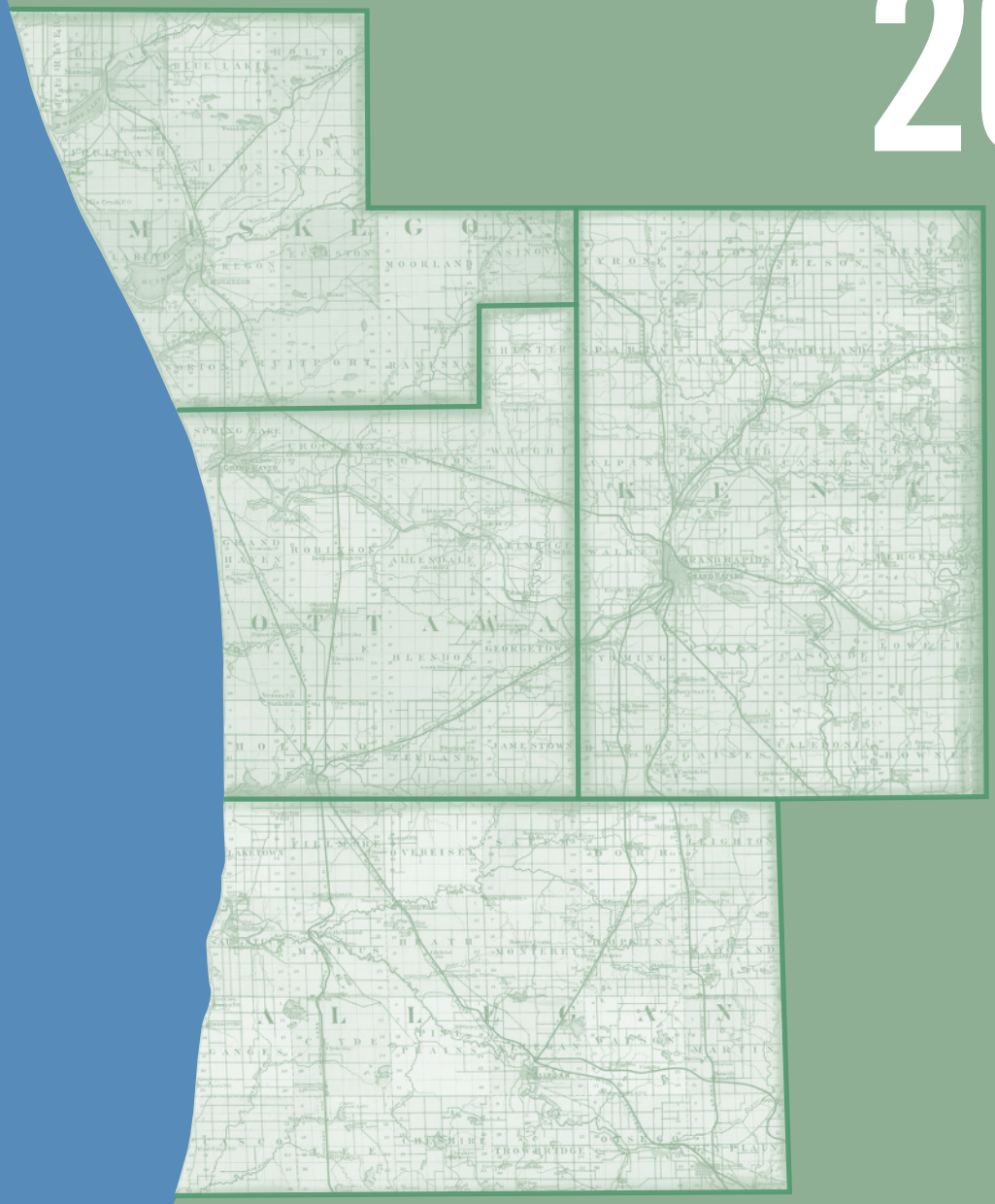
KENT COUNTY OTTAWA COUNTY MUSKEGON COUNTY ALLEGAN COUNTY

Health Check

ANALYZING TRENDS IN WEST MICHIGAN

2019



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Grand Valley State University

Health Check:
Analyzing Trends in West Michigan 2019

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GRAND VALLEY STATE UNIVERSITY
OFFICE OF THE VICE PROVOST FOR HEALTH

January 11, 2019

Dear Colleagues,

This year we celebrate the 10th anniversary of Health Check: *Analyzing Trends in West Michigan*, as we release the 2019 edition of this publication. The report is intended to support decision making of regional health care, government, education, and business leaders and identify health care trends and issues in the Kent, Ottawa, Muskegon, and Allegan (KOMA) counties. The study is made possible by a partnership among Grand Valley's Office of the Vice Provost for Health and Seidman College of Business, Blue Cross Blue Shield of Michigan, Blue Care Network, and Priority Health.

The report examines multiple, health-related aspects of our West Michigan environment. The section on knowledge foundations includes data on education and job growth as well as trends in the development of medical patents. Other sections provide current information about population and health care trends through an evaluation of demographic changes, risk factors, and access to health care. As in previous years, authors conducted an economic analysis by examining health care expenditure and utilization data through comparisons of the KOMA region, the Detroit region, and selected benchmark communities outside of Michigan.

New to this year's study is the addition of data on telehealth visits for conditions such as coronary artery disease (CAD) and diabetes, highlighting variations in use between the West Michigan and the Detroit areas. Detailed data on (CAD) patients includes examination of inpatient admissions and discharges, patient characteristics, and expenditures.

The study documents that, for the most part, growth in West Michigan health care jobs has outpaced job growth in other industries and that the regional health care industry has grown at a faster pace than that of the state and nation. In addition to job growth rates, the study examines wage changes in specific health care related occupations. West Michigan also has had the benefit of increased medical patents since 1990, but a recent slowdown in new medical patents over the last four years highlights the critical need for continued research and development support.

Population growth rates in the KOMA region have remained positive, but in both 2016 and 2017 the growth rate fell below one percent. However, West Michigan exceeds the state and national growth rates.

Little change in health behaviors from previous years was noted. Binge drinking rates have remained steady and adult obesity is slightly higher with nearly two-thirds of our West Michigan population assessed as being overweight or obese. A decrease in smoking rates is an important, positive trend. Additionally, substantial decreases in the numbers of uninsured adults in both West Michigan and Detroit between the years of 2011 and 2016 are documented. This finding is consistent with the nation as a whole and largely attributed to the Affordable Care Act and the expansion of Medicaid eligibility.

Member data provided by our insurance partners reveals that expenditures for nearly all studied conditions (i.e., asthma, CAD, depression, diabetes, hyperlipidemia, and low back pain) have decreased.

This report is intended to serve as a tool to assist in shaping policy and supporting decision making for identification of priority issues and for planning health care workforce preparation, services, and delivery systems. The continued development of strong collaborations among health care-related sectors helps to assure quality, cost-effective care, reduce social barriers, and develop a coordinated population health strategy.

Respectfully,

Jean Nagelkerk
Vice Provost for Health

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Acknowledgments

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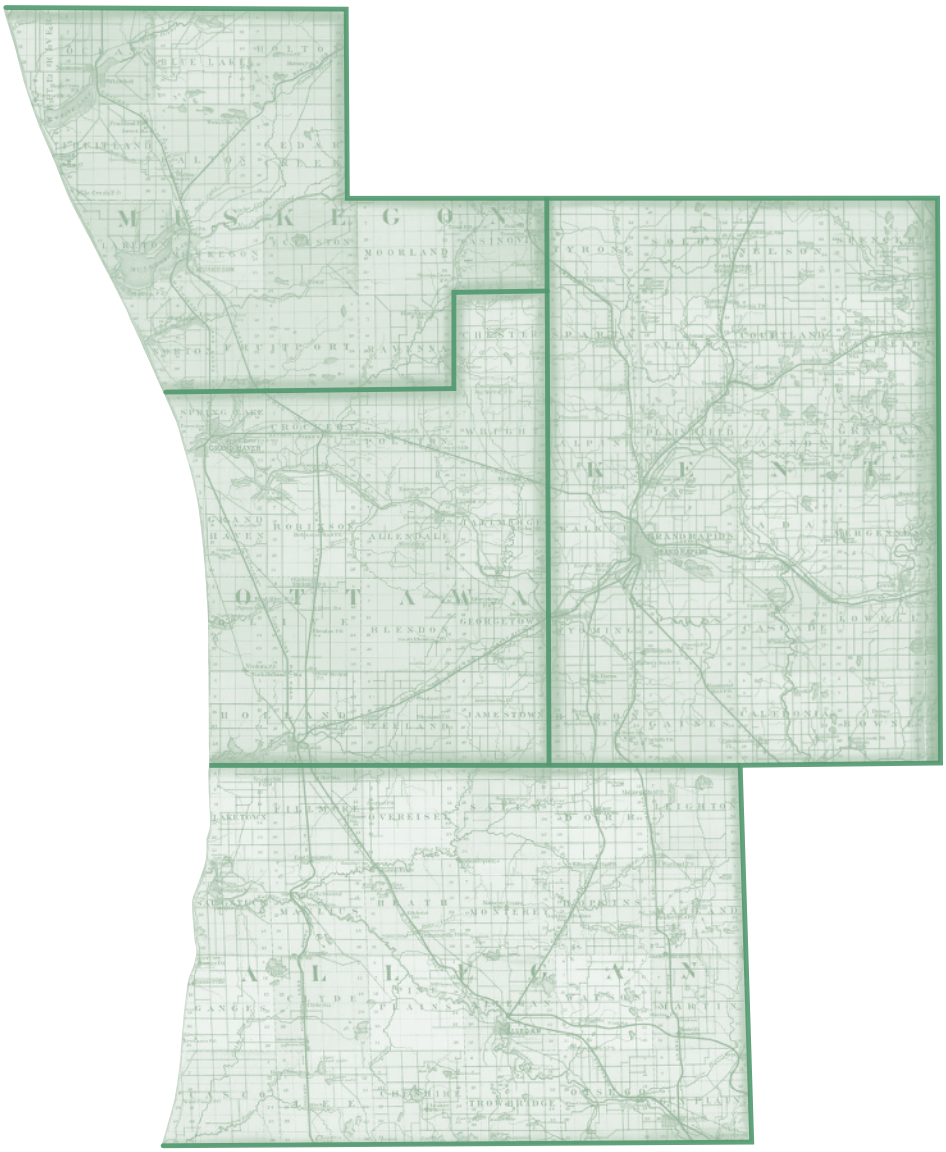
All the data used in this project are based on primary and secondary sources. We acknowledge our data sources in each section by listing source information; these sources are not duplicated or specifically cited in text discussions to preserve readability.

We are particularly indebted to the following organizations for use of their data:

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

Enrollment and graduation data were collected from websites owned by these colleges and universities:

Albion College
Andrews University
Calvin College
Central Michigan University
Cornerstone University
Davenport University
Ferris State University
Grand Valley State University
Kuyper College
Michigan State University
Western Michigan University



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Executive Summary

Knowledge Foundations

Education and Job Growth

Since emerging from the recession in early 2010, the U.S. has continued to add jobs each month. Overall, nonfarm payroll jobs in the U.S. are up more than 12 percent from prerecession levels in 2005. Although Michigan has not fared as well as the U.S. as a whole, the state has maintained generally positive job growth since 2010, reversing a trend of job losses through much of the 2000s. According to data gathered from the Bureau of Labor Statistics (BLS), job growth in the health care sector has outpaced growth in other industries in West Michigan with the exception of the personal care and service industries. In addition, health care jobs have grown at a faster pace in West Michigan than in either the state of Michigan or the entire U.S. Specifically, large job growth is predicted for occupational therapists and occupational therapy assistants, physical therapists, and home health aides. We also note high demand for both nurse practitioners and physician assistants. Our analysis indicates that regional educational programs are graduating students at a rate that will meet or, in some cases, exceed projected job growth in many health-related occupations. Finally, we examine wage changes in health care-related occupations in West Michigan over the past decade and find that physician assistants, EMTs and paramedics, and physical therapists have seen the largest real wage growth. Alternatively, speech-language pathologists and diagnostic medical sonographers saw large declines in real wages over the same period.

Medical Patents

There has been an increase in medical patent activity in West Michigan since the 1990s and a growing number of new innovators. Patents assigned in Kent County have increased from an annual average of 6.2 from 1990 to 1999, to 10.3 from 2000 to 2009, and to 12.3 patents from 2010 to 2017. However, behind these averages is a concerning recent development — there has been a significant decrease in the number of medical patents since 2014, mirroring a decline seen nationally. 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

We continue to monitor various trends in population demographics in West Michigan and the Detroit region and compare changes in these trends to national averages. After maintaining an annual population growth rate above 1 percent from 2013 through 2015, the KOMA region saw its population growth rate fall below 1 percent to 0.8 percent in 2016 and increase slightly to 0.9 percent in 2017. While still positive, recent growth rates are far below growth rates throughout the 1990s that averaged around 1.5 percent per year and may indicate that migration into the area is slowing. Despite this recent downturn, the population growth rate in West Michigan exceeds the national growth rate and the growth rate for the state of Michigan as a whole. After several years of population loss, the state of Michigan has seen positive population growth for six consecutive years, while the Detroit region saw positive population growth in 2017 after several years of negative or near zero growth. Population age distribution trends appear to be holding steady. The proportion of the population over the age of 65 continues to increase both locally and nationally, which will create challenges for the health care system and drive demand for employment in the health care sector.

Health Care Overview

The latest data from the Michigan Behavioral Risk Factor Surveillance System indicate that changes related to health behaviors over the past several years has been minimal. Rates of binge drinking have remained steady at approximately 20 percent of the population in both the West Michigan and Detroit regions. The share of the adult population that is overweight or obese has risen slightly since 2011. More than two-thirds of adults in the Detroit region are overweight or obese and that number is nearly two-thirds in West Michigan. Smoking rates appear to have fallen from approximately 20 percent of the adult population to 16 percent in West Michigan as of 2016, while smoking rates have consistently hovered around 23 percent in the Detroit region over our sample period.

We also examine issues with access to health care and find that fewer residents in West Michigan and the Detroit region lack health insurance in 2016 than in 2011. These changes have been substantial with the share of the adult population lacking health insurance falling from nearly 17 percent in the Detroit region in 2011 to 8.6 percent in 2016. Similarly, the share of the uninsured in West Michigan fell from 12.3 percent in 2011 to 7.3 percent in 2016. Rates of uninsurance throughout much of the U.S. have fallen since the implementation of the Affordable Care Act and reductions have been significantly larger in states that have expanded eligibility for Medicaid. Likely as a result of increased insurance coverage, the share of people reporting that they are unable to access health care due to cost has fallen in both West Michigan and the Detroit region, while access to a routine source of care has increased.

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 with 90.69 admissions per 1,000 residents in Grand Rapids vs. an average of 121.42 in the peer communities. However, outpatient visits to hospitals are high 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 visits in Grand Rapids numbered 475 per 1,000 residents in 2016 compared to a national average of 441 visits per 1,000 individuals. Similarly, total hospital expenses per admission averaged $29,900 in Grand Rapids in 2016 compared to a national average of $27,890. Both findings could contribute to higher levels of health spending in the region. On the other hand, we find that Medicare expenditures in Grand Rapids are lower than the national average ($9,439 per capita in Grand Rapids vs. $10,020 per capita nationally) and are significantly below expenditures for Medicare beneficiaries in the Detroit region ($10,307 per capita). We also provide suggestive evidence that these lower Medicare expenditures may be the result of a high level of care coordination in West Michigan.

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, for the first time since tracking these outcomes, expenditures for nearly all conditions decreased from 2016 to 2017 in KOMA counties. We document a particularly large expenditure decrease for those diagnosed with CAD after several years of consistent increases. Average annual per member expenditures for those diagnosed with CAD and living in KOMA counties was $29,206 in 2016 and $25,329 in 2017, a decline of 13 percent. Average annual expenditures for each of the chronic conditions we studied were higher in the Detroit region than in West Michigan and year-over-year increases in spending tended to be greater on the east side of the state compared to the west side. We find that average annual inpatient admissions, visits to the emergency department, and the average number of prescription fills are all greater in the Detroit region than in KOMA for the six chronic conditions we study. We continue to map variations in health expenditures and utilization for select conditions at the zip code level and, for the first time, include maps of variation in telehealth visits. In general, the east side of the state contains more high expenditure and high utilization zip codes than the west, but areas to the north and southwest of Grand Rapids are consistently among the highest expenditure zip codes in our sample. Those living on the west side of the state tend to exhibit much greater use of telehealth services than those living on the east side, however overall telehealth use for the conditions we examine remains low.

Knowledge Foundations

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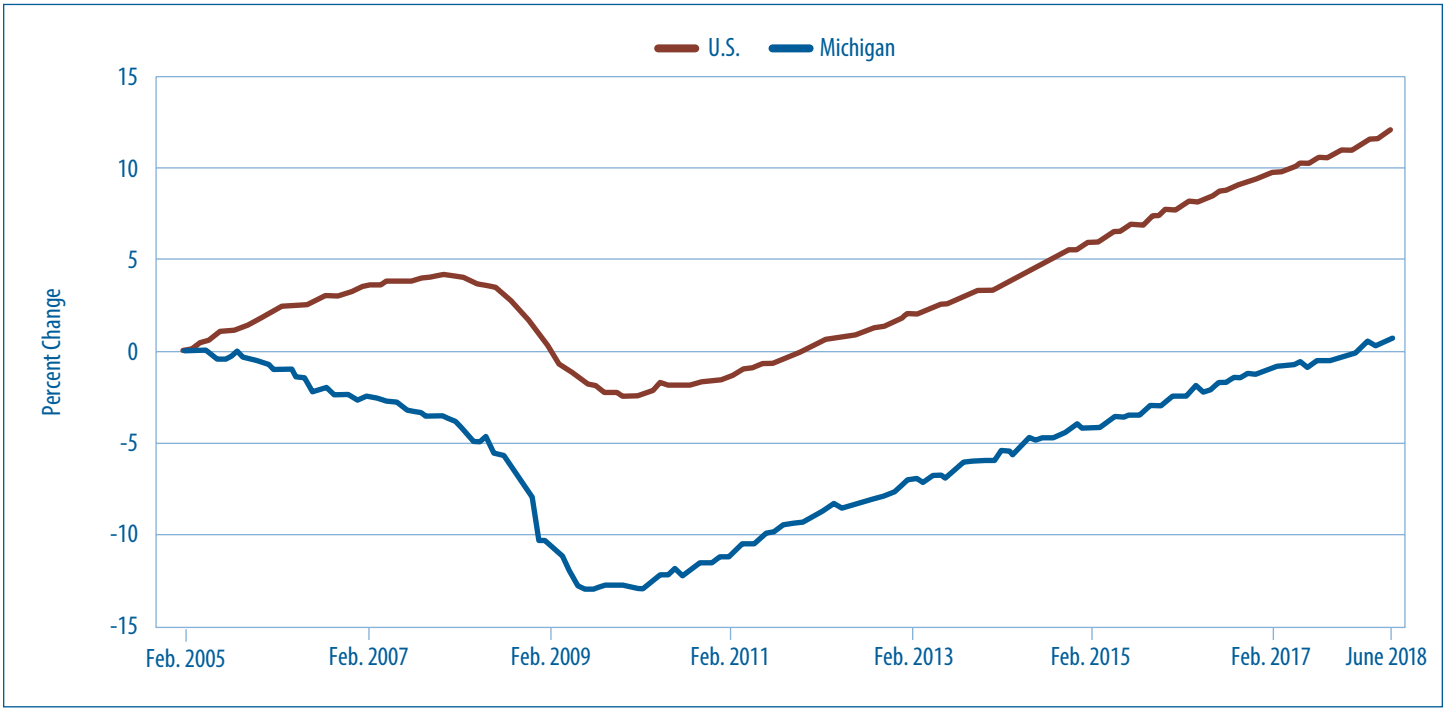
Education and Job Growth

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 February 2005. **Figure 1** plots growth in nonfarm payroll jobs from February 2005 through June 2018. Prior to the recession, the trends in job growth for Michigan and the U.S. were diverging. While the U.S. added jobs from early 2005 through late 2007, Michigan lost approximately 3.5 percent of its nonfarm payroll jobs over the same period. The recession in 2008 had devastating effects on job growth 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. Despite the divergent prerecession trends, 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 pre-recession level and has continued to increase. As of June 2018, the number of nonfarm payroll jobs in the U.S. has grown by more than 12 percent since early 2005. Michigan has also experienced steady job growth since the depth of the recession, however job losses in Michigan were much higher in relative terms than for the U.S. as a whole. As a result, Michigan did not recover to prerecession job levels until January 2018, meaning that the state has experienced only a small net gain in payroll jobs over the past 13 years.

Figure 1: Nonfarm Payroll Jobs Percent Change Relative to February 2005.

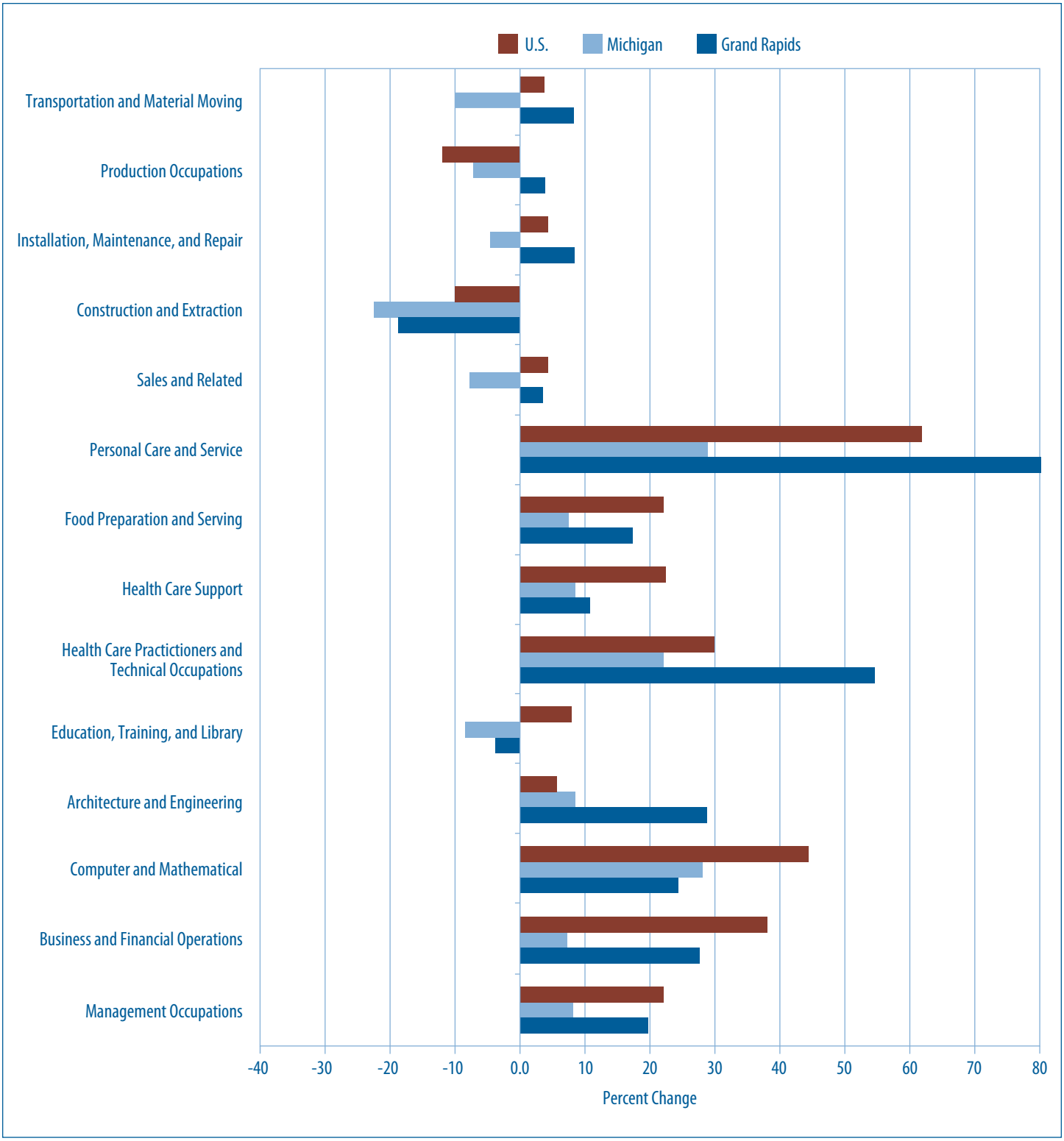


U.S. Source: http://data.bls.gov/cgi-bin/srgate. U.S. Series ID: CES0000000001
State Source: http://data.bls.gov/cgi-bin/srgate. State Series ID: SMS26000000000000001

Figure 2 provides a more detailed analysis of employment changes by examining job growth or job losses at the industry level from 2005 to 2017. 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 (> 20 percent) over this period in four occupational categories: personal care and service (80 percent growth), health care practitioners and technical occupations (55 percent growth), architecture and engineering (29 percent), business and financial operations (27 percent), and computer and mathematical occupations (24 percent).

Employment in personal care and service occupations is not typically associated with high wages, so robust job growth concentrated in this area may be a cause for concern. Alternatively, Grand Rapids has seen substantial employment growth over the past decade in higher wage 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 double the state and national rates since 2005. Employment sectors in the U.S. that suffered the largest job losses over this period include construction and extraction and

Figure 2: Job Growth for Select Major Occupational Groups, 2005–2017



National 2005: http://www.bls.gov/oes/2005/may/oes_nat.htm
National 2017: http://www.bls.gov/oes/2017/may/oes_nat.htm

Michigan 2005: http://www.bls.gov/oes/2005/may/oes_mi.htm
Michigan 2017: http://www.bls.gov/oes/2017/may/oes_mi.htm

Grand Rapids 2005: http://www.bls.gov/oes/2005/may/oes_24340.htm
Grand Rapids 2017: http://www.bls.gov/oes/2017/may/oes_24340.htm

production occupations, a function of the housing bubble that burst in 2006 and precipitated the recession.

Given these shifts 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 growing labor demand.

To analyze this issue, we proceeded in three steps:

1. We observed job growth for selected health care occupations over the past decade.
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. 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 cardiovascular technologists and technicians, diagnostic medical sonographers, medical assistants, optometrists, physical therapists, physical therapy assistants, family and general practitioner physicians, physician assistants, and surgical technologists. Only a few occupations experienced job losses in Grand Rapids over the past decade; those include home health aides, medical transcriptionists, and licensed practical or licensed vocational nurses. The state of Michigan saw significant job growth among physician assistants, surgical technologists, and psychiatrists and job losses among nuclear medicine technologists, licensed practical or licensed vocational nurses, medical transcriptionists, and recreational therapists.

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

Table 6 presents employment projections for Michigan and Grand Rapids generated by matching data on historic and projected employment levels from the Bureau of Labor Statistics to estimates of employment growth rates from the Michigan Department of Technology, Management and Budget. The left-hand columns in **Table 6** display occupation-specific employment in 2017, the corresponding annualized average growth rates, and projected employment in 2024. In the next two columns, we convert the growth rates into annual job growth numbers. Replacement rate figures in the next two columns indicate the share of current employment that is expected to turn over through retirements or other forms of employment transitions. Projected employment has two components: job growth (i.e. new positions) and replacement (i.e. existing positions that have been vacated). We combine these two components to estimate the average annual job openings in both Michigan and in the Grand Rapids metro area in the last two columns of **Table 6**. Occupations for which we expect to see the highest number of annual job openings include registered nurses (544 in Grand Rapids and 3,429 for the state), nursing assistants (269 in Grand Rapids and 1,665 for the state), and home health aides (91 in Grand Rapids and 1,322 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 the wage estimates come from the Bureau of Labor Statistics, and we compared changes in these estimates from 2007 to 2017. We specifically focused on fields in which real earnings have increased or decreased by more than 10 percent over this time. In Grand Rapids, the occupations with the largest decline in real earnings include diagnostic medical sonographers, optometrists, speech-language pathologists, and surgical technologists. Dental hygienist was the only occupation to see double-digit real earnings losses for the state of Michigan. Occupations experiencing the largest real earnings gains in the Grand Rapids region from 2007 to 2017 include physician assistants and EMTs and paramedics. Occupational therapists, occupational therapy assistants, and physician assistants all saw double-digit wage growth 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, over the past decade, real wages for speech-language pathologists and surgical technologists increased nationally, but have declined in both Michigan and Grand Rapids.

We emphasize that our estimates 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. In the long run, it is important not only to create educational opportunities in Michigan, but also to adopt policies that encourage graduates to continue their lives and employment in Michigan after graduation. The continued growth and success of the West Michigan region will depend largely on our capacity to create and retain a skilled workforce with the ability to adapt to an evolving labor market.

Table 1: Projected Health Care Employment in Michigan

Occupation	Grand Rapids			Michigan		
	Employment (2007)	Employment (2017)	Employment Growth (%)	Employment (2007)	Employment (2017)	Employment Growth (%)
Cardiovascular Technologists/Technicians	160	390	143.8	2,370	2,470	4.2
Dental Assistants	880	920	4.5	9,660	9,550	-1.1
Dental Hygienists	790	1,190	50.6	8,630	10,090	16.9
Dentists, General	350	520	48.6	4,210	4,060	-3.6
Diagnostic Medical Sonographers	100	310	210.0	1,820	2,510	37.9
Dietitians and Nutritionists	140	230	64.3	1,970	1,790	-9.1
EMT and Paramedics	380	440	15.8	6,200	6,850	10.5
Home Health Aides	2,610	1,710	-34.5	32,210	27,100	-15.9
Medical Assistants	1,230	2,500	103.3	17,850	22,790	27.7
Medical Records/Health Info Technicians	540	660	22.2	4,800	5,890	22.7
Medical Transcriptionists	360	90	-75.0	2,810	1,950	-30.6
Nuclear Medicine Technologists	60	60	0.0	1,210	670	-44.6
Nurse Practitioners	N/A	370	N/A	N/A	3,970	N/A
Nurses, RN	6,840	11,450	67.4	84,480	94,090	11.4
Nurses, LPN or LVN	2,420	2,060	-14.9	18,650	14,920	-20.0
Nursing Aides and Assistants	5,100	6,940	36.1	48,860	51,640	5.7
Occupational Therapists	380	650	71.1	3,740	4,780	27.8
Occupational Therapy Assistants	120	200	66.7	1,010	1,140	12.9
Opticians, Dispensing	200	340	70.0	2,500	3,650	46.0
Optometrists	70	240	242.9	1,260	1,440	14.3
Pharmacists	650	890	36.9	8,640	9,420	9.0
Pharmacy Technicians	770	1,400	81.8	10,470	14,390	37.4
Physical Therapists	490	1,020	108.2	5,890	8,250	40.1
Physical Therapist Assistants	210	530	152.4	2,500	3,870	54.8
Physician Assistants	250	780	212.0	2,350	4,780	103.4
Physicians, Family and General Practitioners	210	830	295.2	3,920	4,860	24.0
Physicians, Obstetricians and Gynecologists	60	70	16.7	670	680	1.5
Physicians, Pediatricians	50	N/A	N/A	710	730	2.8
Physicians, Psychiatrists	50	50	0.0	340	590	73.5
Physicians, Surgeons	70	120	71.4	1,160	1,270	9.5
Physicians and Surgeons, All Other	1,150	1,120	-2.6	10,770	16,370	52.0
Radiologic Technologists and Technicians	550	650	18.2	6,170	6,390	3.6
Recreational Therapists	80	100	25.0	680	610	-10.3
Respiratory Therapists	350	540	54.3	3,620	4,270	18.0
Speech-language Pathologists	450	570	26.7	3,400	3,400	0.0
Surgical Technologists	230	540	134.8	2,760	4,010	45.3

Source: Bureau of Labor Statistics Occupational Employment Statistics

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

Color Key: Students Enrolled Over Last 3 Years; Graduates Over Last 3 Years

	Davenport University		Ferris State University		Grand Rapids Community College		Kellogg Community College	
Allied Health Sciences			683	25				
Biology								
Chemistry								
Dental Assistant/Assisting					55	42		
Dental Hygiene/Hygienist			184	117	192	93	150	56
Diagnostic Medical Sonography			75	59				
Dietary and Food Service Management			10	9				
Electrocardiogram (ECG) Technician								
Emergency Medical Services							71	16
Emergency Medical Technician[1]							51	91
Fire Science								
Gerontology			0	130	19	0		
Health Information Technology	442	197	142	117				
Health Insurance Claims Management	118	19						
Kinesiology								
Magnetic Resonance Imaging (MRI)							15	0
Medical Assistant[2]	373	244					94	27
Medical Billing								
Medical Laboratory Technology			11	5			0	12
Medical Office Administration								
Nursing[3]	123	116			701	431	1,040	870
Nursing Assistant (CNA)								
Occupational Therapy Assistant					148	57		
Phlebotomy	5	11						
Physical Therapist Assistant							155	71
Radiography[4]			184	117	133	61	94	54
Respiratory Care			129	72				
Surgical Technology								

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

Lansing Community College		Montcalm Community College		Muskegon Community College		Southwestern Michigan College		West Shore Community College		TOTAL ENROLLMENT	TOTAL GRADUATES
										683	25
1,311	38									1,311	38
754	15									754	15
										55	42
419	67									945	333
										75	59
										10	9
						6	0			6	0
										71	16
257	95					13	0			64	91
						24	9			281	104
										19	130
						56	29			640	343
789	35									118	19
										789	35
										15	0
		121	27					11	0	599	298
								26	5	26	5
										11	17
		164	39							164	39
3,293	844	421	141	1,264	478	436	162	181	185	7,459	3,227
						1	0	49	2	50	2
										148	57
						7	2			12	13
										155	71
369	90							8	0	788	322
				209	53					338	125
182	51									182	51

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

Color Key: Students Enrolled Over Last 3 Years / Graduates Over Last 3 Years	Albion College		Aquinas College		Calvin College		Central Michigan University		Cornerstone College	
Allied Health Sciences										
Animal Science/Preveterinarian										
Athletic Training	51	14	73	177			228	70		
Biochemistry	84	29			388	115	207	60		
Biochemistry and Molecular Biology										
Biochemistry and Molecular Biology/Biotechnology										
Biology	314	110	239	94	621	139	834	702	139	3
Biomedical Laboratory Science										
Biomedical Sciences										
Biopsychology										
Biosystems Engineering										
Cardiac Rehabilitation									26	0
Cell and Molecular Biology										
Chemistry	53	14	29	8	114	16	98	29		
Clinical Laboratory Sciences										
Communication Disorders							645	239		
Community Health									1	0
Dental Hygiene										
Diagnostic Medical Sonography										
Dietetics							323	92		
Environmental Biology/Microbiology										
Environmental Biology/Plant Biology										
Exercise Science	158	48	88	22			1,500	586	164	55
Genomics and Molecular Genetics										
Health Administration							447	169		
Health Care Systems Administration										
Health Communication										
Health Fitness in Preventive and Rehabilitative Programs							13	166		
Health Information Management										
Health Services Administration										
Human Biology										
Kinesiology					506	104				
Medical Case Management										
Medical Laboratory Sciences										
Microbiology										
Molecular Diagnostics										
Neuroscience	17	0					457	141		
Nuclear Medicine Technology										
Nursing*			557	0	879	184				
Nutritional Sciences										
Occupational Therapy										
Physics	24	9			53	10	32	10		
Physiology										
Public Health										
Psychology	261	98	212	81	567	159			230	151
Radiation Therapy										
Radiologic and Imaging Sciences										
Social Work					330	93	574	165	163	34
Sociology	64	26	47	22	127	32	151	188		
Speech Pathology and Audiology					448	98				
Therapeutic Recreation					151	34				

Notes:
[1]Nursing Program for Aquinas is a parternship with Detroit Mercy, and students graduate from Detroit Mercy with a BSN.
Tables do not include programs with a value of 0 for both enrollment and graduates.

	Davenport University		Ferris State University		Grand Valley State University		Hope College		Kuyper College		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
			471	150	2,834	700									3,305	850
											1,847	375			1,847	375
					657	71	67	21			445	66	80	39	1,601	298
			27	3	263	32							233	35	1,202	274
							129	26			871	183			1,000	209
			115	26							297	57			412	83
			157	288	1,885	337	438	155			27	8	736	105	5,390	1,941
											934	195			934	195
					3,571	740							1,905	306	5,476	1,046
					75	23									75	23
											667	126			667	126
															26	0
					270	60									270	60
					325	63					830	180	205	21	1,654	331
											125	63			125	63
															645	239
															1	0
			119	41											119	41
					653	90									653	90
											585	209	76	59	984	360
											58	10			58	10
									4	0	68	14			72	14
					3,141	689	428	121	7	1			1,110	265	6,596	1,787
											543	141			543	141
															447	169
			596	261											596	261
					323	103									323	103
															13	166
	405	96	220	71											625	167
	668	133													668	133
											4,494	1,092			4,494	1,092
											3,318	951			3,824	1,055
	543	27													543	27
			126	57	263	50									389	107
											513	145			513	145
			46	33											46	33
											1,834	303			2,308	444
			173	105											173	105
	2,213	428	1,777	711	1,407	620	509	136			1,385	600	1,085	359	9,812	3,038
											586	143			586	143
													289	139	289	139
					140	24					761	102	119	21	1,129	176
											856	213			856	213
			70	0											70	0
			381	98	3,052	848	724	251			3,590	1,109	947	426	9,964	3,221
					339	51									339	51
					96	20									96	20
			618	186	1,291	384	268	90	171	39	634	181	352	212	4,401	1,384
			34	8	337	126	204	71			356	118	332	122	1,652	713
													227	95	675	193
					449	109									600	143

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

Color Key: Students Enrolled Over Last 3 Years / Graduates Over Last 3 Years	Davenport University		Calvin College		Central Michigan University	
Animal Science						
Biochemistry and Molecular Biology						
Biology/Biological Sciences					82	87
Biomedical Laboratory Science/Operations						
Biomedical Sciences						
Biostatistics						
Cell and Molecular Biology						
Chemical Engineering						
Chemistry					76	16
Communication Disorders					1	118
Comparative Medicine and Integrative Biology						
Counseling Psychology						
Dietetics					28	68
Epidemiology						
Exercise Physiology						
Health Administration					123	424
Health and Risk Communication						
Integrative Pharmacology						
Kinesiology						
Laboratory Research in Pharmacology and Toxicology						
Medical and Bioinformatics	119	10				
Neuroscience					22	11
Nursing	70	12				
Occupational Therapy	78	0				
Physician Assistant					209	124
Pharmacology and Toxicology						
Physics					57	28
Physiology						
Psychology						
Public Health						
Speech Language Pathology			101	77	241	118
Social Work						
Sociology						
Vision Rehabilitation Therapy						

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

	Ferris State University		Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
					35	15			35	15
					0	2			0	2
			112	35			106	31	300	153
					56	6			56	6
			56	13					56	13
			101	47	40	15			141	62
			105	40					105	40
					15	14	36	16	51	30
							29	10	105	26
					191	93			192	211
					41	7			41	7
							416	113	416	113
									28	68
					44	17			44	17
							66	28	66	28
			217	67					340	491
					33	15			33	15
					21	14			21	14
					186	89			186	89
					0	1			0	1
			66	22					185	32
					2	0			24	11
	299	70	46	13	523	184	56	10	994	289
			402	155			560	291	1,040	446
			417	134			226	118	852	376
					423	102			423	102
					5	46	8	10	70	84
					11	6			11	6
					119	48	309	127	428	175
			327	127	481	293			808	420
			241	117			179	87	762	399
	205	29	990	475			1,089	397	2,284	901
					1	16	26	6	27	22
							85	48	85	48

Table 5:
College and University Programs — Doctoral Degree

Color Key: Students Enrolled Over Last 3 Years; Graduates Over Last 3 Years

	Central Michigan University		Ferris State University		
Animal Science					
Audiology	145	32			
Biochemistry and Molecular Biology					
Biochemistry and Molecular Biology — Environmental Toxicology					
Biological Sciences					
Biosystems Engineering					
Cell and Molecular Biology					
Cell and Molecular Biology — Environmental Toxicology					
Chemical Engineering					
Chemistry					
Communicative Sciences and Disorders					
Comparative Medicine and Integrative Biology					
Counseling Psychology					
Epidemiology					
Genetics					
Genetics — Environmental Toxicology					
Health Administration	0	54			
Human Nutrition					
Kinesiology					
Medicine	1,040	62			
Neuroscience	48	3			
Nursing					
Optometry			443	107	
Pathobiology					
Pharmacology and Toxicology					
Pharmacy			1,744	420	
Physical Therapy	517	147			
Physics					
Physiology					
Psychology					
Rehabilitation Counseling					
Social Work					
Sociology					

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

	Grand Valley State University		Michigan State University		Western Michigan University		TOTAL ENROLLMENT	TOTAL GRADUATES
			62	10			62	10
					66	15	211	47
			139	23			139	23
			5	2			5	2
					79	7	79	7
			62	12			62	12
			90	12			90	12
			2	0			2	0
			144	33			144	33
			596	92	84	16	680	108
			23	1			23	1
			102	12			102	12
					159	23	159	23
			65	9			65	9
			67	21			67	21
			2	0			2	0
							0	54
			36	10			36	10
			134	34			134	34
			6,179	612			7,219	674
			65	16			113	19
	319	62	61	7			380	69
							443	107
			7	5			7	5
			37	4			37	4
							1,744	420
	523	155					1,040	302
			445	53	65	7	510	60
			49	4			49	4
			158	35	287	47	445	82
			50	10			50	10
			59	14			59	14
			108	23	84	10	192	33

Table 6: Need for Selected Professions in Michigan

Selected Professions	Michigan Employment (2017)[1]	Grand Rapids Employment (2017)[2]	Michigan Annual Growth Rate[3]	Grand Rapids Annual Growth Rate[4]
Dental Assistants	9,550	920	0.004	0.008
Dental Hygienists	10,090	1,190	0.004	0.008
Diagnostic Medical Sonographers	2,510	310	0.018	0.029
Dietitians and Nutritionists	1,790	230	0.001	0.019
EMTs and Paramedics	6,850	440	0.016	0.018
Family and General Practitioners	4,860	830	0.004	0.006
Home Health Aides	27,100	1,710	0.024	0.028
Nurses, RN	94,090	11,450	0.012	0.022
Nurses, LPN or LVN	14,920	2,060	0.005	0.009
Medical Assistants	22,790	2,500	0.001	0.016
Nurse Practitioners	3,970	370	0.021	0.029
Nursing Assistants	51,640	6,940	0.009	0.015
Occupational Therapy Assistants	1,140	200	0.023	0.032
Occupational Therapists	4,780	650	0.015	0.024
Optometrists	1,440	240	0.012	0.017
Physician Assistants	4,780	780	0.018	0.024
Physical Therapists	8,250	1,020	0.02	0.028
Respiratory Therapists	4,270	540	0.01	0.022
Speech-language Pathologists	3,400	570	0.007	0.014
Surgical Technologists	4,010	540	0.009	0.020

Notes:
[1]Source: https://www.bls.gov/oes/2017/may/oes_mi.htm
[2]Source: https://www.bls.gov/oes/2017/may/oes_24340.htm
[3]Source: http://milmi.mt.gov/datasearch/projections-excel (Statewide Long-Term Projections 2014-2024, Occupational Projections)
[4]Source: http://milmi.mt.gov/datasearch/projections-excel (Michigan Regional Long-Term Employment Projectsions 2014-2024, West Michigan Propserity Region Occupational Projections

	Michigan Projected Employment (2024)	Grand Rapids Projected Employment (2024)	Michigan Annual Job Growth	Grand Rapids Annual Job Growth	Michigan Annual Replacement Rate	Grand Rapids Annual Replacement Rate	Average Annual Job Openings in Michigan	Average Annual Job Openings in Grand Rapids
	9,821	973	39	8	0.025	0.024	277	30
	10,376	1,258	41	10	0.016	0.017	202	30
	2,844	379	48	10	0.019	0.018	95	15
	1,803	262	2	5	0.008	0.006	16	6
	7,655	499	115	8	0.016	0.016	225	15
	4,998	865	20	5	0.027	0.027	151	27
	31,994	2,075	699	52	0.023	0.023	1,322	91
	102,284	13,334	1,171	269	0.024	0.024	3,429	544
	15,450	2,193	76	19	0.028	0.028	493	77
	22,950	2,794	23	42	0.021	0.021	501	94
	4,592	452	89	12	0.024	0.023	184	20
	54,982	7,702	477	109	0.023	0.023	1,665	269
	1,337	249	28	7	0.029	0.029	61	13
	5,305	767	75	17	0.019	0.019	166	29
	1,565	270	18	4	0.035	0.037	68	13
	5,416	921	91	20	0.023	0.023	201	38
	9,477	1,238	175	31	0.027	0.027	398	59
	4,578	629	44	13	0.023	0.024	142	26
	3,570	628	24	8	0.025	0.025	109	23
	4,270	620	37	11	0.010	0.010	77	17

Table 7: Average Annual Earnings for Select Health Care Professions

Selected Professions Color Key: Above 7% Below Negative 7% (-7%)	2007 Mean Annual Earnings			2017 Mean Annual Earnings			% Change in Real Annual Earnings		
	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.	Grand Rapids	Michigan	U.S.
Dental Assistant	$40,212	$39,372	$38,166	$41,990	$36,480	$38,690	4.42	-7.35	1.37
Dental Hygienist	$68,269	$70,468	$76,746	$64,550	$62,370	$74,680	-5.45	-11.49	-2.69
Diagnostic Medical Sonographer	$69,746	$64,887	$71,638	$59,480	$60,410	$73,200	-14.72	-6.90	2.18
Dietitian and Nutritionist	$52,886	$56,646	$59,153	$57,520	$55,320	$60,150	8.76	-2.34	1.69
EMT and Paramedic	$30,552	$35,388	$36,499	$35,570	$32,360	$36,700	16.43	-8.56	0.55
Family and General Practitioner	$165,244	$183,086	$181,655	$175,780	$191,260	$208,560	6.38	4.46	14.81
Home Health Aide	$24,877	$24,002	$24,652	$23,810	$23,420	$24,280	-4.29	-2.42	-1.51
LPN	$43,309	$47,767	$46,040	$41,900	$47,660	$45,710	-3.25	-0.22	-0.72
Medical Assistant	$32,373	$32,810	$33,425	$33,240	$31,270	$33,580	2.68	-4.69	0.46
Nurse Practitioner	NA	NA	NA	$97,160	$102,250	$107,480	NA	NA	NA
Nursing Assistant	NA	NA	NA	$28,710	$29,200	$28,540	NA	NA	NA
Occupational Therapist	$44,267	$47,589	$53,418	$46,590	$53,360	$59,470	5.25	12.13	11.33
Occupational Therapy Assistant	$72,773	$72,655	$77,491	$68,710	$80,110	$84,640	-5.58	10.26	9.23
Optometrist	$144,305	$125,991	$120,410	$111,740	$113,880	$119,100	-22.57	-9.61	-1.09
Physician Assistant	$77,337	$83,615	$84,561	$83,670	$89,060	$88,080	8.19	6.51	4.16
Physical Therapist	$97,555	$93,689	$91,986	$109,210	$103,480	$104,760	11.95	10.45	13.89
Respiratory Therapist	$55,913	$58,396	$60,217	$55,120	$55,830	$61,810	-1.42	-4.39	2.65
RN	$65,738	$72,158	$73,873	$64,030	$69,120	$73,550	-2.60	-4.21	-0.44
Speech-language Pathologist	$91,076	$82,681	$75,363	$71,450	$78,160	$79,770	-21.55	-5.47	5.85
Surgical Technologist	$49,363	$46,372	$45,875	$41,050	$42,410	$48,060	-16.84	-8.54	4.76

Note:
*2007 Mean Annual Wages are inflated to 2017 dollars.

Medical Patents

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

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

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

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 2017. For those with inventors living in Kent County, the average annual number of patents increased from 12.6 in the years 1990 to 1999 to 16.3 in the years 2000 to 2009, with a further increase to an average of 21.6 in the years 2010 to 2017. For those with assignees in Kent County, the average annual number of patents increased from 6.2 in the years 1990 to 1999, to 10.3 in the years 2000 to 2009, and to 12.3 patents in the years 2010 to 2017. 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.

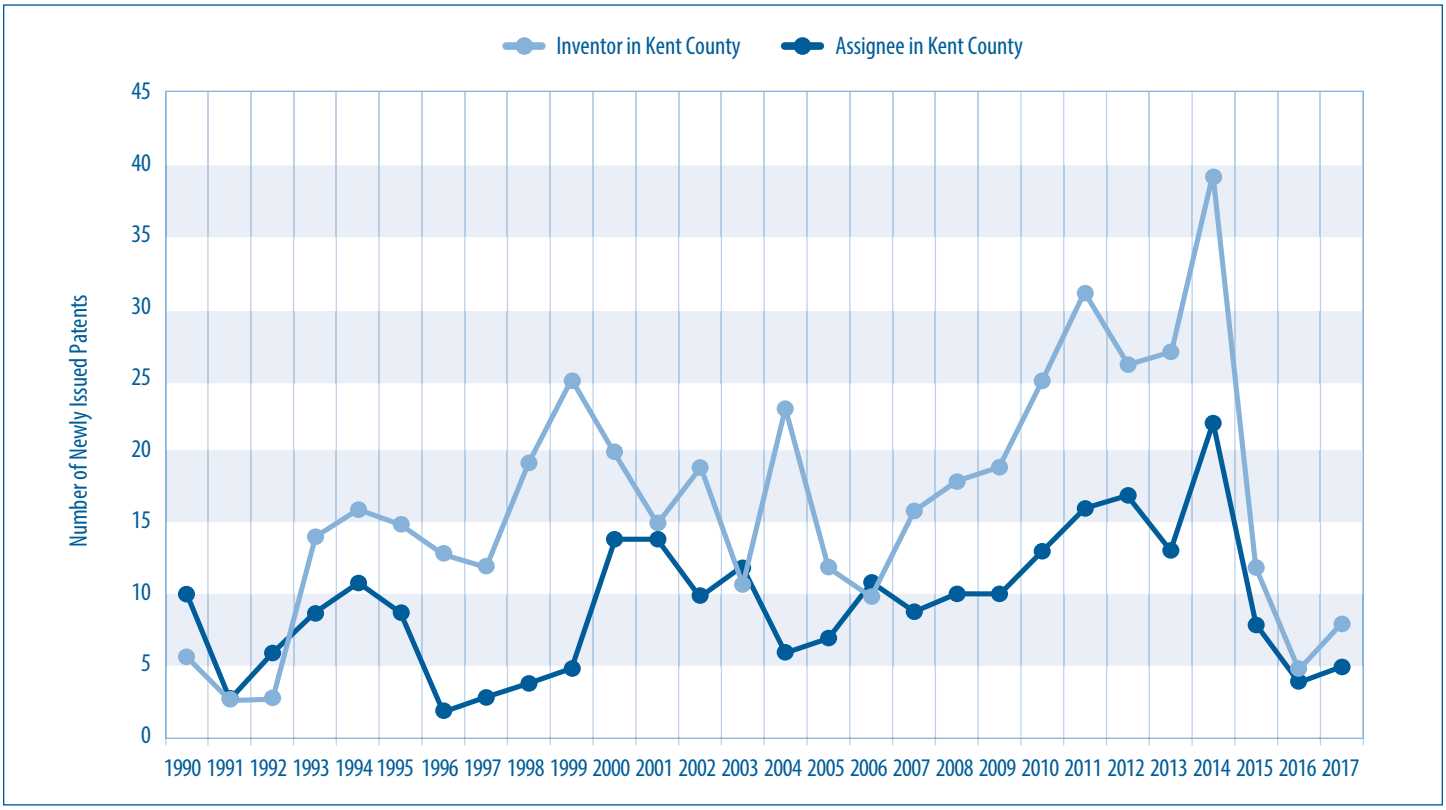
Although both of the measures displayed in **Figure 1** have a positive trend, there has been a significant decrease in patenting since 2014, with the annual number of new patents with inventors living in Kent County falling by 79 percent from 2014 to 2017, and the annual number of new patents with assignees located in Kent County falling by 77 percent over the same period. The patenting process often involves significant time delays between application and approval: for example, a patent applied for in 2017 may not be approved (or issued) until 2022. However, if the processing time lag has remained relatively consistent over time, then the time lag would not explain the recent declines seen in **Figure 1**, as the data presented is for the year that the patents were actually issued, not the year of application. A significant increase in the processing time lag since 2014 could explain the decrease in new medical patents. Other explanations for the recent decline in medical patenting include (1) fewer R&D resources are being devoted to medical innovation, resulting in fewer innovations; (2) even with continued R&D support, researchers are coming up with fewer innovations; and (3) researchers are choosing to apply for fewer patents (for example, *choosing* to patent one "big" innovation rather than several "small" innovations).

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: 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 USA, from 2014–2017.

Comparing the national, state, and local patent data is revealing. In 2014, 2.3 percent of all of the new medical patents with a U.S. inventor had an inventor from Michigan. Although the overall number of new medical patents fell in the following years for both the state and the nation as a whole, this percentage did not change significantly; in 2017, 2.5 percent of new medical patents with a U.S. inventor had an inventor from Michigan. However, of the new medical patents invented in Michigan, 7.2 percent had an inventor from Kent County in 2014, while in 2017 this percentage increased more than four-fold to 29.6 percent. Thus, although the quantity of medical patenting has decreased in recent years, the relative output of inventors in Kent County has comparatively grown.

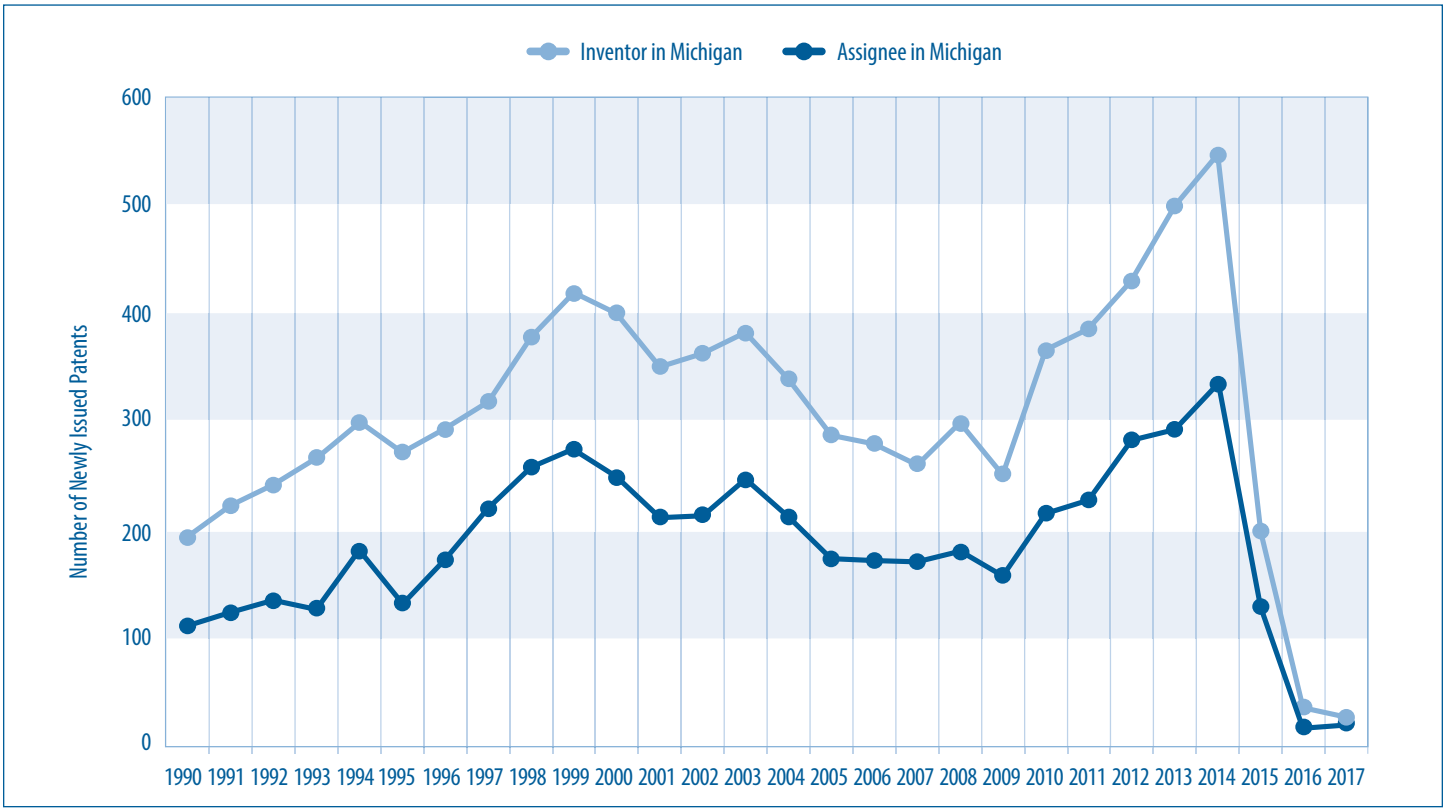
A patent obtained through the USPTO only gives property right protection in the U.S. While this protection is sufficient for some inventors and assignees, others choose to apply for patents in other countries in order to receive property rights elsewhere. One way to do this is through the World Intellectual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

Figure 1: Medical Patenting in Kent County



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

Figure 2: Medical Patenting in Michigan



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

The number of non-duplicate medical patent applications filed by West Michigan companies at the WIPO and at the USPTO from 2011 through 2017 is shown in **Figure 3**. Since the year 2011, there have been 154 medical patent filings from 14 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: 21 percent of the listed companies did not apply for any medical patents in 2017. In contrast to the data shown in **Figures 1 and 2**, the number of new medical patent applications by these 14 companies in 2017 is 28 percent higher than in 2014.

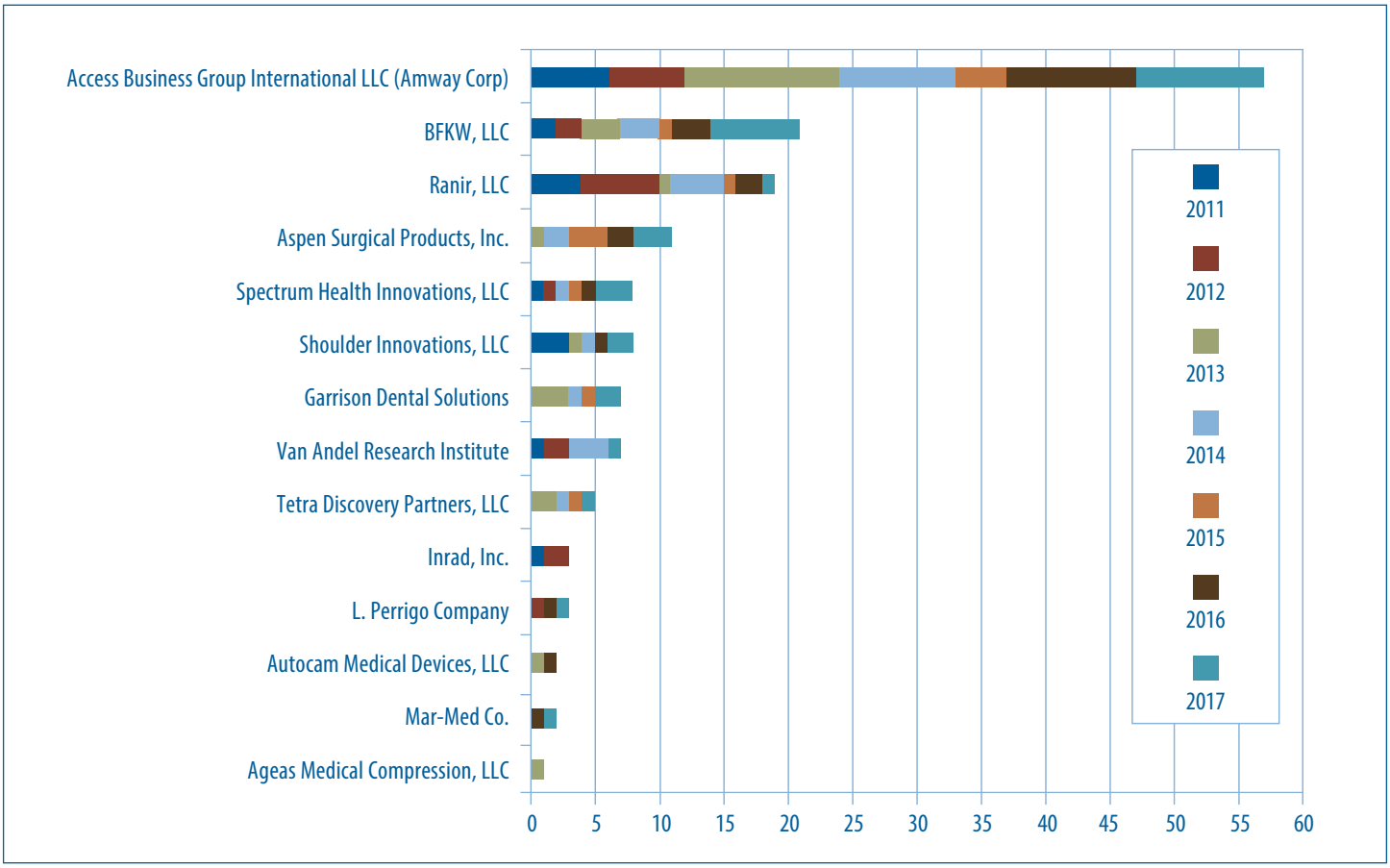
The information shown in these three figures indicates that, although there is a growing rate of overall medical patenting in West Michigan, the level of patenting is relatively modest, with the majority of it being conducted by a small number of regional companies. Furthermore, recent decreases in patenting behavior are concerning. Patented medical innovation in West Michigan has the potential to become a significant driver of regional economic growth, but continued R&D support is vital.

Table 1: Percentage Change in Newly Issued Medical Patents by Location of Inventor and Assignee, 2014-2017

	Location of Inventor			Location of Assignee		
	Kent County	Michigan	U.S.A.	Kent County	Michigan	U.S.A.
% Change 2014-2017	-79	-95	-95	-77	-93	-96

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

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

Health Care Trends

Grand Valley State University
www.gvsu.edu

Demographic Changes

Long-term population and age distribution changes have significant effects on the consumption of health care services. We continue to monitor two demographic trends that have become apparent over the past several years: continued population growth on the west side of the state and a general aging of the population. Since older populations have more complex health care needs than younger populations, an aging demographic can result in increased health care utilization and expenditures. Additionally, geographic shifts in population distribution can affect demand for care and resource allocation in particular localities.

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 exceeded both the growth rate for the state of Michigan and the growth rate for the U.S. However, Michigan was particularly impacted by the recession in the mid 2000s and growth rates for both KOMA and the Detroit region fell precipitously. Though KOMA was able to maintain positive population growth throughout the 2000s, the Detroit region experienced population loss beginning in the early 2000s that lasted for more than a decade. The Detroit region achieved positive population growth in the early part of this decade before leveling off at zero growth for the next four years. From 2016 to 2017, the population in the Detroit region grew at a rate of 0.15 percent, marking the largest year-over-year increase since 1996. However, Detroit region's population growth still lagged behind the rest of the state.

KOMA's population growth rate began escalating in 2010 and surpassed the national growth rate in 2012. Over the past four years, the positive population growth in West Michigan has continued at a slower pace with growth rates falling from 1.2 percent in 2014 to 0.9 percent in 2016. Importantly, given the Detroit region's negative to near zero population growth rate over the past 15 years, these trends are indicative of a geographic shift in the population distribution in Michigan from the east side of the state to the west. In fact, from 2000 to 2010, the state center of population shifted nearly a mile to the west. If 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).

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. The clear trend in all three figures is the steady aging of the population. For example, persons between the ages of 45 and 64 now outnumber all other age groups despite being only the third most populous age group in 1990. Additionally, since 2010, the percentage of the population over the age of 65 has experienced the largest growth of any of the age categories. Due to the aging of the population and the growth in the percentage of those over the age of 45, 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. More than 50 percent of lifetime spending on medical care occurs 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. This change will be especially salient for the Detroit region which, compared to the national average, has a higher proportion of its population in the 45 to 64 and 65 and over age categories. The share of the population over the age of 65 in the Detroit region grew from approximately 12 percent in 1990 to nearly 16 percent in 2017. By contrast, KOMA is in a more favorable position with 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 prove challenging across the entire state.

Second, **Figures 2 through 4** indicate that the proportion of those over the age of 65 has already eclipsed the proportion of 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 elderly. 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, 2018).

Finally, the aging of the population has important implications for employer-sponsored health insurance. 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 2005 to 2017, average annual employer-sponsored health insurance premiums for family coverage increased 72 percent, from $10,880 to $18,764, while real annual wages increased by less than 2 percent over the same period

(Kaiser Family Foundation, 2017). Gains from a steady reduction in the growth rate of health care expenditures since the early 2000s, due in part to reduced income growth and a shift toward high-deductible health insurance plans, are likely to be at least partially offset by this shift in the age distribution of workers.

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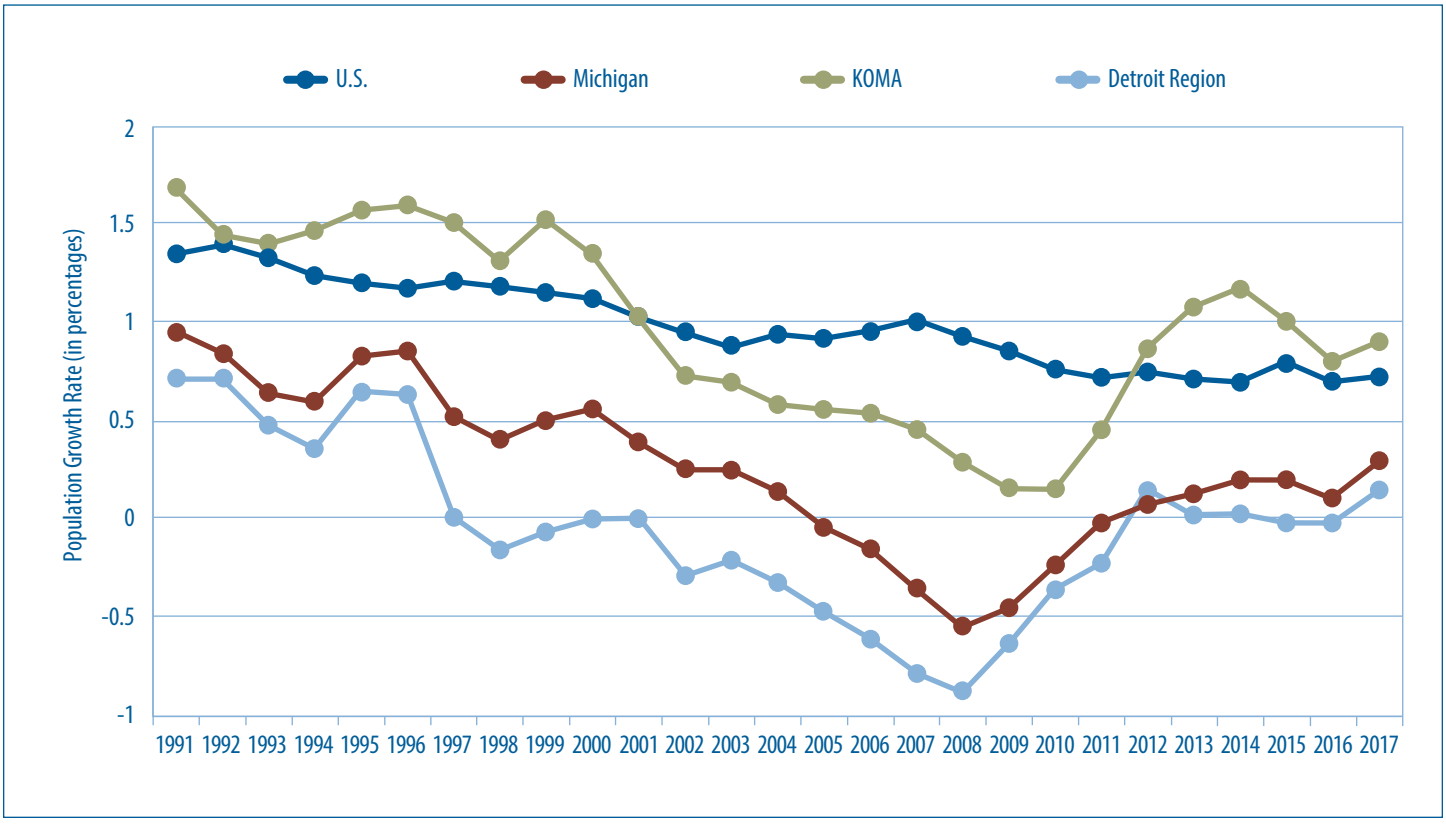
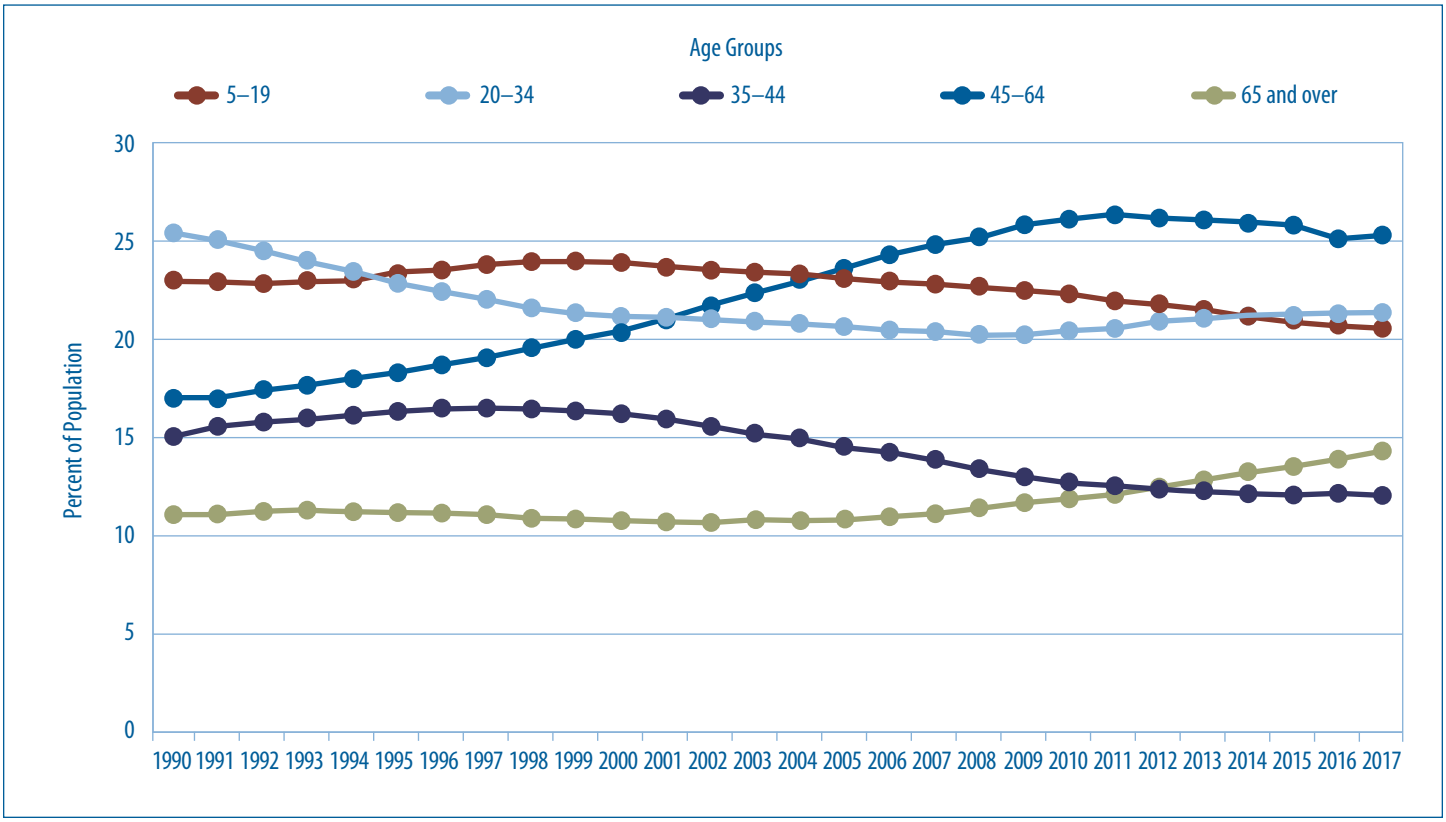
Figure 1: Annual Population Growth Rate 1991–2017



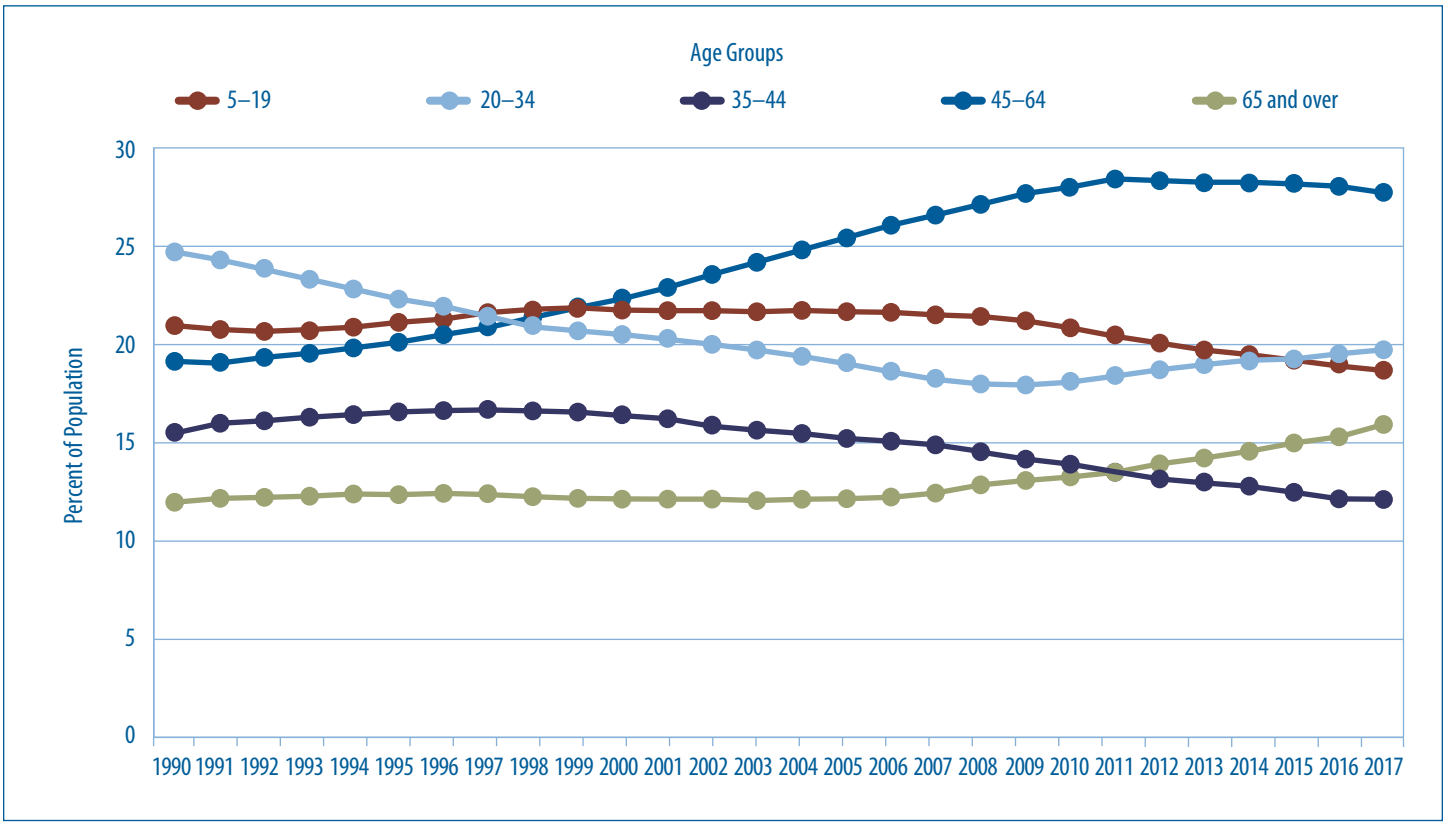
Source: U.S. Census. *Population and housing unit estimates*

Figure 2: Population Distribution as a Percent of KOMA



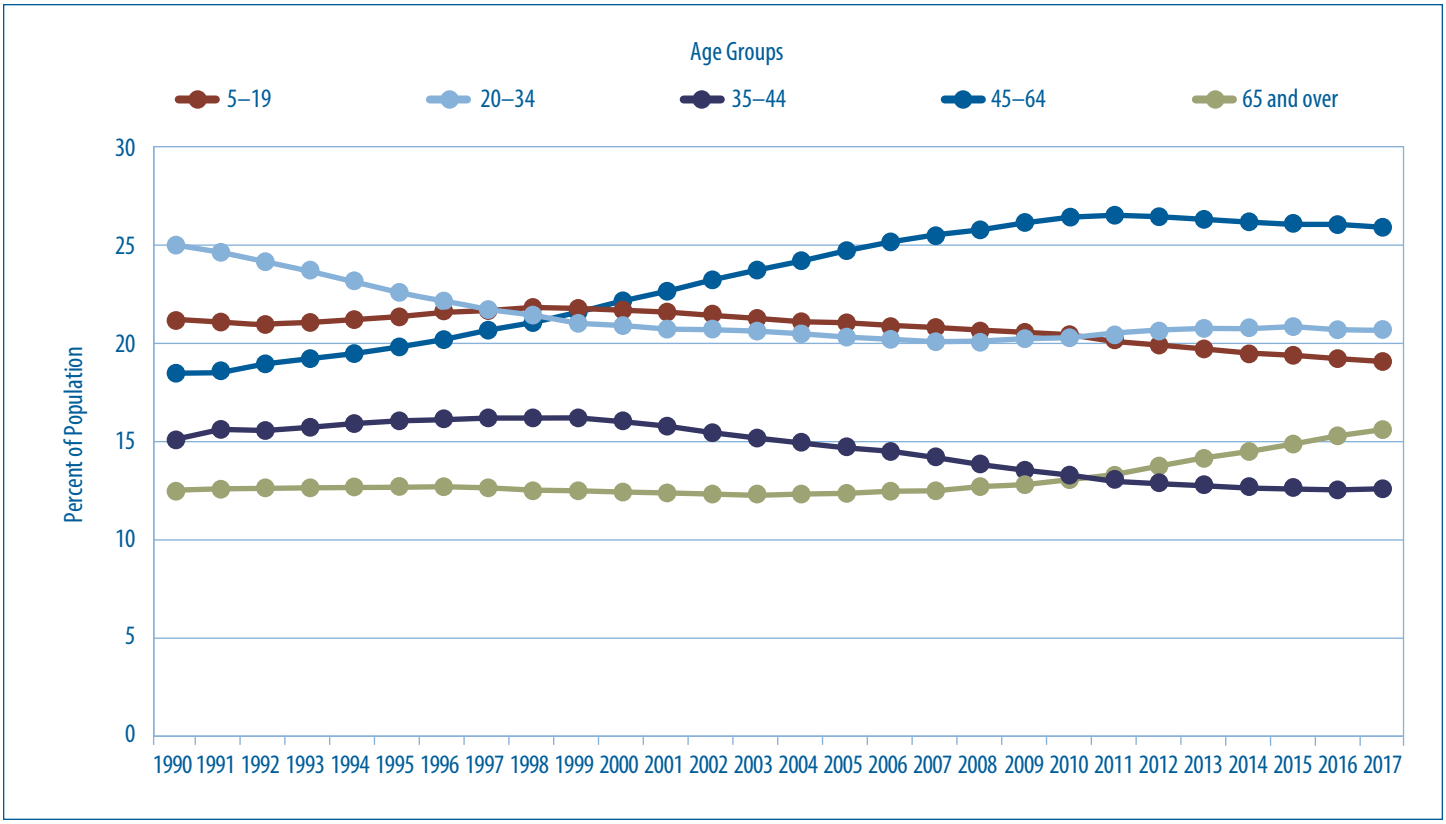
Source: U.S. Census. *Population and housing unit estimates*

Figure 3: Population Distribution as a Percent of the Detroit Region



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

Figure 4: Population Distribution as a Percent of Total United States



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

Health Care Overview

In this section, we consider differences in risk factors and access to care between West Michigan (Allegan, Ionia, Kent, Montcalm, and Ottawa counties) and the Detroit region (Macomb, Oakland, and Wayne counties). A caveat about this data: all estimates are based on self-reported surveys. Consequently, the actual incidence and prevalence rates for the factors examined may differ from those reported by respondents.

Risk Factors

Figure 1 presents estimates of the prevalence of heavy drinking for West Michigan 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 more than 7 percent of the West Michigan population and nearly 6 percent of the population in the Detroit region were classified as heavy drinkers in 2016. Rates of heavy drinking have remained largely stable from 2011 through 2016.

Figure 2 also focuses on alcohol consumption, but shifts from heavy drinking to binge drinking. Binge drinking is defined as consuming four or more drinks on a single occasion for women and five or more drinks on a single occasion for men. Rates of binge drinking on both the west and east sides of the state are similar and remained steady over the time period included in the analysis. Approximately 19 percent of the population of West Michigan and the Detroit region reported a binge drinking episode in the past 30 days.

Figure 3 displays estimates of the proportion of the adult population who currently smoke cigarettes. As of 2016, nearly 16 percent of the West Michigan population and 23 percent of residents in the Detroit region were current smokers. Using 2016 county population estimates, this equates to approximately 132,000 smokers in West Michigan and 622,500 smokers in the Detroit region. In 2014, the Centers for Disease Control estimated that 15.5 percent of the U.S. population currently smoked cigarettes and cigarette smoking was responsible for 480,000 annual deaths (CDC, 2018). Treatment for illnesses related to smoking and tobacco use can be costly and resource-intensive. Reductions in the prevalence of smoking and tobacco use could lead to increased worker productivity and provide some relief for rising health care expenditures (Berman et al., 2014)

Figures 4 and 5 track the share of the West Michigan and Detroit populations that are overweight and obese, respectively. An individual is considered to be overweight if their body mass index (BMI) is greater than or equal to 25 and less than 30 and obese if their (BMI) is above 30. In 2016, approximately one-third of the population in each region was considered to be overweight and nearly another third was obese. In sum, 65.5 percent of adults in West Michigan and 67.2 percent of adults in the Detroit region were either overweight or obese in 2016. These estimates are similar to the share of the overall U.S. population who is overweight or obese (Ogden et al., 2014). Recent studies place the health care costs associated with obesity at between 10 percent and 20 percent of total U.S. health-related spending (Cawley & Meyerhoefer, 2012; Finkelstein et al., 2009).

Finally, **Figure 6** plots the share of the population in each region reporting that their general health was either “fair” or “poor”. Nearly one in five residents in the Detroit region reported themselves to be in fair or poor health in 2016, while that number was slightly more than 14 percent in West Michigan. The gap between self-reported health on the west and east sides of the state has remained relatively consistent over time.

Access to Care

In addition to an examination of the risk factors associated with poor health outcomes, we are also interested in measures involving access to health care services. **Figure 7** plots the percentage of the population in West Michigan and the Detroit region that reports having no health insurance. Uninsured rates in both regions have fallen since 2013 because of the improving economy and the expanded health insurance options available under the Affordable Care Act. For example, as of August 2018, more than 670,000 people have enrolled in the Healthy Michigan expansion of the state’s Medicaid program (MDHHS, 2018). In 2011, the first year of our data, nearly 17 percent of the adult population in the Detroit region was uninsured. By 2016, that figure had fallen to 8.6 percent. The reduction in the share of the population with no health insurance coverage has been less pronounced in West Michigan due to the lower initial uninsured rate. However, the west side of the state still experienced a reduction in the uninsured rate of 5 percentage points from 2011 to 2016 (12.3 percent to 7.3 percent).

The next three figures capture measures of health care access that are likely to respond to the increase in insurance coverage that was observed in **Figure 7. Figure 8** includes estimates of the share of the population who report that 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 2016 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 2015 to 2016 in the Detroit region. **Figure 9** 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. Lastly, **Figure 10** plots the share of the population in West Michigan and the Detroit region with no routine checkup in the past year. Although we’ve seen a slight decrease from 2011 to 2016, approximately 25 percent of respondents in both regions go without an annual routine checkup. 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.

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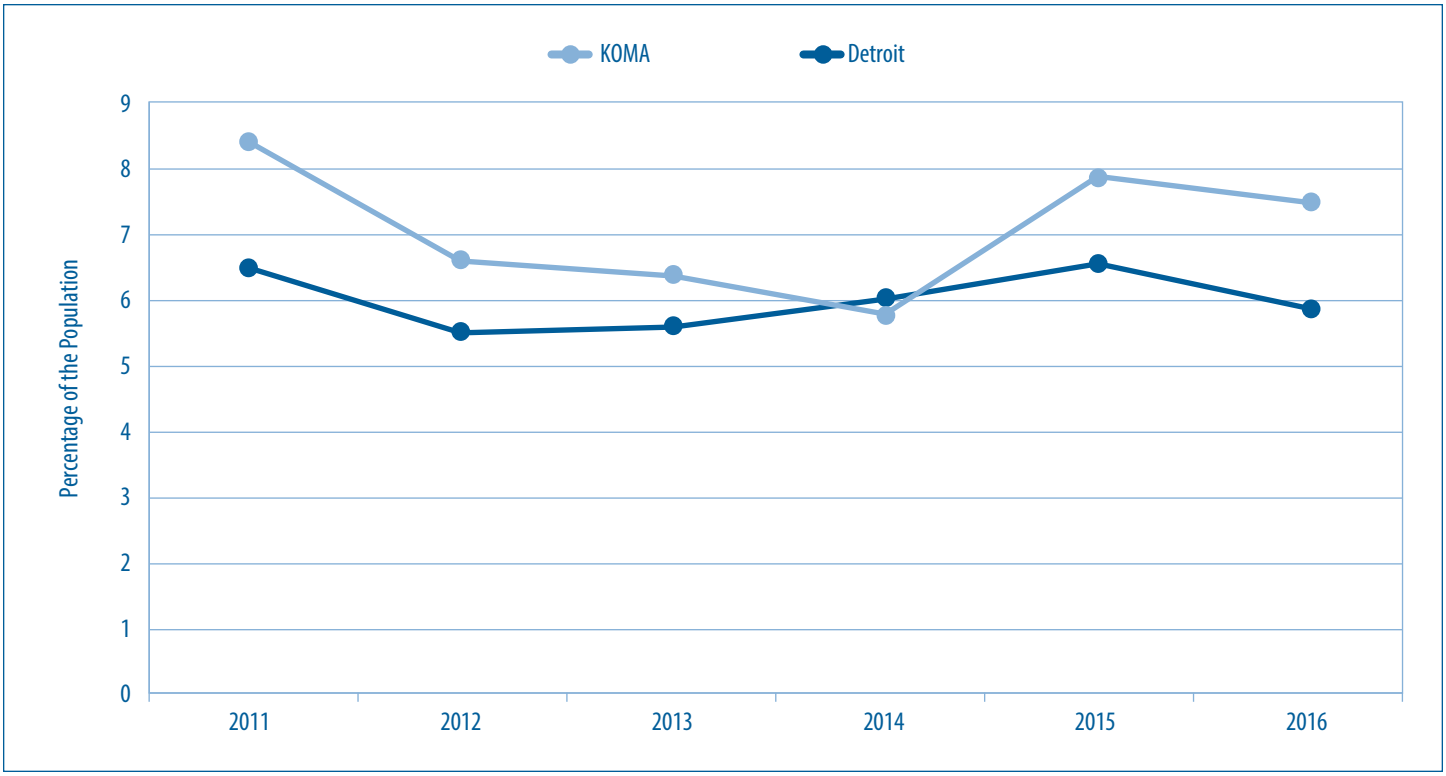
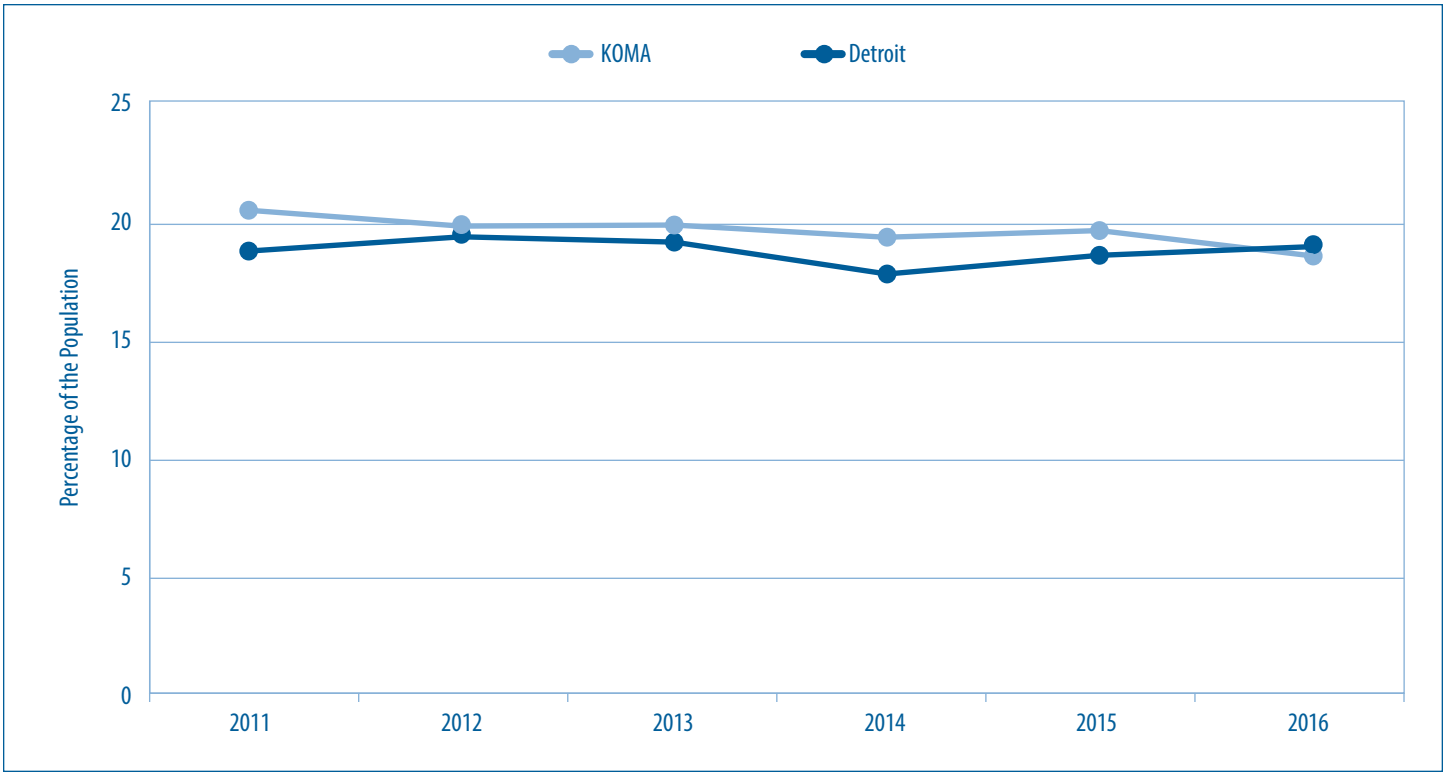
Figure 1: Heavy Drinking



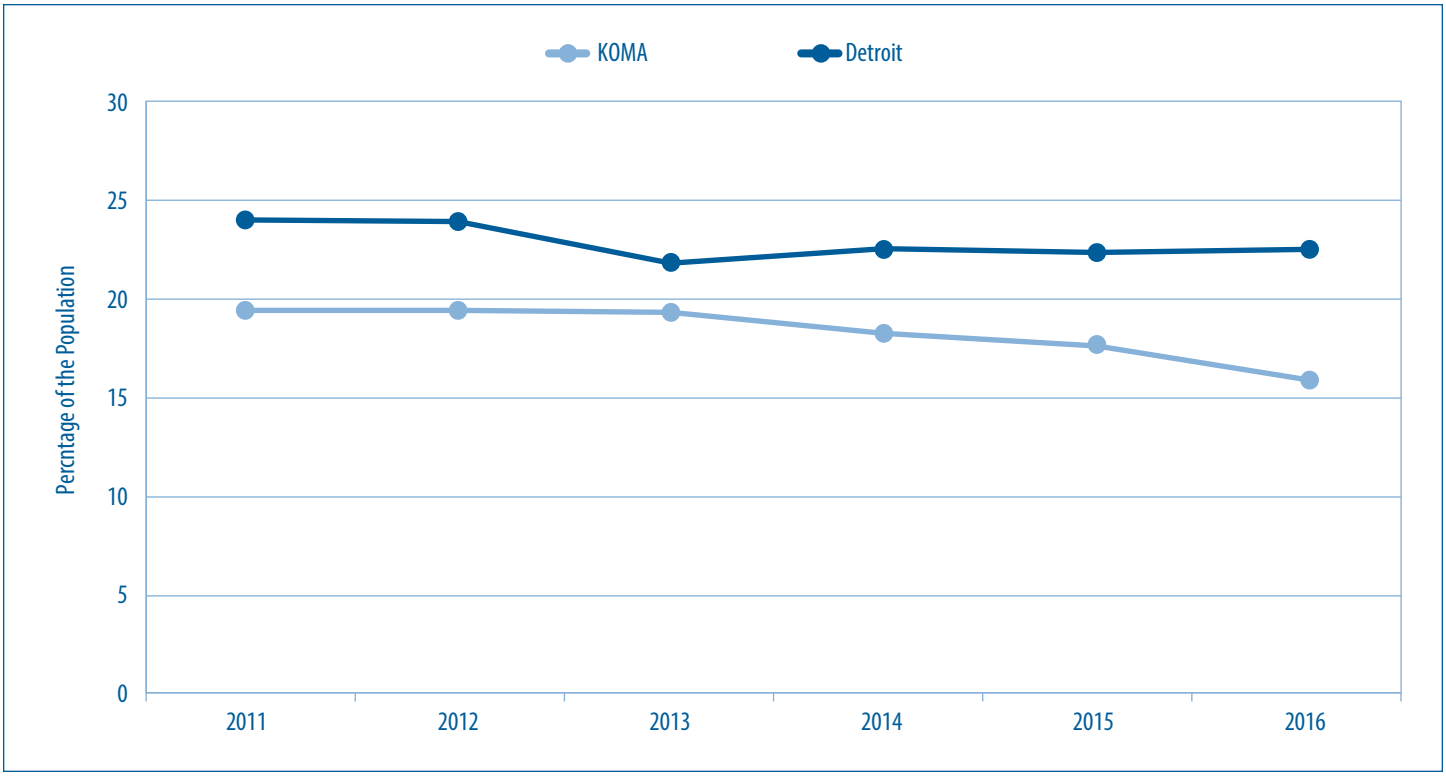
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported consuming an average of more than two alcoholic drinks per day for men or more than one per day for women.

Figure 2: Binge Drinking



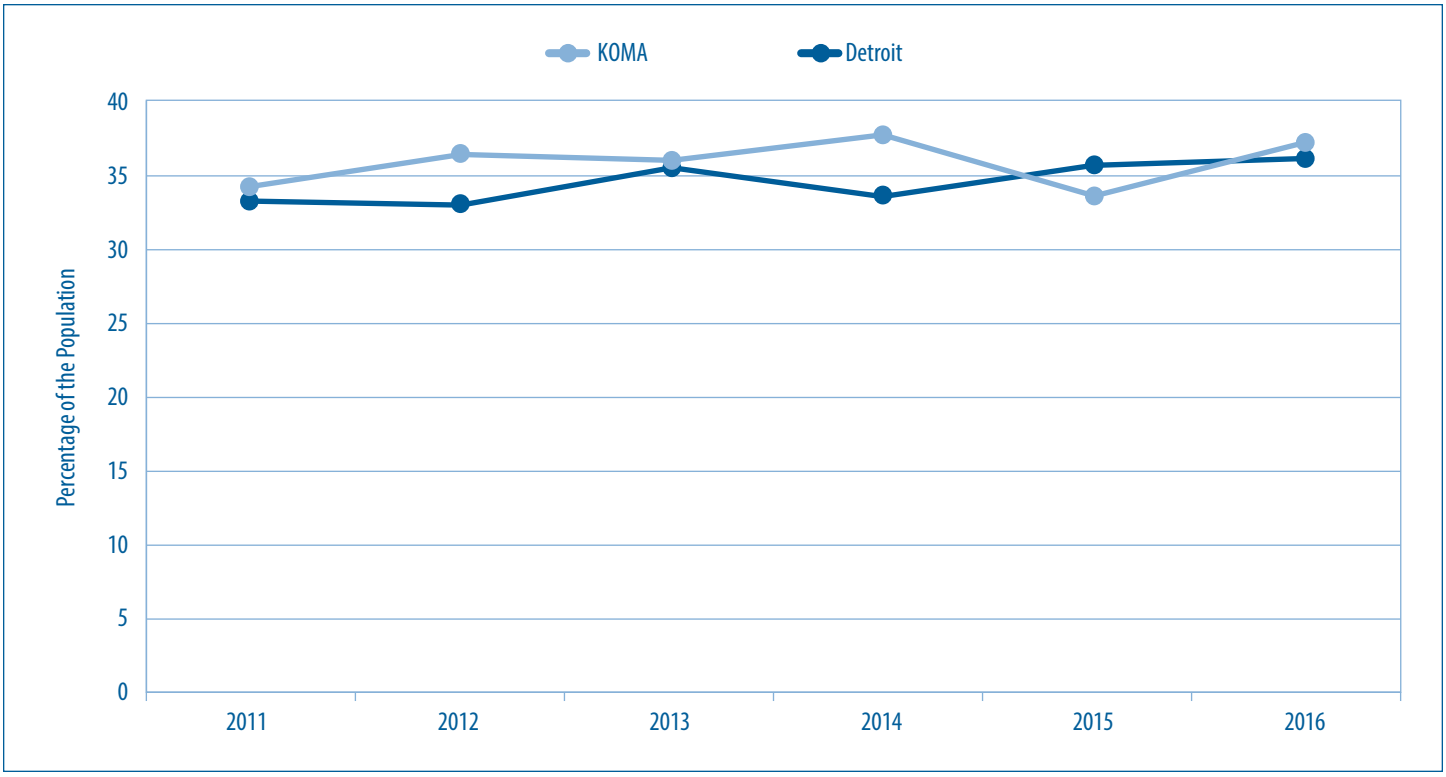
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported consuming 5 or more drinks on a single occasion for men or 4 or more drinks on a single occasion for women.

Figure 3: Current Smokers



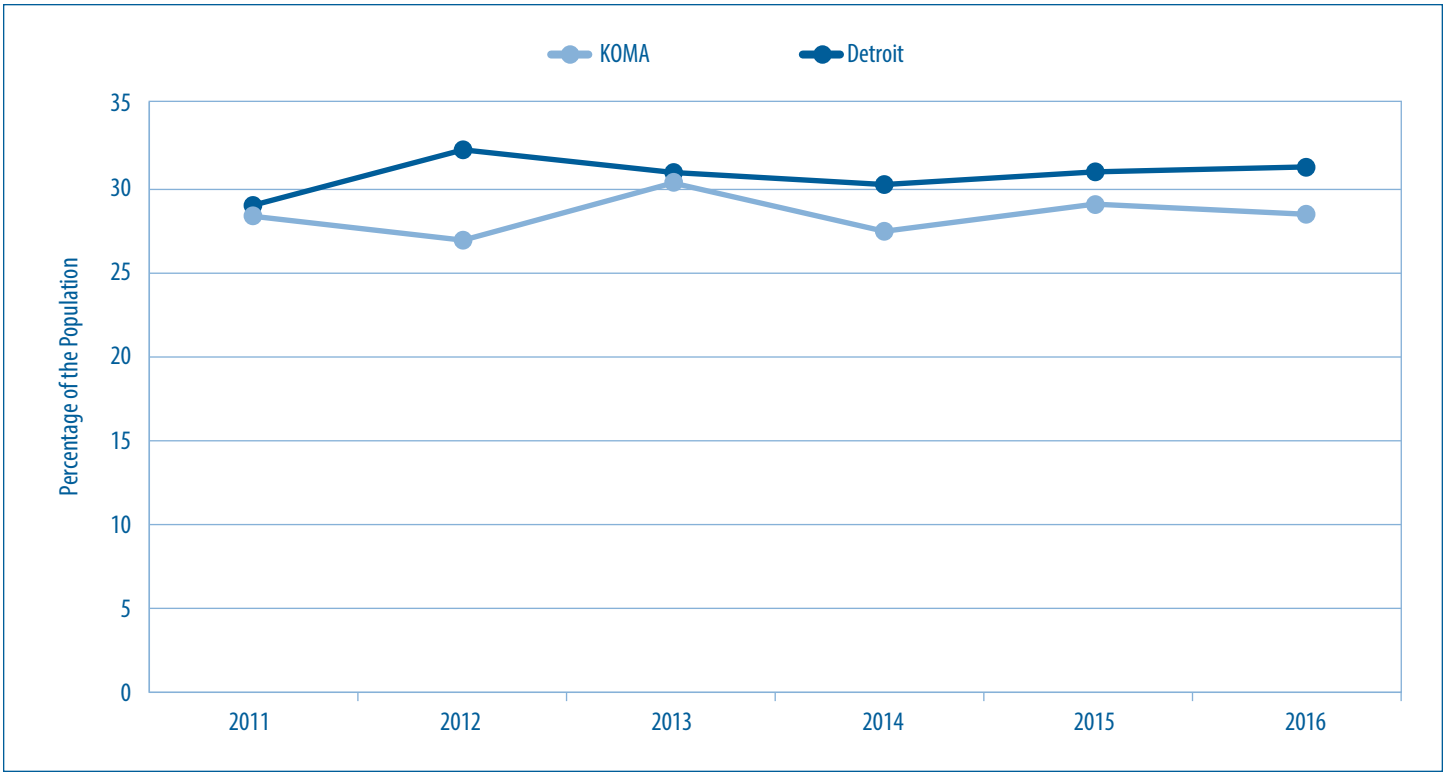
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported that they had ever smoked at least 100 cigarettes in their life and that they smoke cigarettes now, either every day or some days.

Figure 4: Overweight



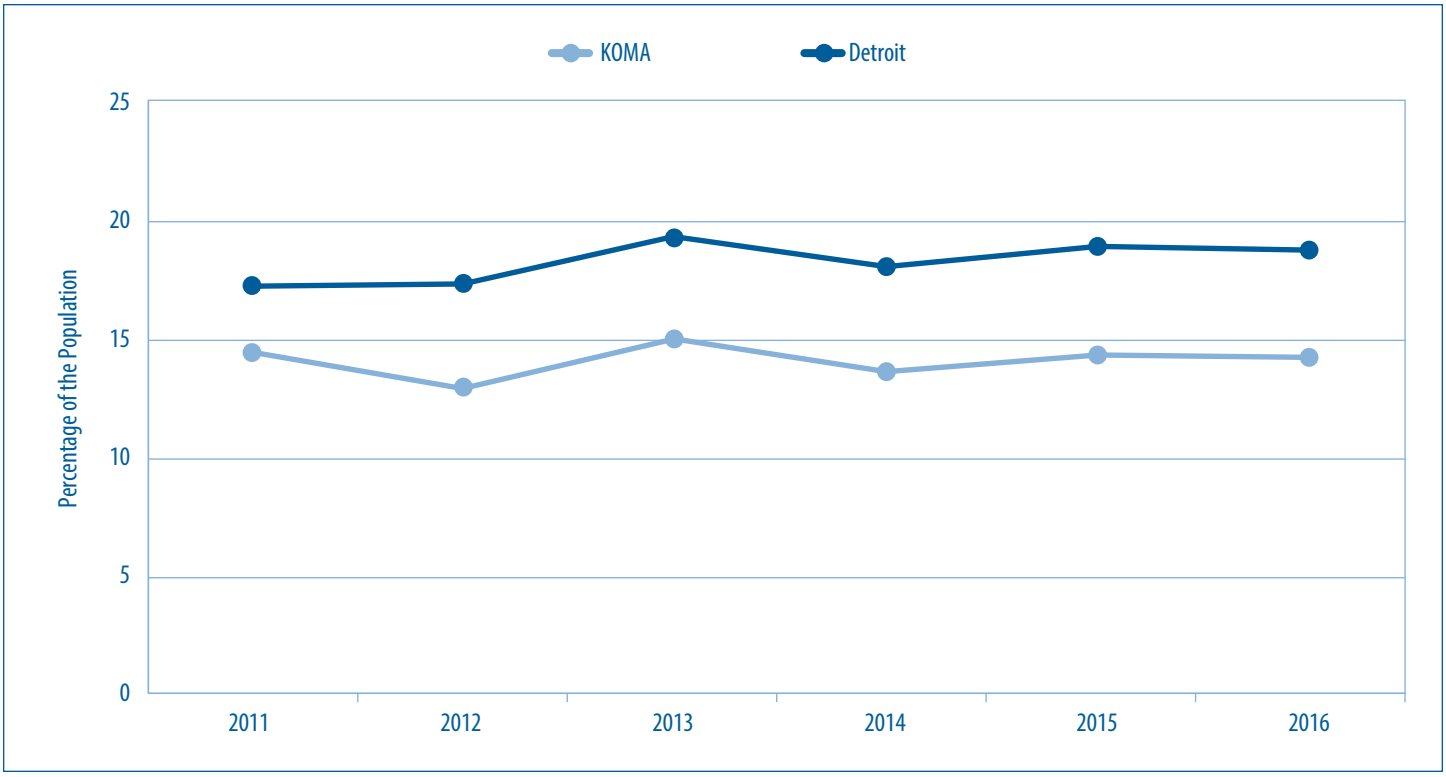
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion of respondents whose Body Mas Index (BMI) was greater than or equal to 25 and less than 30.

Figure 5: Obesity



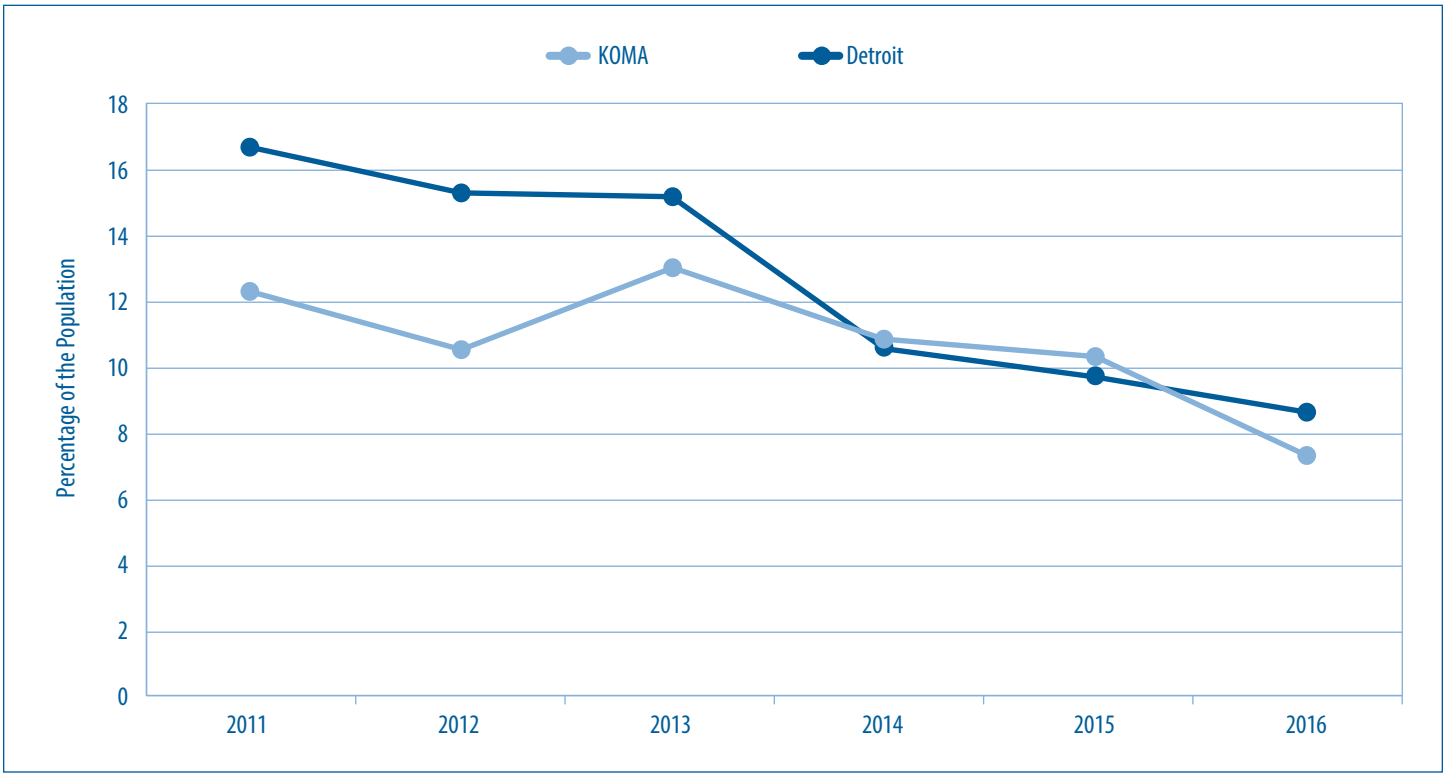
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion of respondents whose Body Mas Index (BMI) was greater than or equal to 30.

Figure 6: Health Status - Fair or Poor Health



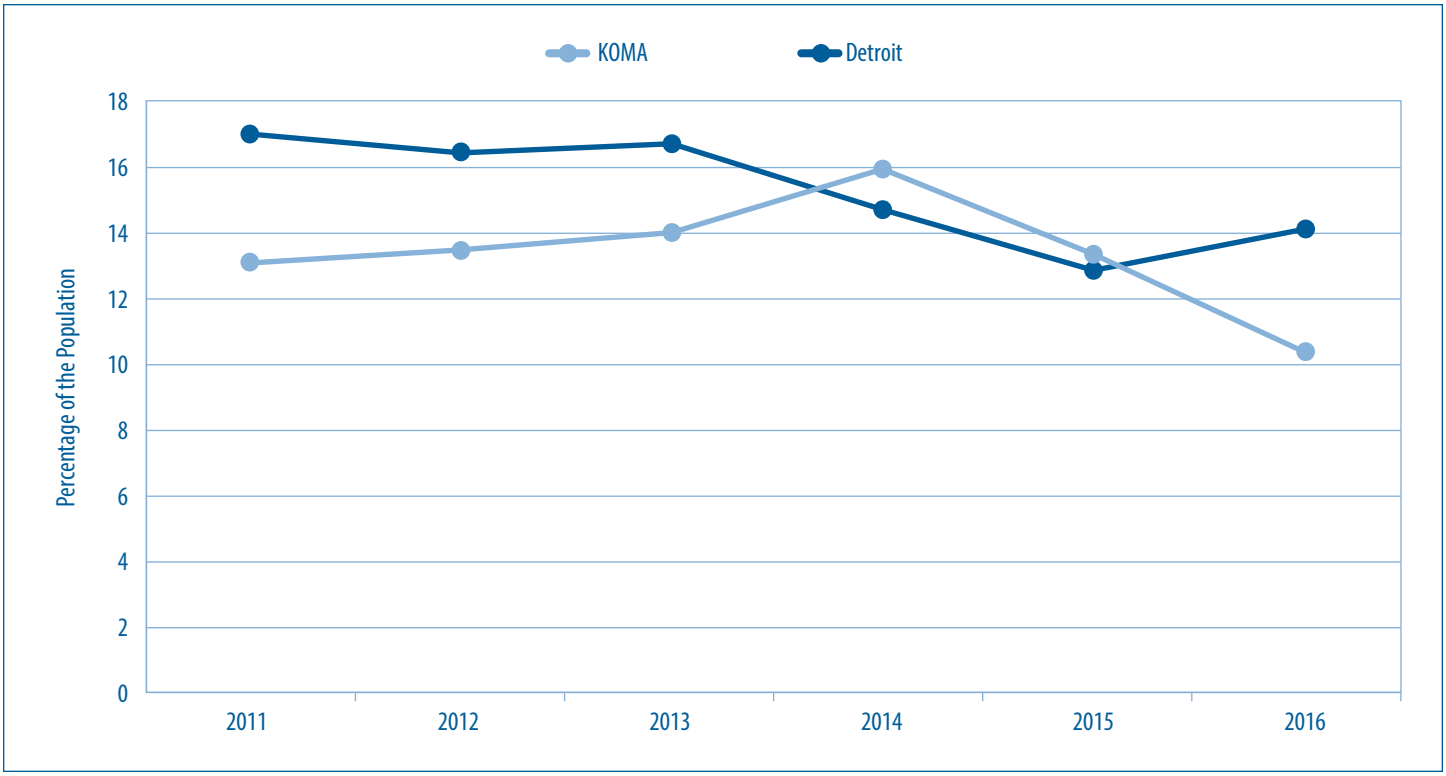
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion of respondents who reported that their health, in general, was either fair or poor.

Figure 7: No Health Insurance



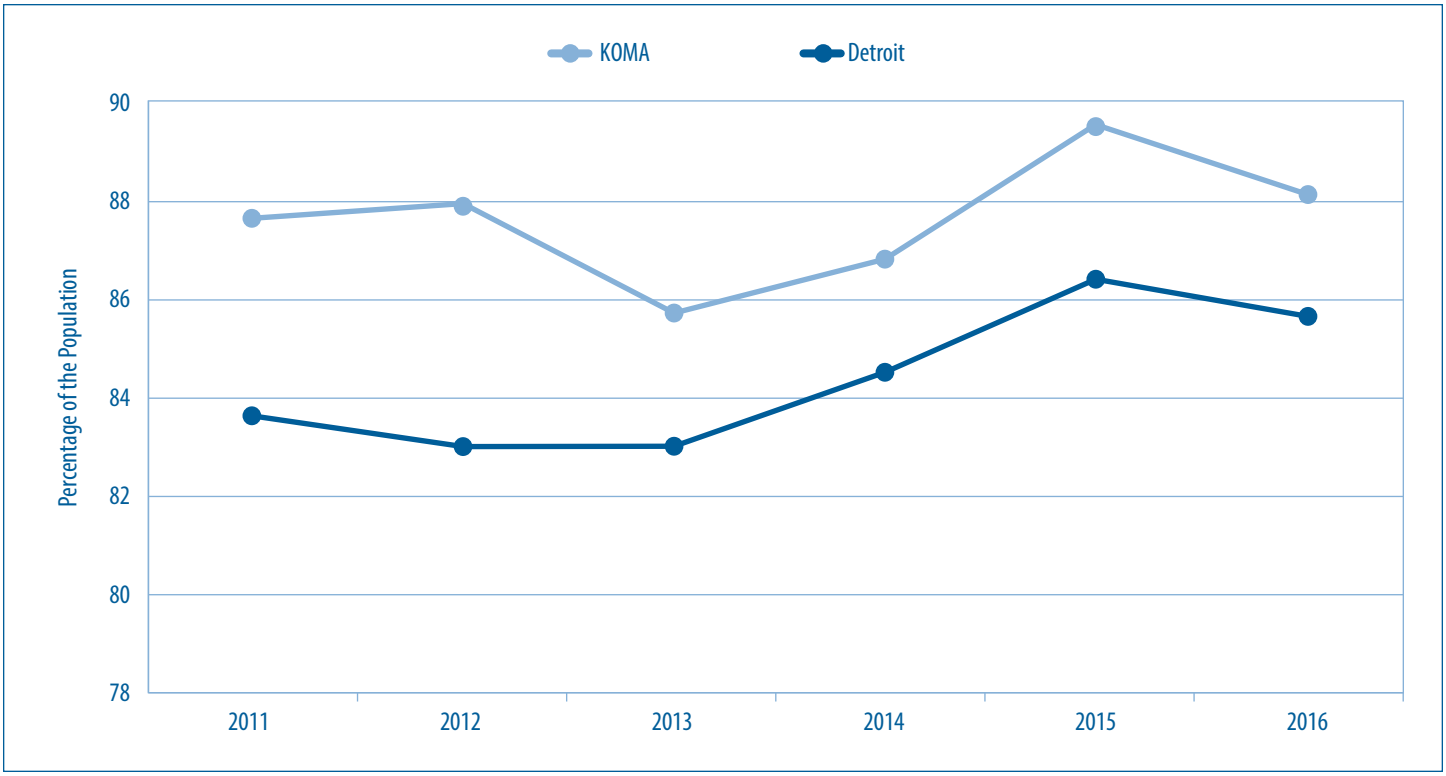
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among adults aged 18-64 years, the proportion who reported having no health care coverage, including health insurance, prepaid plans such as HMOs.

Figure 8: No Health Care Access Due to Cost



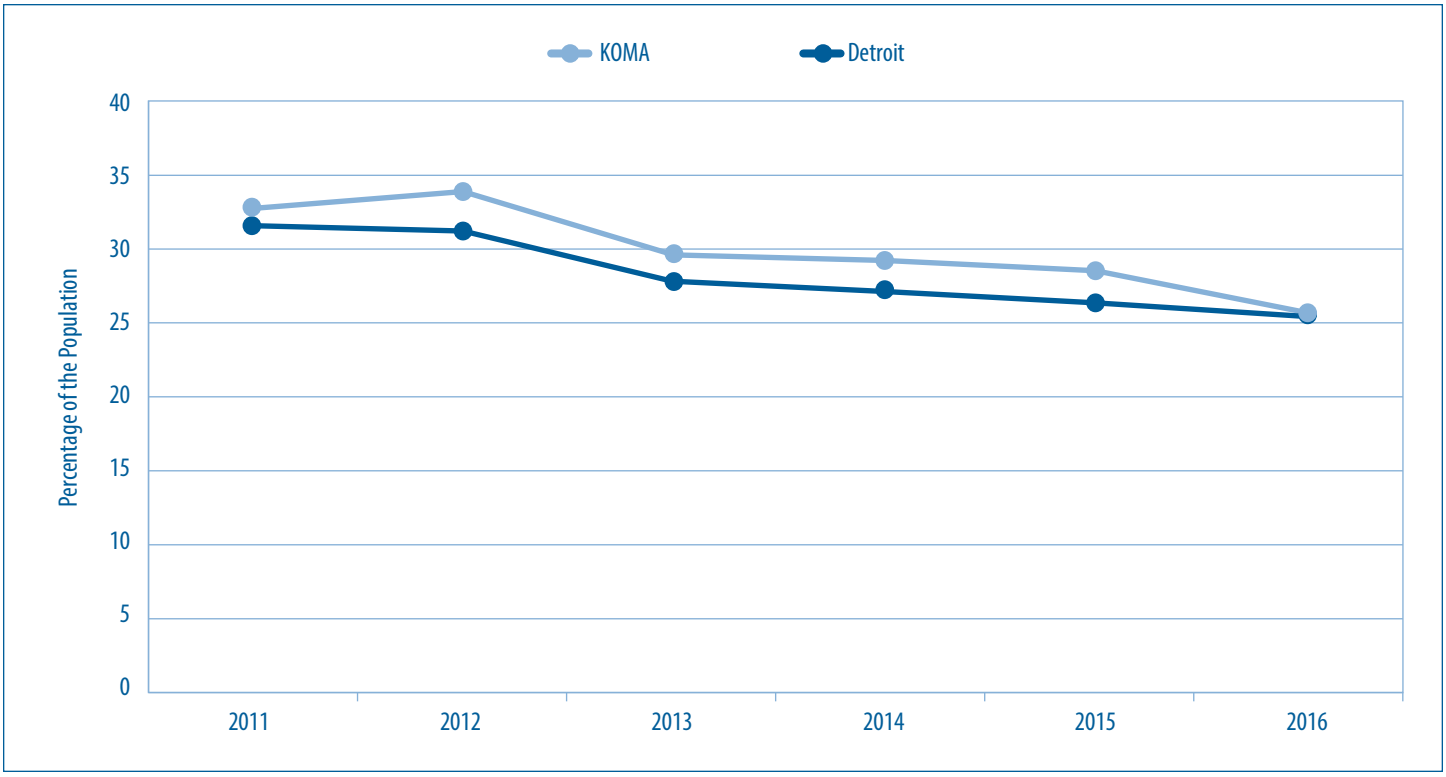
Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported that in the past 12 months, they could not see a doctor when they needed to due to the cost.

Figure 9: Has a Usual Source of Care



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported that they have a usual source of care when ill.

Figure 10: No Routine Checkup in Past Year



Source: Michigan Department of Health and Human Services, Behavioral Risk Factor Survey, 2017
Definition: Among all adults, the proportion who reported that they did not have a routine checkup in the past year.

Economic Analysis

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Benchmarking Communities

In this section, we compare the Grand Rapids combined statistical area to a selected 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. Finally, we note that the passage of the Affordable Care Act in 2010 and the 2014 Medicaid expansion in Michigan likely had significant impacts on the trends discussed below.

The Supply and Utilization of Hospital Services

Figures 1-7 provide a detailed examination of both hospital capacity and utilization across Grand Rapids and the 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. 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. For example, a destination hospital like the Cleveland Clinic attracts patients from outside of the Cleveland region who contribute to the numerator in the utilization calculation, but not to the denominator. In cases where patient inflow is particularly high, utilization measures will be overstated. We provide evidence in this section that approximately 20 percent of hospitalized patients in Grand Rapids come from outside the immediate region. Unfortunately, we are unable to measure patient inflow for the other regions we examine.

Figure 1 includes data on the number of hospital beds per 1,000 residents in each region from 2005 to 2016. This measure serves as a proxy for hospital capacity. For Grand Rapids, the benchmark communities, and the U.S., per capita hospital inpatient capacity has declined over the past decade. Alternatively, Detroit has experienced an increase in per capita hospital beds since 2005. Nationally, the trend has been a movement away from investments in additional inpatient capacity, which means that Detroit's increase is likely due to the region's population losses rather than the construction of new beds. We note that Grand Rapids has fewer beds per capita than the national average. It's likely that this results in lower overhead, which could lead to less costly hospital care.

Figure 2 displays the number of hospital admissions per 1,000 residents. While **Figure 1** focused on inpatient capacity, **Figure 2** provides data on inpatient utilization. Grand Rapids has significantly fewer admissions per capita than the benchmark regions and is below the national average. This could be an indication of a relatively healthy population in West Michigan or a stronger reliance on outpatient rather than inpatient care. In either case, given the high cost associated with inpatient care, fewer hospital admissions bode well for the Grand Rapids region. Hospital admissions have generally been falling over time, but this does not appear to be true over the past decade in Detroit. After a slight decrease in per capita admissions in 2007, Detroit has seen increasing admission rates in nearly every subsequent year.

Figure 3 plots per capita outpatient visits from 2005 to 2016. While inpatient admissions have generally fallen over this period, outpatient visits have increased indicating a possible substitution between the two types of care. Of note in **Figure 3** is the steep increase in outpatient hospital visits in both the Grand Rapids and Detroit regions over this period. Outpatient hospital visits increased from approximately two per person per year in Grand Rapids in 2005 to nearly four per person per year in 2016. The increase in Detroit was of a similar magnitude. If this growth is simply reflecting the substitution between outpatient hospital visits and inpatient stays, then this would likely represent a net decline in expenditures due to the high cost of a hospital admission. However, this substitution is unlikely to fully explain the changes in **Figure 3** since the decline in per capita hospital admissions for Grand Rapids over the past decade has been moderate and per capita admissions actually increased in Detroit (**see Figure 2**).

Another factor to consider is that since values in **Figure 3** are calculated as the ratio of outpatient visits to the number of area residents, those coming from outside the Grand Rapids or Detroit areas to receive treatment are included in the numerator, but not in the denominator of the calculation. Therefore, the large increases in outpatient hospital visits from 2005 to 2016 could be driven, in part, by changes in the inflow of patients to the area. To test this hypothesis, we used hospital-level data to calculate the share of hospital admissions in Kent, Ottawa, Muskegon, and Allegan counties (KOMA) that belonged to residents of those counties. In other words, if only KOMA residents visited KOMA hospitals, then this share would equal 100%. **Figure 4** plots the KOMA resident share of local hospital admissions for years 2006, 2008, 2010, 2012, 2014, and 2016. In 2006, 82. Percent of admissions to KOMA hospitals were from people living in a KOMA zip code. By 2016, that figure had fallen to 79.3 percent. Based on an average annual admissions figure of approximately 125,000 for KOMA hospitals, this change translates to roughly 4,000 more patients from outside the KOMA counties admitted to local hospitals in 2016 than in 2006[2]. So while we have seen an increase in patients from outside the KOMA region using local hospitals, the magnitude

[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.

has been rather small and does not support the claim that increased patient inflow is driving the pattern observed in **Figure 3**. Clearly testing geographic changes in inpatient admissions is not equivalent to testing changes in outpatient hospital visits, but we believe that inpatient treatments would be more likely than outpatient treatments to draw patients from abroad.

A more plausible explanation for the growth in outpatient visits to hospitals in both Grand Rapids and Detroit involves the transition to provider-based billing arrangements (also known as hospital outpatient billing) as independent physician practices increasingly align 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). Reliance on this potential source of additional hospital revenue has increased sharply over the study period and has been credited with accelerating the rate at which physician practices have aligned with hospital systems[3]. Furthermore, hospital alignment has become increasingly attractive to physicians as a means to leverage the scalability and efficiencies needed to comply with quality-based reporting needs and to invest in efforts to modernize their practices (e.g. electronic medical records, billing and accounting systems, etc.). Importantly, for the data displayed in **Figure 3**, patient visits to non-hospital settings are often categorized as hospital outpatient visits under a provider-based billing system[4]. So what appears to be a doubling of per capita outpatient visits to hospitals in Grand Rapids from 2005 to 2016 could simply be a change in billing practices. Moving forward, recent attempts by the Centers for Medicare and Medicaid Services (CMS) to reduce the advantages of provider-based billing could affect future trends in **Figure 3**. In July 2018, CMS announced a policy proposal to move to "site neutral payments" beginning in 2019. As noted in the CMS policy announcement, "Currently, CMS pays more for the same type of clinic visit in the hospital outpatient setting than in the physician office setting. If finalized, this proposal is projected to save patients about $150 million in lower copayments for clinic visits provided at an off-campus hospital outpatient department" (CMS, 2018a).

Figure 5 examines an additional component of hospital utilization by plotting per capita emergency department (ED) visits for Grand Rapids and each of the comparison regions. Most notably, **Figure 5** indicates that Detroit experiences far greater ED use than either Grand Rapids or the national average, which likely contributes to a higher cost of care on the east side of the state. Reflecting the trend seen in **Figure 3**, the Grand Rapids region has seen substantial growth in ED utilization over the past decade. At 363 ED visits per 1,000 residents, Grand Rapids ED use was below both the benchmark communities and the national average in 2005. By 2016, ED visits in Grand Rapids had increased to 475 per 1,000 residents. The higher rate of increase observed between 2014 and 2015 for all regions is likely a function of increased insurance coverage associated with the Affordable Care Act. Overall, this trend of increasing ED use in Grand Rapids should be a concern for stakeholders in the region. 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 reverse this upward trend in ED use.

Figure 2 suggested that Grand Rapids residents are relatively less likely to be admitted to the hospital than those in the benchmark communities, and **Figure 6** indicates that our average hospital lengths of stay, conditional on admission, tend to be shorter as well. The average length of hospital stays in Grand Rapids has declined over the past decade and remains below the national average. Given the expense that accompanies a day in the hospital, minimizing the average length of stay can have a substantial impact on hospital costs.

Finally, **Figure 7** highlights the supply of hospital-based personnel per 1,000 residents in each region. These personnel counts represent 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 over the past decade. In fact, as of 2016, Grand Rapids now has a greater number of per-capita, hospital-based personnel than the national average. However, Grand Rapids continues to remain below the benchmark communities and the Detroit region.

A lower hospital personnel-to-population ratio is likely a contributing factor to the relatively low cost of care experienced in West Michigan. Interestingly, the Detroit region has seen an increase in hospital-based personnel over this time period. In 2005, Detroit had approximately 15.5 hospital-based FTEs for every 1,000 residents. By 2015, that number had increased to 21.

Hospital and Medical Expenditures

Figure 8 examines payroll and benefits expenses per hospital employee, which is inflation adjusted to 2016 dollars using the consumer price index. Average compensation for hospital workers in Grand Rapids is below the national average, below the benchmark level, and has remained fairly flat since 2005. On the other hand, Detroit has relatively high levels of compensation for hospital employees, though the level has fallen recently from its high in 2008.

Figure 9 displays total hospital expenses per admission. It is important to recognize that **Figure 9** is measuring the expenses reported by the hospital to provide treatment for the average

[2] The analysis was also conducted removing anyone with a Florida zip code due to the possibility of splitting time between West Michigan and Florida. Results were not substantially changed.

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

[4] 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 pg. 235).

admission, but does not represent 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. Despite the relatively low hospital employee compensation noted in **Figure 8**, we see that hospital expenses per admission in Grand Rapids are significantly higher than the national average and are approximately $3,000 greater per admission than Detroit. On average, inflation-adjusted expenses per hospital admission in Grand Rapids have grown from approximately $19,700 in 2005 to $29,900 in 2016. Growth in per-admission hospital expenses could be explained by at least two factors: (1) increasing reliance on advanced technology; and (2) changes 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). If technological advancement generates improved outcomes, then the additional expenses may be worthwhile. However, even worthwhile spending raises overall costs. Additionally, due in part to changes in the payment incentives for inpatient care, certain types of care have migrated to outpatient settings (Berenson, Ginsburg, & May, 2011). As a result, the health of the average patient admitted to the hospital today is likely to be worse than the health of the average patient admitted in 2005. Ultimately, the effect of this shift in treatment settings has been to reduce the hospital share of total health expenditures, but increase per admission expenses (Moses et al., 2013). Estimates in **Figure 9** provide another area of focus for residents and local stakeholders who have an interest in stemming the growth in health care expenditures. More work should be done to understand the contributors to the high cost of hospital admissions in Grand Rapids and to determine whether this expenditure growth can be addressed without negatively impacting patient health.

Figure 10 plots per capita Medicare expenditures for both Fee-for-Service (FFS) and Medicare Advantage (MA) enrollees from 2007 through 2016. These figures represent the average, annual, per capita government expenditure for a Medicare beneficiary in each of the comparison communities. Data on FFS Medicare enrollment and expenditures and MA enrollment were obtained through the CMS Geographic Variation Public Use File (CMS, 2018b). Measures of MA expenditures were calculated using year-specific benchmark payment rates, which provides an approximate estimate of county-level MA spending. Unfortunately, data on specific plan payment rates, which has been used in earlier versions of this publication, are no longer available. Due to the nature of the data used to construct **Figure 10**, geographic regions are defined as the primary county in the MSA (e.g. estimates for Grand Rapids are specific to Kent County). Expenditures in **Figure 10** are adjusted for regional differences in prices, population age, gender, and race. These figures include expenditures for physician and hospital care, but *exclude expenditures on prescription medications*. Additionally, in cases where treatment was received in a county outside of where the patient resides, CMS assigns expenditures to the county in which the patient lived and not the county where the treatment was performed. Notably, Medicare expenditures for nearly all regions and the U.S. as a whole fell from 2010 through 2015. This unprecedented string of year-over-year reductions in per-member Medicare expenditures received a good deal of attention, but the downward trend appears to have leveled off in recent years. Medicare expenditures in Grand Rapids are below the national average and in line with expenditures in the benchmark communities, while expenditures in Detroit are substantially higher than in the other regions.

Care Coordination

Lastly, **Figure 11** provides evidence on the quality of care received in each region using hospital discharges for ambulatory care-sensitive conditions as a proxy for care coordination. This measure is often equated to preventable hospitalizations and can be used as an indicator of care efficiency. In this case, a lower number is preferable, so Grand Rapids performs particularly well. Overall, it appears that Grand Rapids and West Michigan Medicare FFS residents receive a higher level of care coordination than those in many of the comparison regions.

Data for **Figure 11** were collected from the Dartmouth Atlas of Health Care (2017) and exhibit two primary differences from the previous figures. First, **Figure 11** focuses solely on Medicare FFS beneficiaries and does not include data on Medicare Advantage enrollees. Claims data for Medicare Advantage enrollees are typically not made available to researchers. Nationally, slightly more than one-third of Medicare beneficiaries are enrolled in a Medicare Advantage plan. However, Medicare Advantage enrollment in Grand Rapids is now above fifty percent. This should be kept in mind when evaluating **Figure 11**. Additionally, the Dartmouth Atlas of Health Care defines geographic regions at the hospital referral region (HRR) level and not the MSA[5].

In conclusion, while Grand Rapids compares favorably to the comparison regions on metrics associated with care coordination and efficiency, there are several areas of concern and opportunities for potential improvement. For example, rates of outpatient visits to hospitals and ED visits in Grand Rapids are above the national average and have grown substantially over the past decade. If, as the evidence suggests, this increase in outpatient hospital visits is due to the practice of provider-based billing, then this identified pattern is adding to the overall cost of care, but is not adding value; it simply represents a transfer of resources from patients and insurers to providers. Additionally, total hospital expenses per admission in Grand Rapids are above the national average and grew at a relatively steep rate from 2011 to 2014 before declining somewhat in 2015 and increasing again in 2016. On the plus side, per capita Medicare expenditures in the Grand Rapids area remain below the national average and are similar to other comparable regions. Evidence presented in this section suggests that high levels of care coordination may have been a significant factor in limiting the growth of health care expenditures in West Michigan.

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

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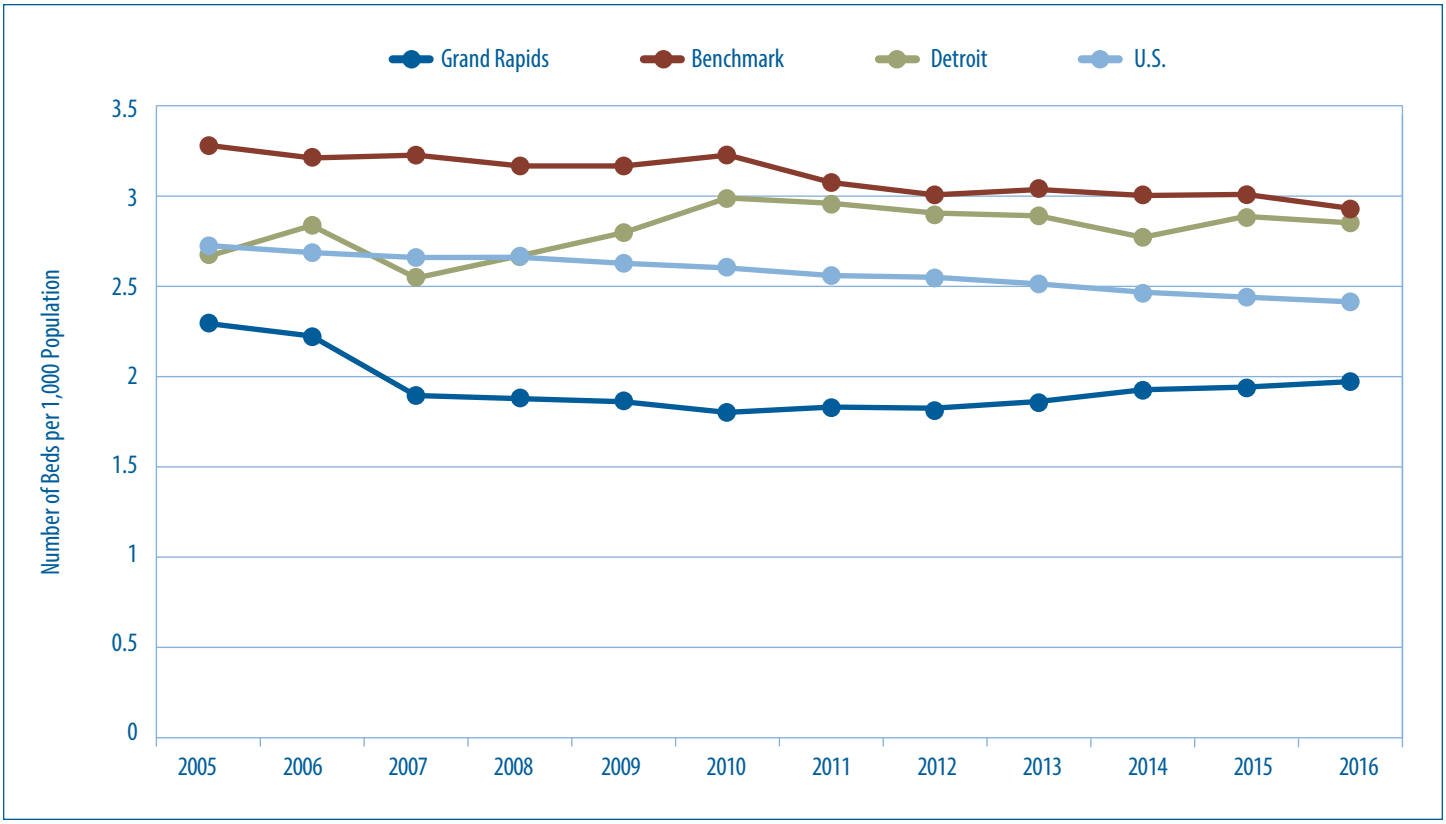
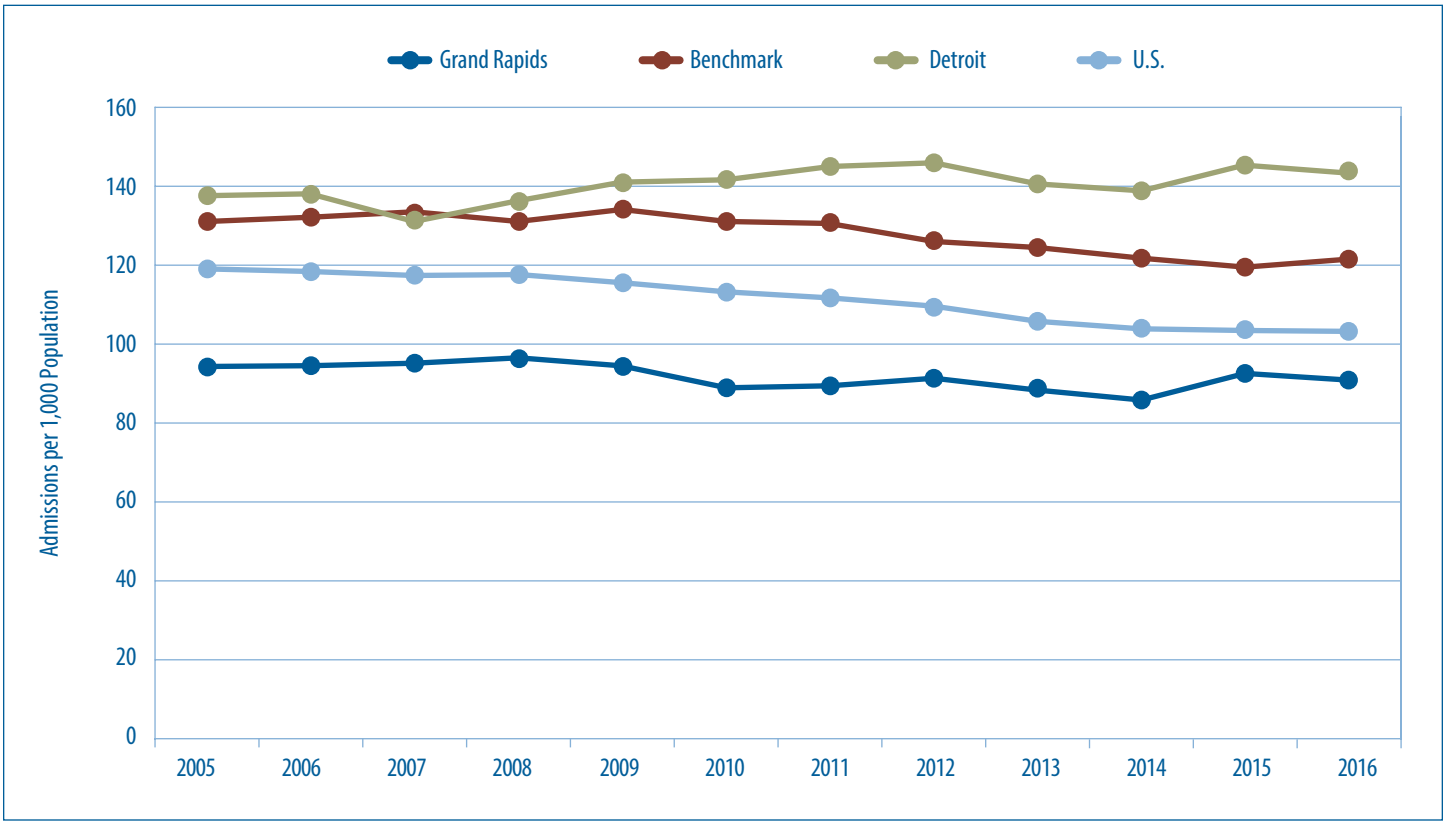
Figure 1: Hospital Beds per 1,000 Population



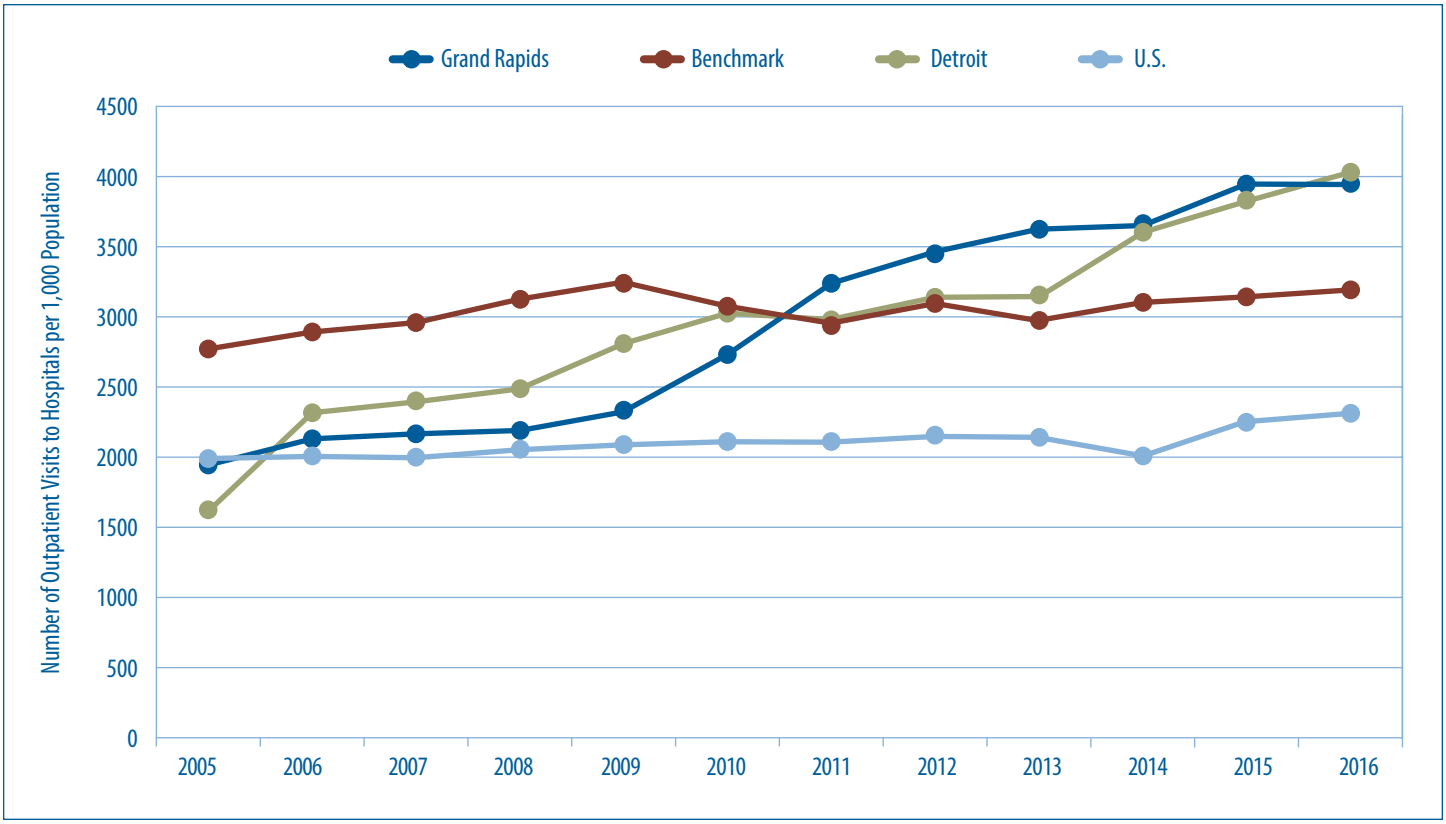
Source: U.S. Census. *Bureau population data estimates*

Figure 2: Hospital Admissions per 1,000 Population



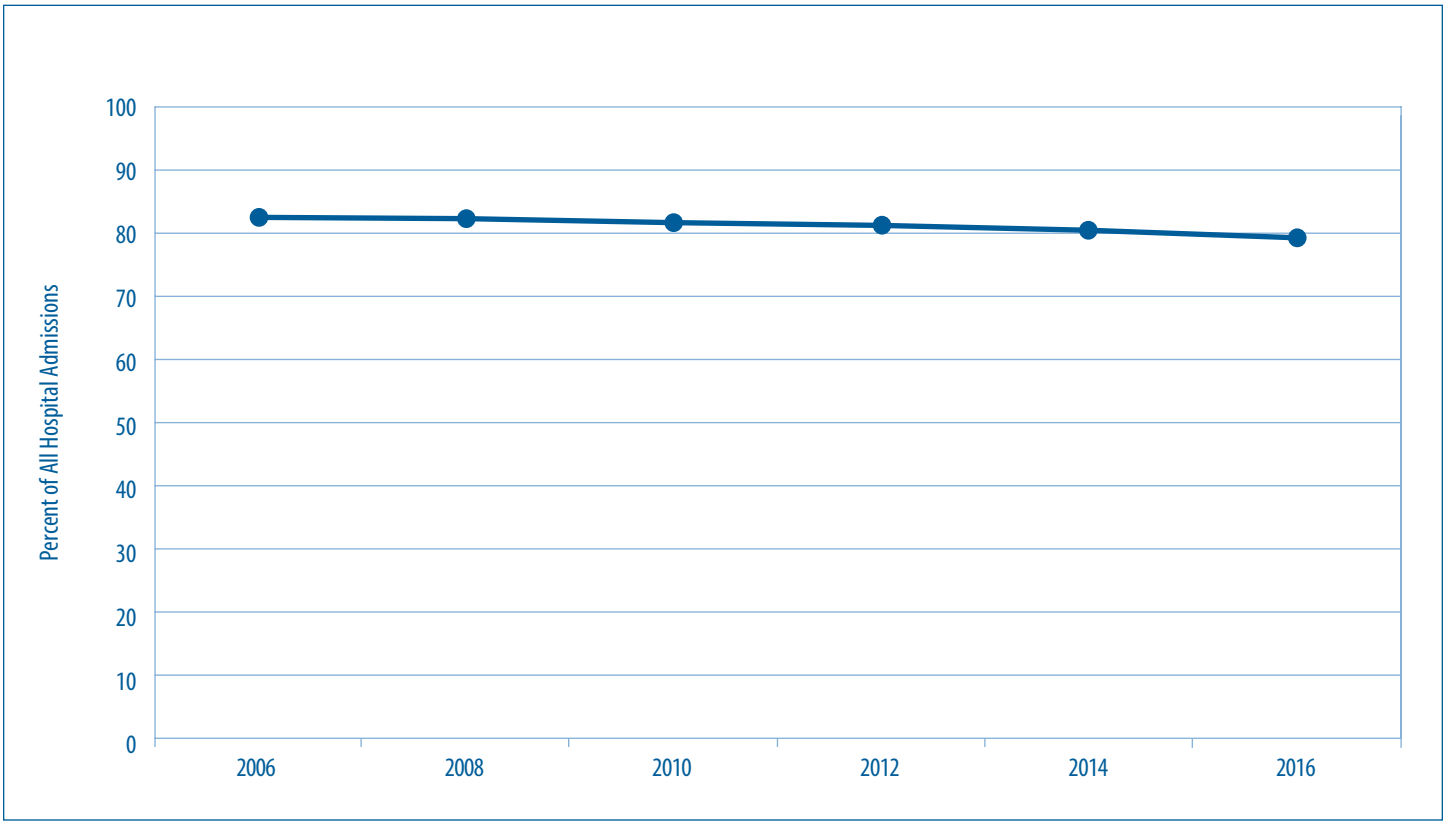
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 3: Outpatient Visits to Hospitals per 1,000 Population



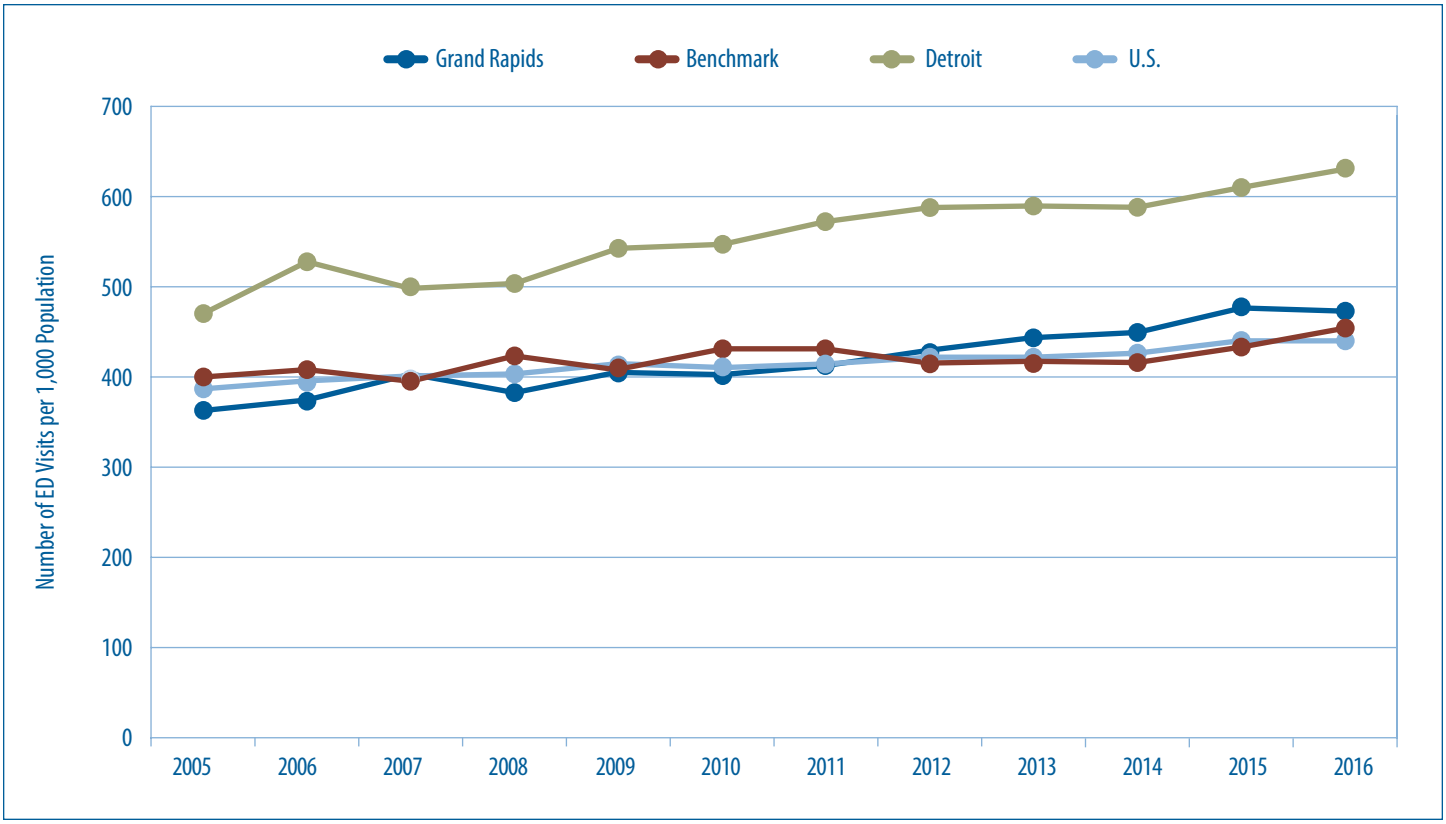
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 4: KOMA Resident Share of Local Hospital Admissions



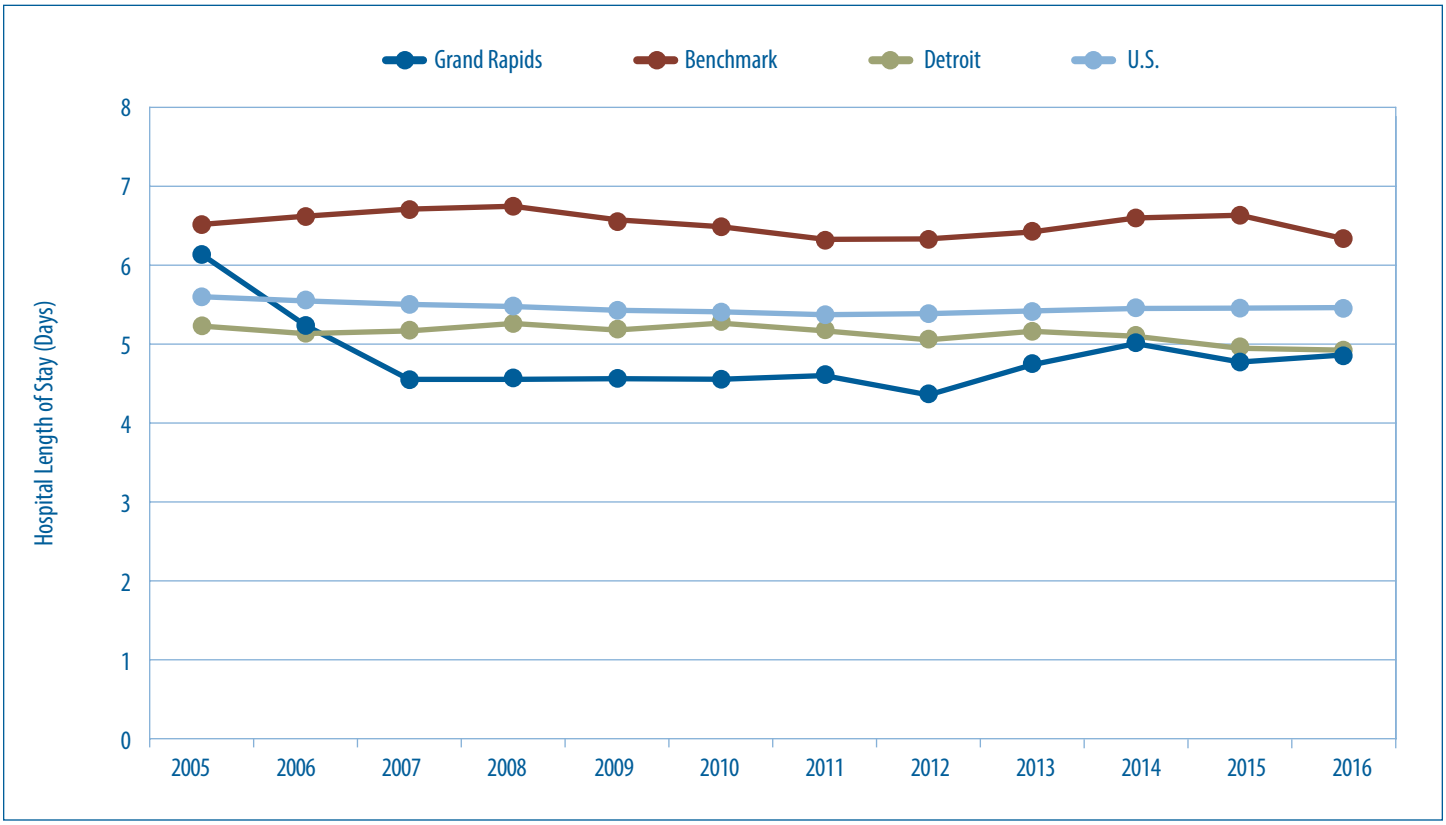
Source: Health Care Utilization Project's State Inpatient Databases

Figure 5: Emergency Department Visits per 1,000 Population



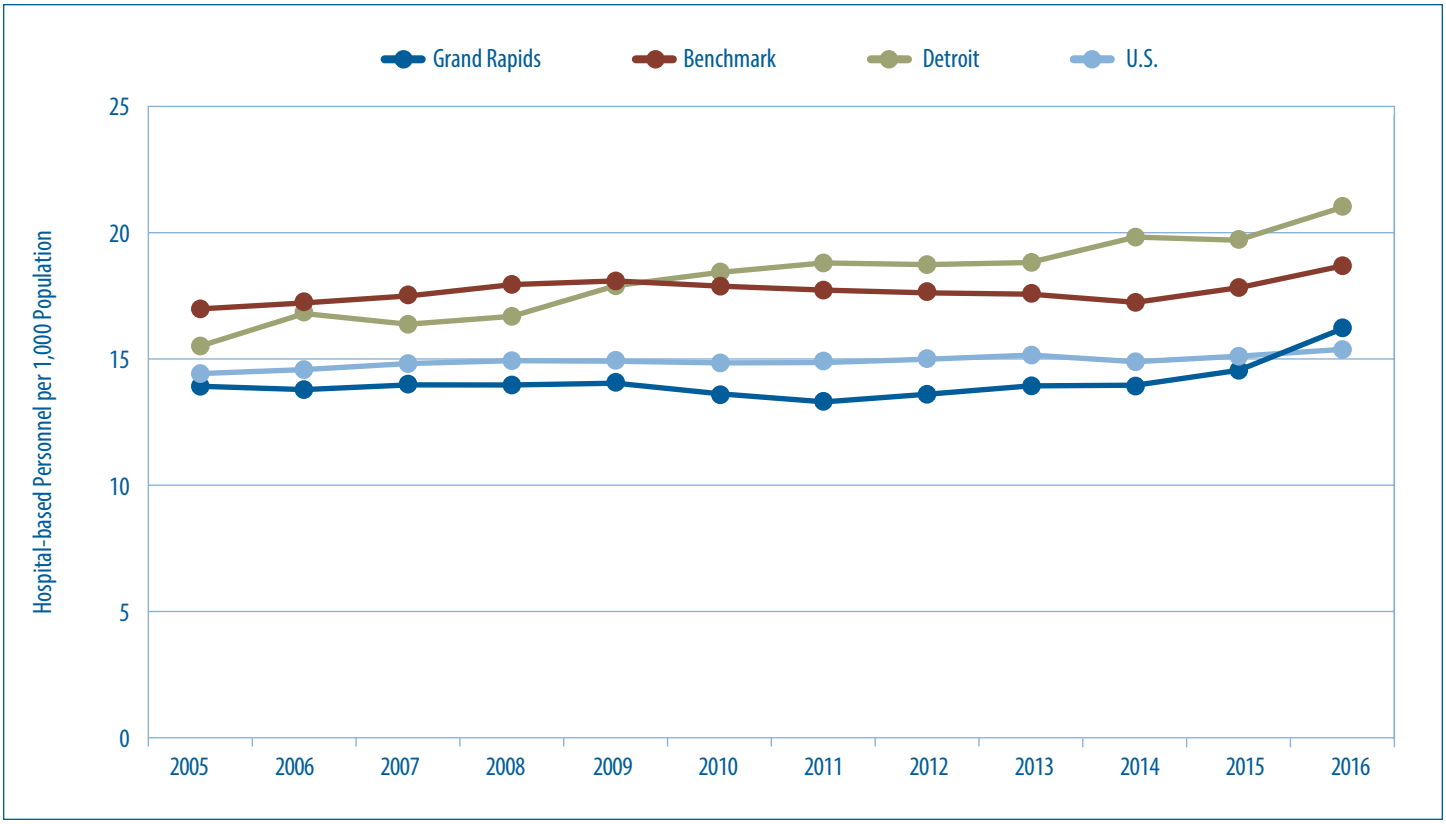
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 6: Average Hospital Length of Stay



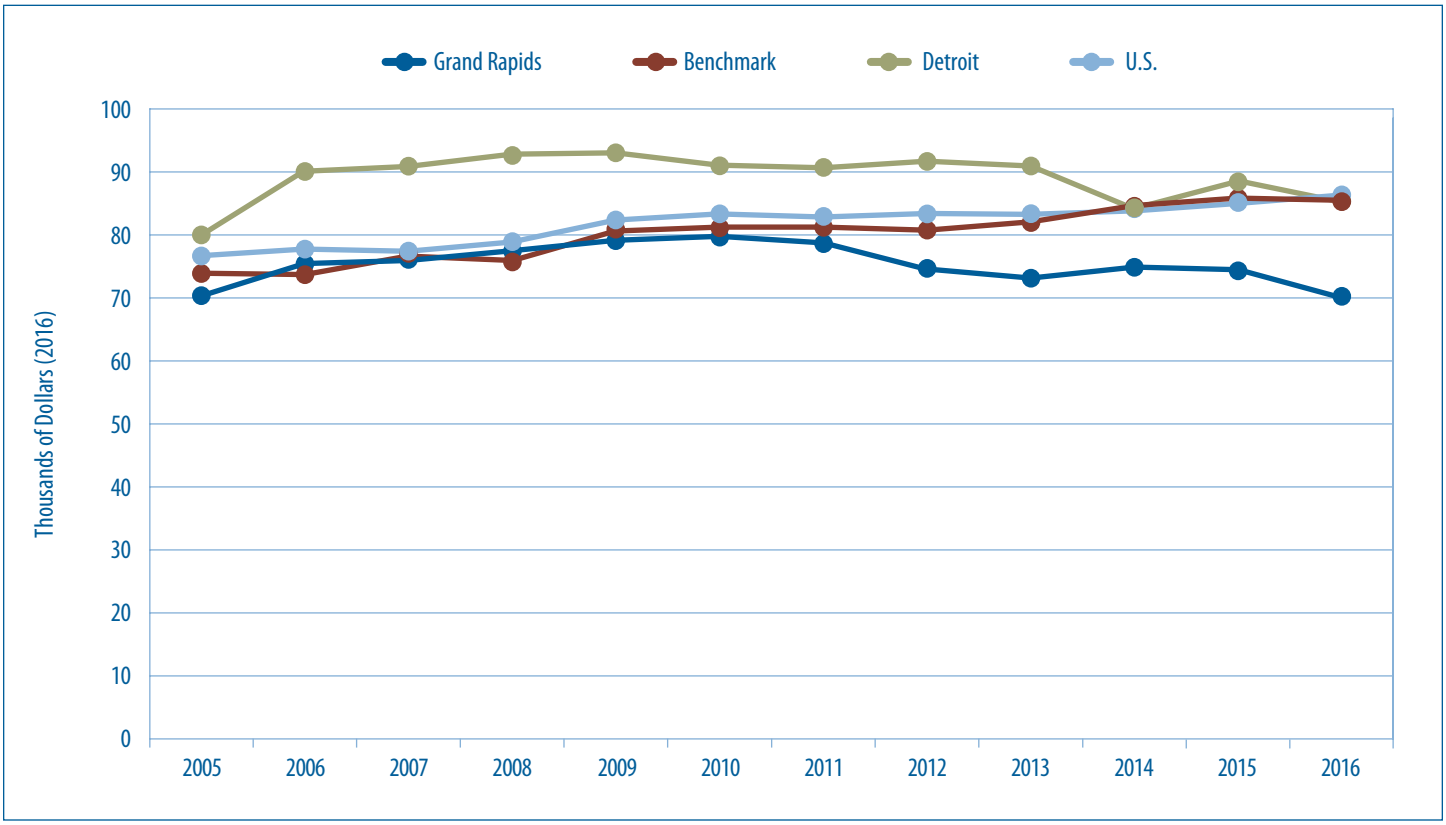
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 7 - Hospital-based Personnel per 1,000 Population



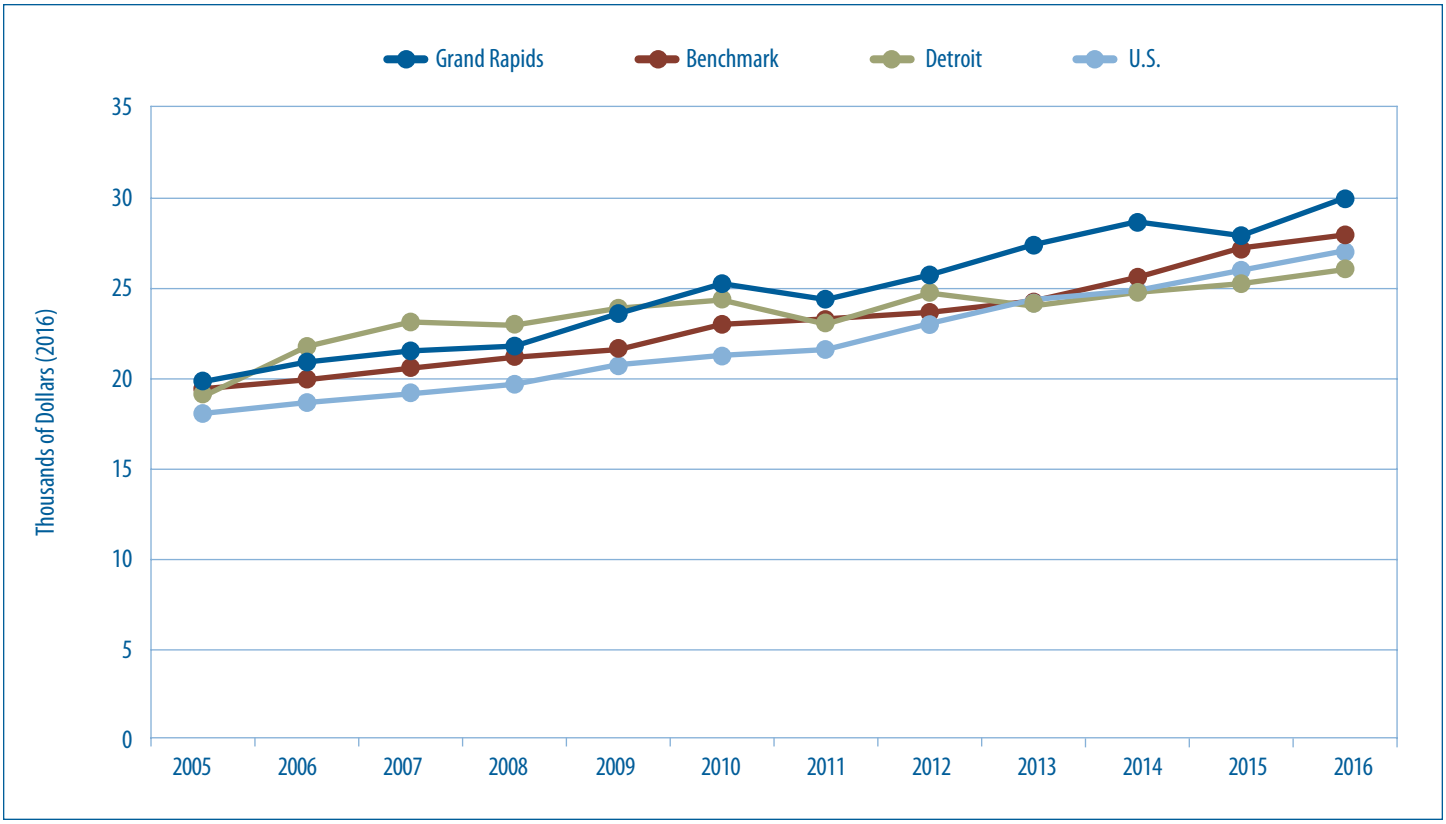
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 8: Average Payroll and Benefit Expenses per Hospital Employee



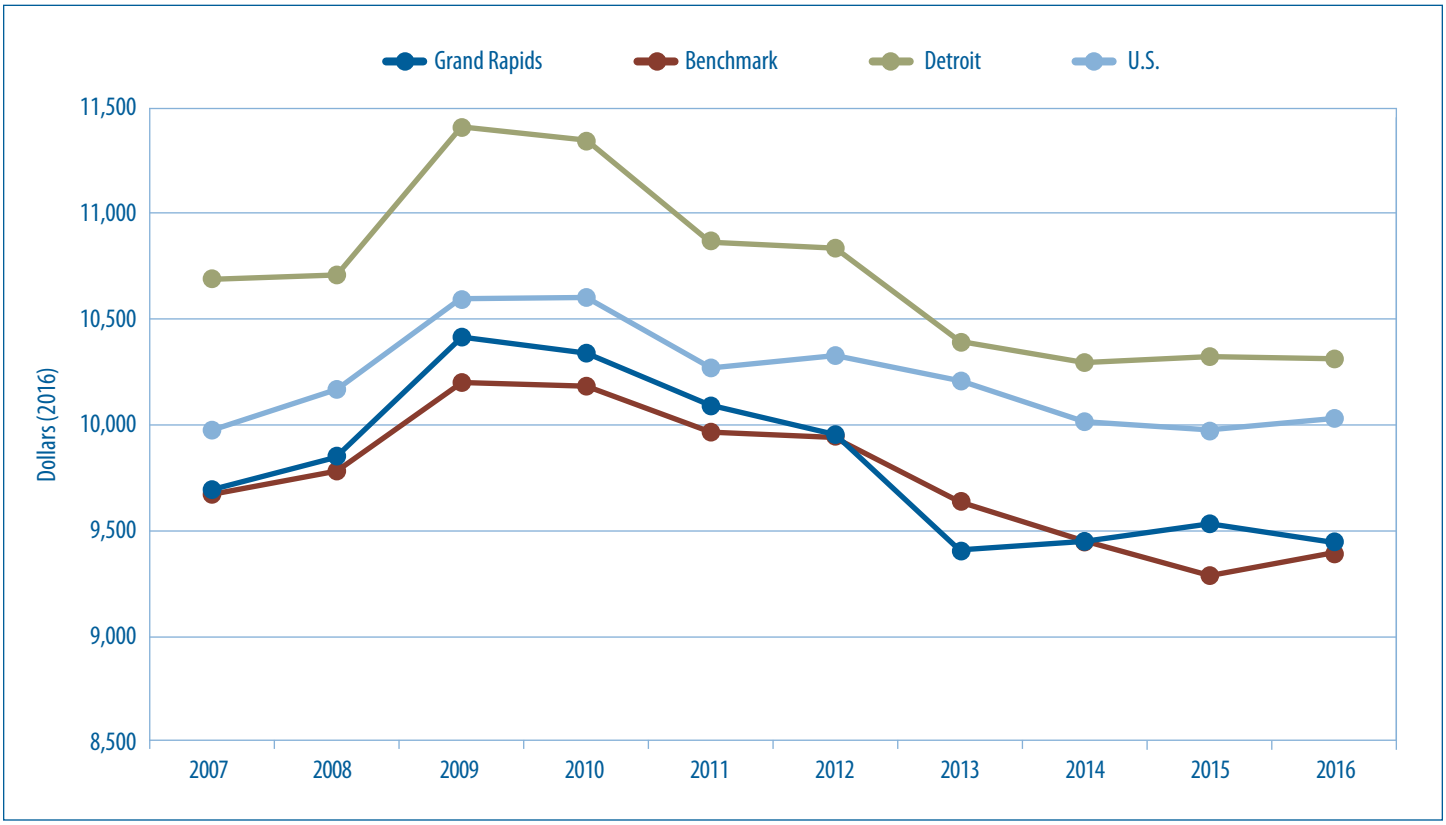
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 9: Total Hospital Expenses per Admission



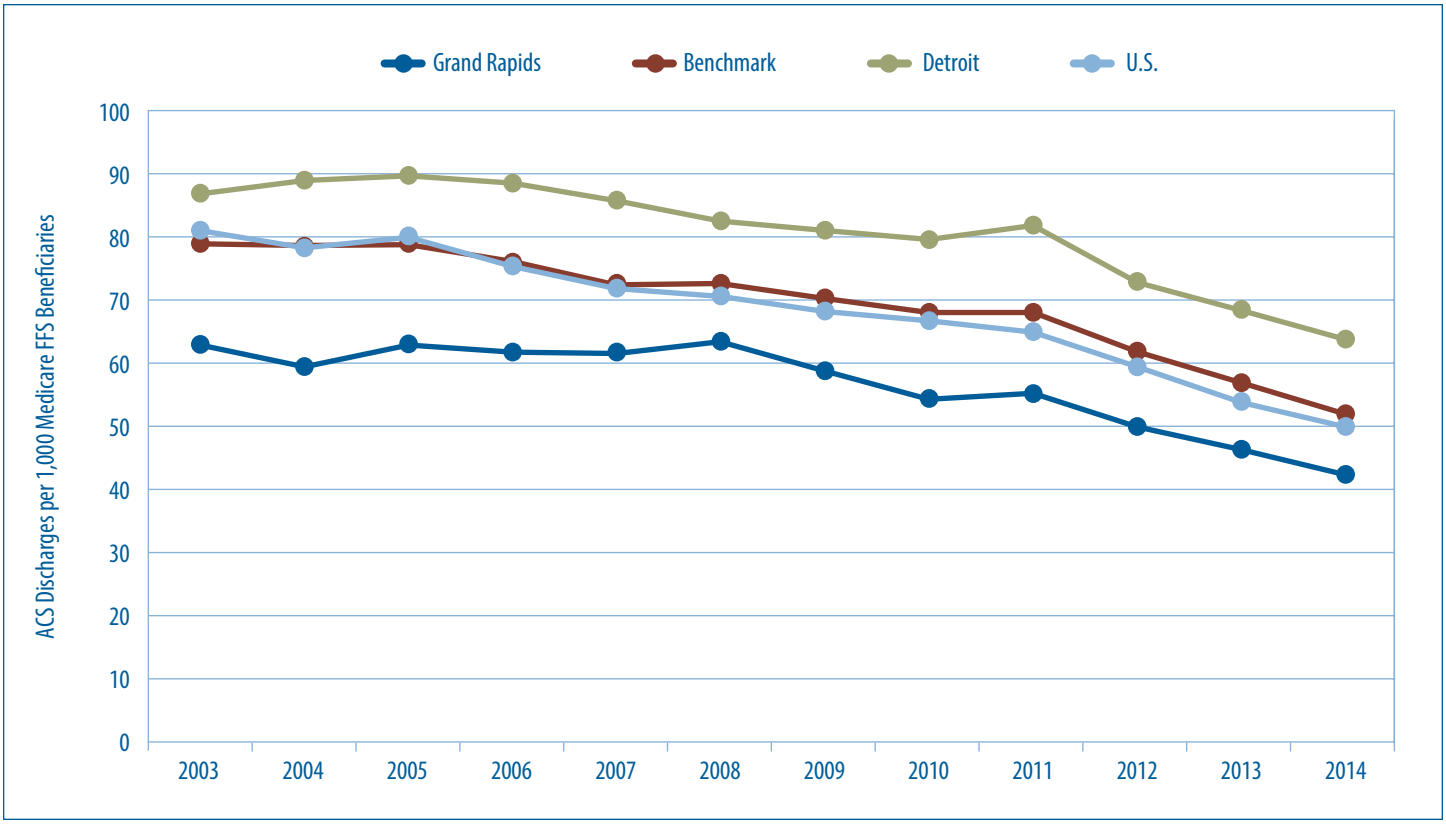
Source: American Hospital Association. *AHA hospital statistics, 2017*

Figure 10: Adjusted Medicare Expenditures per Medicare Enrollee



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

Figure 11: Discharges for Ambulatory Care-Sensitive Conditions per 1,000 Medicare Beneficiaries



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

Major Medical Conditions: Expenditure Analysis

This analysis provides general cost information about some of the most prevalent and expensive medical conditions to assist with focusing resources to improve community health. The long-term goal of this analysis is to identify and track trends in health care expenditures for selected 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 2012-2017. 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 in order 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. In other words, patients in some counties insured by one payer may be sicker than patients in other counties who are insured by a different payer.

- **Expenditures beyond disease.** In each case, the average patient expenditure data is for services not only related to the specific disease in question, but also for other unrelated medical costs the member may have incurred during the year. Differences in expenditures or treatment intensity for 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. One additional caveat is the change from the 9th revision to the 10th revision of the International Classification of Diseases (ICD) codes for the 2015 through 2017 data. This change impacts the categorization of specific medical conditions and, therefore, could lead to additional differences in expenditures between 2015-2017 and the previous years included in the analysis.

KOMA Expenditures

As we have done in previous versions of this publication, we chose to focus on six chronic conditions that are associated with high prevalence rates and high levels of resource utilization: asthma, coronary artery disease (CAD), depression, diabetes, hyperlipidemia, and low back pain.[1] For comparison, we also 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 listed above and who have total annual expenditures below $450,000. **Figure 1** provides the average annual expenditures per member for each of these conditions in Kent, Ottawa, Muskegon, and Allegan (KOMA) counties in 2012 through 2017. Caution must be used when interpreting trends between 2013 and 2014 due to the presence of Affordable Care Act (ACA) exchange enrollment beginning in 2014. Preliminary studies found that exchange enrollees have higher utilization than those with private insurance coverage through non-exchange plans and this compositional change could explain some of the expenditure difference between 2013 and 2014 (Express Scripts, 2014; Truven, 2015). Therefore, **Figure 1** distinguishes between the pre-exchange years of 2012-2013 and the post-exchange years of 2014-2017. **Figures 2-4** include only data on post-ACA periods. 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 1** are reported in 2017 dollars.

We note that, even after adjusting for inflation, **Figure 1** indicates that expenditures for most of the conditions we consider increased from 2014 through 2016. However, we see a reversal in this trend for several conditions from 2016 to 2017. The most dramatic change in expenditures from 2016 to 2017 occurred for those with a diagnosis of CAD. After rising steadily since 2012, average annual expenditures for a member with CAD fell from $29,206 in 2016 to $25,329 in 2017, a decline of more than 13 percent. Holding disease prevalence (measured in member months) constant at 2016 levels, this change implies a total reduction in spending on

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

members with CAD of more than $10 million from 2016 to 2017. Unfortunately, we are unable to identify the cause of this sudden reversal in trend for CAD expenditures. Possible causes include a change in the composition of non-Medicare/Medicaid patients diagnosed with CAD and insured by BCN, BCBSM, and PH; a reduction in treatment intensity for CAD members; or a reduction in the prices of treatments commonly received by members with CAD. We also see declining expenditures in the past year for those with asthma, depression, hyperlipidemia, and for healthy members, though the magnitude of these declines is far smaller than the reduction in CAD spending. Average annual spending for asthma members fell from $9,821 in 2016 to $9,709 in 2017, spending for depression fell from $12,168 in 2016 to $11,570 in 2016, and spending for hyperlipidemia fell from $10,310 in 2016 to $10,208 in 2017. Only diabetes and low back pain saw spending increases from 2016 to 2017: diabetes spending grew from $15,385 per member per year in 2016 to $15,796 in 2017 and low back pain spending grew from $5,228 in 2016 to $5,274 in 2017. Lastly, spending for healthy members who have no indication of the six chronic conditions fell slightly from $3,056 in 2016 to $2,992 in 2017.

Tables 1 and 2 use data on inpatient admissions for KOMA residents with a primary diagnosis of CAD to further investigate changes in CAD spending over time. The data source for these figures is the Healthcare Cost and Utilization Project's State Inpatient Database, which includes the universe of admissions to hospitals in the state of Michigan in 2006, 2008, 2010, 2012, 2014, and 2016. While the data include detailed information about an individual's hospital experience, it is important to note that these data only capture treatment in an inpatient setting and that 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.[2] **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 2016 despite maintaining a consistent definition of diagnosis codes for CAD, likely indicating a local shift in CAD treatment from inpatient to outpatient settings, which would be consistent with national trends (Truven, 2016). The average age of a CAD patient is approximately 66 years and has remained largely stable over the sample period, while the share of female admissions has fallen from about 35 percent in 2006 to 32 percent in 2016. The share of uninsured patients has fallen from more than 4 percent per year prior to the ACA and Medicaid expansion to less than 1 percent in 2016. The last two columns provide some indication that, at least for hospitalized patients, those diagnosed with CAD have become more ill over time. For example, while 2.23 percent of CAD admission in 2006 resulted in an in-hospital death, that number rose to 3.44 percent in 2016. Additionally, the average number of recorded diagnoses for these patients increased from 8.22 in 2006 to 14.63 in 2016. These figures indicate that some of the recent increases in CAD expenditures leading up to 2017 could have been the result of a growing disease burden among those diagnosed with CAD.

Table 2 uses the same data that was used in **Table 1**, but focuses on outcomes and treatment for KOMA residents hospitalized with a primary diagnosis of CAD. The average number of procedures remained largely stable until 2016 when it fell slightly to 4.5, while the average length of stay has increased from 3.46 days in 2006 to 4.46 days in 2016. Length of stay along with other outcomes in **Table 2** are potentially associated with both the severity of the patient's illness and with treatment decisions made by clinicians in the hospital. Notably, the share of CAD patients discharged to a skilled nursing facility, an intermediate care facility, or an inpatient rehabilitation facility increased sharply from 2006 to 2014 before declining slightly in 2016. This could contribute to the aforementioned pattern of CAD spending as time spent in a facility is more costly than time spent at home. Were the rise in post-acute facility use coupled with a reduced length of hospital stay, then an argument for cost-saving substitution between treatment settings could be made, however this was not the case. The next two columns include the share of patients receiving any of the two most commonly used inpatient treatments for CAD that signify varying degrees of treatment intensity: percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass graft (CABG). PTCA involves the unclogging of a coronary artery by inserting a catheter, inflating a balloon at the blockage site, and sometimes implanting a stent, while CABG is a more intensive procedure for reperfusion where arteries or veins from the leg or forearm are used to bypass the coronary blockage (Pocock et al., 1995). From 2006 to 2016, the share of CAD patients receiving PTCA fell by nearly 20 percentage points from 54 percent to 36 percent, while the share of patients receiving CABG rose from slightly less than 14 percent to more than 20 percent. This pattern could be indicative of worsening health of patients diagnosed with CAD, a shift in treatment style towards more intensive interventions, or a shift in the share of PTCA procedures performed in an inpatient vs. outpatient setting. Regardless of the cause, substitution from PTCA to more expensive CABG procedures likely increases overall spending on CAD. Finally, the last column displays average total charges per CAD admission in 2016 dollars. Before interpreting changes over time in this measure, there is a critical distinction to be made between charges and payments. Charges represent the "list price" for a hospital stay and do not reflect negotiated discounts with private insurers or administratively set rates under the Medicare and Medicaid programs. Therefore, actual payments tend to be below charges, but charges can still provide an indication of changes in treatment intensity or rising prices associated with CAD hospital care. Average total charges for a CAD hospital admission increased from $36,557 in 2006 to $58,343 in 2016.

Figure 2 separates the disease-specific expenditure figures for 2016 and 2017 in **Figure 1** into medical and prescription drug components. The prescription drug share of total spending ranges from 17-18 percent for members with low back pain to 36-38 percent for those diagnosed with asthma. We include this information in order to establish a baseline with which to track expenditures on prescription drugs moving forward.

Differences in Average Annual Expenditures between KOMA and the Detroit Region

Figure 3a compares average annual per member expenditures in both the KOMA and Detroit regions. We define the Detroit region as Oakland, Macomb, and Wayne counties. **Figure 3a** indicates that expenditures for all conditions are higher in the Detroit region than in KOMA. This marks the first time in the past four years that

[2] We have limited the analyses in Tables 2 and 3 to those under the age of 65 who are privately insured. Results are similar to the overall patient population and will be provided upon request.

average per-member per-year spending on CAD has been higher in the Detroit region than in KOMA. Higher spending for the same condition on one side of the state compared to the other 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 2016 to 2017. So, while **Figure 3a** provides differences in spending levels between the two regions, **Figure 3b** presents a more dynamic look at how those spending levels changed in the past year. Growth in expenditures was higher in the Detroit region for healthy members, members with low back pain, hyperlipidemia, depression, and asthma. Expenditure growth was more than 5 percent in the Detroit region for both healthy members and those with an asthma diagnosis. Expenditure growth rates were higher in KOMA for diabetes, while expenditures for healthy members, hyperlipidemia, depression, CAD, and asthma all declined in KOMA from 2016 to 2017 with the reduction in CAD spending being particularly large. This is not a pattern that we have seen in the past as condition-specific spending has generally increased in both regions from one year to the next.

Health Services Use

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

Figure 4a displays the average number of annual inpatient visits for a member in KOMA or the Detroit region in 2017. It is clear from this figure that hospitalization rates tend to be higher on the east side of the state than the west. For example, CAD members in KOMA experience an average of 0.440 inpatient admissions each year, while those with CAD in Detroit have an average of 0.560 hospital visits per year. Even more striking is the hospitalization rate for those diagnosed with diabetes. Compared to diabetics in KOMA, those in Detroit experience nearly 50 percent more hospitalizations per year (0.187 visits per year in KOMA and 0.295 visits per year in Detroit).

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 0.708 ED visits per year in Detroit compared to 0.446 ED visits per year in KOMA. We note that data on ED use in the Benchmarking Communities section of this book suggests that ED use has been increasing in both Detroit and the Grand Rapids region over the past decade.

Our last utilization metric, 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 diabetic member in KOMA had 60 prescription fills in 2016 compared to 71.53 for diabetics in the Detroit region. Assuming that each member filled a prescription 12 times throughout the year, then this would represent an average of five distinct prescriptions for a diabetic in KOMA and six distinct prescriptions for a diabetic in Detroit.

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, 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 nearly $18,000 to the annual expenditure estimate.

Figure 5b displays the results of a similar analysis that focuses on depression. Results are similar to those in **Figure 5a**: the presence of multiple conditions greatly increases average annual expenditures for members with depression.

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 over relatively small geographic areas. For each condition analyzed in this section, we limit our analysis to zip codes with at least 30 members distributed across at least two of the three payers supplying member data. We also adjusted our expenditure estimates for differences in zip code level population age, income, and education. Therefore, estimates can be interpreted as comparisons for individuals at the same age, with the same income, and the same level of education across different zip codes. On average, over the conditions that we examined, age, income, and education can explain approximately 15 percent of the variation in expenditures at the zip code level. The remaining variation could be attributed to some combination of underlying differences in population health, physician practice styles, or prices for health care services. We 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 $14,867 and $23,704, while those in the highest quantile have average annual expenditures between $28,892 and $39,080. For the past four years, we have noted that areas to the north and southwest of Grand Rapids experience the highest average annual expenditures for members with a CAD diagnosis in West Michigan and tend to have higher expenditure levels for each condition we analyzed. Additionally, for the last three years, we have seen zip codes in the city of Grand Rapids included in the top CAD spending quantile. On the east side of the state, expenditures for those diagnosed with CAD who live in the city of Detroit tend to be higher than those living in more suburban zip codes.

Figure 6b follows the same methodology in order to map the average number of inpatient admissions in 2017 for members with CAD. Those in the lowest quantile of the distribution experienced between

0.160 and 0.383 inpatient admissions, while those in the highest quantile had between 0.659 and 1.219 inpatient admissions. As we noted earlier, the Detroit region tends to have a greater reliance on inpatient care than West Michigan, and that is evident in **Figure 6b**. Zip codes in the city of Grand Rapids tend to be on the higher side of the distribution, but are generally not included in the top quantile.

Figure 6c repeats the analysis with the average number of ED visits in 2017 for those diagnosed with CAD by zip code. The lowest quantile of the distribution represents between 0.339 and 0.574 ED visits, on average, while the highest quantile includes 0.951 to 1.685 visits, on average. On the west side of the state, ED use is particularly high for CAD members living on the east and southeast sides of Grand Rapids, while zip codes farther to the north and southwest of the city also experience high 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 2017 are mapped in **Figure 6d**. Here an interesting pattern emerges that will be repeated for members with diabetes (presented below): West Michigan has far fewer prescription fills, on average, than the Detroit region. Only one zip code on the west side of the state is included in the top quantile of the distribution and many of the zip codes in the region are in the lowest quantile of prescription fills.

For the first time this year, we collected data on telehealth visits. Telehealth visits are a relatively new treatment option that some patients may find more convenient than traditional office visits. Overall, use of telehealth visits for those with CAD on both the east and west sides of the state is relatively low, but geographic differences in use are stark. **Figure 6e** suggests that use of telehealth visits for CAD patients are much more common in West Michigan and the Grand Rapids region than in the Detroit region. This is a pattern that will be repeated when we examine telehealth visits for diabetes below.

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 $15,035 to $16,606, while expenditures for those in the highest quantile are between $18,243 and $19,939. Here we see that the Detroit region contains a greater proportion of high expenditure zip codes than Grand Rapids and its surrounding areas. We also note a similar pattern on the west side of the state for diabetes in that zip codes to the north and southwest of the city of Grand Rapids tend to experience relatively higher expenditures.

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. However, as was the case with many of the CAD outcomes, zip code 49022 that includes Benton Harbor, has among the highest rates of hospital admissions for diabetics.

Figure 7c maps ED use by zip code and suggests that several West Michigan zip codes are in the top two quantiles of the ED visit distribution. Consistent with the pattern that has prevailed for annual expenditures, zip codes to the north and southwest of Grand Rapids tend to have high levels of ED use. In addition, the city of Grand Rapids has especially high ED use for diabetics. Notably, we see the same discrepancy in ED use between zip codes in the city and suburbs of Detroit with much higher use documented in the city and much lower use in the suburbs.

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 diabetics 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 quantile 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, while overall use is relatively low, members on the west side of the state are far more likely to use telehealth services than those on the east side of the state.

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Table 1: Characteristics of Inpatients in KOMA Diagnosed with CAD

	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

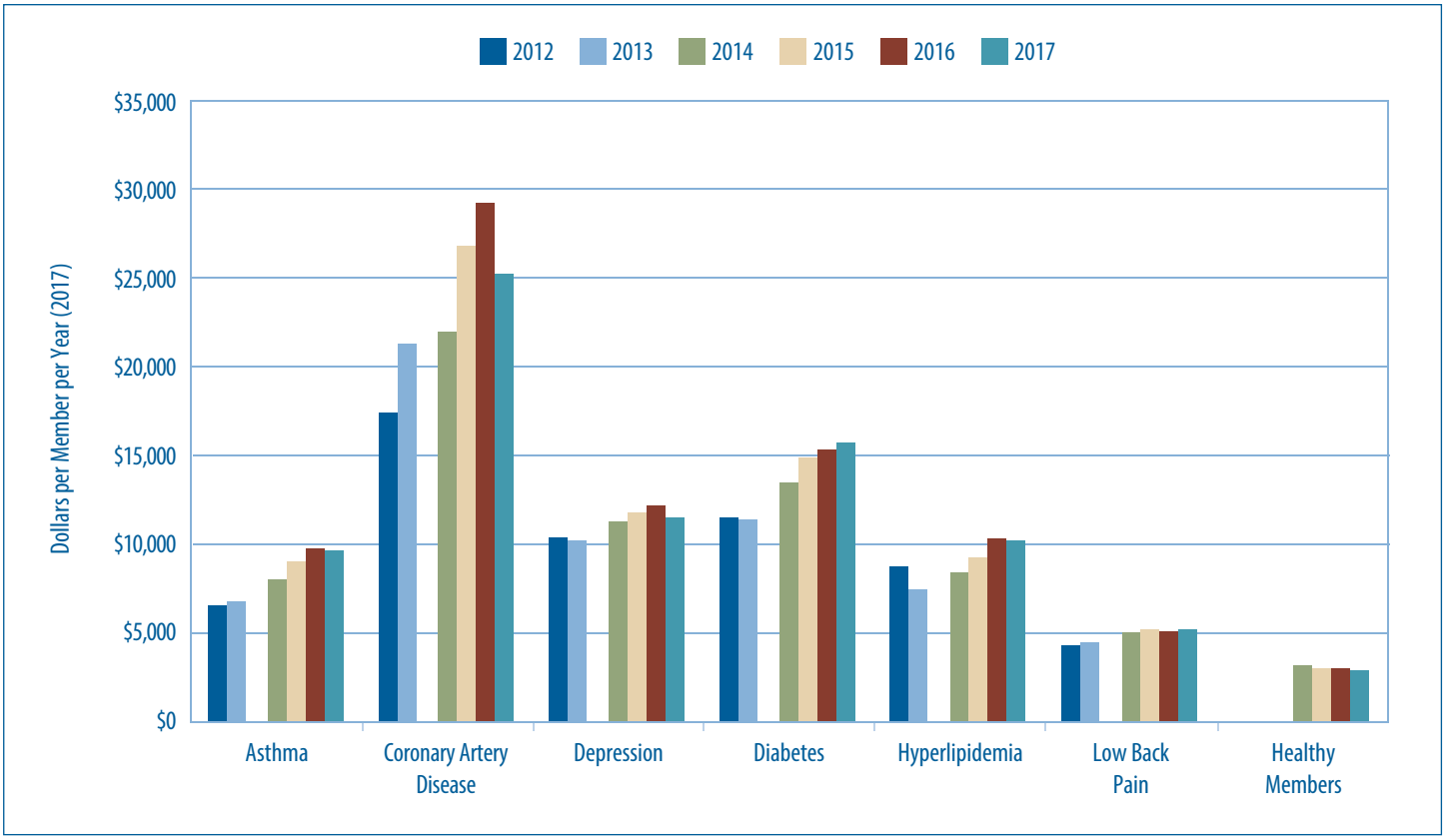
Source: Healthcare Cost and Utilization Project's State Inpatient Databases

Table 2: Outcomes for Inpatients in KOMA Diagnosed with CAD

	Number of CAD Admissions	Average Number of Procedures	Average Length of Stay	Share of Survivors Discharged to Facility	PTCA Rate	CABG Rate	Average Total Charges ($2016)
2006	4,928	5.27	3.46	6.71%	53.94%	13.78%	$36,557.42
2008	3,717	5.16	3.83	7.09%	45.90%	15.39%	$38,157.13
2010	3,341	5.15	3.89	10.95%	44.15%	15.18%	$41,745.83
2012	3,328	5.29	4.07	11.36%	43.09%	15.78%	$46,342.16
2014	2,785	5.49	4.58	12.33%	40.39%	20.65%	$54,201.69
2016	2,937	4.50	4.46	10.93%	36.36%	20.39%	$58,343.61

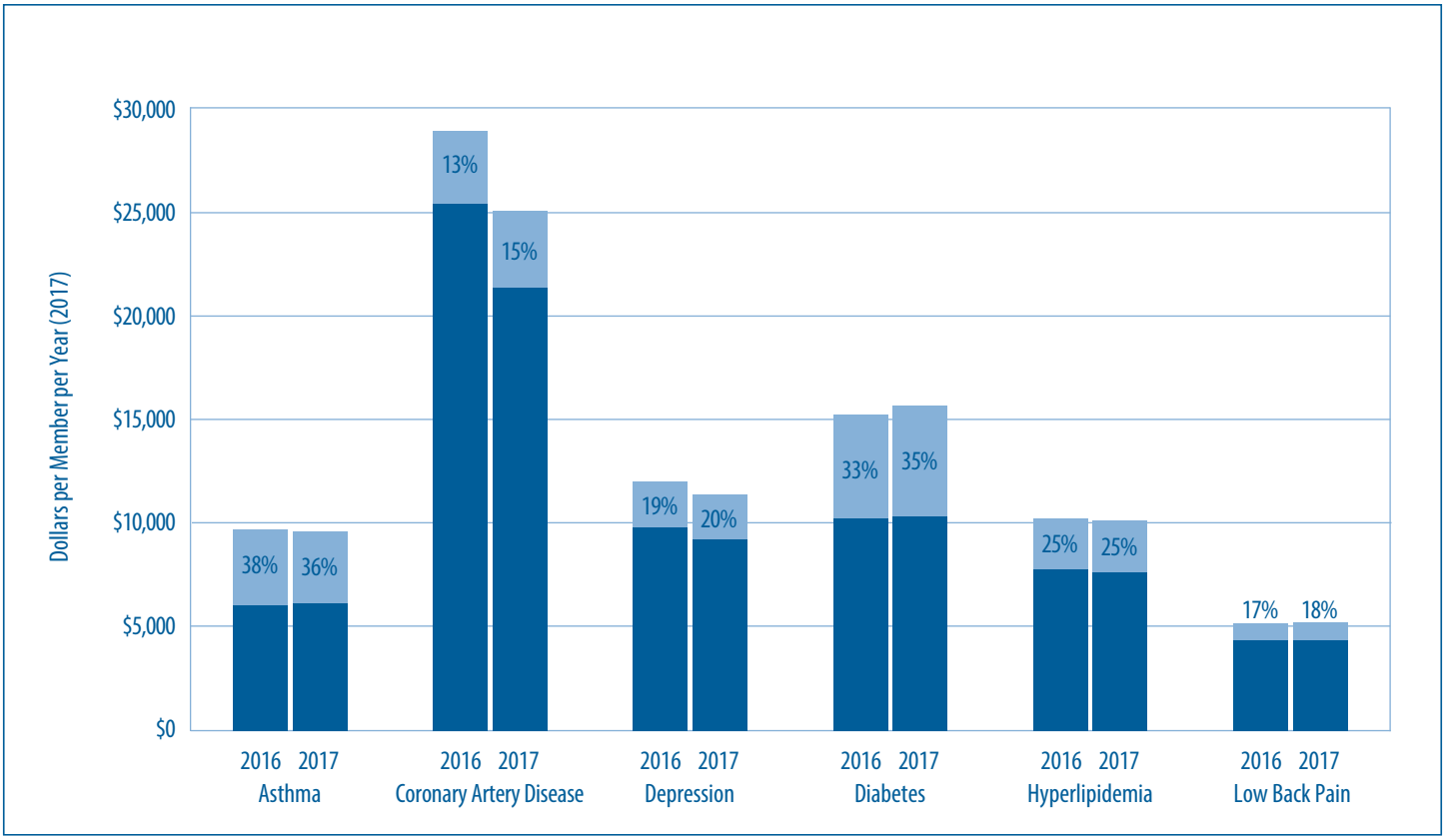
Source: Healthcare Cost and Utilization Project's State Inpatient Databases

Figure 1: Average Expenditures per Member in KOMA, 2012-2017



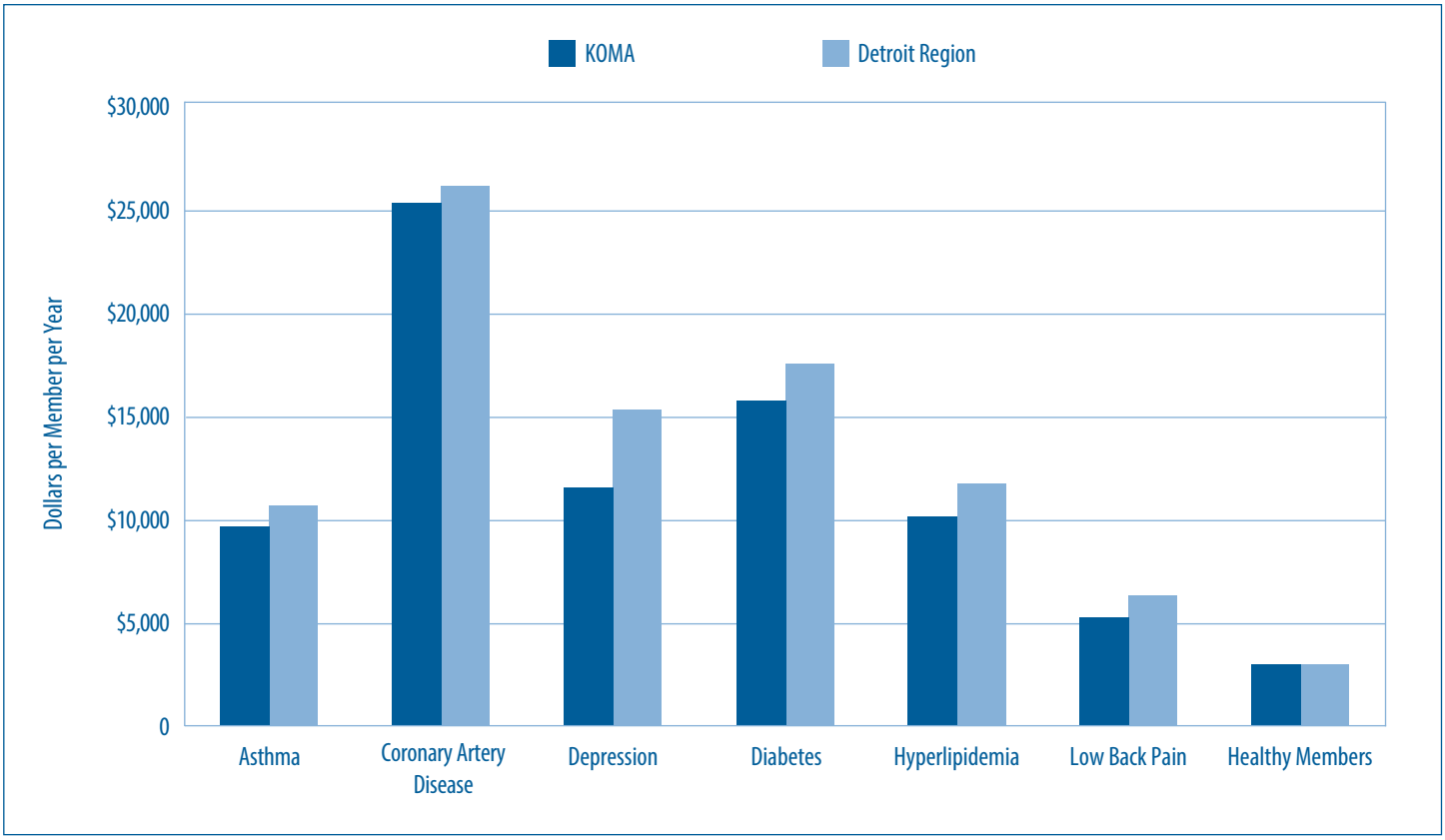
Source: BCBSM, BCN, and Priority Health member data

Figure 2: Rx Share of Average Expenditures per Member in KOMA, 2016 & 2017



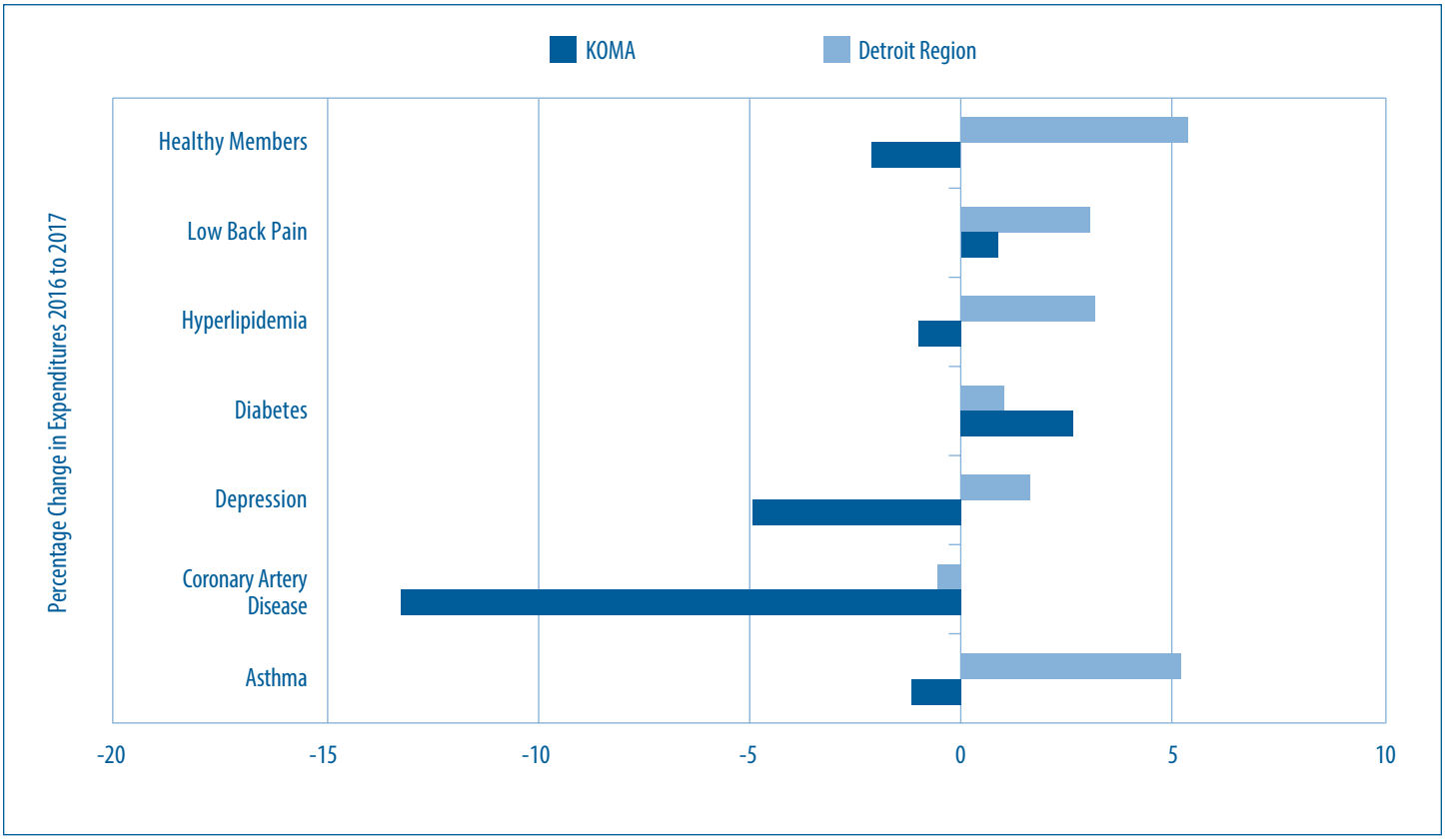
Source: BCBSM, BCN, and Priority Health member data

Figure 3a: Average Expenditures per Member, 2017



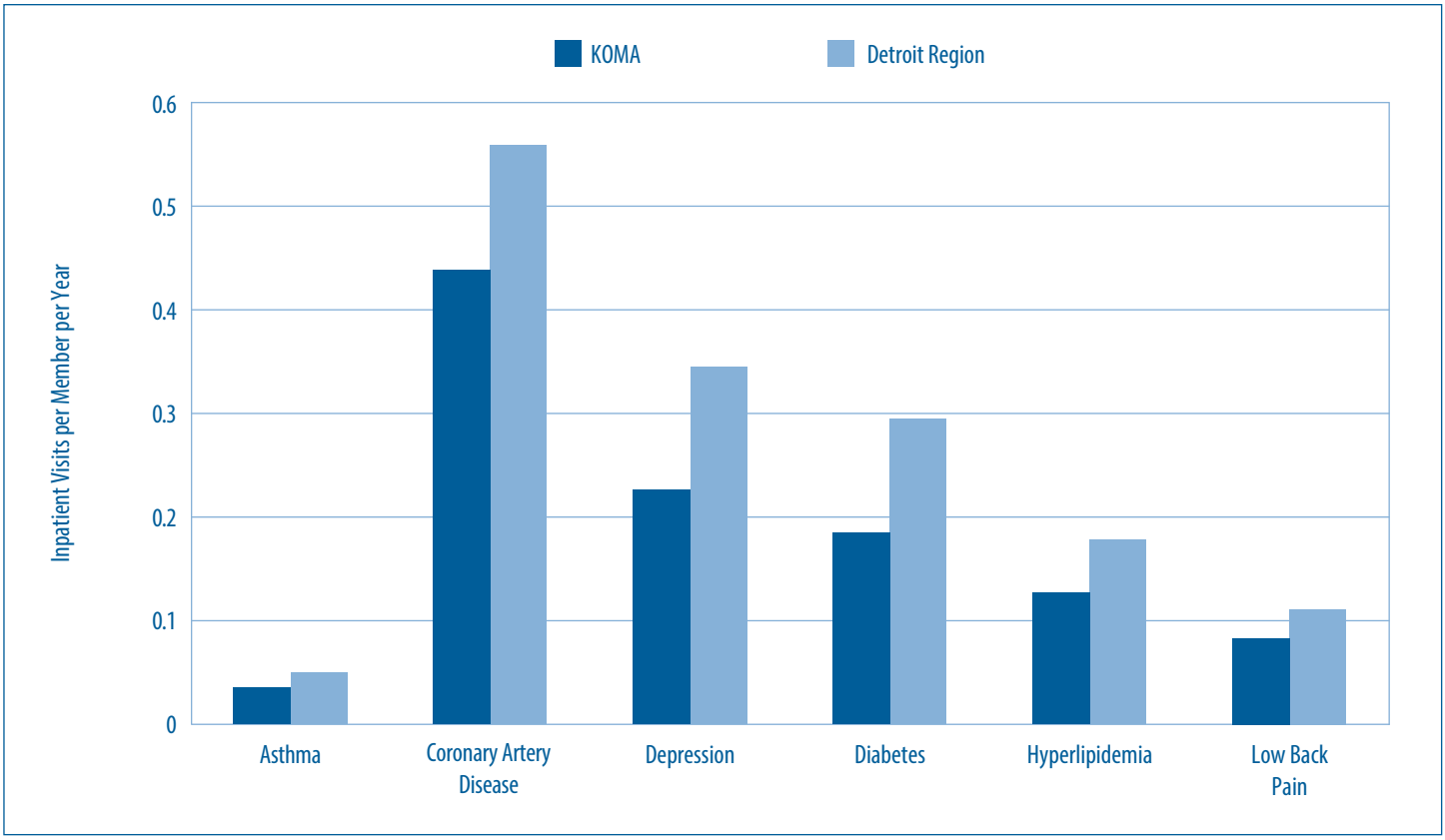
Source: BCBSM, BCN, and Priority Health member data

Figure 3b: 2016-2017 Percentage Change in Average Expenditures per Member



Source: BCBSM, BCN, and Priority Health member data

Figure 4a: Average Annual Inpatient Visits per Member, 2017



Source: BCBSM, BCN, and Priority Health member data

Figure 4b: Average Annual Emergency Department Visits per Member, 2017

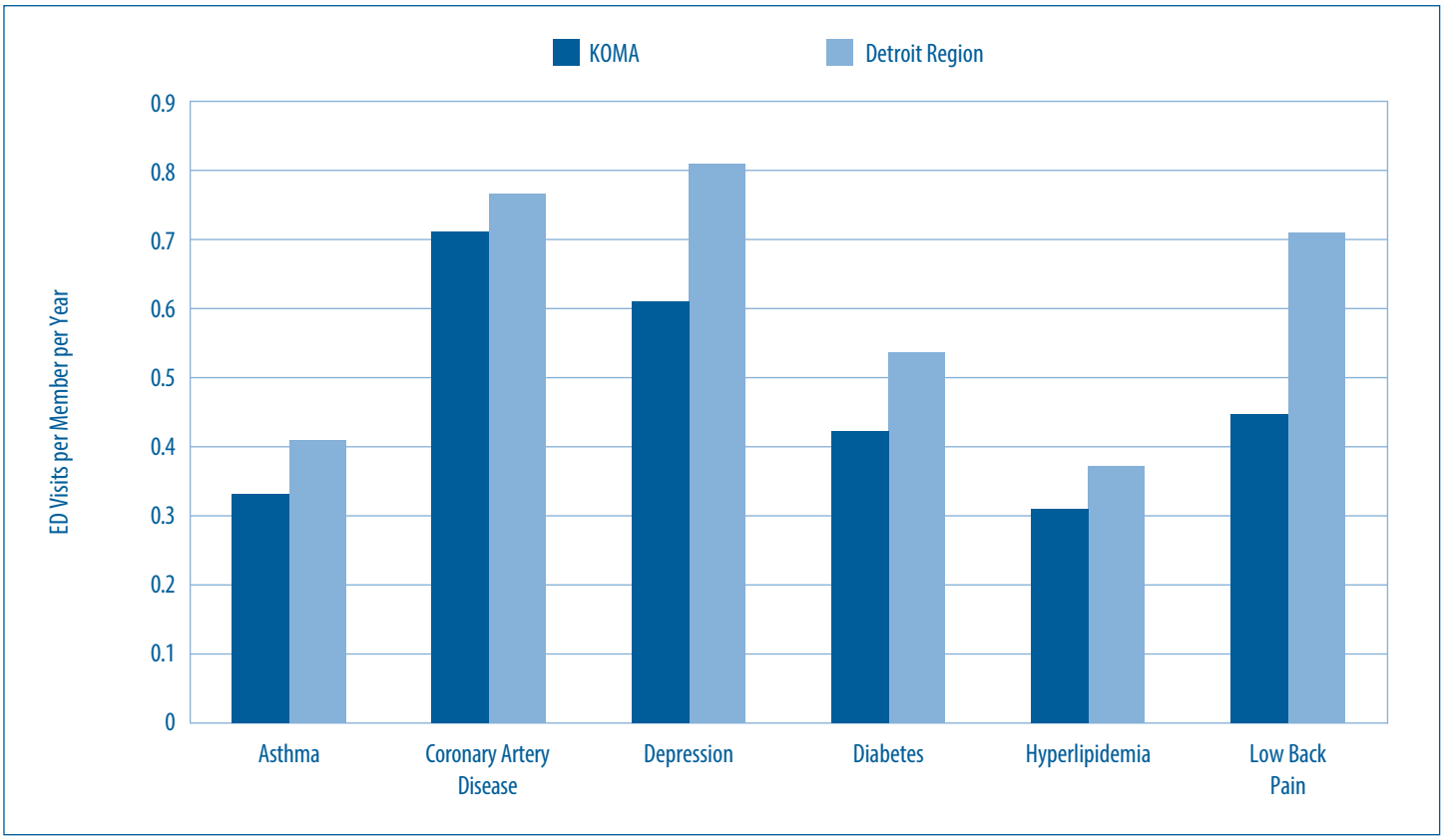
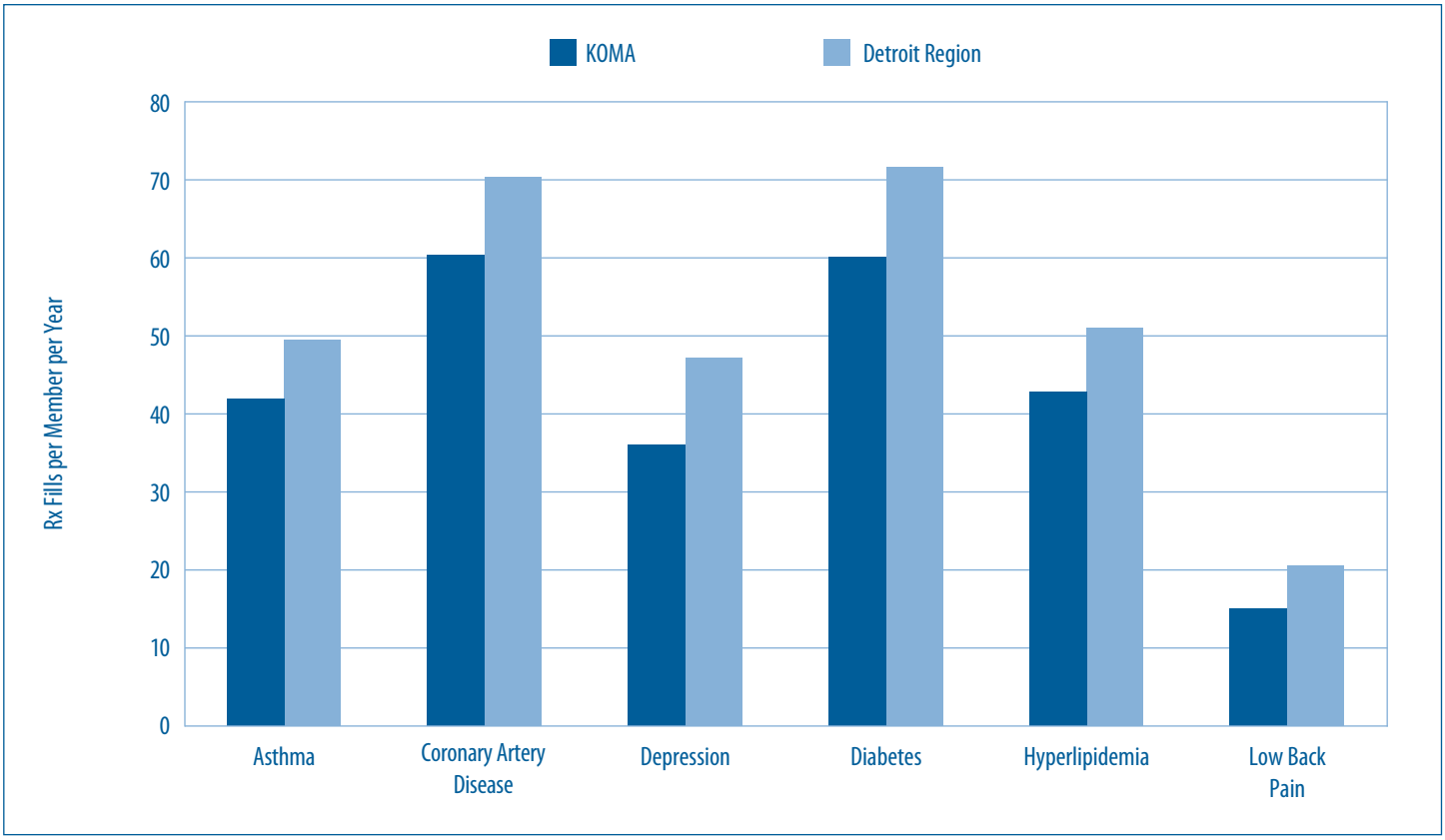
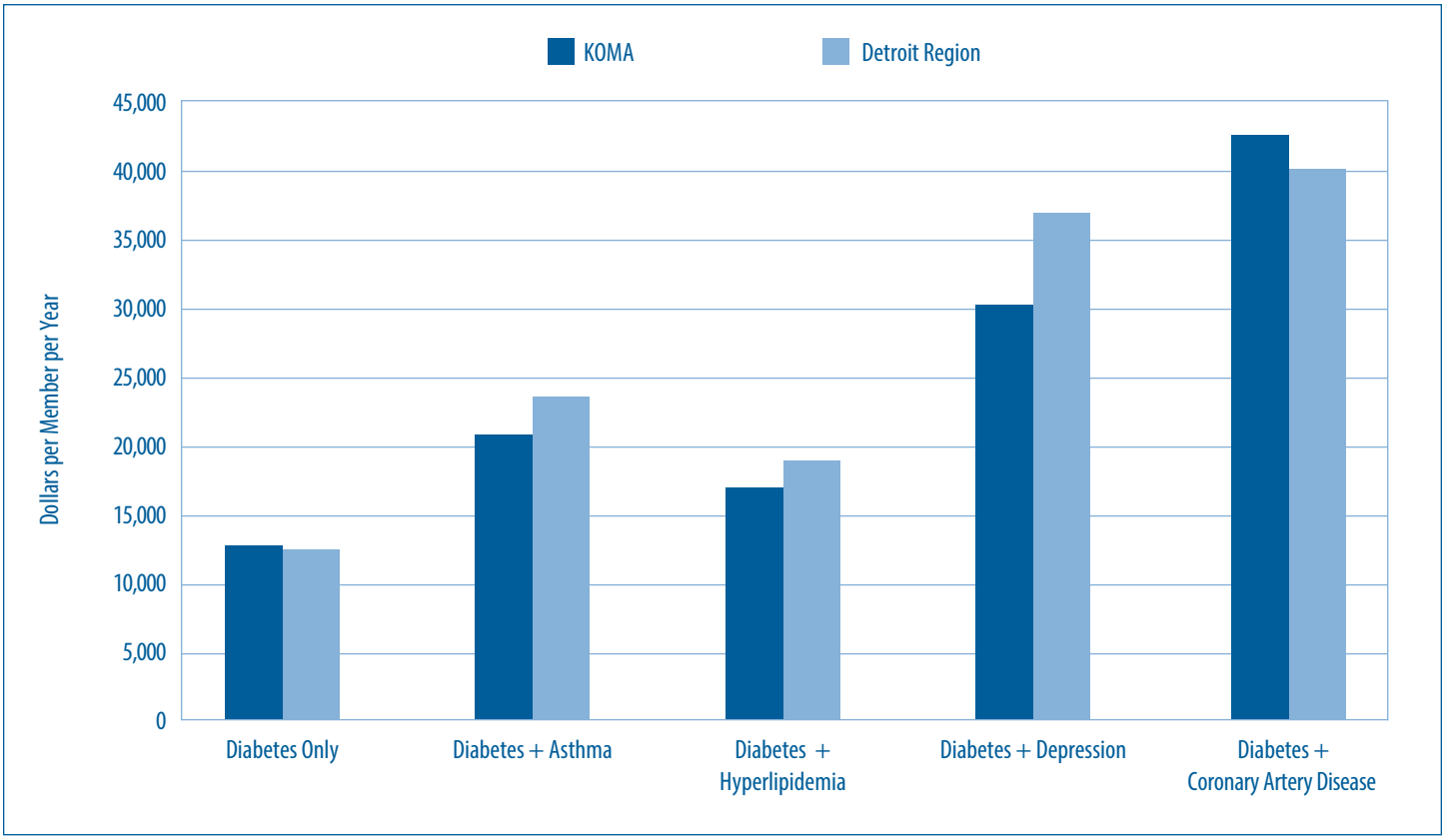


Figure 4c: Average Annual Prescription Fills per Member, 2017



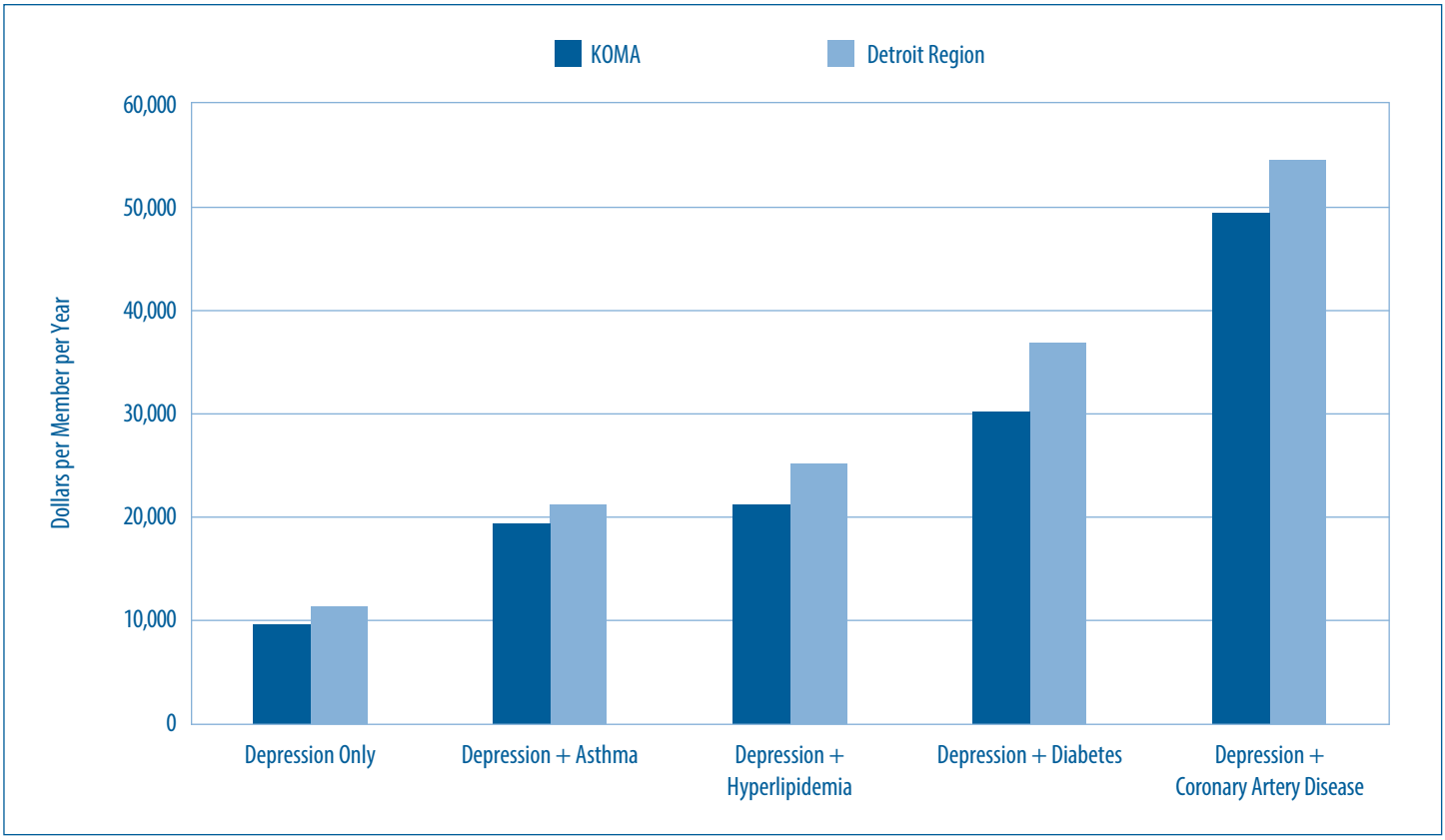
Source: BCBSM, BCN, and Priority Health member data

Figure 5a: Expenditures on Members with Diabetes and Comorbidities, 2017



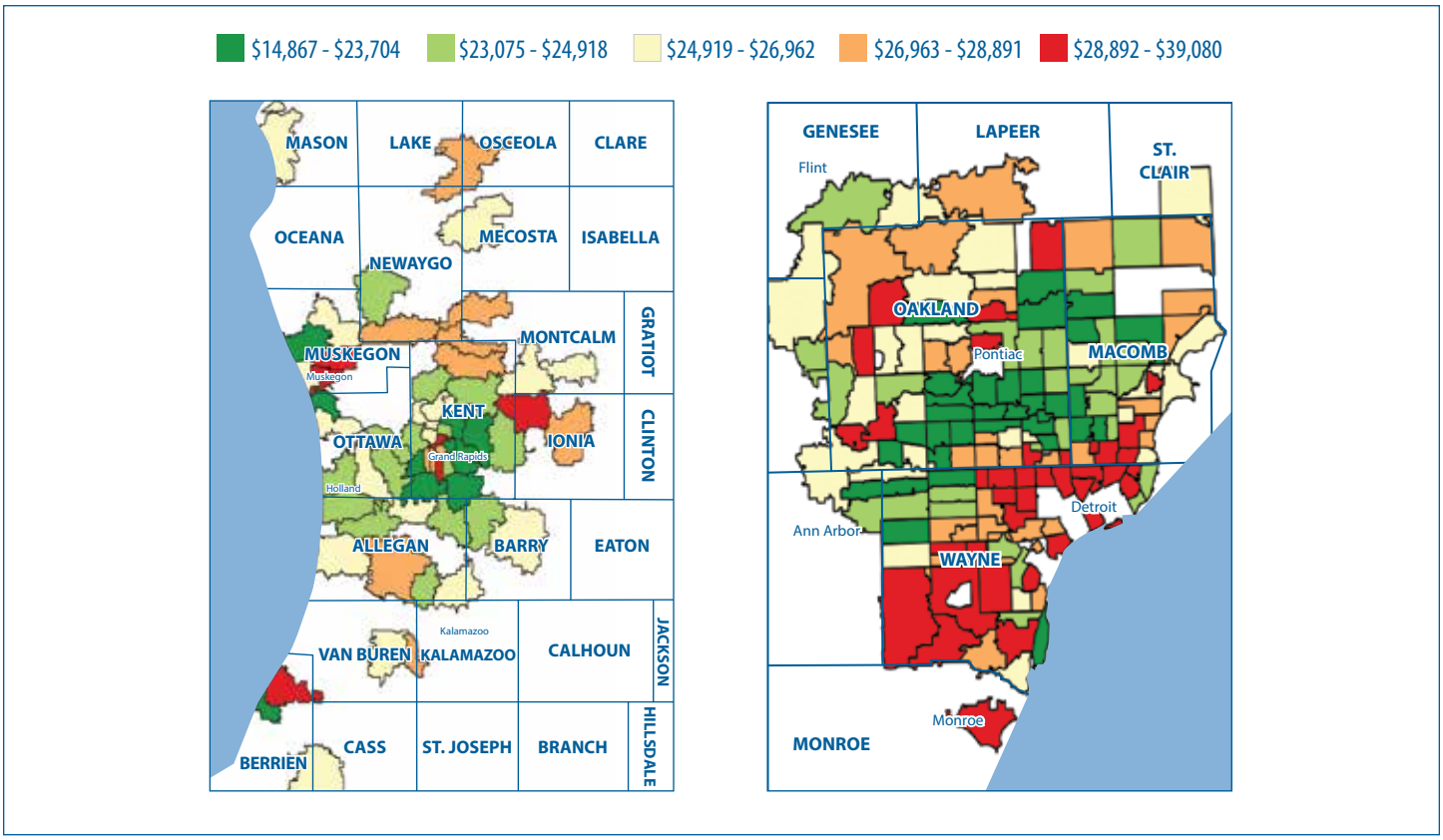
Source: BCBSM, BCN, and Priority Health member data

Figure 5b: Expenditures on Members with Depression and Comorbidities, 2017



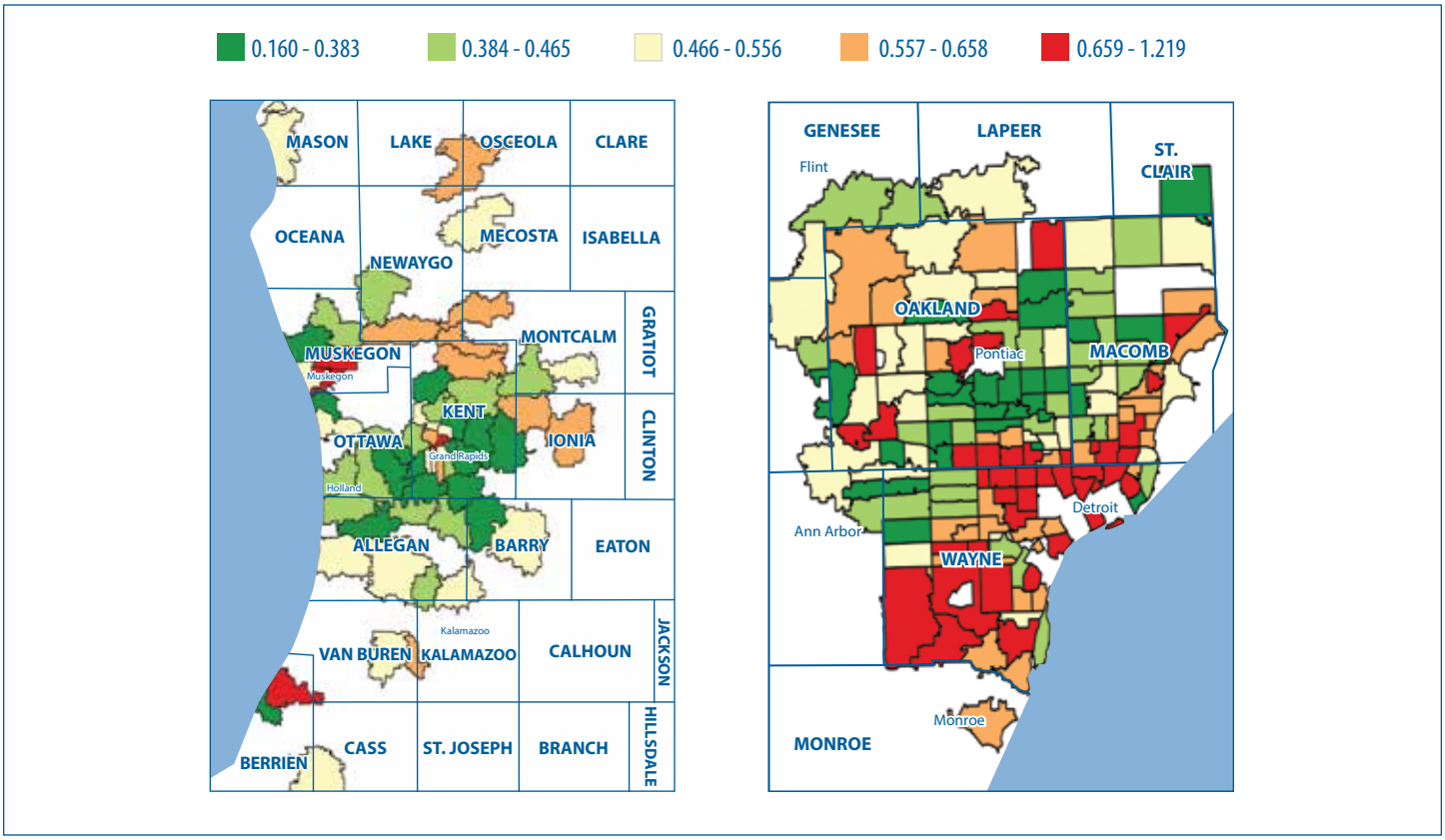
Source: BCBSM, BCN, and Priority Health member data

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



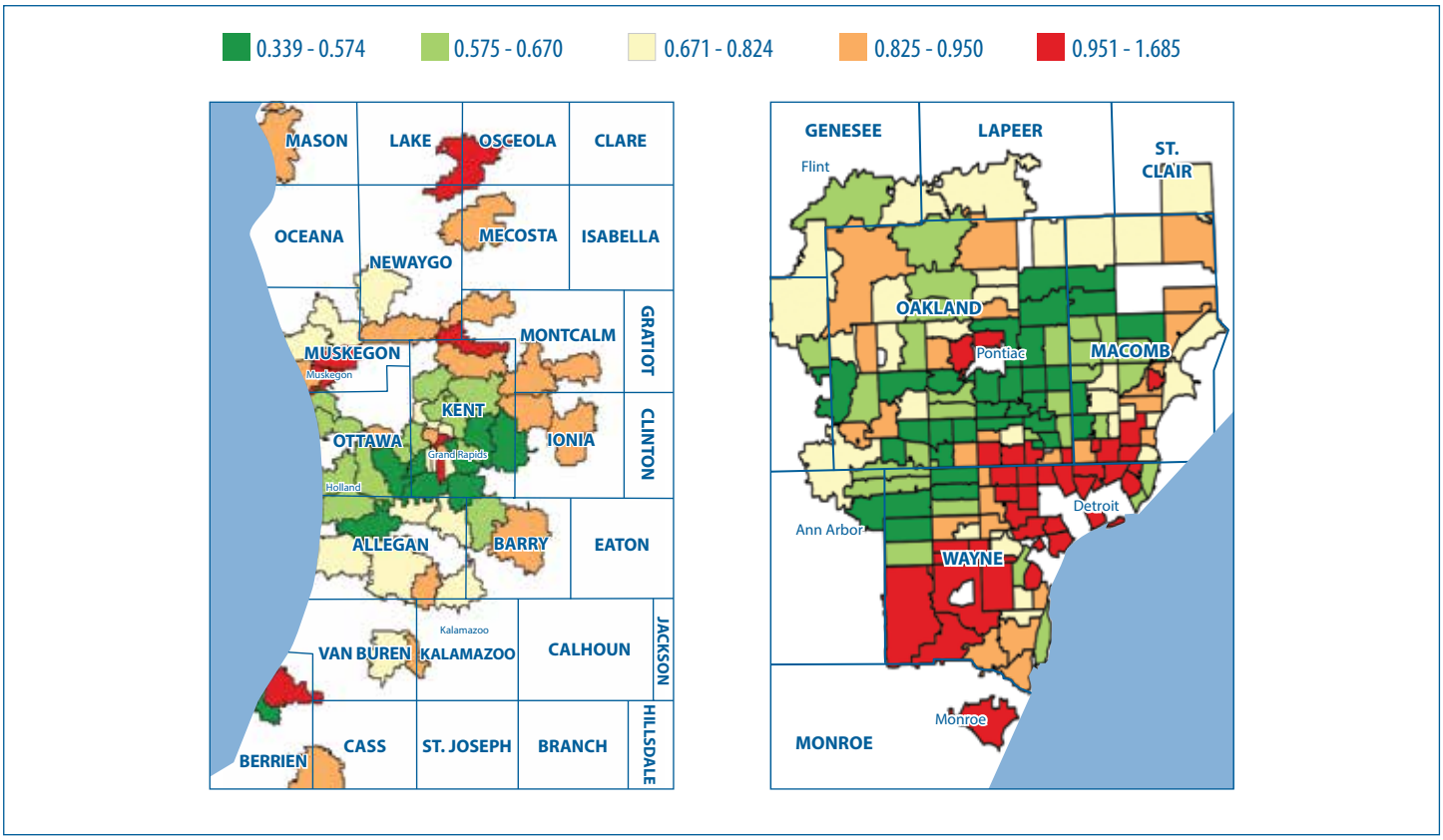
Source: BCBSM, BCN, and Priority Health member data

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



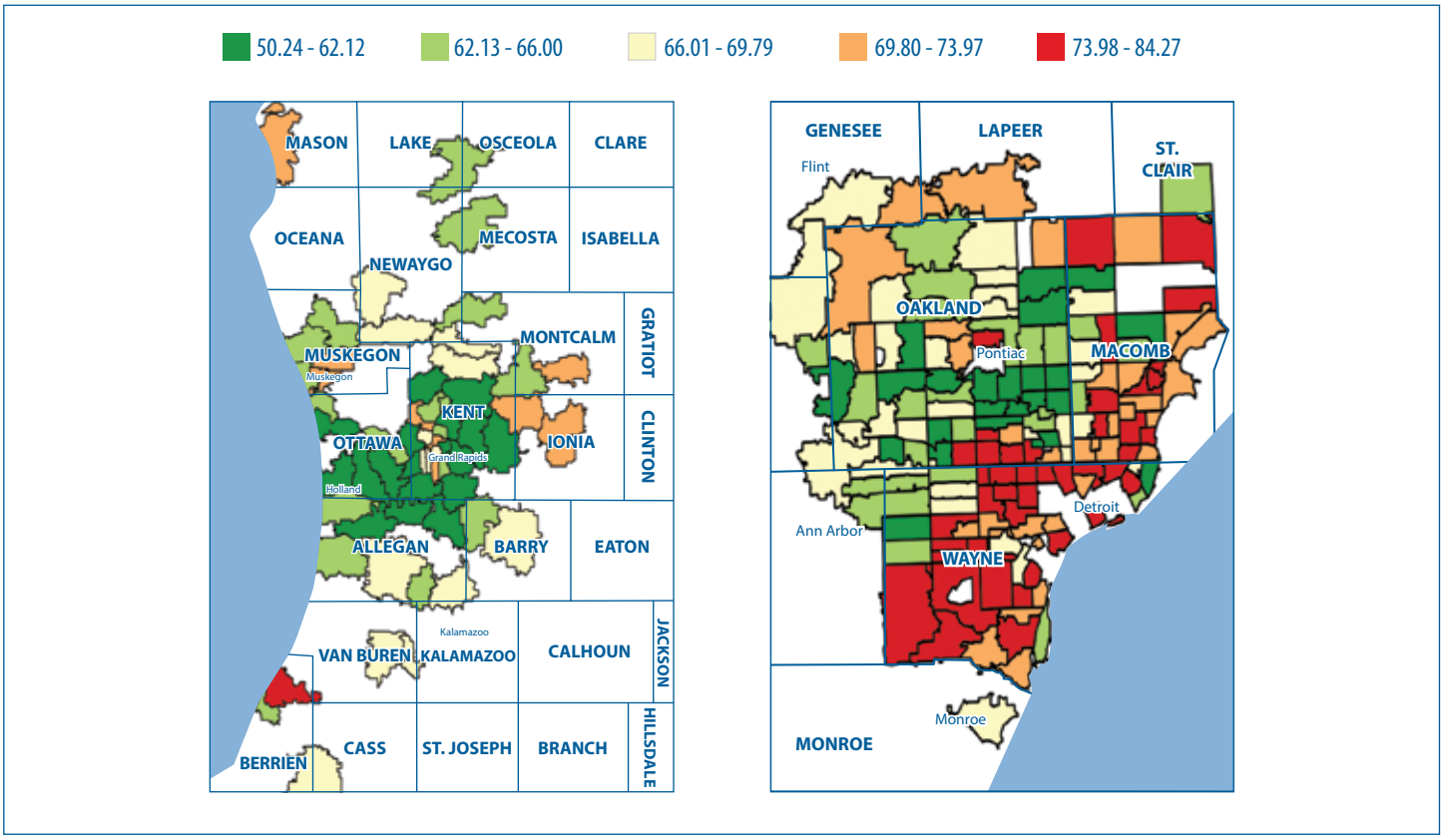
Source: BCBSM, BCN, and Priority Health member data

Figure 6c: Distribution of Average Annual ED Visits per Member with CAD by Zip Code



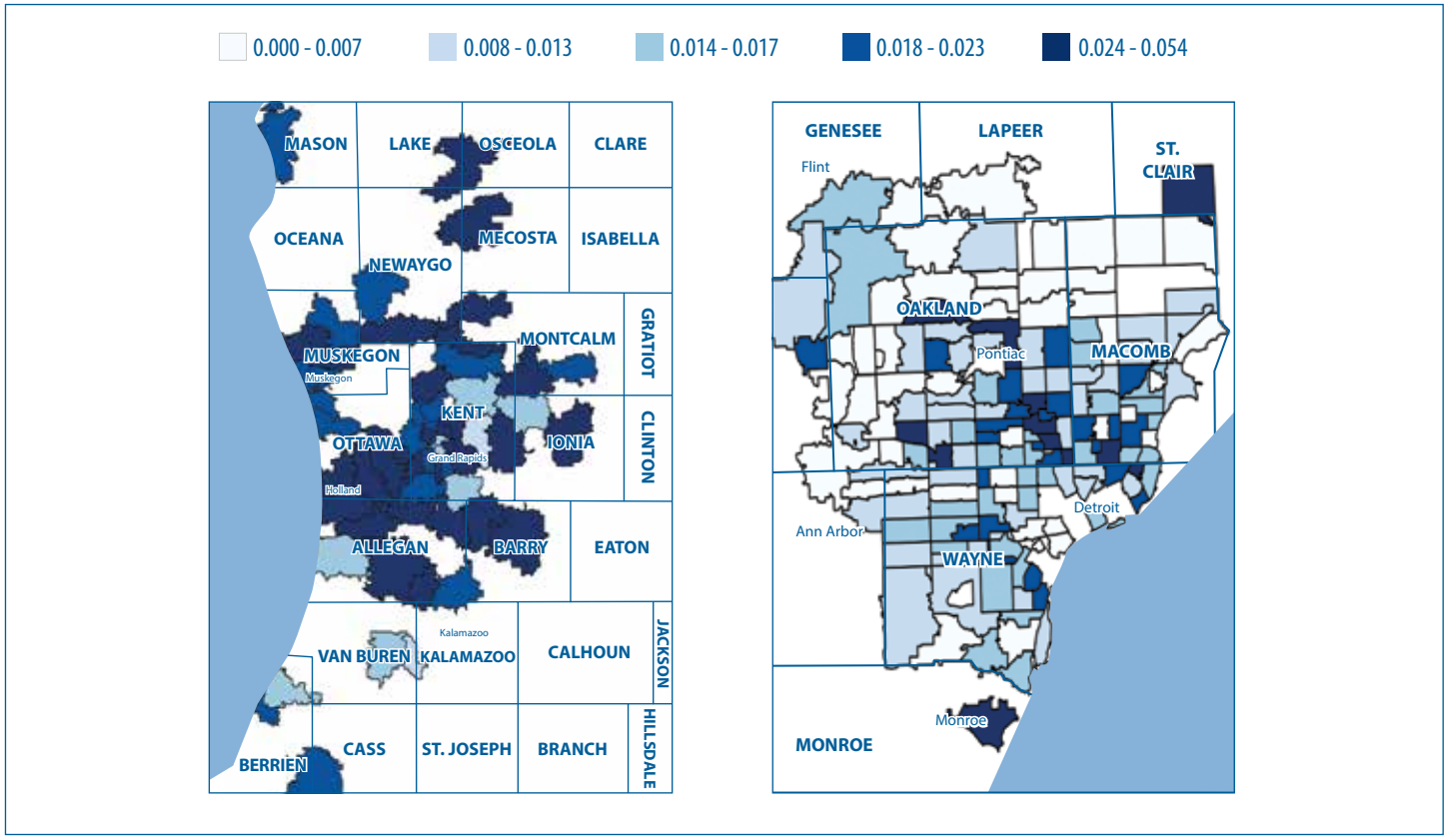
Source: BCBSM, BCN, and Priority Health member data

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



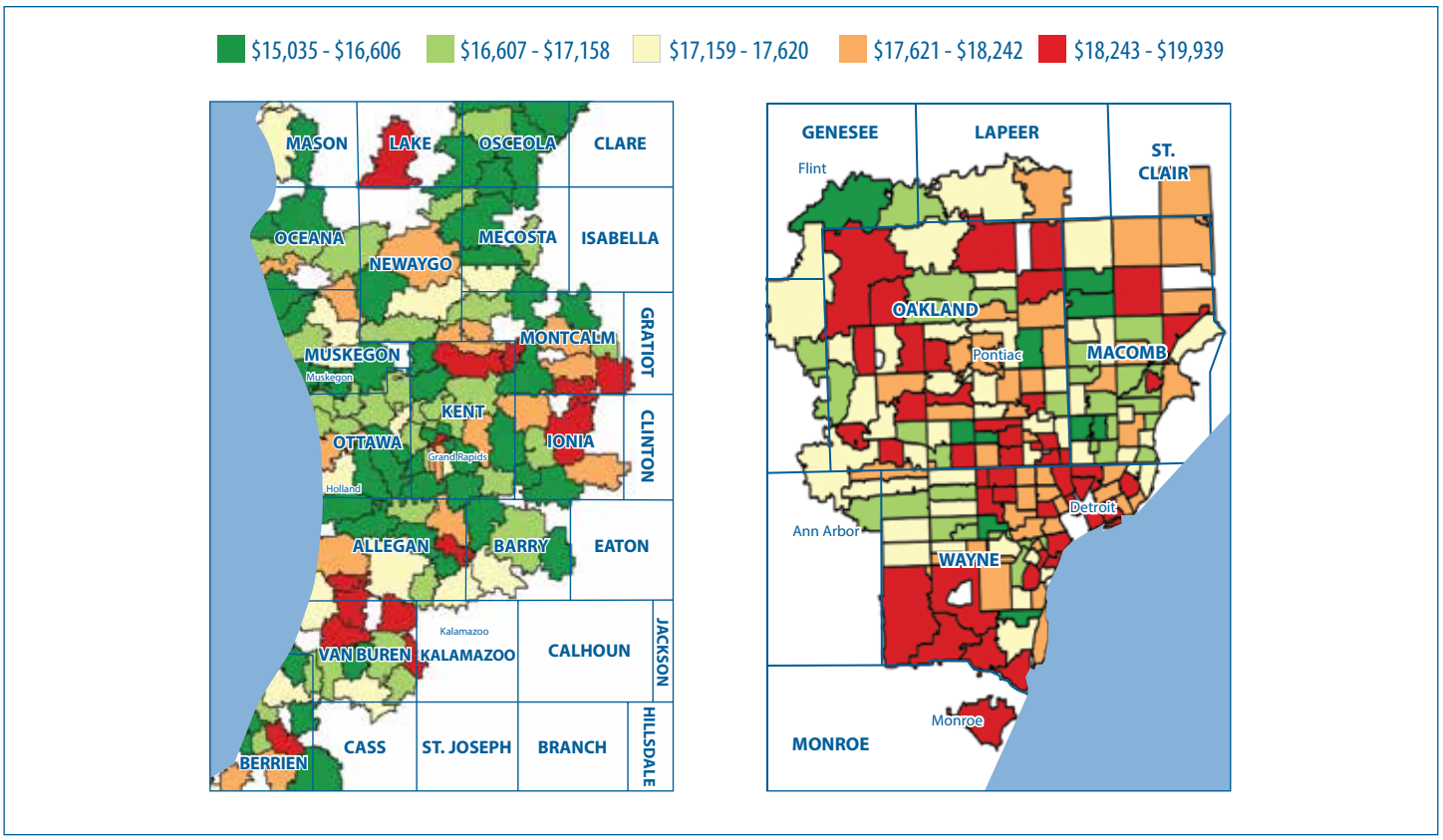
Source: BCBSM, BCN, and Priority Health member data

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



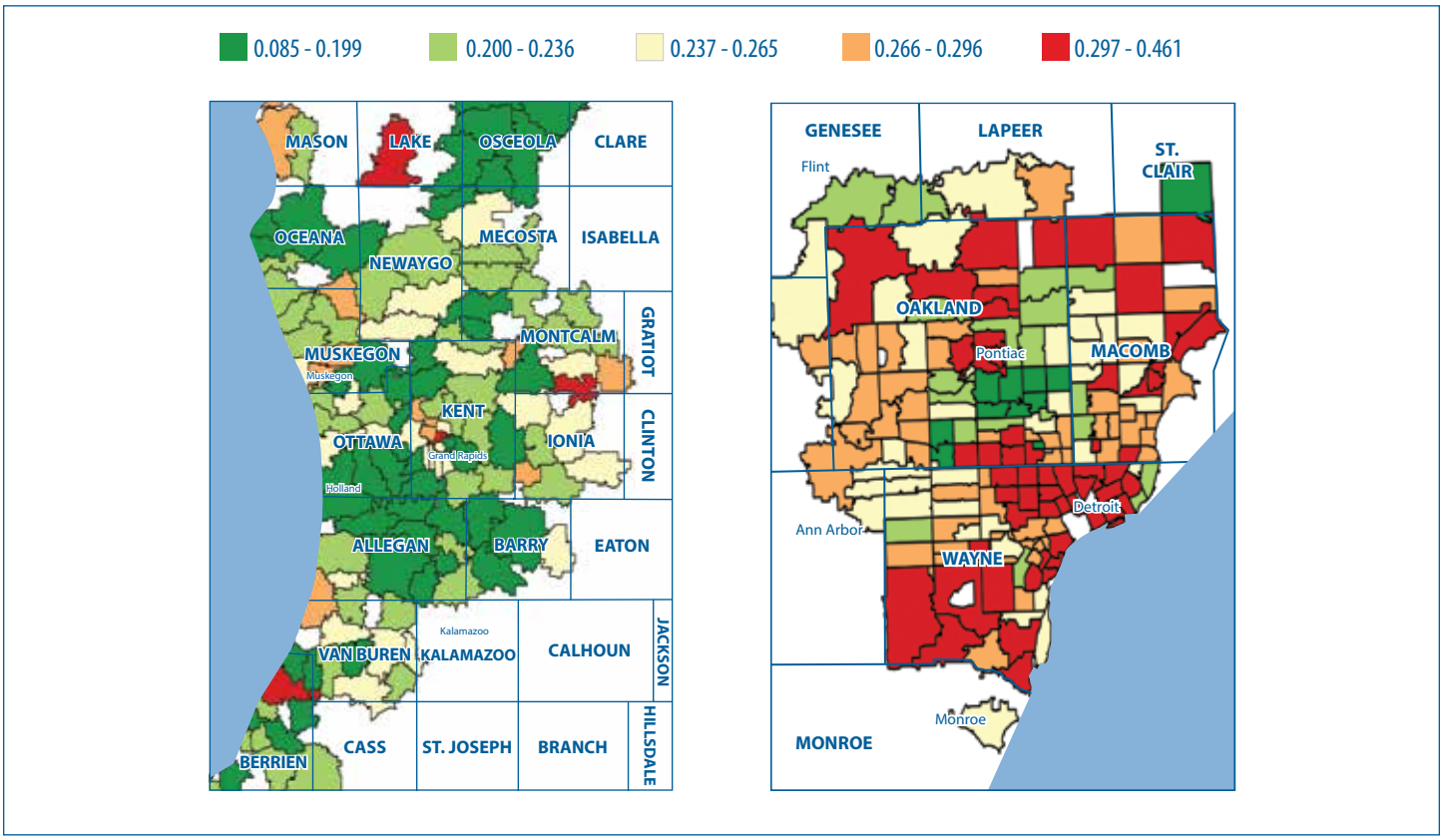
Source: BCBSM, BCN, and Priority Health member data

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



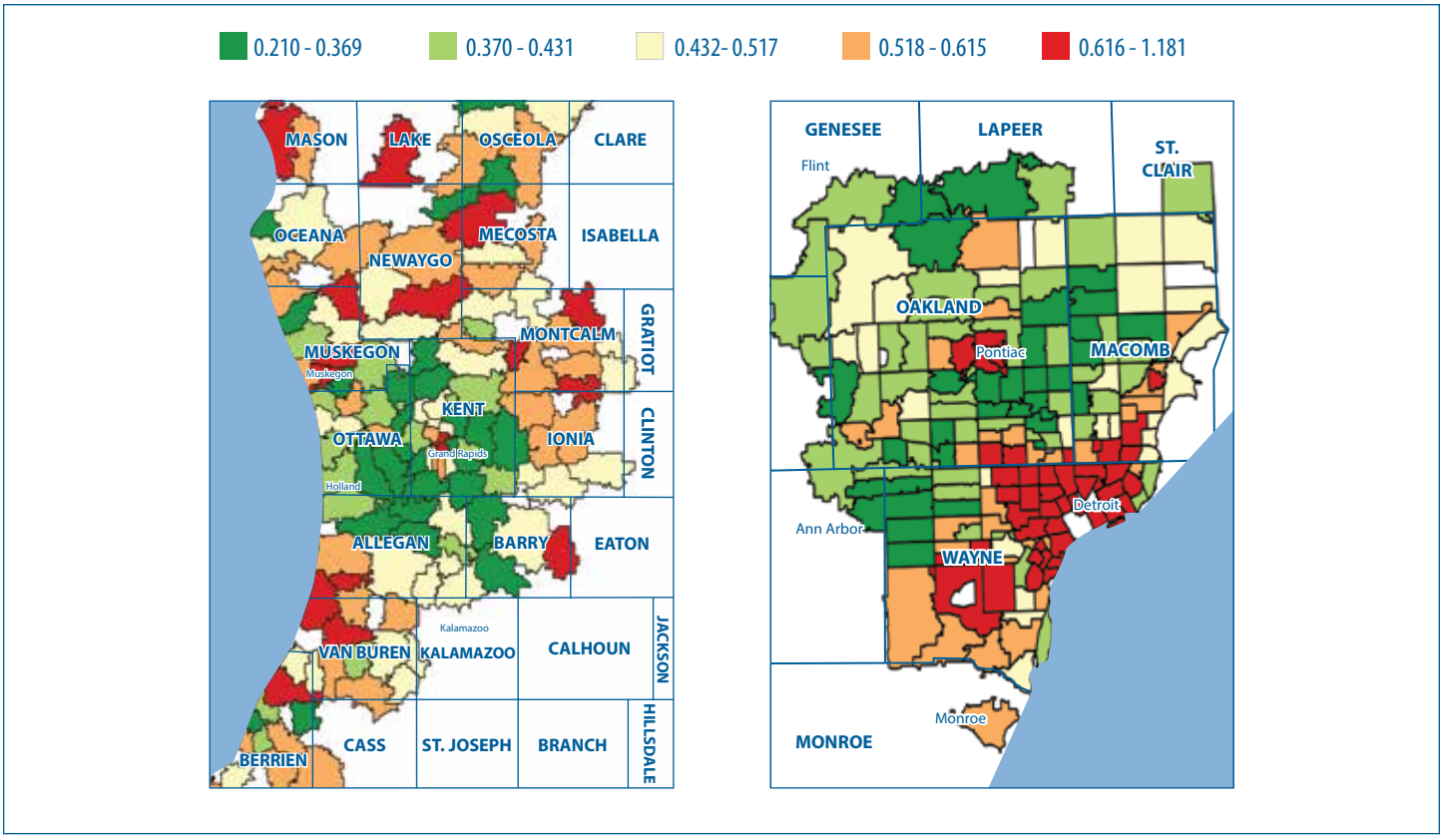
Source: BCBSM, BCN, and Priority Health member data

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



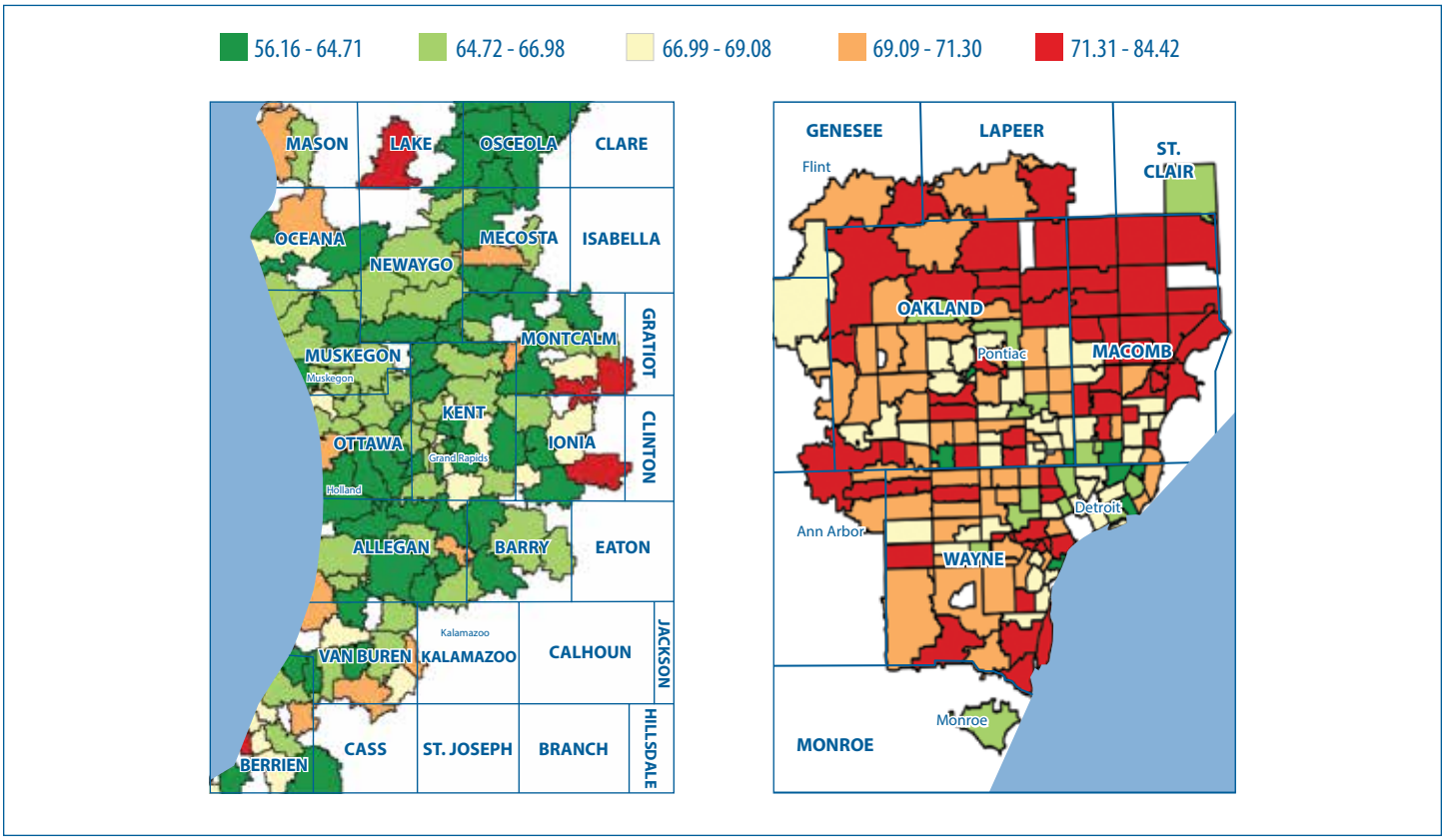
Source: BCBSM, BCN, and Priority Health member data

Figure 7c: Distribution of Average Annual ED Visits per Member with Diabetes by Zip Code



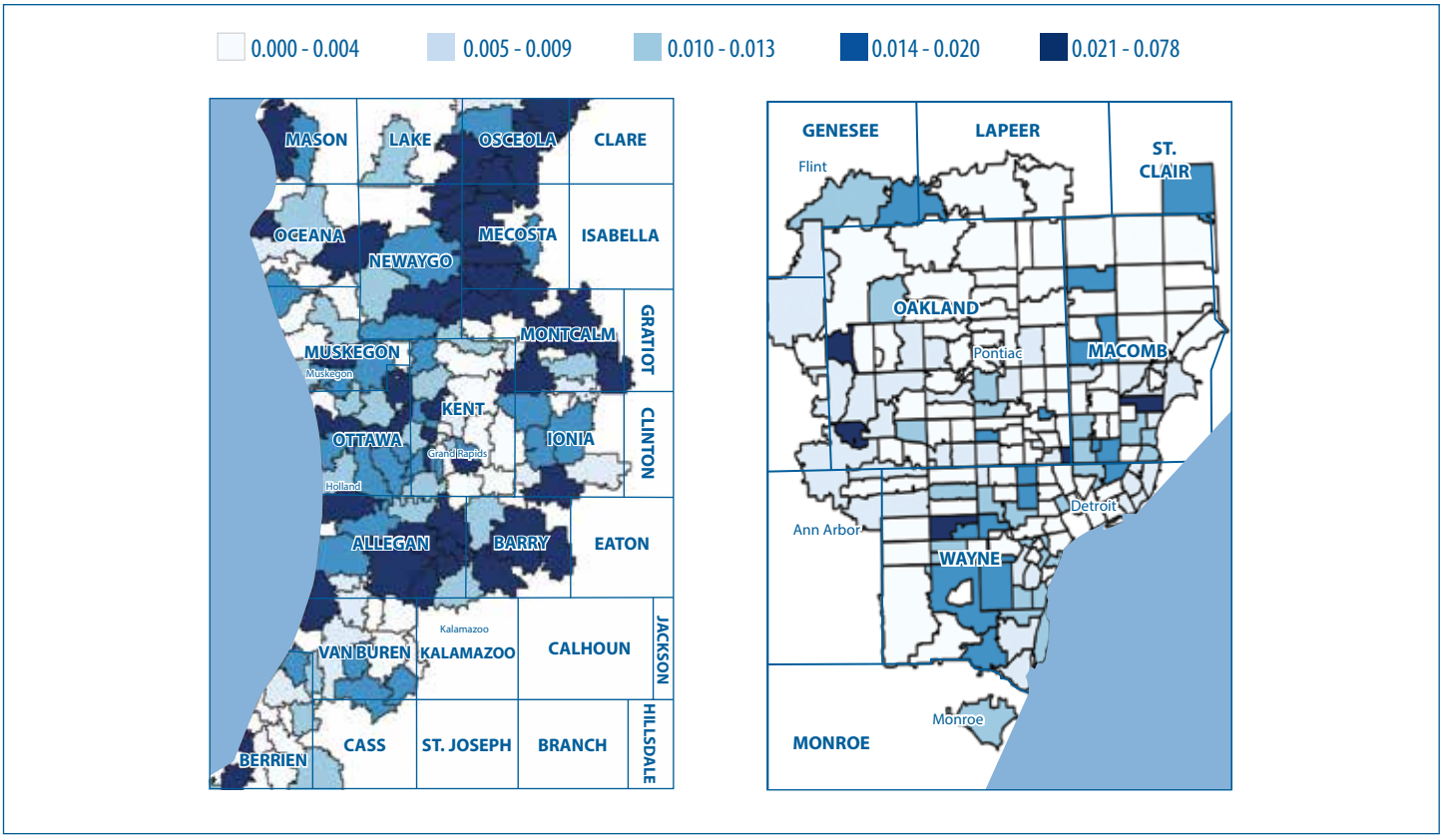
Source: BCBSM, BCN, and Priority Health member data

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



Source: BCBSM, BCN, and Priority Health member data

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



Source: BCBSM, BCN, and Priority Health member data

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