in Grand Rapids had increased to 477 per 1,000 residents. Overall, this trend of increasing ED use in Grand Rapids appears to have begun to reverse since 2015, resulting in use per capita being roughly equal to the benchmark in 2017 and 2018. This 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 non-emergent 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.

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 5** indicates that our average hospital lengths of stay, conditional on admission, tend 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.

Finally, **Figure 6** 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 it is good that Grand Rapids has exceeded the national average since 2016, it continues to remain below both the benchmark communities and the Detroit region.

Hospital and Medical Expenditures

Figure 7 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 continues to remain below the national average and the benchmark level, and it has remained fairly flat since 2005. There has been some narrowing of the gap between Grand Rapids and the benchmark communities since 2016. On the other hand, Detroit has relatively high levels of compensation for hospital employees.

Figure 8 displays total hospital expenses per admission. It is important to recognize that **Figure 8** is measuring the expenses reported by the hospital to provide treatment for the average admission, but it 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 2017 to 2018, expenses per admission continued to rise for all regions. Despite the relatively low hospital employee compensation noted in **Figure 7**, we see that hospital expenses per admission in Grand Rapids are significantly higher than the national average and are approximately $5,170 greater per admission than Detroit in 2018. This marks a $2,450 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 $32,000 in 2018.

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). Based on the available data, it is not clear how much this second explanation is playing a role. On one hand, the steady number of per capita admissions in **Figure 2** and the rise of outpatient visits in **Figure 3** could indicate success at moving less-severe cases to an outpatient setting. On the other hand, the steady length of stay shown in **Figure 6** does not suggest that high-severity patients are more concentrated among the remaining hospitalizations. Estimates in **Figure 8** 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 9 plots per capita Medicare expenditures for both Fee-for-Service (FFS) and Medicare Advantage (MA) enrollees from 2007 through 2018. 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, 2018c). Measures of MA expenditures were calculated using year-specific benchmark payment rates, which provides an approximate estimate of county-level MA spending. Due to the nature of the data used to construct **Figure 9**, 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 9** 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. Following a steady decline in per-member Medicare expenditures for nearly all regions and the U.S. between 2009 and 2015, the trend has reversed itself. In fact, Grand Rapids has experienced a greater increase ($1,245) since 2015 than any of the comparison groups: $1,058 for the benchmark, $866 for the national average, and $553 for Detroit. In 2018, for the first time, per-enrollee Medicare expenditures in Grand Rapids are above the national average. Greater investigation is needed into the reasons behind the surge in Grand Rapids' numbers, which may be due to some combination of changes in characteristics or needs in the city's Medicare population and the ways in which they are treated.

In conclusion, while Grand Rapids compares favorably to the other regions on metrics associated with efficiency, there are several areas of concern and potential opportunities for 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 have grown at a relatively steep rate since 2005. While some relative success in moving less-severe cases to an outpatient setting could explain these trends, the available data is not conclusive. The rather steep increase in Medicare expenditures between 2016 and 2018 is a concern. 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.

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). (2020). *AHA hospital statistics 2020 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 www.cms.gov/newsroom/press-releases/cms-empowers-patients-and-ensures-site-neutral-payment- proposed-rule.

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

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

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.

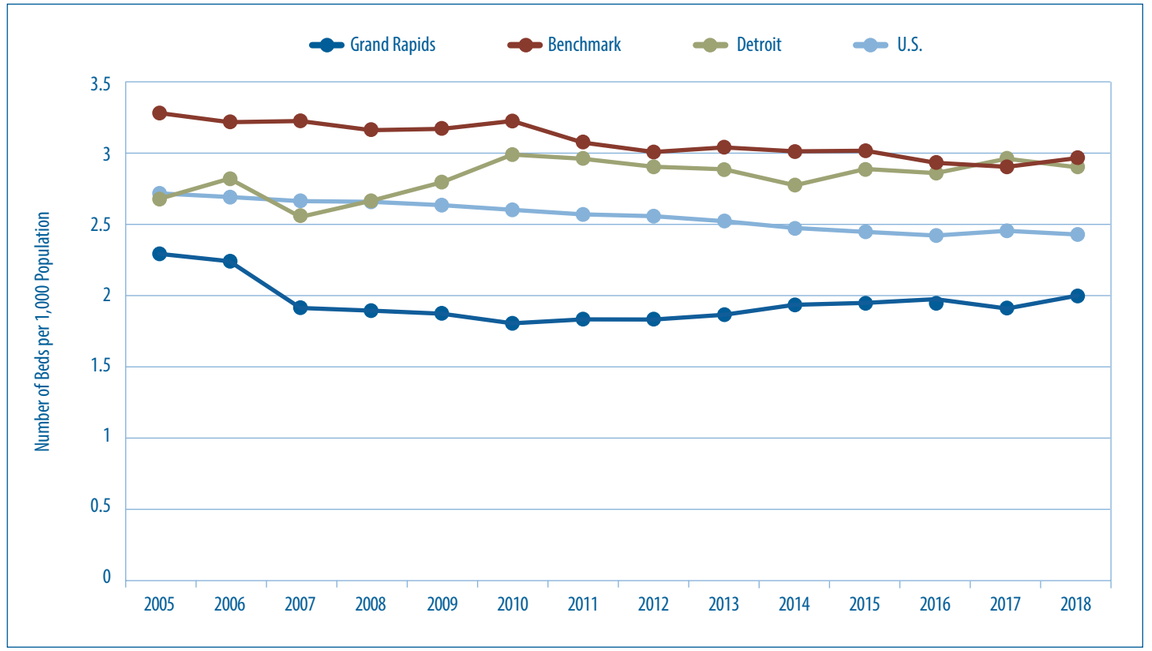
Kumar, R.K. (2011). Technology and healthcare costs. *Annals of Pediatric Cardiology*, *4*(1), 84-86.

Medicare Payment Advisory Commission (MedPAC). (2012). *Report to the Congress Medicare Payment Policy*. Retrieved September 10, 2016 from 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.

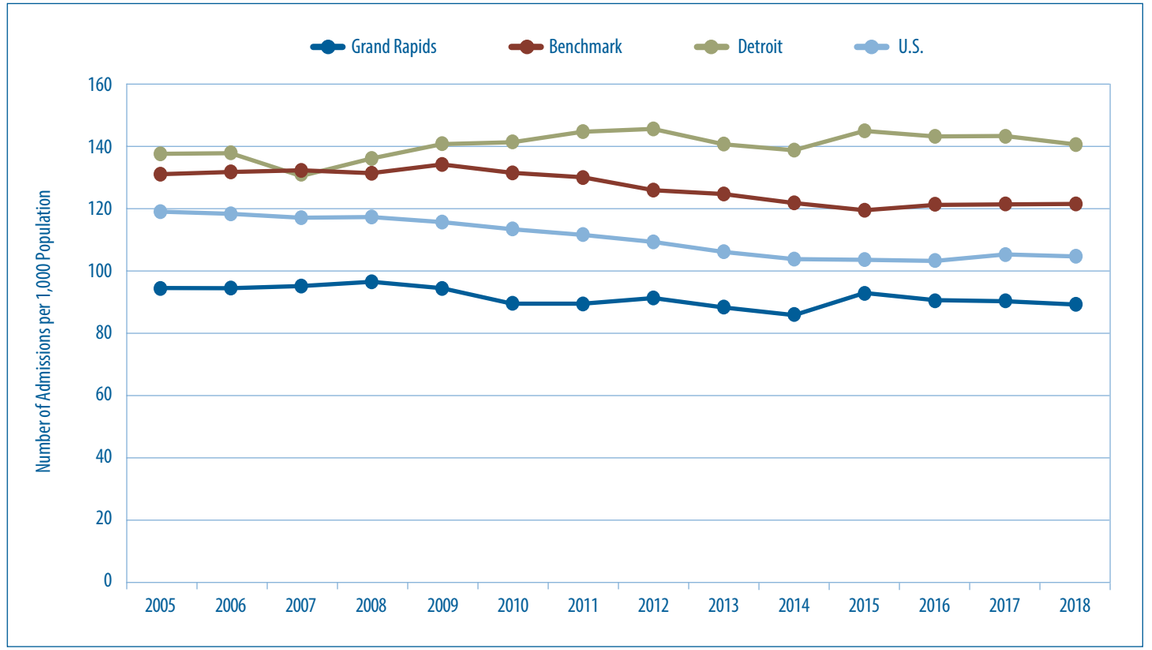
Weinick, R.M., Burns, R.M., & Mehrotra, A. (2010). Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Affairs*, *29*(9), 1630-1636.

Figure 1: Hospital Beds, 2005–2018



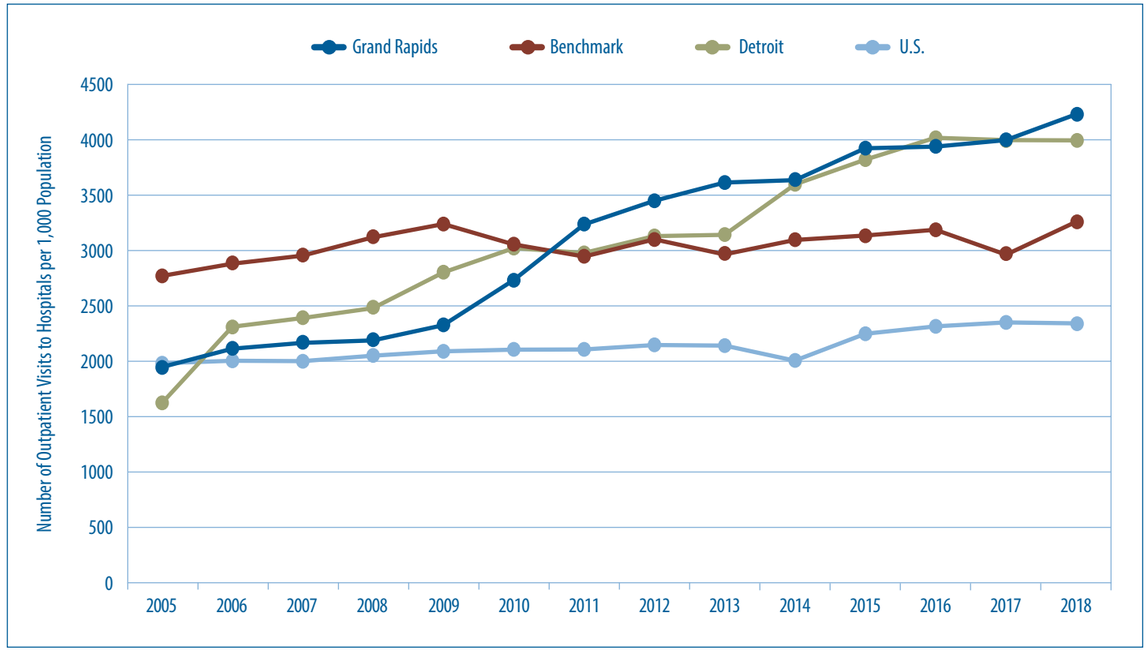
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 2: Hospital Admissions, 2005–2018



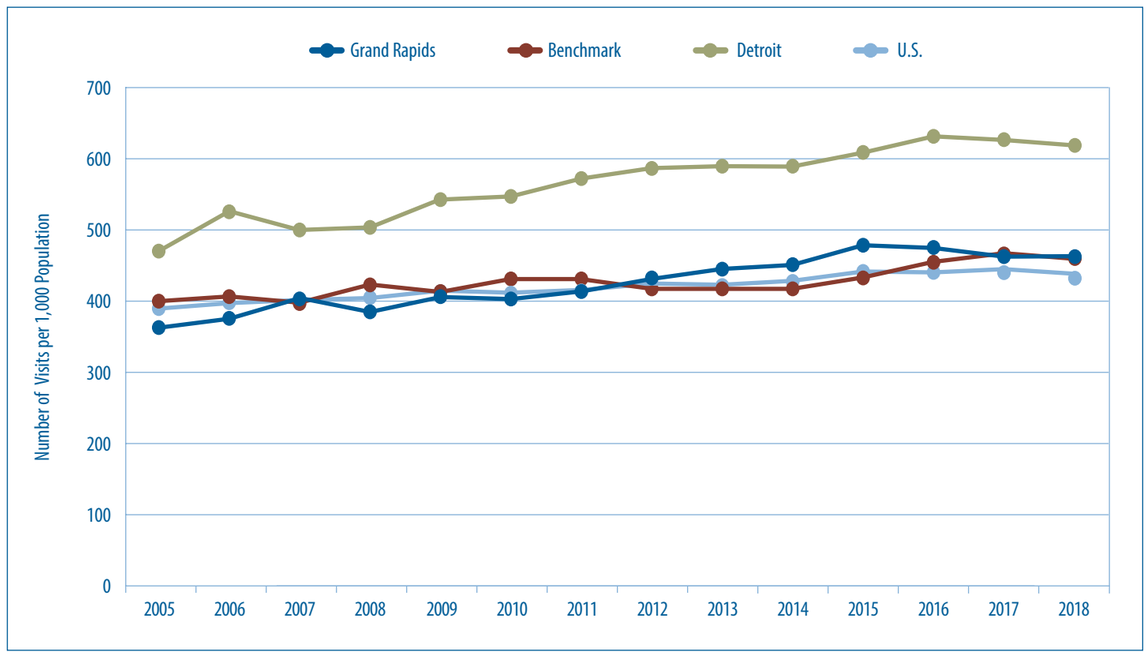
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 3: Outpatient Visits to Hospitals, 2005–2018



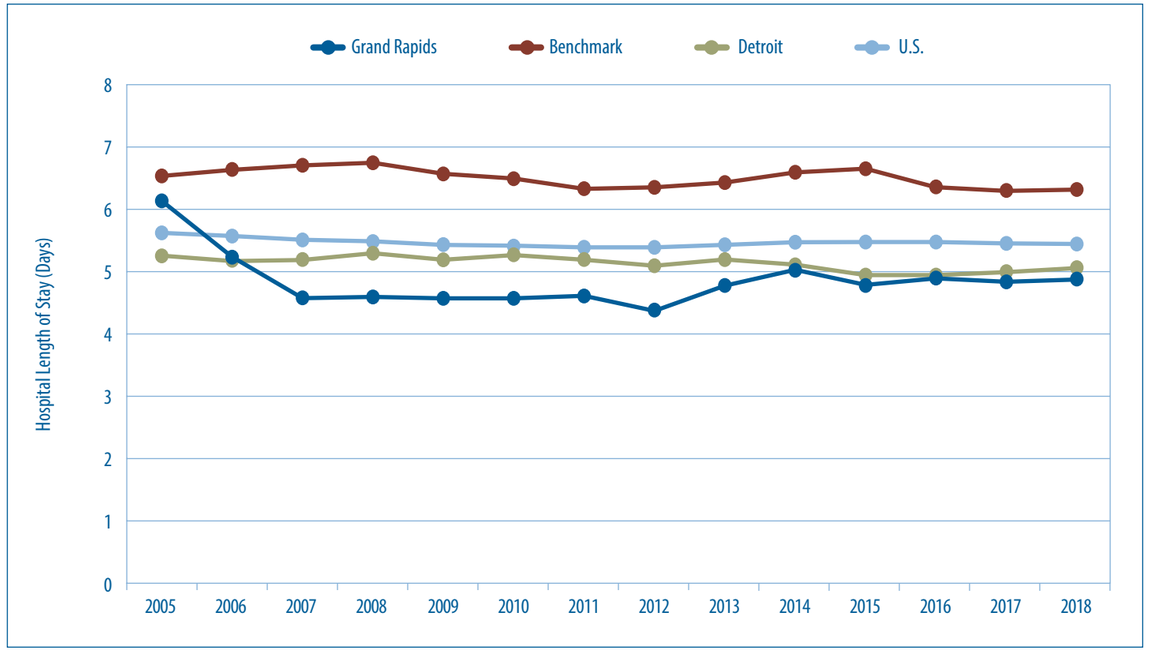
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 4: Emergency Department Visits, 2005–2018



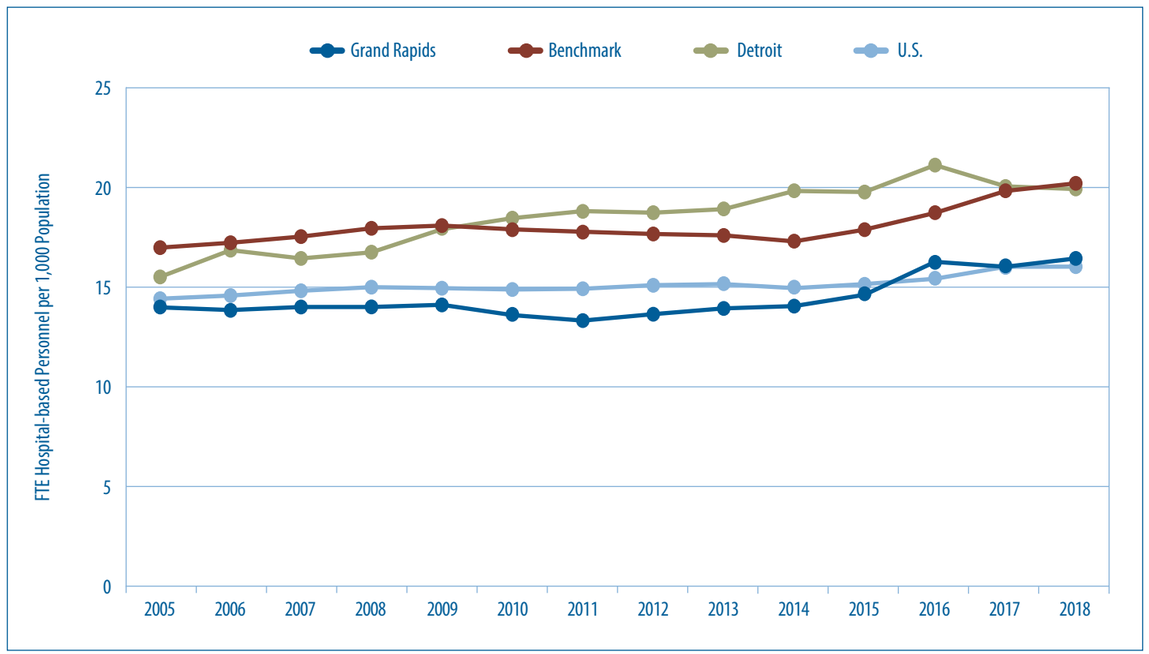
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 5: Average Hospital Length of Stay, 2005–2018



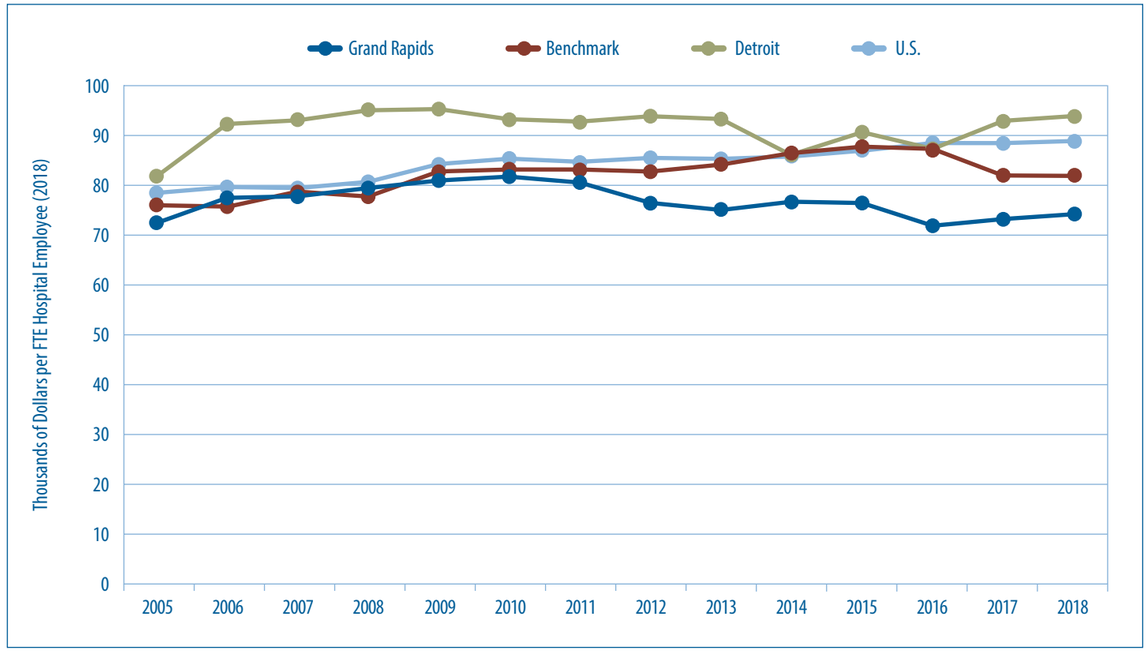
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 6: FTE Hospital-based Personnel, 2005–2018



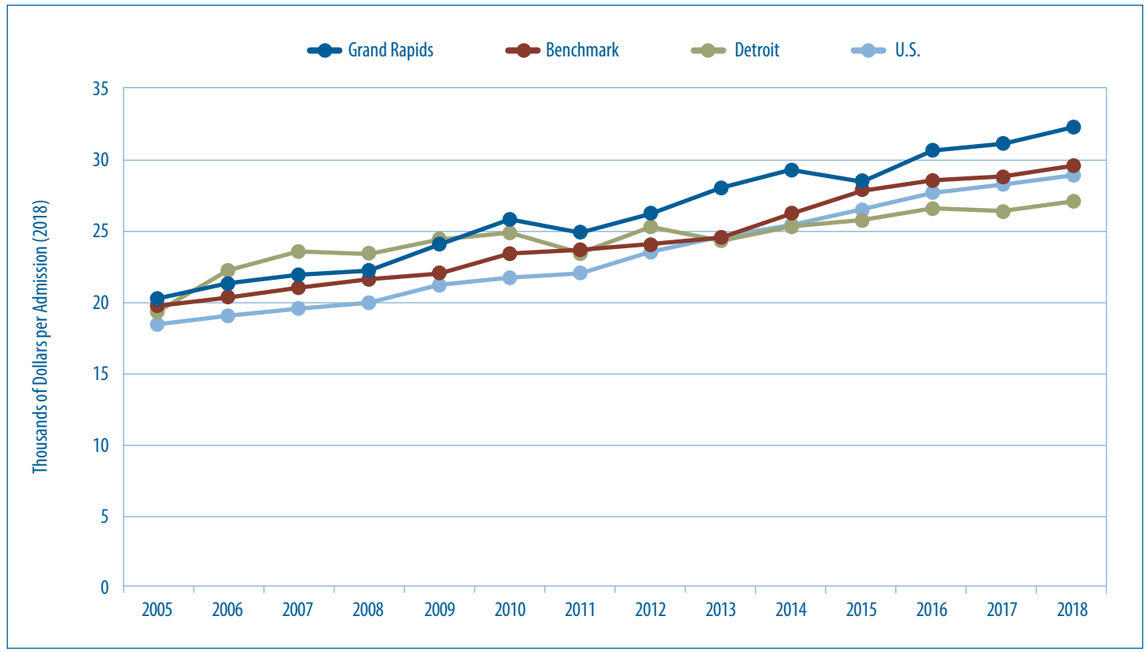
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 7: Average Payroll and Benefit Expenses, 2005–2018



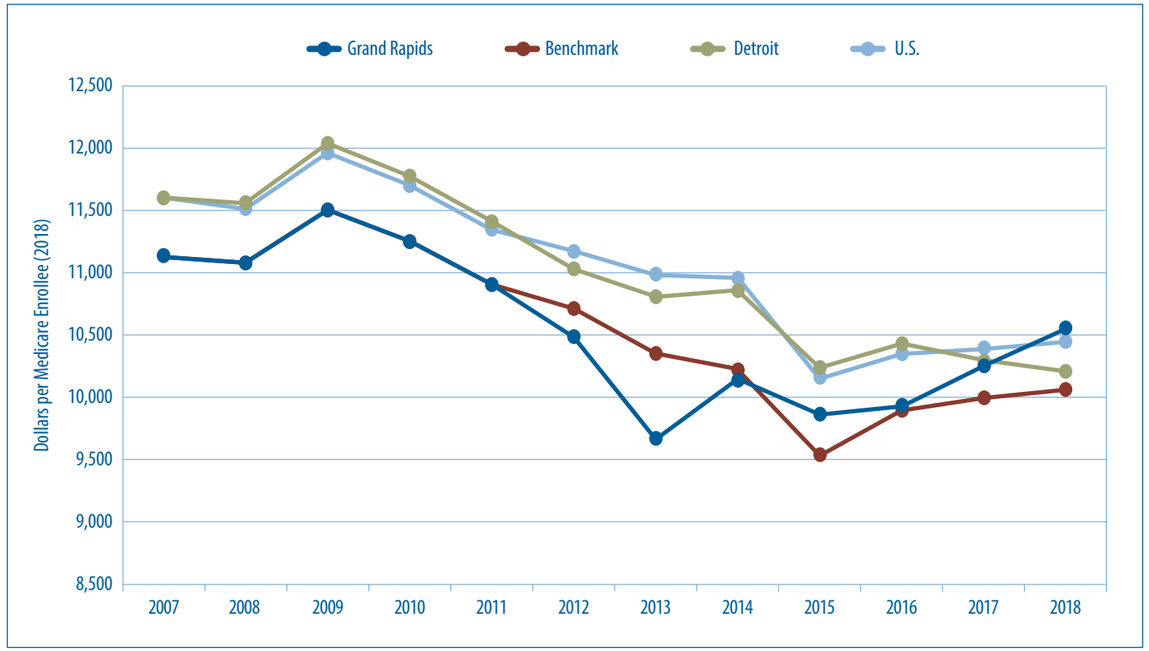
Source: American Hospital Association, AHA hospital statistics, 2020

Figure 8: Total Hospital Expenses, 2005–2018



Source: American Hospital Association, AHA hospital statistics, 2020

Figure 9: Adjusted Average Medicare Expenditures, 2007–2018



Sources: CMS Geographic Variation Public Use File; CMS Monthly Enrollment by Contract/Plan/State/County Files; CMS Plan Payment Data Files, 2020

Major Medical Conditions: Expenditure 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 2018-2019.[1] 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 more sick 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 these 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.

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.[2] For comparison, we also include "healthy members," which we define 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 these conditions in Kent, Ottawa, Muskegon, and Allegan (KOMA) counties in 2018 and 2019. 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 2019 dollars.

We note that, even after adjusting for inflation, **Figure 1a** indicates that changes in expenditures from 2018 through 2019 were mixed across the six conditions. **Figure 1b** further highlights the percentage change to average member costs. Here we note that expenditures increased for diabetes (6.1 percent), depression (5 percent), and hyperlipidemia (2.6 percent). On the other hand, expenditures decreased for asthma (-6.7 percent), CAD (-1.5 percent), low back pain (-2.6 percent), and for healthy members (-8.0 percent). In dollar terms, the greatest average per-member increase in expenditures were seen in diabetes ($1,000) and depression ($633).

[1] Analysis of expenditures in previous Health Check reports was based on total allowable expenses for members with prescription coverage. While this variable is present in this year's data for BCBSM and BCN data, it is not present for PH due to a coding change. As an alternative, we used PH data from the previous year (2018) to estimate the share of total allowable expenses incurred among members without prescription coverage as a linear function of the share of total member months that were without prescription coverage. Only member ZIP codes from 2018 with a share of uncovered months between 0 and 1 were used for the estimation. The model fit the 2018 data well ($R^2 = 0.701$) and the estimated coefficients were used to produce predicted shares for the 2019 data. The predicted shares were used to build total allowable expenses for members with prescription coverage for the member ZIP codes in 2019 with a share of uncovered months between 0 and 1 (25 percent of observations). For the remaining 75 percent, the share was inferred as 1 for member ZIP codes with no covered months and 0 for member ZIP codes where all months had prescription coverage.

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

Unfortunately, we are unable to identify the cause of the increased spending on diabetes and depression. Possible causes include a change in the composition of non-Medicare/Medicaid patients insured by BCN, BCBSM, and PH; an increase in treatment intensity for diabetes and depression; or an increase in the prices of treatments commonly received by members with these diagnoses. To better understand these trends, we have begun efforts to track changes in payors' patient risk pools, which we hope to incorporate in future editions of the Health Check.

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 (HCUP) State Inpatient Database, which includes the universe of admissions to hospitals in the State of Michigan in 2006, 2008, 2010, 2012, 2014, 2016, and 2017.[3] 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 so are not directly comparable to our sample of the privately insured.[4] **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 Health Analytics, 2016). The last two columns provide some indication that those hospitalized with a diagnosis of CAD 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. While this may be partially explained by a shift of relatively less-severe cases to an outpatient setting, leaving the hospitalized population with a greater concentration of severe cases, these figures may reflect a growing disease burden among members with CAD, which could explain rising CAD expenditures in recent years. **Table 2** uses the HCUP State Inpatient Database to show outcomes and treatment for KOMA residents hospitalized with CAD. It shows a rise in the share of CAD patients discharged to a skilled nursing facility, intermediate care facility, or inpatient rehabilitation facility. If these findings coincided with a reduced length of hospital stay, then this could reflect cost-saving substitution between treatment settings, however, as noted in prior years, this does not appear to be the case.

Next, we return to the insurer data. **Figure 2** separates the disease-specific expenditure figures for 2018 and 2019 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 34-37 percent for those diagnosed with asthma or diabetes. We note that prescription drug expenditures' share of overall disease-specific expenditures has remained approximately constant in real terms at 23 percent across all conditions between 2018 and 2019. In dollar terms, real increases in average prescription drug expenditures were observed for members with depression ($29), CAD ($190), hyperlipidemia ($203), and diabetes ($641). Only members with low back pain or asthma experienced an average reduction in expenditures on prescriptions (-$51 and -$95, respectively).

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 2019 expenditures for CAD, hyperlipidemia, and healthy members are higher in KOMA than in the Detroit region. The percent differences vary across diagnoses, with CAD expenditures in KOMA being 22.4 percent higher than Detroit while asthma expenditures are 12 percent lower. Differences in spending for the same condition between the east and west sides of the state would likely 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 2018 to 2019. 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. Expenditures on healthy members and those with hyperlipidemia and diabetes grew in both regions, though much more so in KOMA than in the Detroit region. This is most striking among members with diabetes, where expenditures grew 6.1 percent in KOMA compared to 0.3 percent in the Detroit region. Expenditures declined in both regions for healthy members and those with asthma, CAD, or low back pain. The percentage declines in KOMA were greater than in Detroit for all four of these diagnoses. Depression was the only diagnosis where expenditures increased in KOMA (5 percent) but decreased in Detroit (-1.8 percent). The broad message from **Figures 3a and 3b** is that, even though expenditures on all seven diagnosis classifications were lower in KOMA as recently as 2017, the KOMA expenditures have caught up to (and even exceeded) those of the Detroit region in a relatively short amount of time.

As was the case last year, we have access to the average risk scores of 2019 members, which allows us to adjust for expenditure differences between the KOMA and Detroit regions that are due to differences in the underlying health of their residents. Unlike last year, however, these risk scores are not available for BCN members. Using the available data, **Figure 3c** reports two average member expenditure measures in KOMA across all conditions. The first measure is the actual (raw) KOMA expenditures as calculated for **Figure 1a** for the set of PH and BCBSM members only. The second is the predicted average KOMA expenditures for these members if the KOMA risk scores were the same (on average) as those of the PH and BCBSM members in the Detroit region, which are also shown in the figure. Therefore, a comparison of the middle and right bars for each diagnosis reveals expenditure differences due to factors other than the wellness of the regional member populations.

[3] The State Inpatient Database for Michigan for the year 2018 was published in 2020, but not in time to be incorporated into this report.

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

Figure 3c shows that raw expenditures in KOMA compared to Detroit are lower for PH and BCBSM members with asthma by 11.6 percent, depression by 17.7 percent, diabetes by 10.2 percent, and low back pain by 10.4 percent. Raw KOMA expenditures are slightly greater than those in Detroit for hyperlipidemia (less than 1 percent) and significantly greater for CAD (21.1 percent) and healthy members (11.3 percent). This is the same pattern observed in the previous year's report, with two exceptions. First, the percentage gap between KOMA and Detroit has increased for asthma (from 8.2 percent to 11.8 percent) and diabetes (from 7.7 percent to 10.2 percent). Second, KOMA expenditures are now higher than those in Detroit for hyperlipidemia and healthy members, whereas they were lower in 2018. The message from this part of **Figure 3c** is that KOMA expenditures are lower than those of Detroit for four of the seven diagnoses.

The adjusted expenditures for KOMA in the middle columns of **Figure 3c**, however, tell a different story. Upon accounting for differences in the underlying health of members in the two regions, KOMA's expenditure advantages are effectively eliminated or reversed. Considering adjusted expenditures instead of raw, KOMA expenditures are higher than those of Detroit by 6.2 percent for asthma, 13.7 percent for CAD, 7.1 percent for diabetes, 9.1 percent for hyperlipidemia, and 12.2 percent for healthy members. KOMA retains expenditure advantages for depression and low back pain, but they are close to zero (0.4 percent and 1.7 percent, respectively). The adjustment reveals that lower raw expenditures on members with these diagnoses in KOMA relative to those in Detroit are largely due to KOMA having a relatively healthy population. CAD is the only exception, where the adjustment reveals that the KOMA members with this diagnosis are less healthy, on average, than their counterparts in the Detroit region. **Figure 3c** suggests that, while BCBSM and PH members in the KOMA region do ultimately enjoy lower expenditures for the majority of these diagnoses, there could be additional savings from bringing prices or treatment approaches more in-line with the Detroit region. It is not clear how this would affect access to or quality of care in the KOMA region, however, additional investigation is necessary before a recommendation can be made.

Health Services Use

Figures 4a through 4c examine regional differences in health care utilization for each of the six conditions. This is the fourth 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 members in KOMA and the Detroit region in 2019. On one hand, this figure is consistent with the most recent Health Check reports in showing that hospitalization rates tend to be higher on the east side of the state than the west. For example, members with diabetes experience an average of 0.17 inpatient admissions per year in KOMA while those in Detroit average 0.26 hospital visits per year. On the other hand, the regional difference in hospitalization rates has narrowed for five out of six diagnoses, relative to 2018. For example, while the average number of annual inpatient visits for asthma was 30 percent lower in KOMA than in Detroit in 2018, that gap was reduced to 28 percent in 2019. There is a similar pattern for CAD (15 percent to 6.5 percent), depression (32 percent to 26 percent), hyperlipidemia (21 percent to 19 percent), and diabetes (38 percent to 34.8 percent). Low back pain is the only condition for which the difference in average annual inpatient visits has grown (19 percent to 21 percent). Consistent with the narrowing of the expenditure gap in **Figure 3a, Figure 4a** suggests that hospitalization rates in KOMA are catching up to those in the Detroit region.

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 average 0.69 ED visits per year in Detroit compared to 0.44 ED visits per year in KOMA (indicating that we observe close to 56 percent more ED visits per member in Detroit for low back pain than in KOMA). Once again, however, many of the gaps in ED visits have narrowed, though not as dramatically as for inpatient visits. While those in Detroit had 7 percent more ED visits per member with CAD than in KOMA in 2018, that difference shrank to 3.5 percent in 2019. Similar patterns are observed for depression (29 percent to 27 percent), diabetes (29 percent to 26 percent), and hyperlipidemia (14 percent to 13 percent). The exceptions are asthma (18 percent to 22 percent) and low back pain (50 percent to 56 percent).

While this narrowing of the percentage gaps in ED and inpatient visits is a source of concern, it should be noted that the narrowing is not reflected in **Figures 2 and 4** of the Benchmarking Communities section. While the insurer data indicates that KOMA is catching up to the Detroit region in ED and inpatient visits for the six diagnoses evaluated here, the gap in total hospital admissions and ED visits between the two regions has remained relatively stable since 2016. One potential explanation for this inconsistency is that hospitalizations and ED visits among self-pay and publicly insured individuals may have declined sufficiently to offset the increases in the privately insured population. As any declines in utilization among the uninsured or publicly insured may have implications for access to and quality of care, future research is needed to investigate this question further. Alternatively, while utilization in KOMA may be increasing relative to Detroit among those diagnosed with these six conditions, it may be declining among those with different diagnoses. This is another subject for future investigation.

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 64 prescription fills in 2019 compared to 75 for individuals with diabetes in the Detroit region. Assuming that each member filled a prescription 12 times throughout the year, this would represent an average of about five distinct prescriptions for a person with diabetes in KOMA and a little more than six distinct prescriptions in Detroit. Beyond diabetes, we note an average of 19 percent more prescription fills in Detroit than in KOMA for members with a depression diagnosis, and similarly 18 percent more prescription fills in Detroit for members with a low back pain diagnosis. Unlike for inpatient and ED visits, these gaps have been relatively stable since 2018.

Annual telehealth visits per member constitute the final utilization metric examined here, in **Figure 4d**. As context, the 2018 data showed KOMA well ahead of the Detroit region in telehealth utilization across all six diagnoses. We now see in **Figure 4d** that telehealth visits are roughly equal across regions for asthma, CAD, hyperlipidemia, and low back pain diagnoses. Second, Detroit has surpassed KOMA in average telehealth utilization per member for depression (0.12 vs. 0.10) and diabetes (0.037 vs. 0.027). This shift in dynamic between the two regions is reflected in **Figure 4e**, which tracks the 2018-2019 percentage changes in average telehealth visits per member. It indicates massive percentage growth in telehealth use in the Detroit region across all six diagnoses, while percent changes in KOMA have been relatively small and even negative for one condition (CAD). There could be a link between the narrowing percentage gaps in ED and inpatient visits across the two regions and the growing telehealth utilization in the Detroit region, perhaps involving the substitution of services, but the available data is insufficient to fully investigate this possibility.

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 $18,819 to the annual expenditure estimate, while a diagnosis of diabetes and CAD (instead of diabetes alone) adds $30,559 to the expenditure estimate.

Figure 5b displays the results of a similar analysis that focuses on depression. The results are consistent with 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 $40,360 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 that suffer from both diabetes and depression are higher than if we simply added the average expenditure of a member that suffers from only diabetes with the average expenditure of a member diagnosed with only depression. For KOMA in 2019, the expenditure difference adds up to $8,777 (up from $4,977 in 2018), while the same difference is considerably higher in the Detroit region at $11,449. Notably, however, the 2018 difference in Detroit was $15,708, so these figures reveal another apparent narrowing of the gap in expenditure on members suffering from both depression and diabetes.

Geographic Variation in Expenditures and Health Care Use

In **Figures 6-7**, 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 across 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, for the conditions that we examined, approximately 15 percent of the variation in expenditures at the ZIP code level can be explained by age, income, and education. 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 choose 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 $14,125 and $24,729, while those in the highest quantile have average annual expenditures between $35,286 and $61,211. 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 on the western side of Ottawa county and the Kent-Ionia county border region. At the same time, we see some clustering of low expenditure ZIP codes in western Oakland county, as well as high expenditure clusters in the northern parts of Oakland and Macomb counties and the southwestern part of Wayne county.

Figure 6b follows the same methodology to map the average number of inpatient admissions in 2019 for members with CAD. Those in the lowest quantile of the distribution experienced between 0.14 and 0.37 inpatient admissions, while those in the highest quantile had between 0.62 and 1.10 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**. Several ZIP codes in the City of Grand Rapids have reached the top quantile of the distribution, which was not generally the case in recent years. ZIP codes in the Kent-Ionia county border region show inpatient visits that are relatively close to the median, which contrasts with the high expenditures found in **Figure 6a**. This may indicate that high expenditures there are driven by prices or severity rather than utilization.

Figure 6c repeats the analysis with the average number of ED visits in 2019 for those diagnosed with CAD by ZIP code. The lowest quantile of the distribution represents between 0 and 0.63 ED visits, on average, while the highest quantile includes 0.98 to 1.80 visits, on average. On the west side of the state, ED use is particularly high for CAD members living in ZIP codes within the counties of Allegan, Kent, and Ionia, while ZIP codes farther to the northwest 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 CAD members in 2019 are mapped in **Figure 6d**. Here, an interesting pattern emerges that will be repeated for members with diabetes (shown in **Figures 7a – 7e**): West Michigan has far fewer prescription fills, on average, than the Detroit region. Eleven 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 many more ZIP codes in the top prescription fill quantile, with a particularly large cluster in the southeast of Wayne county.

This year, we continue our reporting of telehealth visits, which were first reported two years ago. 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 in the Detroit region in 2019 compared to 2018; 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. **Figure 6e** suggests that while use of telehealth visits for CAD patients remains common in the outlying ZIP codes of West Michigan, there is now considerable use of telehealth services in the Detroit region, particularly in the northwest of Oakland county. Telehealth utilization remains relatively low in the western part of Allegan county, as well as Wayne county.

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 $9,449 to $16,062, while expenditures for those in the highest quantile are between $20,889 and $60,172. 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 northwest ZIP codes of the Detroit region.

Figure 7b indicates that inpatient admissions for diabetics 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 a cluster in the Mecosta-Montcalm-Isabella county region where a number of ZIP codes are observed in the top two inpatient visit quantiles.

Figure 7c maps ED use by ZIP code and suggests a roughly even distribution between the east and west sides of the state of ZIP codes in the top quantile. Notably, there are high-use clusters in West Michigan in the north and south parts of the region, as well as in the north-central part of the Detroit region.

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, telehealth use is prevalent among members in the northern parts of both the east and west sides of the state.

References

Healthcare Cost and Utilization Project (HCUP). State Inpatient Databases (SID). 2006, 2008, 2010, 2012, 2014, and 2016. 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.

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 truvenhealth.com/Portals/0/Assets/fact-files/Shifts_Cardiology_ Treatment_ May_Fact_File_2016.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

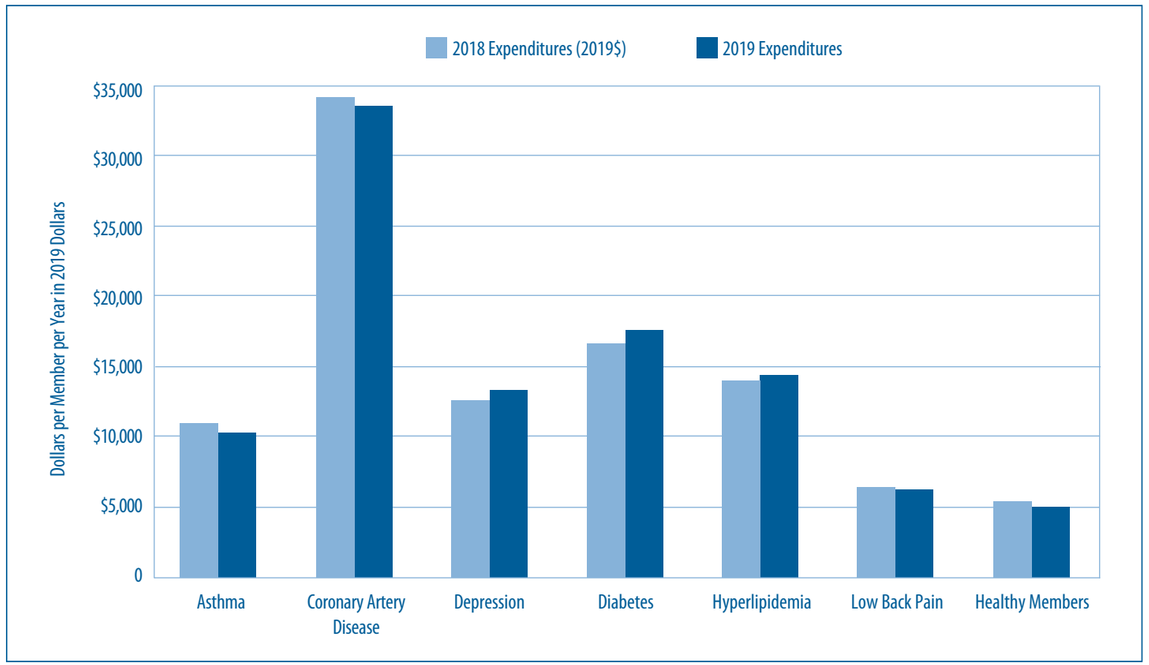
Source: Healthcare Utilization Project's State Inpatient Databases

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

Year	Number of CAD Admissions	Average Number of Procedures	Average Length of Stay (days)	Share of Survivors Discharged to Facility	PTCA* Rate	CABG** Rate	Average Total Charges (2017 dollars)
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

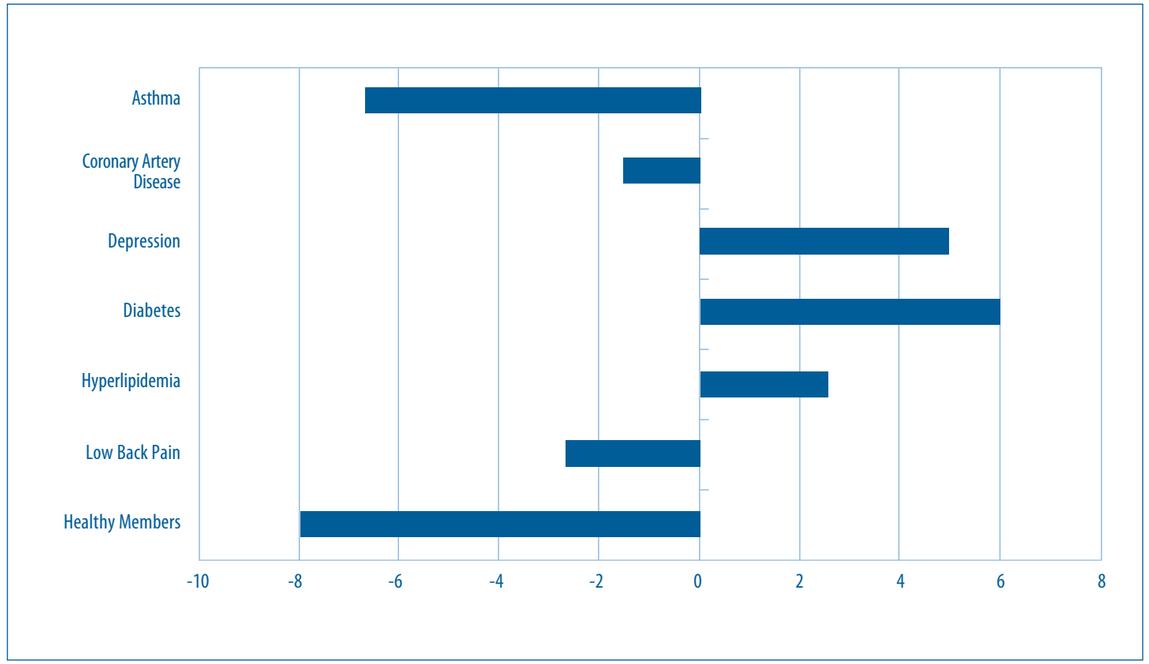
Source: Healthcare Utilization Project's State Inpatient Databases
*PTCA: Percutaneous transluminal coronary angioplasty
**CABG: Coronary artery bypass graft

Figure 1a: Average Expenditures per Member in KOMA, 2018-2019



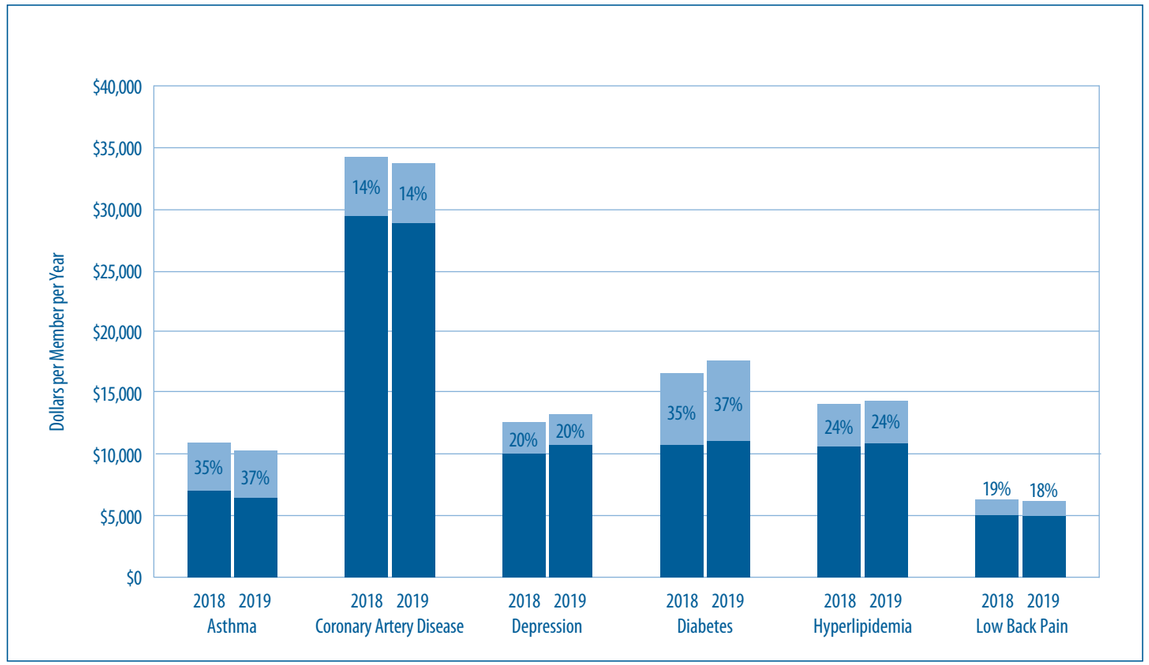
Source: BCBSM, BCN, and Priority Health member data

Figure 1b: Percentage Change in Average Member Costs in KOMA, 2018-2019



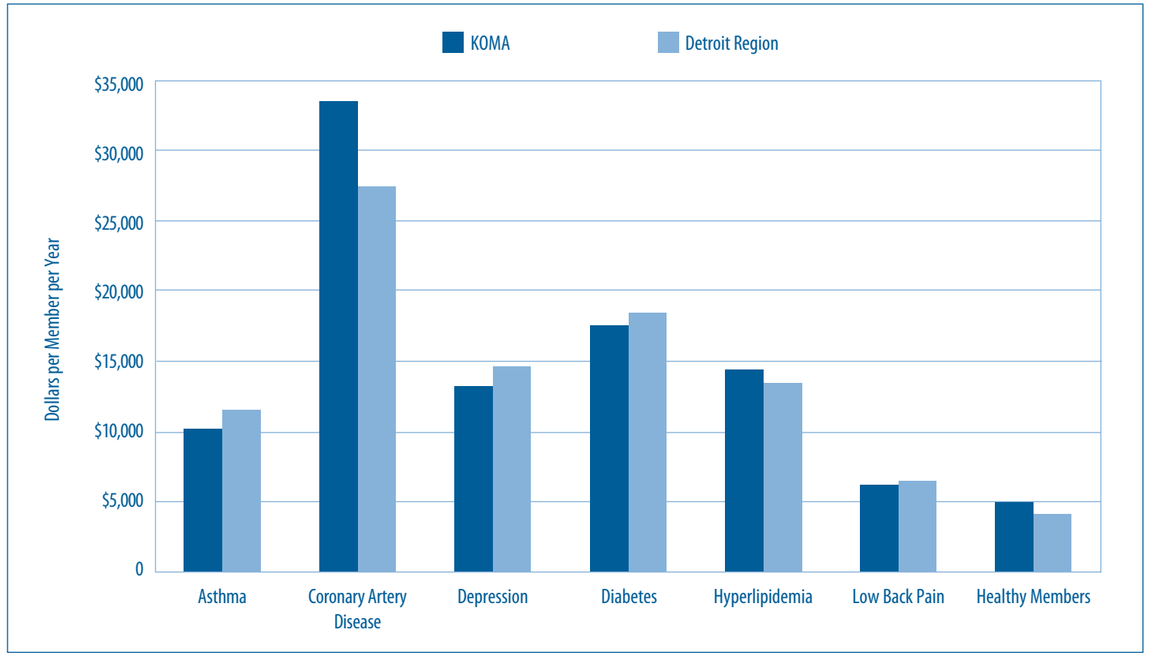
Source: BCBSM, BCN, and Priority Health member data

Figure 2: Rx Share of Average Expenditures per Member in KOMA, 2018 and 2019



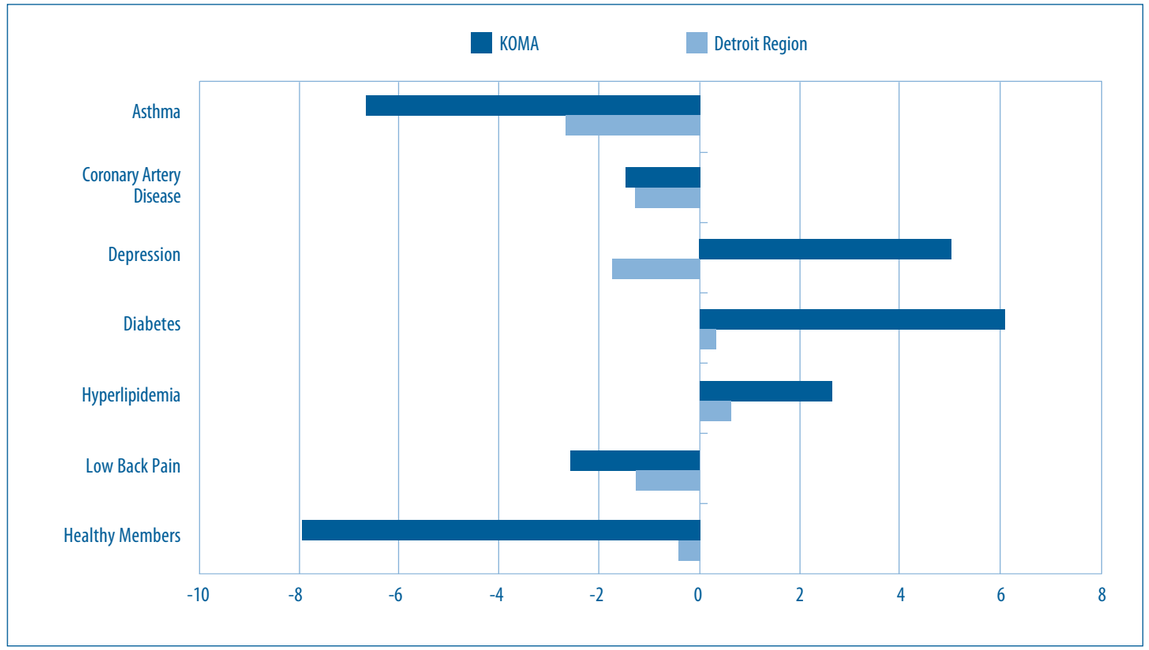
Source: BCBSM, BCN, and Priority Health member data

Figure 3a: Average Expenditures per Member, 2019



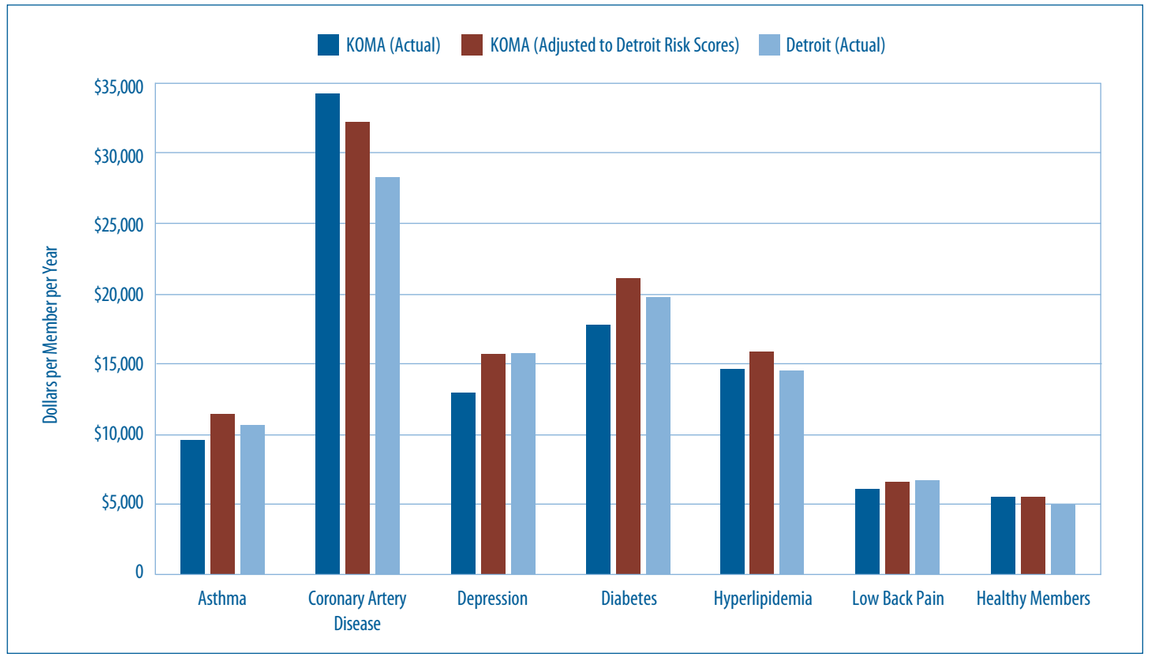
Source: BCBSM, BCN, and Priority Health member data

Figure 3b: Percentage Change in Average Expenditures per Member, 2018–2019



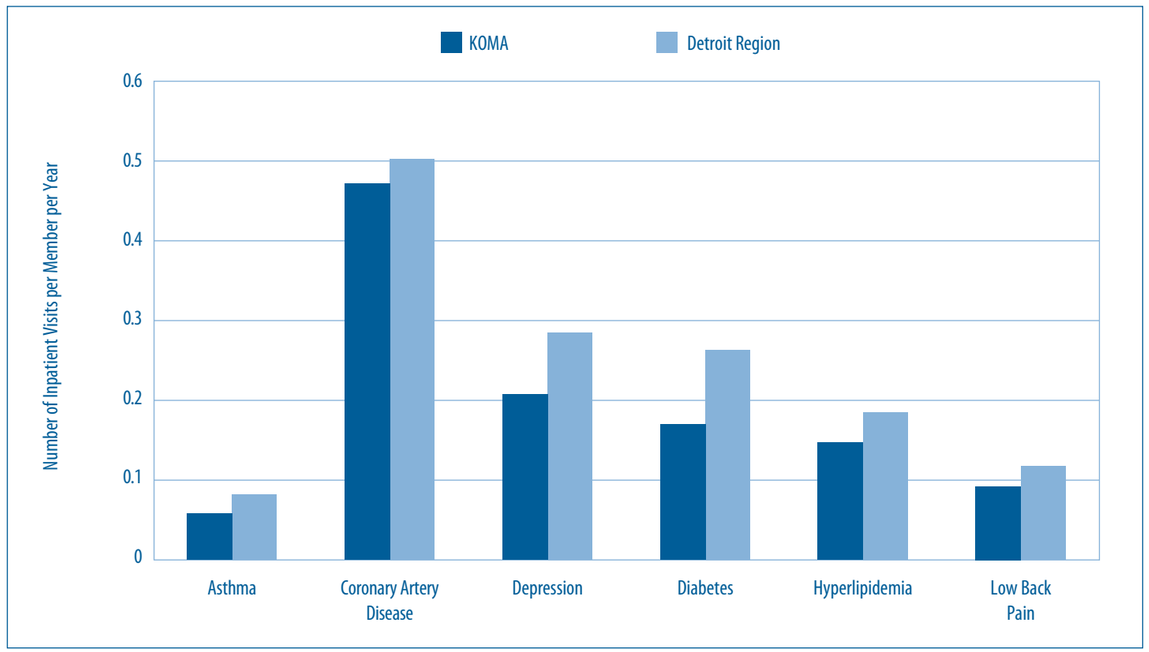
Source: BCBSM, BCN, and Priority Health member data

Figure 3c: Average Expenditures per Member with Risk-Score Adjusted KOMA Values, 2019



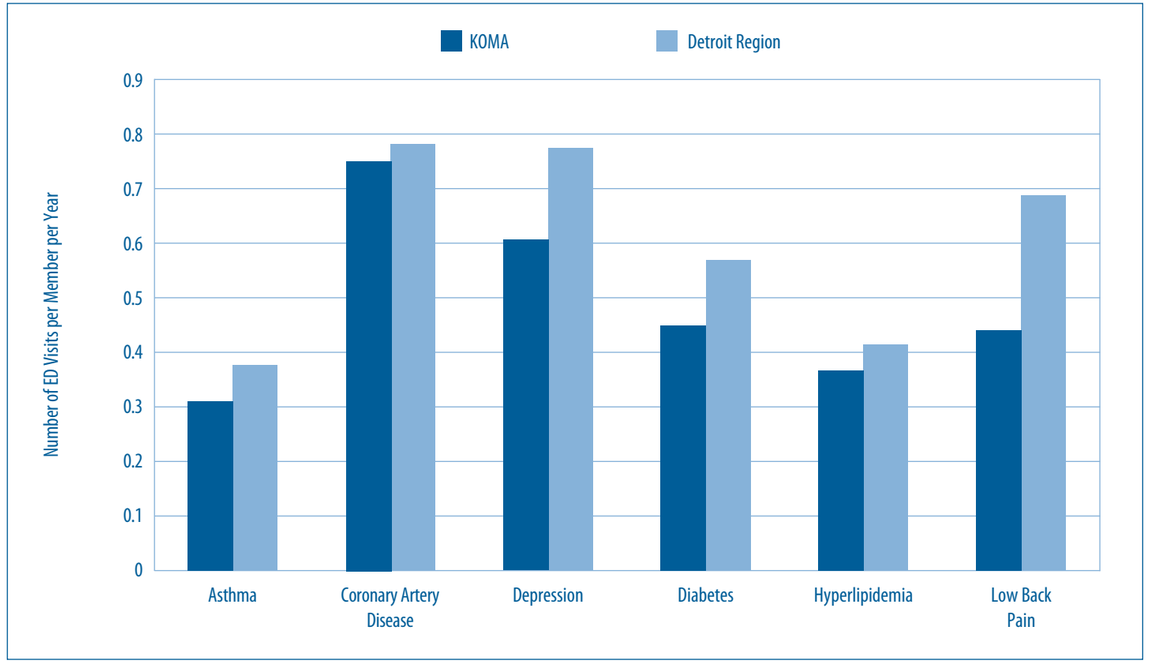
Source: BCBSM and Priority Health member data
Note: BCN is not included in this graph.

Figure 4a: Average Annual Inpatient Visits per Member, 2019



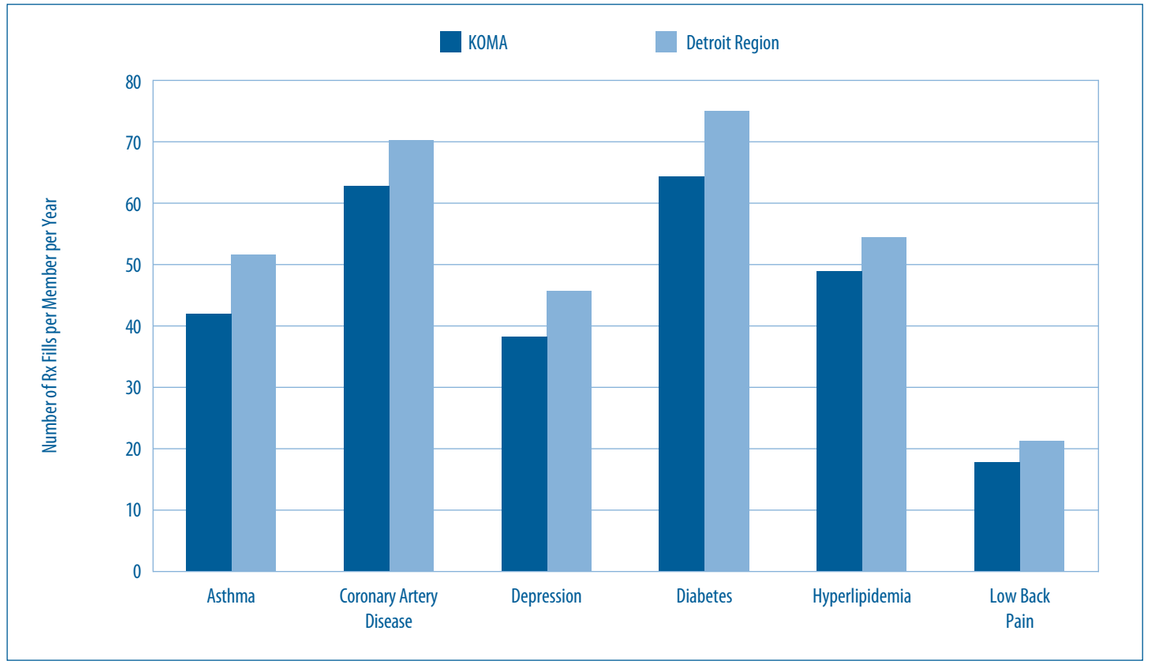
Source: BCBSM, BCN, and Priority Health member data

Figure 4b: Average Annual Emergency Department Visits per Member, 2019



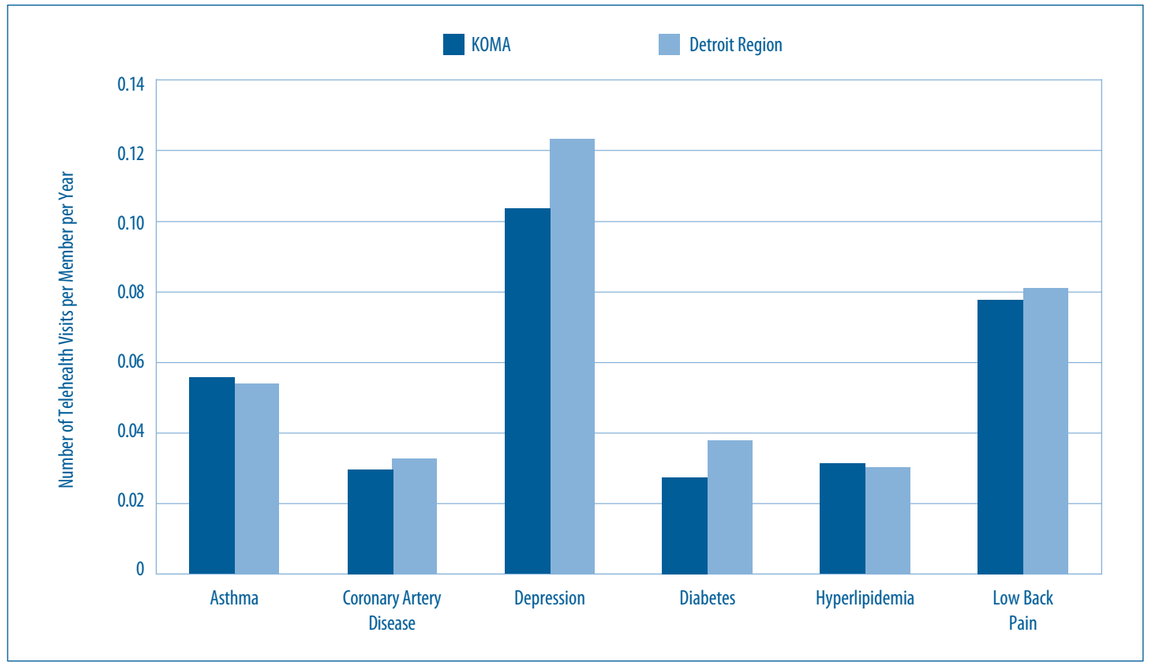
Source: BCBSM, BCN, and Priority Health member data
Note: Not risk-score adjusted

Figure 4c: Average Annual Prescription Fills per Member, 2019



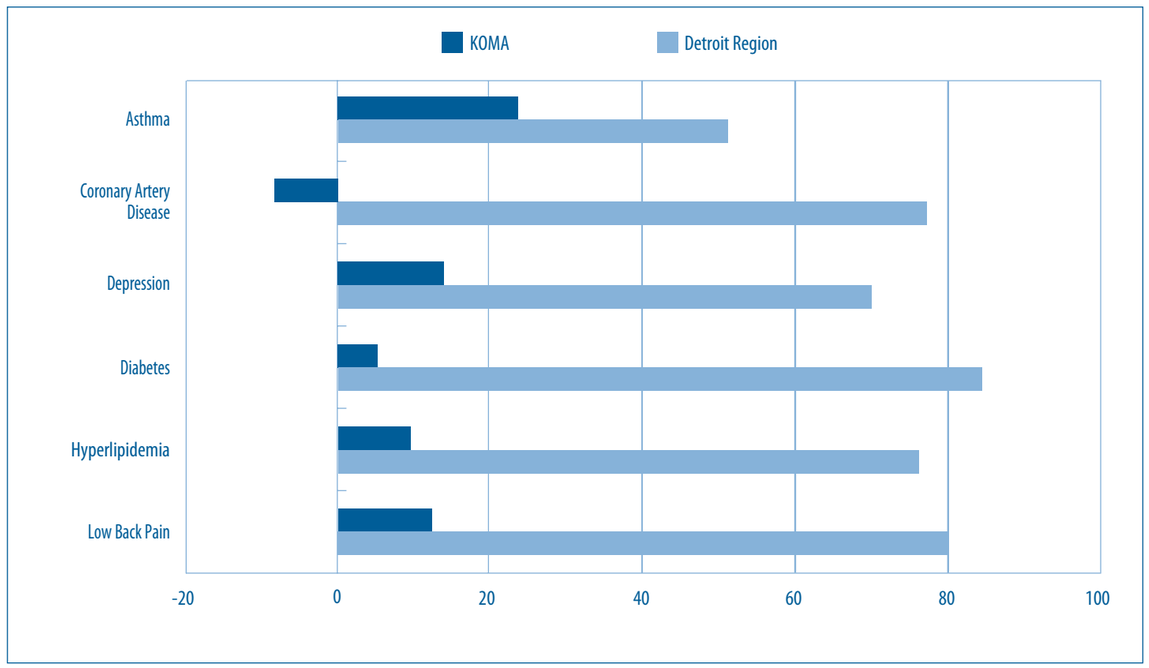
Source: BCBSM, BCN, and Priority Health member data

Figure 4d: Average Annual Telehealth Visits per Member, 2019



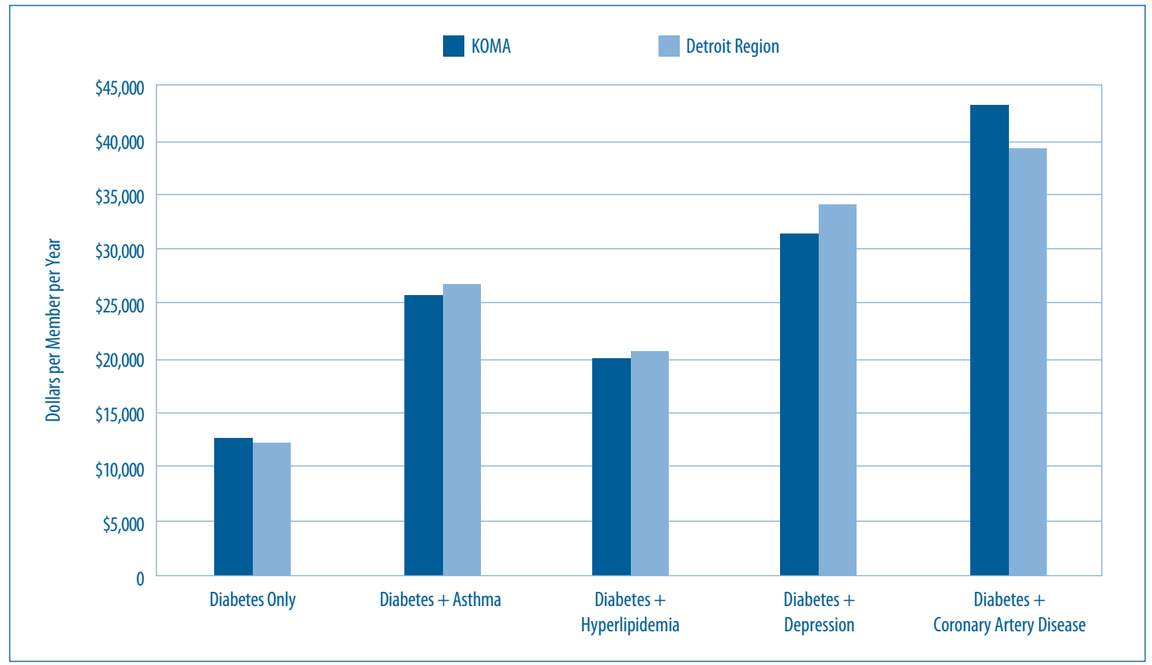
Source: BCBSM, BCN, and Priority Health member data

Figure 4e: Percentage Change in Average Telehealth Visits per Member, 2018-2019



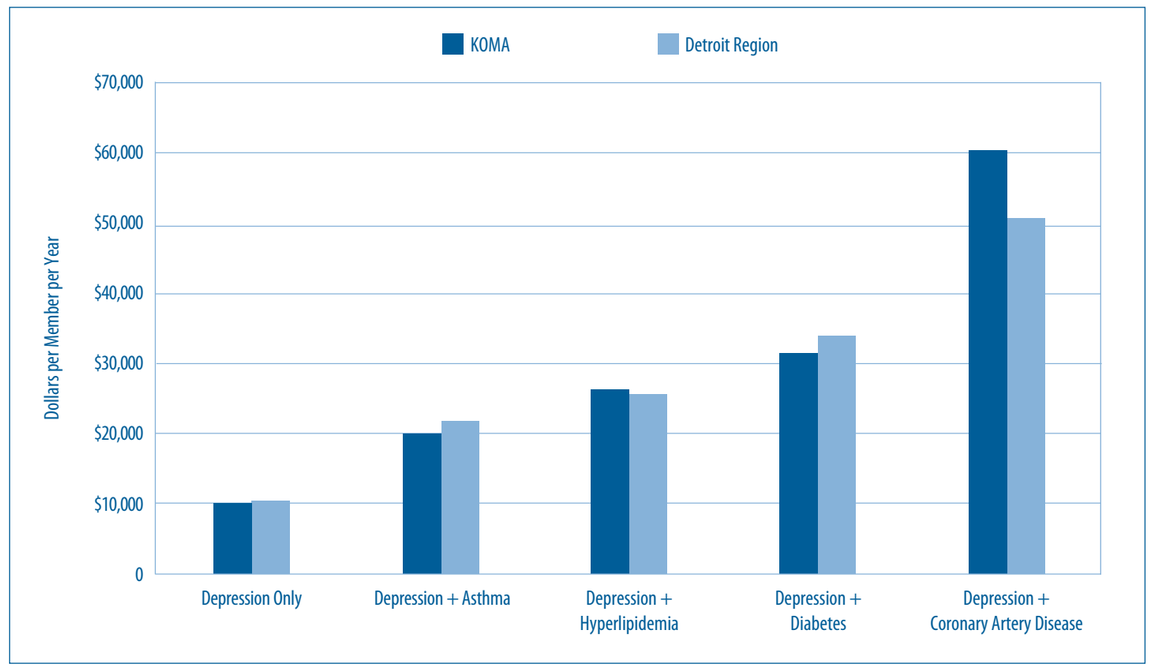
Source: BCBSM, BCN, and Priority Health member data

Figure 5a: Expenditures for Members with Diabetes and Comorbidities, 2019



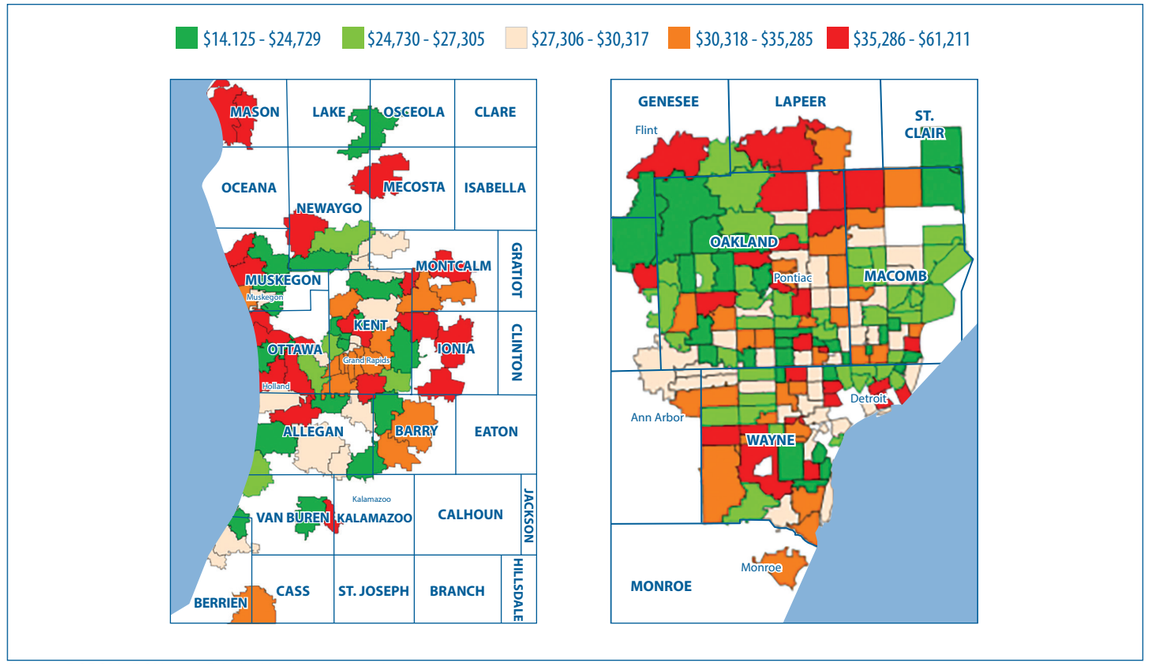
Source: BCBSM, BCN, and Priority Health member data

Figure 5b: Expenditures for Members with Depression and Comorbidities, 2019



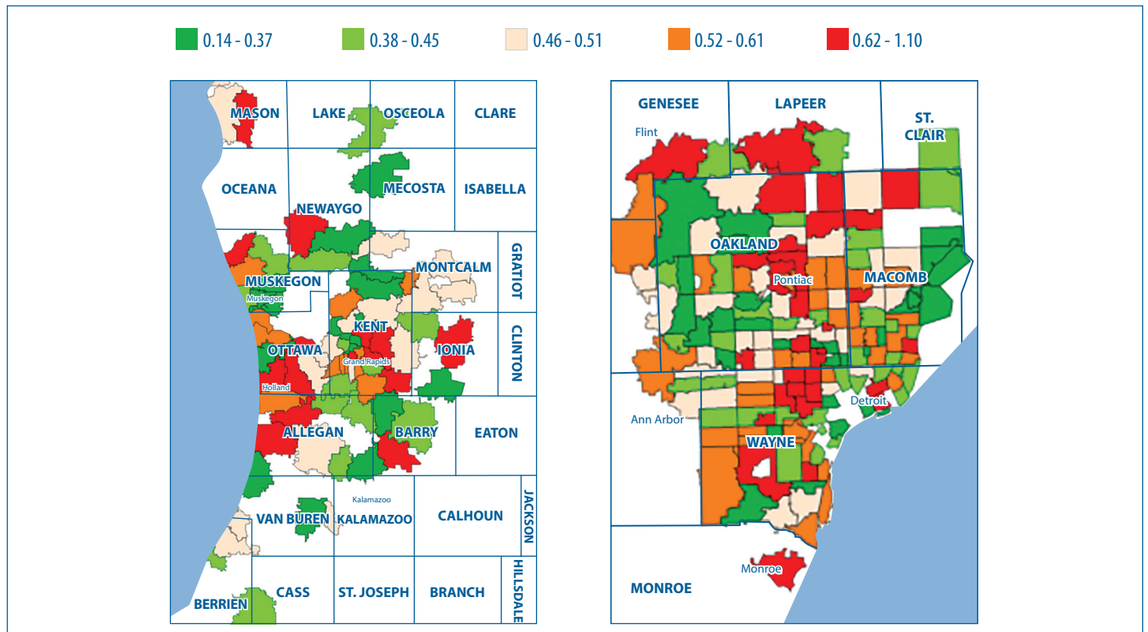
Source: BCBSM, BCN, and Priority Health member data

Figure 6a: Distribution of Average Annual Expenditures per Member with CAD by ZIP Code, 2019



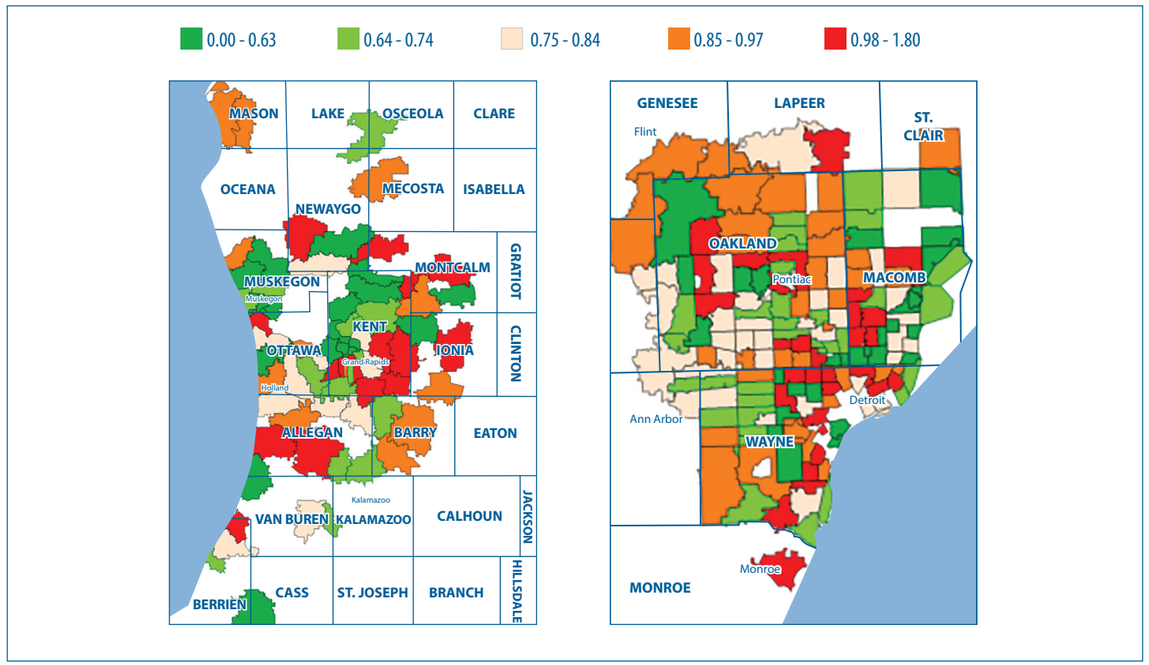
Source: BCBSM, BCN, and Priority Health member data

Figure 6b: Distribution of Average Annual Inpatient Admissions per Member with CAD by ZIP Code, 2019



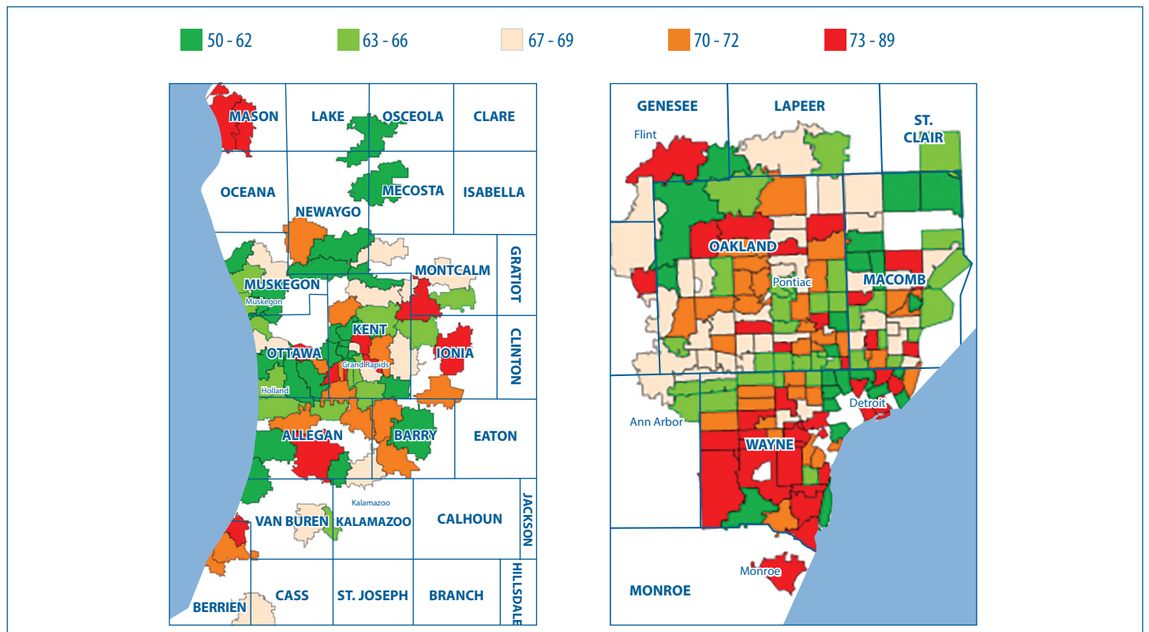
Source: BCBSM, BCN, and Priority Health member data

Figure 6c: Distribution of Average Annual Emergency Department Visits per Member with CAD by ZIP Code, 2019



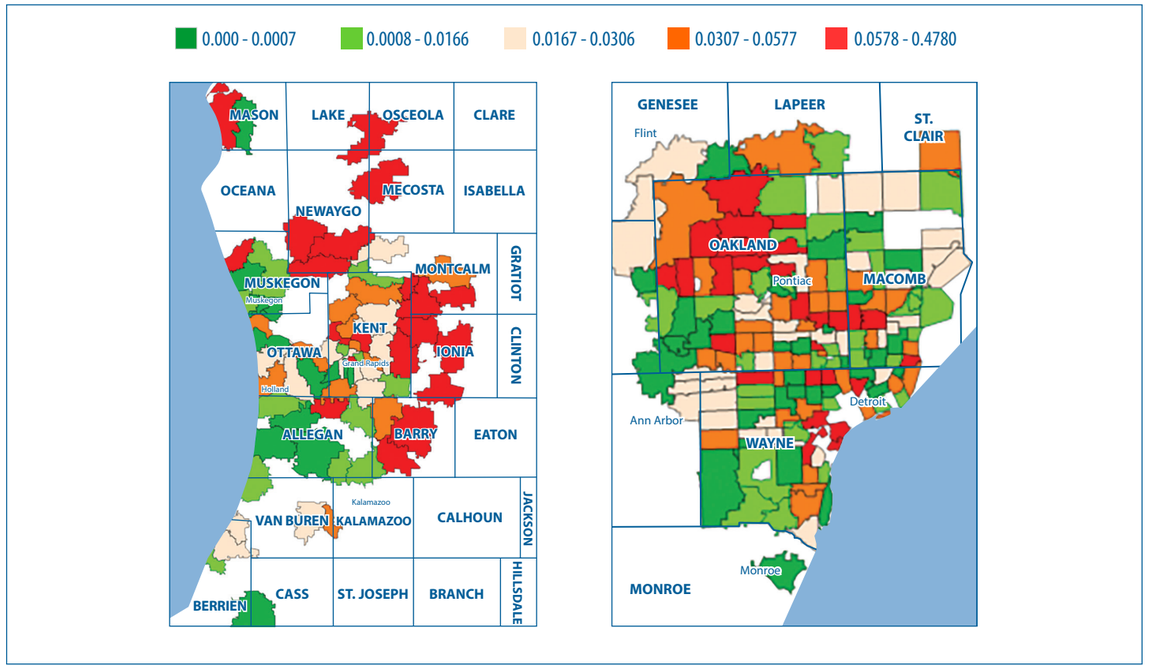
Source: BCBSM, BCN, and Priority Health member data

Figure 6d: Distribution of Average Annual Prescription Fills per Member with CAD by ZIP Code, 2019



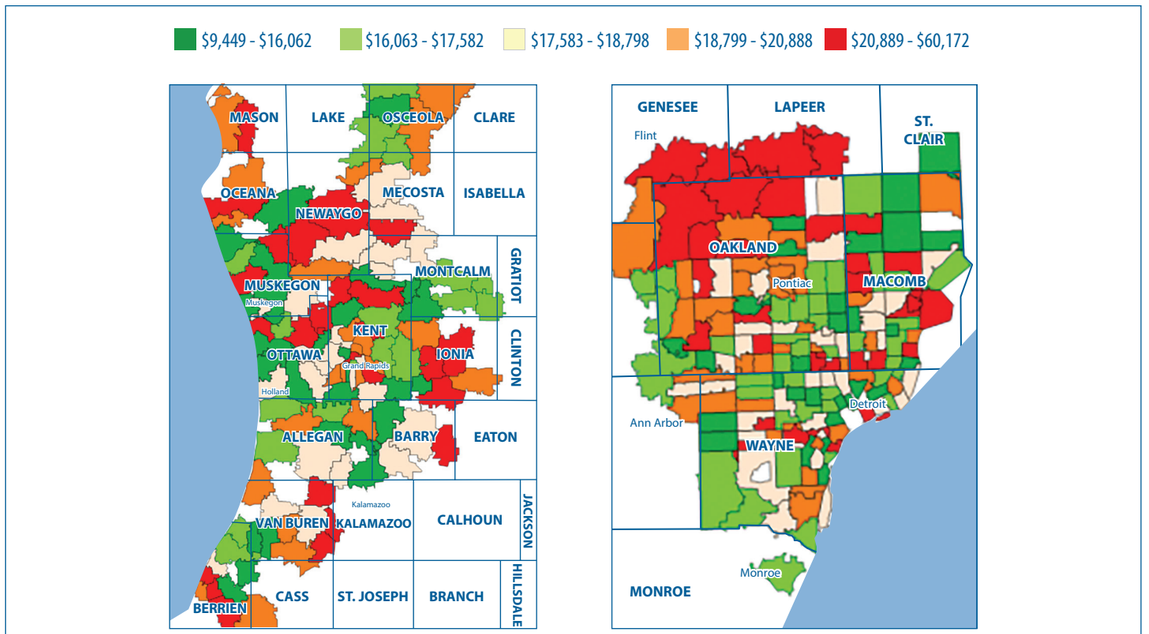
Source: BCBSM, BCN, and Priority Health member data

Figure 6e: Distribution of Average Annual Telehealth Visits per Member with CAD by ZIP Code, 2019



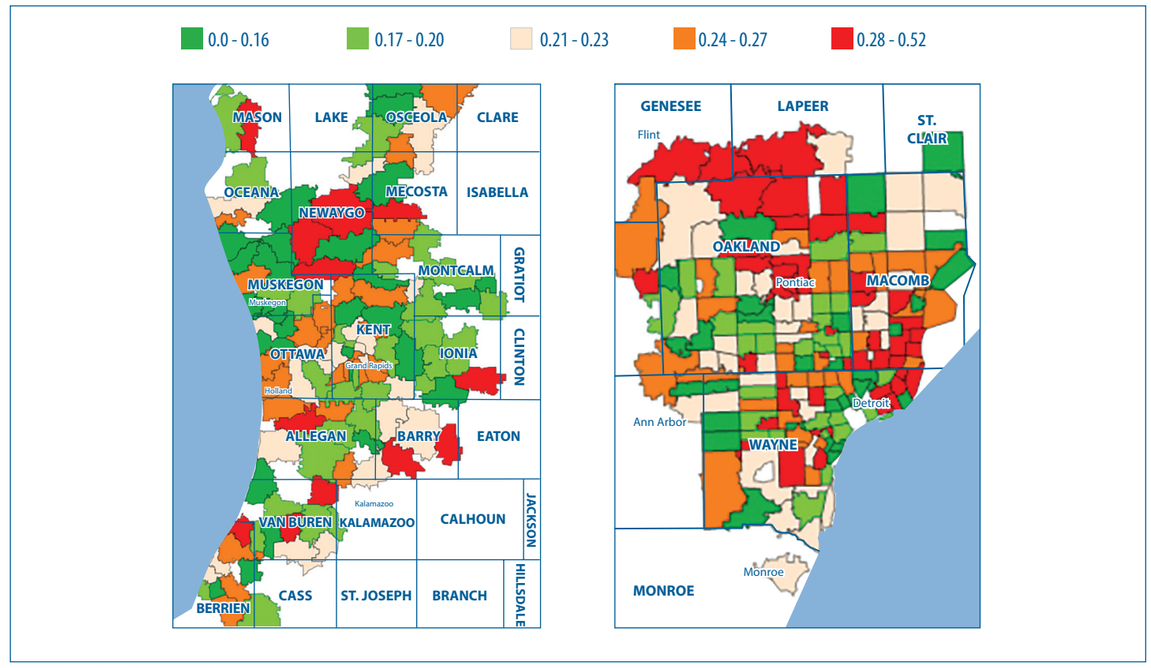
Source: BCBSM, BCN, and Priority Health member data

Figure 7a: Distribution of Average Annual Expenditures per Member with Diabetes by ZIP Code, 2019



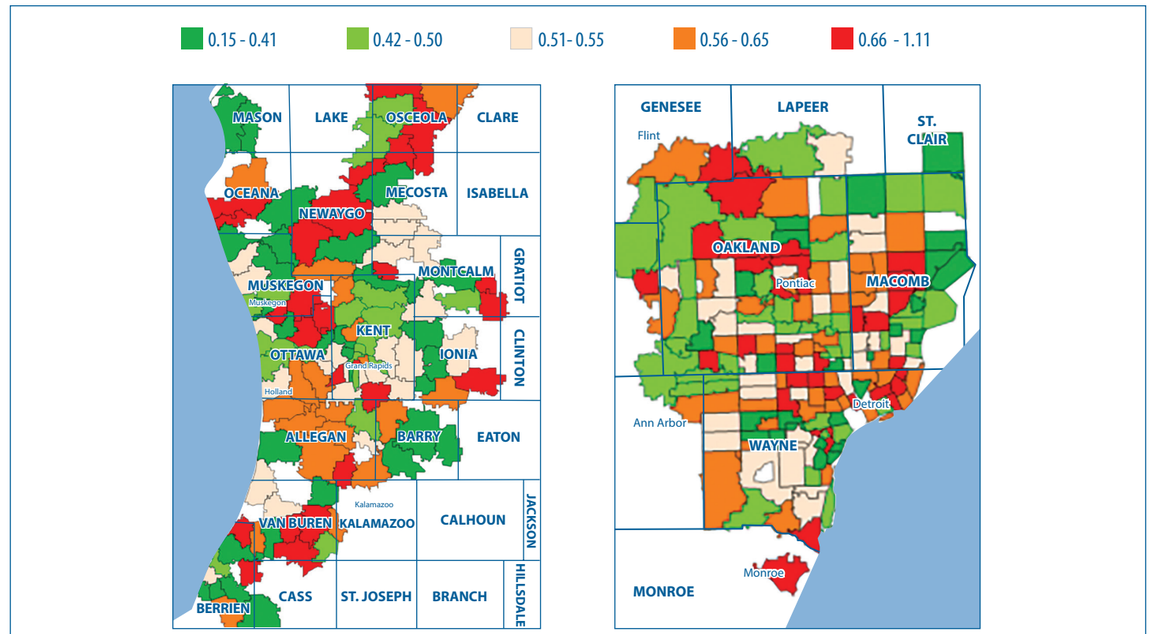
Source: BCBSM, BCN, and Priority Health member data

Figure 7b: Distribution of Average Annual Inpatient Admissions per Member with Diabetes by ZIP Code, 2019



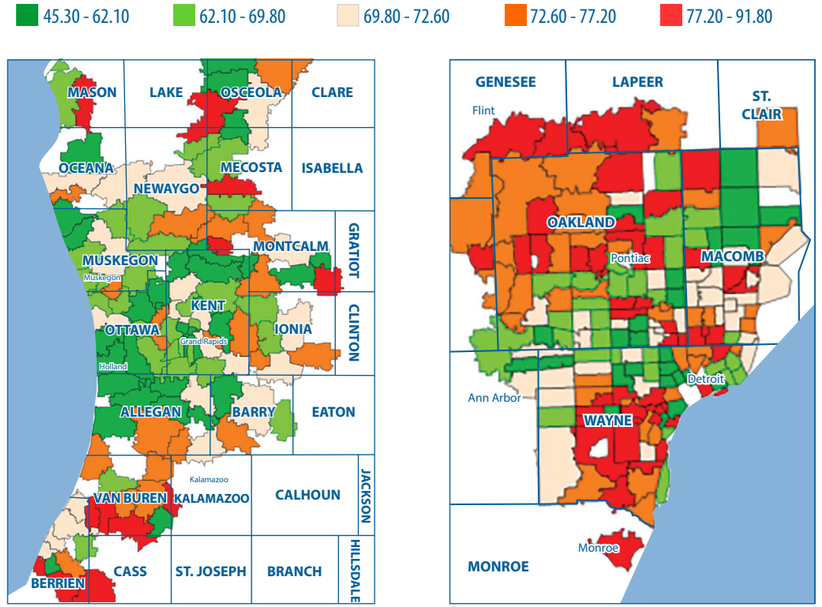
Source: BCBSM, BCN, and Priority Health member data

Figure 7c: Distribution of Average Annual Emergency Department Visits per Member with Diabetes by ZIP Code, 2019



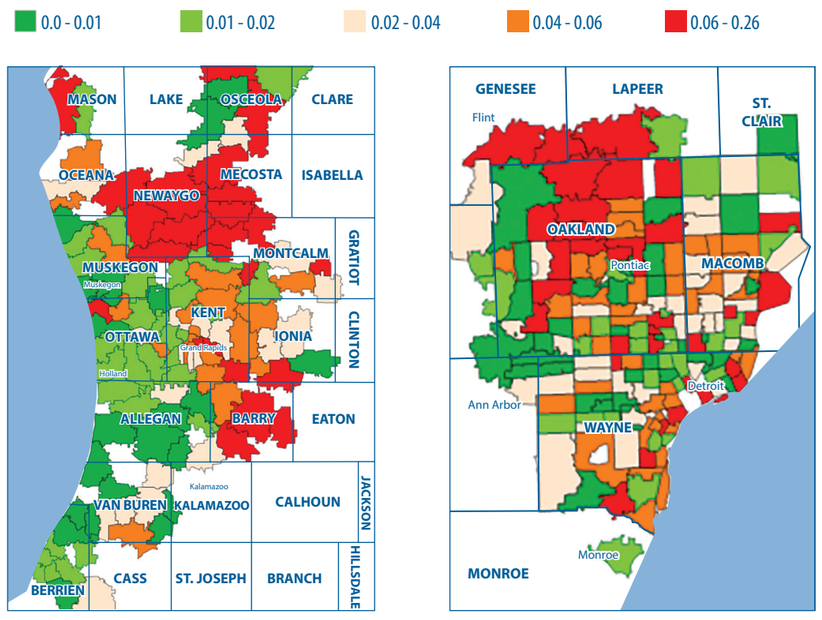
Source: BCBSM, BCN, and Priority Health member data

Figure 7d: Distribution of Average Annual Prescription Fills per Member with Diabetes by ZIP Code, 2019



Source: BCBSM, BCN, and Priority Health member data

Figure 7e: Distribution of Average Annual Telehealth Visits per Member with Diabetes by ZIP Code, 2019



Source: BCBSM, BCN, and Priority Health member data

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