# Defeat Diabetes:

## Disparities and Opportunities in Missouri's Commercially Insured Population

***Brought to you by the Midwest Health Initiative***

***This report was funded by an unrestricted educational grant from Merck and Company.***

## Key Findings

1. Prevalence of people being treated for type 2 diabetes among commercially insured Missourians aged 18-64 was 5.2% in 2019.

2. 70% of those with a regular source of primary care received three recommended diabetes screenings during the year.

3. Adjusting for age and health risk, people with type 2 diabetes were about 2 times more likely to visit the emergency department and 2.7 times more likely to be hospitalized in comparison to people without diabetes.

4. Medication adherence is an improvement opportunity. People with type 2 diabetes did not consistently refill blood pressure (32%), cholesterol (40%), and anti-diabetes medications (26%).

5. The average annual cost of a person with Type 2 diabetes ($14,791) was over 2.5 times higher than those without diabetes ($5,568).

6. This study's statistical models show that social factors as well as age were associated with type 2 diabetes prevalence and care management.

7. By understanding disease prevalence, gaps in care, and spending at a local level, resources can be targeted to areas with the greatest opportunities for improvement.

***"Small changes, community by community, employer by employer, family by family, can add up to meaningful improvements in health outcomes across the state."***

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*Recent past Chair, St. Louis Chapter of the American Diabetes Association*
*and Midwest health Initiative Board member.*

# Table of Contents

# Introduction

Epidemiologists have long noted disparities in diabetes prevalence and health outcomes related to poverty, education and race. The Missouri Department of Health and Senior Services *2019 Diabetes Department Report* to the Missouri legislature[i] confirms that these disparities exist in Missouri. Their report used survey and other public health data to estimate diabetes prevalence across all adult populations for Missouri statewide and in its individual counties. The Department reported a 2017 statewide prevalence of 10.4 percent, with higher prevalence among populations who are poorer, older, African American, and those who have attained less education. The Department also reviewed known opportunities to prevent diabetes and prediabetes to improve health outcomes for people with diabetes.

Employers provide health benefits to their employees, contributing significantly to the health and health security of a large proportion of the American public. Because one or more household members in this population is healthy enough to work full-time, has an income and health care coverage, this population is thought to fare better when it comes to a chronic illness like diabetes. However, the presence of disparities in health outcomes related to social factors is not well researched or understood in commercially insured populations.

Focusing solely on commercially insured people in Missouri with type 2 diabetes, this Midwest Health Initiative (MHI) report explores the disparities and opportunities that exist in a population where all members receive health benefits through an employer or labor union. It seeks to identify if social economic factors such as those found in the Department's report also influence health outcomes in Missouri's commercially insured population. Increasingly aware of the impact of social factors on health outcomes, employers seek to better understand their impact on the health and wellbeing of their population and their overall impact on health care spending.

Findings in this report are based on information from the Midwest Health Initiative multi-payer commercial dataset and the Robert Graham Center's Social Deprivation Index (SDI) which incorporates findings from the American Community Survey data.[ii] Details about the MHI dataset can be found in the About the MHI Dataset portion of this report.

# Observations from the MHI Data

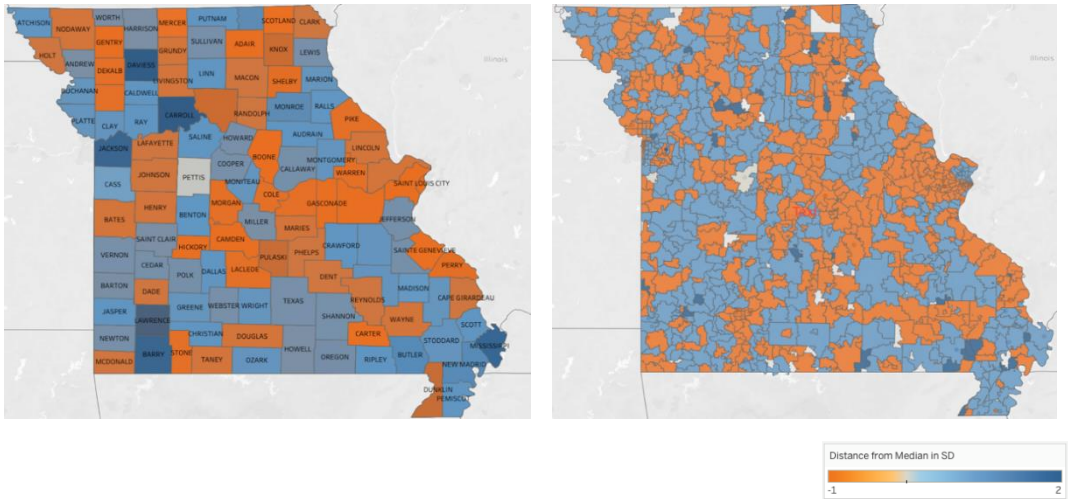
MHI data was used to observe findings at the county level in 2019 for continuously enrolled commercially insured adults, ages 18 to 64, residing in Missouri. Detailed findings at the county level are provided in the Appendices.

## Prevalence

MHI found that Missouri's 2019 prevalence of type 2 diabetes among commercially insured adults 18 to 64 years of age was 5.2 percent (95% CI (5.2% - 5.3%), as indicated in Appendix 1.

## Geography

Prevalence of type 2 diabetes varies by geography. The maps below show the difference in prevalence by county (left) and then by zip code (right). The blue colored counties have prevalence greater than the median prevalence in the state, and those in orange have a lower prevalence. The intensity of the blue or orange colors indicates the distance from the median in standard deviations from the median value (4.99%, SD=5.0%). The county level data shows higher prevalence in the southeast, southwest, and western regions of the state (Kansas City), with lower prevalence in the eastern region (St. Louis). However, the zip code view reveals that the northern portion of Saint Louis County has a higher prevalence than the rest of the county.




## Age

Age is an important consideration in any analysis of diabetes prevalence, as chronic conditions increase with age[iii]. The average age of the subset of the MHI dataset studied in this report is 40 years and the average age of the people with type 2 diabetes in Missouri is 54 years, a difference of 14 years. With this in mind, MHI used age as a variable in all analyses, to control for potential age differences.

## Obesity

Being obese is a leading risk factor for type 2 diabetes and a common co-morbidity. Researchers at Harvard's School of Public Health, Willett and colleagues, were among the first to document the connection between weight and diabetes, reporting that being slightly overweight increased the rate of diabetes fivefold and being seriously overweight increased the rate of diabetes 60 times.[iv] They further clarified that, while about only 30 percent of obese individuals have diabetes, about 90 percent of people with diabetes are overweight. The United States Centers for Disease Control and Prevention defines being overweight as having a body mass index (BMI) of 25 to 30, and being obese, as having a BMI of 30 or greater. [v]

Given this close connection between excess weight and diabetes, MHI sought to estimate weight status. However, the type and structure of MHI's data did not support valid analysis. The claims data shows that only 14.2 percent of adults age 18 to 64 have been diagnosed as being overweight or obese, which is substantially lower than expected rates from population-based research. For example, prior research indicates

that more than 2 out of 3 adults in the U.S. are overweight or obese.[vi] The Behavior Risk Factor Surveillance System (BRFSS) finds that 66.9 percent of Missourians reported being overweight or obese in 2018. Coding obesity or overweight as a diagnosis in medical records is an inconsistent practice. Given the importance of obesity as a disease and a risk factor for other diseases, like diabetes, improving the use of the ICD-10 codes related to obesity and body mass index (BMI) is warranted.

## Care Management

Medical experts recommend that everyone with or at risk for diabetes have a routine source of primary care and regularly receive recommended screenings and care oversight. Four recommendations include assessments of HbA1c (blood sugar), kidney function, cholesterol levels, and a retinal exam. The first three of these are commonly provided under the medical benefit and reflected in medical claim data, such as MHI's dataset. Retinal exams are often not. MHI has applied the National Committee for Quality Assurance (NCQA) standardized measure criteria for recommended diabetes screenings, to determine how often commercially insured adults with type 2 diabetes in Missouri receive recommended care.

Across Missouri, 93 percent of patients diagnosed with type 2 diabetes and evaluated by a provider during the year, received at least one HbA1c test to assess their blood sugar levels and risk for long-term complications. Only 84 percent of patients received a recommended kidney function test, even though diabetes is a leading cause of kidney failure and 80 percent had their cholesterol level checked.

**Table 1. Care Management**

| People with Type 2 Diabetes, Ages 18 - 64 with a Provider Visit During the Year | |
|---|---|
| Had HbA1c Test (Blood Sugar) | 93% |
| Had Kidney Screening (nephropathy) | 84% |
| Had Cholesterol Test | 80% |
| Had all Three Tests Listed Above | 70% |

Each screening is important to the long-term wellbeing for people with diabetes. Of people diagnosed with diabetes that were evaluated by a provider during the year, 70 percent received all three recommended screenings. Inversely, 30 percent of those diagnosed with diabetes did not receive all three screenings. Those missed opportunities have consequences. The opportunity for improvement is greater when considering potential gaps in care for those who did not have a medical evaluation during the year. County level data about these three screenings can be found in Appendix 2.

## Medication Adherence

Doctors often prescribe medications to help control type 2 diabetes. However, MHI data shows that many patients do not refill those medications on time. MHI looked at adults with type 2 diabetes in Missouri and found that 32 percent did not consistently refill their blood pressure medications, while 40 percent did not consistently refill their cholesterol medications, and 26 percent did not refill their prescription for anti-diabetes medications. Adherence is defined as possession of a medication for 80 percent of the days prescribed. The reasons for a lack of medication adherence are varied. It may be due to the precipitous rise in prescription drug costs or employee cost sharing, a lack of

understanding or commitment on the part of patients, or a patient's inability to tolerate a medication, among other reasons. When adherence to drug therapy is poor, the risk of unfavorable outcomes and costs rise.

## ED Use and Hospitalizations among People with Diabetes

MHI observed that commercially insured people with type 2 diabetes are 1.97 ($p<0.001$, 95% CI 1.91-2.02) times more likely to have an emergency department (ED) visit than people of a similar age and health risk score. This is a statistically significant difference in ED visits. Making similar adjustments for age and health risk, it was found that people with type 2 diabetes are 2.69 ($p<0.001$, 95% CI 2.59-2.78) times more likely to be admitted to the hospital during a year compared to people without diabetes.

Higher hospital admissions and ED visits by people with diabetes may indicate that the individual's disease is not well controlled. Other research has shown that uncontrolled diabetes results in higher cost, higher rates of complications, more ED visits and a diminished quality of life. [vii] Conversely, successful management of diabetes can result in reduced morbidity, improved quality of life and lower health care costs.

## Relationship of Recommended Screenings to ED Visits

Receiving appropriate care, such as recommended screenings is thought to prevent diabetes complications and the need for emergent care. The odds ratio for ED use among people with diabetes who received all recommended screenings compared to those who did not was .998, (95% CI .96-1.03). This suggests that receiving all recommended screenings is not associated with ED use. People with diabetes who did and did not receive all recommended screenings visited the emergency department with equal frequency. Approximately 17 percent of all people with diabetes visited the emergency room at least once. It should be noted, that receiving a screening is not indicative of having diabetes in control. It may be an indicator of outpatient medical care access and quality.

## Cost of Diabetes Treatment

The American Diabetes Association estimates the direct cost of treating people with diabetes in Missouri at $4.9 billion in 2017. [viii] Looking at annual per person healthcare costs for adults with diabetes, MHI data shows an average 2019 statewide cost of $14,791 for adults with diabetes, as compared to $5,568 for those without diabetes, or 2.6 times less. Variations in annual spending by county for people with and without diabetes are notable and can be found in Appendix 4.

MHI calculated the median cost of diabetes spending per county and found that as age increases, so does cost. Delaying or preventing the development of diabetes has the potential to reduce healthcare spending while improving quality of life. Given the number of people with diabetes, even small reductions in prevalence have the potential to add up to large savings.

# Analysis of Socioeconomic Factors

To gain insight into the relationship of socioeconomic factors to diabetes prevalence and outcomes within communities, MHI supplemented its data with findings from the

American Community Survey (ACS), maintained by the U.S. Census Bureau. ACS is an ongoing, annual survey that provides vital information on a yearly basis about the people of the United States. Among other things, the survey results are used to help determine how federal and state funds are distributed. ACS findings were incorporated through the use of a social deprivation index.

## Social Deprivation Index

Understanding the impact of social determinants on health outcomes is central to reducing disparities and to effectively managing the health of a population. Yet, a challenge with understanding the individual relationships between social factors such as race, income, and education is that they are often interrelated. Researchers have recognized and overcome this challenge by blending relevant social factors into an index. The Social Deprivation Index (SDI) created by the Robert Graham Center in Table 2 blends ten variables across seven domains from the American Community Survey for analytical purposes.

**Table 2. Robert Graham Center Social Deprivation Index (SDI)**

| DOMAIN | VARIABLE |
|---|---|
| Income | Percent population less than 100% FPL |
| Education | Percent population 25 years or more with less than 12 years of education |
| Employment | Percent non-employed<br>Percent unemployed |
| Housing | Percent population living in renter occupied and crowded housing units |
| Household Characteristics | Percent single-parent households with dependents < 18 years |
| Transportation | Percent population with no car |
| Demographics | Percent population black<br>Percent high needs population- under 5 years and, 65 years and over |

MHI used the SDI to assess how these blended social variables are associated with diabetes. Doing so enabled a clearer understanding of how social deprivation factors are associated with associated with type 2 diabetes prevalence, care management and emergency department use.

## Impact of Social Factors on Diabetes Prevalence

MHI used a weighted least squares regression analysis to examine whether higher SDI levels (more social deprivation) are predictive of higher diabetes prevalence to understand the relationship between the prevalence of diabetes in a community and the social deprivation index. Age was also included in the regression model, using average age of the MHI population. Age and SDI were both significant predictors such that older age, and a higher SDI indicated higher prevalence of type 2 diabetes.

**Table 3. Multiple Regression Results, Diabetes Prevalence**

| Diabetes Prevalence | B | 95% CI | | SE B | Beta | $R^2$ adj. |
|---|---|---|---|---|---|---|
| | | LB | UB | | | |
| Constant | -8.246 | -11.011 | -5.482 | 1.409 | | |
| Age | 0.289 | 0.224 | 0.353 | 0.033 | 0.274 | |
| SDI | 0.027 | 0.021 | 0.032 | 0.003 | 0.296 | 0.131 |

Note: Model= Enter in SPSS statistics B= unstandardized regression coefficient; CI= Confidence Interval. LB= Lower Bound; UB= Upper Bound; SE B= standard error of coefficient; Beta= standardized coefficient; R2= coefficient of determination (adjusted).

## Adherence to Recommended Screenings

To understand the impact of SDI on the adherence to recommended screenings among people with diabetes, we first determined the percentage of the diabetes population that had received all recommended screenings according to the measure definitions and exclusions. A weighted least squares regression was completed, with age, and SDI as predictors of the percent of people who received all three recommended screenings.

The overall model was significant ($R^2_{adj}$=0.073, F=14.55, p<0.001) and accounted for 7.3 percent of the total variance in the percent of persons who received all three recommended screenings. Both age and SDI were significant predictors, such that older age and higher SDI scores predicted a lower percentage of those who received all recommended screenings indicated for them.

**Table 4. Multiple Regression Results for Care Quality**

| % Received All Indicated Care | B | 95% CI | | SE B | Beta | $R^2$ adj. |
|---|---|---|---|---|---|---|
| | | LB | UB | | | |
| Constant | 108.829 | 79.83 | 137.82 | 14.739 | | |
| Age | -0.852 | -1.542 | -0.162 | 0.351 | -0.131 | |
| SDI | -0.102 | -0.14 | -0.064 | 0.019 | -0.287 | 0.073 |

Note: Model= Enter in SPSS statistics B= unstandardized regression coefficient; CI= Confidence Interval. LB= Lower Bound; UB= Upper Bound; SE B= standard error of coefficient; Beta= standardized coefficient; R2= coefficient of determination (adjusted).

Not everyone with diabetes has a regular primary care doctor or receives these important screenings each year. The results of this analysis point to the importance of community environments, as social and structural determinants of health have an impact on all members of the community.

## Emergency Department Use and Hospitalizations

MHI used the SDI factors to understand whether these might play a role in the percent of people who have an ED visit or hospitalization, regardless of diabetes status. Then, MHI sought to understand whether adherence to recommended screenings was associated with ED use or hospital admissions.

MHI used a weighted least squares regression. The overall model was significant ($R^2_{adj}$=0.069, F=35.15, p<0.001) and accounted for 6.9 percent of the total variance in ED use. While age was not a significant predictor of ED use, SDI was. We observed that higher SDI scores were associated with higher percentages of persons who utilized ED services. Future analyses could assess whether this may be explained by reduced access to primary care in areas with a higher social deprivation index.

This method was repeated for the percent of people in the MHI dataset who had a hospital admission. The overall model was not significant, indicating that neither age, nor SDI are significant predictors of hospital admissions.

| Table 5. Multiple Regression Results for ED Use | | | | | | |
|---|---|---|---|---|---|---|
| ED Use | B | 95% CI | | SE B | Beta | $R^2$ adj. |
| | | LB | UB | | | |
| Constant | 4.419 | -0.056 | 8.894 | 2.28 | | |
| Age | 0.077 | -0.028 | 0.182 | 0.053 | 0.046 | |
| SDI | 0.04 | 0.031 | 0.049 | 0.005 | 0.269 | 0.069 |

Note: Model= Enter in SPSS statistics B= unstandardized regression coefficient; CI= Confidence Interval. LB= Lower Bound; UB= Upper Bound; SE B= standard error of coefficient; Beta= standardized coefficient; R2= coefficient of determination (adjusted).

# Policy Considerations

Employment and health insurance coverage do not protect Missourians from type 2 diabetes or assure high quality care. The same underlying socioeconomic factors that predict higher prevalence in other populations also apply to those with commercial insurance. This report on a commercially insured population tells us that policymakers and healthcare leaders would be well served to consider diabetes prevalence and health outcomes in relation to socioeconomic factors within communities. Local social factors, such as those measured by the SDI, influence outcomes for commercially insured people. This study affirms that social factors are associated with disease prevalence, health outcomes and health care costs.

## Neighborhoods Matter

Analyzing data at small geographical areas more closely approximating neighborhoods offers the granularity needed to identify opportunities and focus resources to prevent and treat type 2 diabetes and support environmental and lifestyle changes. Interventions at this level hold promise for reducing disparities and diminishing unwarranted variations in population health across Missouri communities. By understanding disease prevalence, gaps in care, and spending by county, policymakers, public health agencies, employers, and civic leaders will be able to target resources to areas with the greatest opportunities for improvement. They can also measure the impact of their interventions over time. County level data is provided for this purpose in the Appendix of this report.

## Tackling Obesity, the Problem Upstream

"As obesity increases, so does diabetes," says Glenn Studebaker, Diabetes and Heart Disease Coordinator for the Missouri Department of Health and Senior Services. Reducing Missouri's diabetes prevalence and morbidity will require tackling obesity. A starting point would be to increase the practice of diagnosing and reporting obesity and BMI on medical claims. Medical groups, professional associations, and public and private health plans all have a role to play in supporting providers to use the available medical codes and help people understand the increased risk of diabetes that comes with excess weight. Reducing and delaying weight gain can reduce the number of new cases and minimize complications after diagnosis.

## Adherence to Care Guidelines

About 30 percent of commercially insured people with a diagnosis of diabetes that undergo an evaluation by provider failed to receive three recommended screenings for evidenced-based care management. While some of these gaps in care may be due to provider oversight, patients may also fail to get screenings advised by their provider due to cost, convenience or an incomplete appreciation of their importance. There are many benefits to increasing public awareness of diabetes as a preventable, controllable, or reversible disease. Public health campaigns linked to the recommended screenings are actionable by employers, providers and health plans. They can promote specific behaviors of people with diabetes, such as getting a screening for kidney disease or checking cholesterol levels.

## Expanding and Advancing Primary Care

Patients with a regular source of primary care are more likely to receive recommended preventive services and screenings, advice about healthy life choices, and care resulting in early detection of disease and evidence based treatments.[ix] Research shows that having a primary care relationship is associated with positive health outcomes.[x] However, not everyone is so fortunate. In many Missouri communities, including the St. Louis region, establishing a relationship with a primary care provider as a new patient can be a lengthy process. Many employers are taking steps to ensure their employees have guaranteed access to primary care through onsite or near site clinics or other service relationships. Health plans, health systems, and policymakers also have different levers to influence primary care access. Collectively and creatively, opportunities exist to expand and advance primary care services across Missouri.

## Unmasking Plan Design Barriers

Total health spending by and on behalf of a family of four with employer coverage topped $22,000 in 2018, with the average family responsible for $7,726, analysis by the Peterson Foundation finds.[xi] With a median pretax household income of a little over $63,000,[xii] many workers face tough financial decisions when it comes to meeting their family's health care needs. While few employers have adopted tiered benefit offerings based on worker salaries, findings in this report suggest it may be time to evaluate the cost benefit of this strategy or alternative plan designs that reduce disparities in health outcomes among low wage workers.

# Conclusion

MHI's goal is for employers, policymakers and others concerned about population health in Missouri to benefit from information in this report about the prevalence, health outcomes, and social factors impacting type 2 diabetes at the community level. We hope detailed information will attract attention and creative interventions to improve health outcomes for people with or at risk of diabetes. Small changes, community by community, can add up to meaningful improvements in health outcomes across the state. MHI offers its partnership in continuing to monitor the prevalence and predictive factors of type 2 diabetes. Armed with that information, we can learn together the best practices to prevent, identify, treat and support people with diabetes.

## About the MHI Dataset

The MHI dataset represents paid claims for about 2.2 million commercially insured people from Missouri and its bordering metropolitan areas annually. Data is contributed by nine data suppliers who submit fully-insured and self-insured claims. Personal identifying information such as patient names and date of birth are removed in keeping with federal privacy laws.

A subset of the dataset representing 1,153,069 adults ages 18 to 64 residing in Missouri, of which 822,732 were continuously enrolled during calendar year 2019, was used to assess the prevalence of type 2 diabetes and other findings in this report. There are limitations to using administrative claims data, as it does lack some detail about the population. There is, for example, no information about income or race.

## About the Midwest Health Initiative

The Midwest Health Initiative provides a forum for those that provide, pay for, and use health care to join together to solve some of our region's most pressing health care challenges. Created as a nonprofit organization to advance transparency and multi-stakeholder collaboration, MHI stewards the largest multi-payer commercial claims dataset for Missouri and its bordering communities. In this report, MHI examines the personal and economic toll of diabetes in our communities.

Information about local diabetes care providers such as physicians and hospitals, and how often their patients receive recommended tests and treatments, can be obtained by visiting the ChooseWellSTL.org website (http://www.choosewellstl.org/). More information about Diabetes can be found on the Diabetes Basics page of the American Diabetes Association (http://www.diabetes.org/diabetes-basics/).

**MHI is grateful to the organizations below for their support of its vision and ongoing commitment to its work.**

### MHI Champions for Health Care Value

- **Aetna**
- **Amgen**
- **Anthem Blue Cross and Blue Shield of Missouri**
- **Blue Cross and Blue Shield of Kansas City**
- **The Boeing Company**
- **Cigna**
- **Signature Medical Group**
- **St. Louis Area Business Health Coalition**
- **UnitedHealthcare**

### Friends of MHI

- **Arch Resources, Inc.**
- **Graybar Electric Company, Inc.**

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MIDWEST HEALTH INITIATIVE

# Defeat Diabetes:

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# Appendices: Data by County

# Appendix 1.
# Type 2 Diabetes Prevalence by Missouri County

| County | 2017 Public Data | 2019 MHI Data | | | | |
|---|---|---|---|---|---|---|
| | All Population Diabetes Prevalence, BRFSS Survey * | Commercially Insured Adults with Diabetes | | Confidence Intervals | | Number of Residents Continuously Enrolled by County |
| | | % | # | 95% LB | 95% UB | |
| **State of Missouri** | **10.4%** | **5.2%** | **43,138** | **5.2%** | **5.3%** | **822,732** |
| ADAIR | 7.8% | 5.4% | 77 | 4.2% | 6.5% | 1,437 |
| ANDREW | 6.8% | 6.5% | 81 | 5.1% | 7.9% | 1,243 |
| ATCHISON | 11.6% | 6.7% | 37 | 4.6% | 8.7% | 555 |
| AUDRAIN | 10.7% | 5.9% | 148 | 5.0% | 6.9% | 2,495 |
| BARRY | 11.0% | 6.4% | 151 | 5.4% | 7.4% | 2,348 |
| BARTON | 10.8% | 5.4% | 67 | 4.1% | 6.6% | 1,247 |
| BATES | 13.0% | 6.3% | 96 | 5.0% | 7.5% | 1,536 |
| BENTON | 10.2% | 7.2% | 92 | 5.8% | 8.6% | 1,277 |
| BOLLINGER | 12.1% | 6.3% | 81 | 5.0% | 7.7% | 1,280 |
| BOONE | 7.6% | 3.9% | 786 | 3.6% | 4.2% | 20,200 |
| BUCHANAN | 12.5% | 6.5% | 475 | 6.0% | 7.1% | 7,262 |
| BUTLER | 13.2% | 7.9% | 382 | 7.2% | 8.7% | 4,820 |
| CALDWELL | 10.4% | 7.0% | 79 | 5.5% | 8.5% | 1,131 |
| CALLAWAY | 14.1% | 5.9% | 319 | 5.3% | 6.5% | 5,415 |
| CAMDEN | 8.0% | 4.9% | 172 | 4.2% | 5.6% | 3,496 |
| CAPE GIRARDEAU | 11.1% | 4.3% | 574 | 4.0% | 4.7% | 13,214 |
| CARROLL | 21.3% | 6.4% | 54 | 4.8% | 8.1% | 843 |
| CARTER | 5.3% | 3.6% | 8 | 1.1% | 6.0% | 223 |
| CASS | 8.3% | 6.6% | 841 | 6.1% | 7.0% | 12,784 |
| CEDAR | 5.6% | 5.9% | 61 | 4.4% | 7.3% | 1,041 |
| CHARITON | 10.3% | 6.3% | 47 | 4.5% | 8.0% | 750 |
| CHRISTIAN | 12.7% | 4.7% | 456 | 4.3% | 5.1% | 9,692 |
| CLARK | 10.5% | 6.6% | 36 | 4.5% | 8.7% | 545 |
| CLAY | 9.9% | 5.6% | 2,176 | 5.3% | 5.8% | 39,126 |
| CLINTON | 11.1% | 6.0% | 182 | 5.2% | 6.9% | 3,017 |
| COLE | 10.1% | 5.1% | 485 | 4.7% | 5.6% | 9,420 |
| COOPER | 6.2% | 5.2% | 87 | 4.1% | 6.2% | 1,686 |
| CRAWFORD | 14.7% | 5.5% | 95 | 4.5% | 6.6% | 1,717 |
| DADE | 9.3% | 8.1% | 61 | 6.1% | 10.0% | 755 |
| DALLAS | 4.5% | 7.6% | 106 | 6.2% | 9.0% | 1,388 |
| DAVIESS | 6.4% | 6.0% | 46 | 4.3% | 7.7% | 766 |
| DEKALB | 8.5% | 5.8% | 48 | 4.2% | 7.4% | 823 |
| DENT | 7.9% | 8.2% | 61 | 6.3% | 10.2% | 741 |
| DOUGLAS | 8.9% | 5.9% | 37 | 4.1% | 7.8% | 626 |
| DUNKLIN | 15.4% | 8.4% | 135 | 7.0% | 9.8% | 1,607 |
| FRANKLIN | 9.7% | 4.8% | 1,030 | 4.5% | 5.1% | 21,494 |
| GASCONADE | 7.9% | 5.7% | 126 | 4.7% | 6.6% | 2,224 |

| Appendix 1 Cont. | 2017 Public Data | 2019 MHI Data | | | | |
|---|---|---|---|---|---|---|
| | | Commercially Insured Adults with Diabetes | | Confidence Intervals | | Number of Residents Continuously Enrolled by County |
| County | All Population Diabetes Prevalence, BRFSS Survey * | % | # | 95% LB | 95% UB | |
| GENTRY | 13.8% | 5.5% | 31 | 3.6% | 7.4% | 560 |
| GREENE | 10.7% | 5.2% | 1,388 | 4.9% | 5.5% | 26,652 |
| GRUNDY | 11.4% | 5.0% | 55 | 3.7% | 6.3% | 1,095 |
| HARRISON | 14.8% | 6.8% | 47 | 4.9% | 8.7% | 689 |
| HENRY | 19.0% | 7.5% | 158 | 6.3% | 8.6% | 2,119 |
| HICKORY | 8.4% | 5.1% | 27 | 3.2% | 6.9% | 534 |
| HOLT | 8.6% | 6.9% | 41 | 4.9% | 9.0% | 591 |
| HOWARD | 6.0% | 5.5% | 65 | 4.2% | 6.8% | 1,179 |
| HOWELL | 15.6% | 6.5% | 188 | 5.6% | 7.4% | 2,891 |
| IRON | 7.9% | 6.2% | 48 | 4.5% | 7.9% | 774 |
| JACKSON | 10.1% | 6.3% | 5,487 | 6.2% | 6.5% | 86,608 |
| JASPER | 9.5% | 6.7% | 1,110 | 6.3% | 7.1% | 16,533 |
| JEFFERSON | 10.5% | 5.6% | 2,154 | 5.4% | 5.9% | 38,288 |
| JOHNSON | 9.9% | 6.4% | 328 | 5.7% | 7.1% | 5,126 |
| KNOX | 11.3% | 6.5% | 20 | 3.7% | 9.2% | 310 |
| LACLEDE | 10.3% | 6.5% | 234 | 5.7% | 7.3% | 3,609 |
| LAFAYETTE | 9.6% | 6.8% | 256 | 6.0% | 7.6% | 3,769 |
| LAWRENCE | 14.2% | 6.5% | 192 | 5.6% | 7.3% | 2,972 |
| LEWIS | 11.2% | 6.3% | 44 | 4.5% | 8.1% | 695 |
| LINCOLN | 14.8% | 5.0% | 576 | 4.6% | 5.4% | 11,521 |
| LINN | 11.1% | 7.4% | 93 | 5.9% | 8.8% | 1,265 |
| LIVINGSTON | 13.9% | 5.3% | 66 | 4.1% | 6.6% | 1,243 |
| MACON | 8.5% | 6.4% | 86 | 5.1% | 7.7% | 1,351 |
| MADISON | 15.4% | 7.6% | 100 | 6.2% | 9.0% | 1,318 |
| MARIES | 11.0% | 4.5% | 32 | 3.0% | 6.1% | 706 |
| MARION | 13.4% | 5.8% | 143 | 4.9% | 6.8% | 2,449 |
| MCDONALD | 8.0% | 6.4% | 81 | 5.0% | 7.7% | 1,274 |
| MERCER | 8.2% | 5.5% | 27 | 3.5% | 7.5% | 492 |
| MILLER | 5.1% | 6.1% | 123 | 5.1% | 7.2% | 2,004 |
| MISSISSIPPI | 15.7% | 9.0% | 79 | 7.1% | 10.9% | 880 |
| MONITEAU | 7.8% | 5.3% | 77 | 4.1% | 6.4% | 1,464 |
| MONROE | 14.8% | 5.9% | 58 | 4.4% | 7.4% | 985 |
| MONTGOMERY | 5.2% | 6.9% | 111 | 5.6% | 8.1% | 1,616 |
| MORGAN | 3.6% | 4.9% | 67 | 3.8% | 6.1% | 1,363 |
| NEW MADRID | 15.4% | 7.8% | 87 | 6.3% | 9.4% | 1,109 |
| NEWTON | 9.2% | 6.2% | 246 | 5.5% | 7.0% | 3,957 |
| NODAWAY | 8.6% | 5.7% | 131 | 4.8% | 6.7% | 2,287 |
| OREGON | 9.0% | 8.6% | 39 | 6.0% | 11.1% | 456 |
| OSAGE | 12.2% | 4.3% | 83 | 3.4% | 5.2% | 1,933 |
| OZARK | 5.7% | 5.2% | 26 | 3.3% | 7.2% | 496 |
| PEMISCOT | 16.1% | 9.7% | 81 | 7.7% | 11.7% | 838 |
| PERRY | 7.6% | 4.9% | 104 | 4.0% | 5.8% | 2,129 |

| Appendix 1 Cont. | 2017 Public Data | 2019 MHI Data | | | | |
|---|---|---|---|---|---|---|
| | | Commercially Insured Adults with Diabetes | | Confidence Intervals | | Number of Residents Continuously Enrolled by County |
| County | All Population Diabetes Prevalence, BRFSS Survey * | % | # | 95% LB | 95% UB | |
| PETTIS | 13.1% | 5.7% | 235 | 5.0% | 6.4% | 4,096 |
| PHELPS | 7.0% | 4.1% | 161 | 3.5% | 4.7% | 3,955 |
| PIKE | 12.9% | 6.1% | 111 | 5.0% | 7.2% | 1,823 |
| PLATTE | 10.6% | 5.0% | 780 | 4.6% | 5.3% | 15,675 |
| POLK | 8.7% | 6.3% | 164 | 5.3% | 7.2% | 2,624 |
| PULASKI | 10.0% | 5.1% | 189 | 4.4% | 5.8% | 3,693 |
| PUTNAM | 8.1% | 6.9% | 47 | 5.0% | 8.8% | 682 |
| RALLS | 4.4% | 7.6% | 50 | 5.6% | 9.6% | 657 |
| RANDOLPH | 10.7% | 7.9% | 170 | 6.7% | 9.0% | 2,157 |
| RAY | 11.0% | 6.4% | 163 | 5.5% | 7.4% | 2,536 |
| REYNOLDS | 9.4% | 7.3% | 28 | 4.7% | 9.8% | 386 |
| RIPLEY | 16.1% | 7.6% | 83 | 6.0% | 9.2% | 1,091 |
| SAINT CHARLES | 8.7% | 4.0% | 3,569 | 3.8% | 4.1% | 89,897 |
| SAINT CLAIR | 8.2% | 4.3% | 24 | 2.6% | 6.0% | 559 |
| SAINT FRANCOIS | 10.3% | 6.6% | 542 | 6.0% | 7.1% | 8,242 |
| SAINT LOUIS | 8.9% | 4.5% | 8,505 | 4.4% | 4.6% | 187,296 |
| SAINT LOUIS CITY | 12.6% | 4.9% | 1,932 | 4.7% | 5.1% | 39,337 |
| SAINTE | 6.2% | 4.2% | 107 | 3.4% | 4.9% | 2,573 |
| SALINE | 11.3% | 6.5% | 169 | 5.5% | 7.4% | 2,620 |
| SCHUYLER | 7.9% | 6.0% | 18 | 3.3% | 8.7% | 300 |
| SCOTLAND | 10.9% | 3.8% | 11 | 1.6% | 5.9% | 293 |
| SCOTT | 13.3% | 6.2% | 263 | 5.5% | 7.0% | 4,222 |
| SHANNON | 6.8% | 6.6% | 34 | 4.5% | 8.8% | 513 |
| SHELBY | 11.5% | 5.0% | 44 | 3.6% | 6.5% | 875 |
| STODDARD | 14.4% | 6.2% | 158 | 5.2% | 7.1% | 2,567 |
| STONE | 8.1% | 6.2% | 124 | 5.1% | 7.3% | 1,999 |
| SULLIVAN | 11.3% | 6.6% | 83 | 5.2% | 7.9% | 1,266 |
| TANEY | 11.3% | 5.5% | 197 | 4.7% | 6.2% | 3,590 |
| TEXAS | 11.7% | 5.0% | 72 | 3.8% | 6.1% | 1,451 |
| VERNON | 7.2% | 6.1% | 91 | 4.9% | 7.3% | 1,493 |
| WARREN | 7.9% | 4.7% | 308 | 4.2% | 5.2% | 6,585 |
| WASHINGTON | 8.6% | 6.3% | 157 | 5.4% | 7.3% | 2,477 |
| WAYNE | 9.3% | 5.2% | 62 | 4.0% | 6.5% | 1,183 |
| WEBSTER | 11.4% | 5.0% | 199 | 4.4% | 5.7% | 3,943 |
| WORTH | 17.0% | 7.0% | 14 | 3.4% | 10.5% | 201 |
| WRIGHT | 8.3% | 5.9% | 90 | 4.7% | 7.1% | 1,521 |
| State of Missouri | 10.4% | 5.2% | 43,138 | 5.2% | 5.3% | 822,732 |

*Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) survey data is provided here to show the prevalence of Diabetes in Missouri's general population as compared to the prevalence of Type 2 Diabetes among Missouri's commercially insured population, measured by MHI's 2019 medical claims database. The (BRFSS) data is from 2017, which is the most current data available.

# Appendix 2. Characteristics of Type 2 Diabetes Population and Their Care by Missouri County, 2019

| County | Adults (18-64) Average Age | % of Adults Receiving 3 Diabetes Screenings * | Average Risk Score without Diabetes ** | Average Risk Score with Diabetes ** | Social Deprivation Index (Robert Graham Center) |
|---|---|---|---|---|---|
| **State of Missouri** | **54** | **69.8%** | **1.1** | **3.3** | **38.1** |
| ADAIR | 53 | 63.2% | 0.9 | 3.6 | 60.0 |
| ANDREW | 55 | 74.1% | 1.0 | 3.1 | 28.1 |
| ATCHISON | 54 | 65.7% | 0.9 | 2.4 | 34.5 |
| AUDRAIN | 53 | 75.5% | 1.2 | 3.3 | 56.4 |
| BARRY | 54 | 68.2% | 0.9 | 2.9 | 54.8 |
| BARTON | 53 | 64.1% | 0.9 | 2.7 | 51.5 |
| BATES | 54 | 65.2% | 1.1 | 2.6 | 48.7 |
| BENTON | 55 | 66.9% | 1.1 | 2.9 | 46.2 |
| BOLLINGER | 52 | 68.5% | 1.0 | 2.4 | 53.3 |
| BOONE | 54 | 69.9% | 0.9 | 3.3 | 44.0 |
| BUCHANAN | 54 | 74.4% | 1.1 | 3.2 | 55.2 |
| BUTLER | 53 | 66.9% | 1.2 | 3.5 | 68.7 |
| CALDWELL | 55 | 71.7% | 0.9 | 3.3 | 40.8 |
| CALLAWAY | 54 | 70.2% | 1.1 | 3.2 | 44.0 |
| CAMDEN | 54 | 65.5% | 1.1 | 2.6 | 39.1 |
| CAPE GIRARDEAU | 54 | 62.1% | 0.9 | 2.8 | 44.4 |
| CARROLL | 55 | 64.3% | 1.0 | 3.6 | 42.6 |
| CARTER | 50 | 77.5% | 0.5 | 7.0 | 60.4 |
| CASS | 54 | 75.5% | 1.2 | 3.2 | 27.2 |
| CEDAR | 55 | 67.9% | 0.9 | 3.4 | 63.2 |
| CHARITON | 55 | 70.0% | 1.1 | 2.9 | 35.3 |
| CHRISTIAN | 53 | 73.4% | 1.0 | 2.6 | 32.6 |
| CLARK | 55 | 58.8% | 1.0 | 3.9 | 34.6 |
| CLAY | 54 | 74.7% | 1.2 | 3.3 | 27.8 |
| CLINTON | 54 | 71.0% | 1.1 | 3.0 | 36.9 |
| COLE | 54 | 68.0% | 1.0 | 3.3 | 40.5 |
| COOPER | 53 | 65.4% | 0.9 | 2.6 | 43.0 |
| CRAWFORD | 53 | 72.8% | 1.0 | 3.3 | 65.8 |
| DADE | 54 | 70.5% | 1.1 | 3.0 | 46.7 |
| DALLAS | 56 | 70.5% | 1.2 | 2.4 | 62.5 |
| DAVIESS | 53 | 66.0% | 1.0 | 3.2 | 36.1 |
| DEKALB | 56 | 73.2% | 0.9 | 2.7 | 20.1 |
| DENT | 54 | 57.1% | 1.0 | 2.4 | 72.1 |
| DOUGLAS | 55 | 69.4% | 1.0 | 2.4 | 62.8 |
| DUNKLIN | 54 | 66.3% | 1.1 | 3.0 | 79.1 |
| FRANKLIN | 54 | 69.6% | 1.2 | 3.6 | 38.3 |
| GASCONADE | 55 | 71.5% | 1.1 | 3.2 | 42.2 |
| GENTRY | 55 | 70.9% | 1.0 | 3.0 | 41.2 |
| GREENE | 53 | 73.9% | 0.9 | 2.8 | 45.6 |

| Appendix 2 Cont. County | Adults (18-64) Average Age | % of Adults Receiving 3 Diabetes Screenings * | Average Risk Score without Diabetes ** | Average Risk Score with Diabetes ** | Social Deprivation Index (Robert Graham Center) |
|---|---|---|---|---|---|
| GRUNDY | 54 | 59.6% | 1.0 | 2.5 | 52.4 |
| HARRISON | 55 | 63.4% | 1.1 | 2.4 | 44.5 |
| HENRY | 53 | 66.9% | 1.1 | 2.7 | 49.0 |
| HICKORY | 54 | 70.4% | 1.0 | 2.3 | 46.9 |
| HOLT | 57 | 74.2% | 1.1 | 2.5 | 36.0 |
| HOWARD | 54 | 75.3% | 0.9 | 3.3 | 40.2 |
| HOWELL | 53 | 60.6% | 0.9 | 2.5 | 64.7 |
| IRON | 53 | 65.7% | 1.3 | 3.8 | 64.2 |
| JACKSON | 54 | 73.8% | 1.1 | 3.4 | 44.4 |
| JASPER | 52 | 67.3% | 1.0 | 2.8 | 50.5 |
| JEFFERSON | 54 | 68.2% | 1.2 | 3.5 | 33.6 |
| JOHNSON | 54 | 74.6% | 1.0 | 3.1 | 49.9 |
| KNOX | 57 | 58.9% | 1.2 | 2.3 | 43.4 |
| LACLEDE | 54 | 70.1% | 1.0 | 2.9 | 63.8 |
| LAFAYETTE | 55 | 71.4% | 1.0 | 2.9 | 35.9 |
| LAWRENCE | 54 | 71.9% | 1.0 | 2.7 | 50.9 |
| LEWIS | 54 | 64.3% | 0.9 | 2.7 | 37.2 |
| LINCOLN | 53 | 68.1% | 1.1 | 3.5 | 43.7 |
| LINN | 54 | 63.5% | 0.9 | 2.7 | 44.5 |
| LIVINGSTON | 55 | 69.8% | 0.9 | 2.7 | 48.7 |
| MACON | 55 | 63.6% | 1.1 | 2.5 | 47.2 |
| MADISON | 52 | 64.8% | 1.2 | 3.0 | 50.1 |
| MARIES | 55 | 72.1% | 1.0 | 4.7 | 57.4 |
| MARION | 52 | 66.4% | 1.0 | 3.1 | 62.2 |
| MCDONALD | 52 | 63.9% | 0.9 | 2.5 | 65.4 |
| MERCER | 56 | 62.5% | 0.8 | 2.4 | 44.6 |
| MILLER | 53 | 66.9% | 1.0 | 2.8 | 54.5 |
| MISSISSIPPI | 55 | 59.9% | 1.1 | 3.4 | 85.8 |
| MONITEAU | 52 | 68.8% | 0.9 | 2.9 | 39.9 |
| MONROE | 55 | 72.0% | 1.1 | 3.3 | 34.1 |
| MONTGOMERY | 55 | 69.0% | 1.0 | 3.6 | 49.9 |
| MORGAN | 55 | 66.2% | 1.1 | 3.2 | 54.9 |
| NEW MADRID | 55 | 67.5% | 1.1 | 2.3 | 77.9 |
| NEWTON | 53 | 63.6% | 1.0 | 2.7 | 47.3 |
| NODAWAY | 53 | 73.4% | 1.0 | 2.3 | 56.4 |
| OREGON | 54 | 62.8% | 1.0 | 3.2 | 61.1 |
| OSAGE | 54 | 69.2% | 1.0 | 3.7 | 21.3 |
| OZARK | 53 | 61.5% | 0.8 | 2.2 | 58.3 |
| PEMISCOT | 54 | 58.8% | 1.2 | 3.0 | 84.5 |
| PERRY | 53 | 71.4% | 1.0 | 3.0 | 27.9 |
| PETTIS | 53 | 66.6% | 1.0 | 2.6 | 60.1 |
| PHELPS | 54 | 65.3% | 0.9 | 3.7 | 58.7 |
| PIKE | 55 | 62.4% | 1.2 | 3.7 | 54.0 |
| PLATTE | 54 | 74.8% | 1.1 | 3.6 | 27.3 |

| Appendix 2 Cont. County | Adults (18-64) Average Age | % of Adults Receiving 3 Diabetes Screenings * | Average Risk Score without Diabetes ** | Average Risk Score with Diabetes ** | Social Deprivation Index (Robert Graham Center) |
|---|---|---|---|---|---|
| POLK | 53 | 72.1% | 0.9 | 2.4 | 49.7 |
| PULASKI | 53 | 62.4% | 1.0 | 3.3 | 49.2 |
| PUTNAM | 51 | 56.7% | 1.0 | 2.3 | 47.5 |
| RALLS | 55 | 58.2% | 1.1 | 2.5 | 32.0 |
| RANDOLPH | 54 | 69.4% | 1.1 | 3.1 | 52.8 |
| RAY | 54 | 70.5% | 1.2 | 3.5 | 36.8 |
| REYNOLDS | 56 | 67.3% | 0.9 | 1.9 | 56.8 |
| RIPLEY | 53 | 67.4% | 1.1 | 2.9 | 65.3 |
| SAINT CHARLES | 54 | 69.5% | 1.1 | 3.5 | 13.6 |
| SAINT CLAIR | 52 | 65.2% | 1.2 | 2.1 | 61.0 |
| SAINT FRANCOIS | 53 | 67.1% | 1.2 | 3.1 | 62.3 |
| SAINT LOUIS | 54 | 69.3% | 1.1 | 3.7 | 27.6 |
| SAINT LOUIS CITY | 53 | 67.7% | 0.9 | 3.5 | 72.1 |
| SAINTE | 53 | 66.4% | 1.1 | 3.1 | 37.6 |
| SALINE | 54 | 66.3% | 1.0 | 2.6 | 58.9 |
| SCHUYLER | 56 | 53.9% | 1.2 | 3.3 | 50.1 |
| SCOTLAND | 54 | 39.2% | 1.1 | 2.5 | 55.9 |
| SCOTT | 53 | 66.4% | 1.0 | 2.8 | 60.7 |
| SHANNON | 53 | 53.9% | 1.0 | 1.7 | 56.6 |
| SHELBY | 54 | 67.9% | 1.0 | 3.1 | 41.5 |
| STODDARD | 53 | 62.6% | 1.1 | 2.7 | 54.8 |
| STONE | 55 | 64.0% | 1.0 | 3.3 | 44.3 |
| SULLIVAN | 52 | 57.3% | 0.8 | 2.0 | 59.4 |
| TANEY | 55 | 64.7% | 0.9 | 2.7 | 57.2 |
| TEXAS | 53 | 61.7% | 1.0 | 2.8 | 53.2 |
| VERNON | 55 | 65.4% | 1.0 | 3.0 | 52.3 |
| WARREN | 54 | 71.6% | 1.1 | 3.3 | 50.7 |
| WASHINGTON | 54 | 65.6% | 1.3 | 4.0 | 63.8 |
| WAYNE | 55 | 67.9% | 1.2 | 2.5 | 54.3 |
| WEBSTER | 53 | 72.2% | 1.0 | 2.8 | 40.4 |
| WORTH | 57 | 70.0% | 0.8 | 2.1 | 29.6 |
| WRIGHT | 53 | 70.6% | 0.8 | 2.4 | 63.9 |
| State of Missouri | 54 | 69.8% | 1.1 | 3.3 | 38.1 |

*The three recommended diabetes screenings measured are: Hemoglobin A1c, Kidney Function, and Cholesterol.

**The risk score has been calculated using Optum's Episode Risk Group, (ERG) methodology.

# Appendix 3. ED and Inpatient Utilization per 1,000 Commercially Insured Adults, with and without Type 2 Diabetes by Missouri County, 2019

| County | ED Visits Per 1,000 Adults | | Inpatient Discharges Per 1,000 Adults | |
|---|---|---|---|---|
| | Without Diabetes | With Diabetes | Without Diabetes | With Diabetes |
| **State of Missouri** | **132.2** | **265.0** | **41.9** | **122.8** |
| ADAIR | 111.0 | 337.7 | 111.0 | 337.7 |
| ANDREW | 103.3 | 209.9 | 103.3 | 209.9 |
| ATCHISON | 193.1 | 351.4 | 193.1 | 351.4 |
| AUDRAIN | 159.4 | 283.8 | 159.4 | 283.8 |
| BARRY | 205.7 | 344.4 | 205.7 | 344.4 |
| BARTON | 177.1 | 403.0 | 177.1 | 403.0 |
| BATES | 211.8 | 395.8 | 211.8 | 395.8 |
| BENTON | 130.8 | 228.3 | 130.8 | 228.3 |
| BOLLINGER | 154.3 | 456.8 | 154.3 | 456.8 |
| BOONE | 107.8 | 279.9 | 107.8 | 279.9 |
| BUCHANAN | 142.2 | 204.2 | 142.2 | 204.2 |
| BUTLER | 144.0 | 293.2 | 144.0 | 293.2 |
| CALDWELL | 190.1 | 253.2 | 190.1 | 253.2 |
| CALLAWAY | 152.9 | 360.5 | 152.9 | 360.5 |
| CAMDEN | 167.3 | 215.1 | 167.3 | 215.1 |
| CAPE GIRARDEAU | 116.5 | 254.4 | 116.5 | 254.4 |
| CARROLL | 147.0 | 463.0 | 147.0 | 463.0 |
| CARTER | 83.7 | 750.0 | 83.7 | 750.0 |
| CASS | 185.0 | 387.6 | 185.0 | 387.6 |
| CEDAR | 123.5 | 213.1 | 123.5 | 213.1 |
| CHARITON | 130.9 | 234.0 | 130.9 | 234.0 |
| CHRISTIAN | 119.4 | 210.5 | 119.4 | 210.5 |
| CLARK | 161.1 | 277.8 | 161.1 | 277.8 |
| CLAY | 159.5 | 246.3 | 159.5 | 246.3 |
| CLINTON | 169.0 | 269.2 | 169.0 | 269.2 |
| COLE | 132.5 | 241.2 | 132.5 | 241.2 |
| COOPER | 130.1 | 195.4 | 130.1 | 195.4 |
| CRAWFORD | 153.5 | 284.2 | 153.5 | 284.2 |
| DADE | 138.3 | 311.5 | 138.3 | 311.5 |
| DALLAS | 153.7 | 169.8 | 153.7 | 169.8 |
| DAVIESS | 163.9 | 500.0 | 163.9 | 500.0 |
| DEKALB | 100.6 | 104.2 | 100.6 | 104.2 |
| DENT | 216.2 | 557.4 | 216.2 | 557.4 |
| DOUGLAS | 88.3 | 81.1 | 88.3 | 81.1 |
| DUNKLIN | 125.0 | 192.6 | 125.0 | 192.6 |
| FRANKLIN | 159.7 | 253.4 | 159.7 | 253.4 |
| GASCONADE | 179.7 | 420.6 | 179.7 | 420.6 |
| GENTRY | 172.0 | 580.6 | 172.0 | 580.6 |

| Appendix 3 Cont. | ED Visits Per 1,000 Adults | | Inpatient Discharges Per 1,000 Adults | |
|---|---|---|---|---|
| County | Without Diabetes | With Diabetes | Without Diabetes | With Diabetes |
| GREENE | 131.4 | 261.5 | 131.4 | 261.5 |
| GRUNDY | 195.2 | 254.5 | 195.2 | 254.5 |
| HARRISON | 162.0 | 234.0 | 162.0 | 234.0 |
| HENRY | 132.6 | 145.6 | 132.6 | 145.6 |
| HICKORY | 106.5 | 148.1 | 106.5 | 148.1 |
| HOLT | 178.2 | 219.5 | 178.2 | 219.5 |
| HOWARD | 133.8 | 169.2 | 133.8 | 169.2 |
| HOWELL | 158.0 | 292.6 | 158.0 | 292.6 |
| IRON | 225.9 | 395.8 | 225.9 | 395.8 |
| JACKSON | 190.3 | 373.6 | 190.3 | 373.6 |
| JASPER | 138.6 | 257.7 | 138.6 | 257.7 |
| JEFFERSON | 134.3 | 213.1 | 134.3 | 213.1 |
| JOHNSON | 160.3 | 332.3 | 160.3 | 332.3 |
| KNOX | 89.7 | 100.0 | 89.7 | 100.0 |
| LACLEDE | 216.6 | 551.3 | 216.6 | 551.3 |
| LAFAYETTE | 191.0 | 289.1 | 191.0 | 289.1 |
| LAWRENCE | 180.9 | 375.0 | 180.9 | 375.0 |
| LEWIS | 82.9 | 136.4 | 82.9 | 136.4 |
| LINCOLN | 141.4 | 243.1 | 141.4 | 243.1 |
| LINN | 124.6 | 354.8 | 124.6 | 354.8 |
| LIVINGSTON | 138.5 | 242.4 | 138.5 | 242.4 |
| MACON | 107.5 | 116.3 | 107.5 | 116.3 |
| MADISON | 189.7 | 370.0 | 189.7 | 370.0 |
| MARIES | 127.6 | 437.5 | 127.6 | 437.5 |
| MARION | 118.8 | 321.7 | 118.8 | 321.7 |
| MCDONALD | 118.2 | 123.5 | 118.2 | 123.5 |
| MERCER | 144.1 | 185.2 | 144.1 | 185.2 |
| MILLER | 119.1 | 276.4 | 119.1 | 276.4 |
| MISSISSIPPI | 168.5 | 265.8 | 168.5 | 265.8 |
| MONITEAU | 131.2 | 272.7 | 131.2 | 272.7 |
| MONROE | 126.2 | 293.1 | 126.2 | 293.1 |
| MONTGOMERY | 124.3 | 99.1 | 124.3 | 99.1 |
| MORGAN | 165.9 | 209.0 | 165.9 | 209.0 |
| NEW MADRID | 164.4 | 206.9 | 164.4 | 206.9 |
| NEWTON | 135.5 | 130.1 | 135.5 | 130.1 |
| NODAWAY | 121.1 | 99.2 | 121.1 | 99.2 |
| OREGON | 100.7 | 435.9 | 100.7 | 435.9 |
| OSAGE | 116.2 | 277.1 | 116.2 | 277.1 |
| OZARK | 91.5 | 269.2 | 91.5 | 269.2 |
| PEMISCOT | 138.7 | 172.8 | 138.7 | 172.8 |
| PERRY | 127.4 | 230.8 | 127.4 | 230.8 |
| PETTIS | 127.2 | 208.5 | 127.2 | 208.5 |
| PHELPS | 138.1 | 391.3 | 138.1 | 391.3 |
| PIKE | 162.4 | 252.3 | 162.4 | 252.3 |
| PLATTE | 134.9 | 275.6 | 134.9 | 275.6 |
| POLK | 118.7 | 189.0 | 118.7 | 189.0 |

| Appendix 3 Cont. | ED Visits Per 1,000 Adults | | Inpatient Discharges Per 1,000 Adults | |
|---|---|---|---|---|
| County | Without Diabetes | With Diabetes | Without Diabetes | With Diabetes |
| PULASKI | 130.1 | 402.1 | 130.1 | 402.1 |
| PUTNAM | 151.2 | 127.7 | 151.2 | 127.7 |
| RALLS | 153.2 | 260.0 | 153.2 | 260.0 |
| RANDOLPH | 177.2 | 194.1 | 177.2 | 194.1 |
| RAY | 196.0 | 319.0 | 196.0 | 319.0 |
| REYNOLDS | 209.5 | 142.9 | 209.5 | 142.9 |
| RIPLEY | 147.8 | 253.0 | 147.8 | 253.0 |
| SAINT CHARLES | 93.2 | 191.1 | 93.2 | 191.1 |
| SAINT CLAIR | 157.0 | 41.7 | 157.0 | 41.7 |
| SAINT FRANCOIS | 186.6 | 250.9 | 186.6 | 250.9 |
| SAINT LOUIS | 102.4 | 224.7 | 102.4 | 224.7 |
| SAINT LOUIS CITY | 107.1 | 280.5 | 107.1 | 280.5 |
| SAINTE GENEVIEVE | 182.5 | 336.4 | 182.5 | 336.4 |
| SALINE | 173.4 | 153.8 | 173.4 | 153.8 |
| SCHUYLER | 124.1 | 222.2 | 124.1 | 222.2 |
| SCOTLAND | 212.8 | 545.5 | 212.8 | 545.5 |
| SCOTT | 141.7 | 285.2 | 141.7 | 285.2 |
| SHANNON | 183.7 | 235.3 | 183.7 | 235.3 |
| SHELBY | 122.7 | 136.4 | 122.7 | 136.4 |
| STODDARD | 150.3 | 208.9 | 150.3 | 208.9 |
| STONE | 139.7 | 298.4 | 139.7 | 298.4 |
| SULLIVAN | 166.5 | 228.9 | 166.5 | 228.9 |
| TANEY | 137.0 | 253.8 | 137.0 | 253.8 |
| TEXAS | 160.3 | 152.8 | 160.3 | 152.8 |
| VERNON | 164.8 | 395.6 | 164.8 | 395.6 |
| WARREN | 114.7 | 204.5 | 114.7 | 204.5 |
| WASHINGTON | 181.0 | 490.4 | 181.0 | 490.4 |
| WAYNE | 158.8 | 145.2 | 158.8 | 145.2 |
| WEBSTER | 115.4 | 271.4 | 115.4 | 271.4 |
| WORTH | 48.1 | 214.3 | 48.1 | 214.3 |
| WRIGHT | 107.6 | 344.4 | 107.6 | 344.4 |
| State of Missouri | 132.2 | 265.0 | 41.9 | 122.8 |

# Appendix 4. Average Annual Spending for Adults, with and without Type 2 Diabetes by Missouri County, 2019

| County | Average PMPY without Diabetes | Average PMPY with Diabetes | Number of Adults for which MHI has Cost Data |
|---|---|---|---|
| **State of Missouri** | **$5,567.91** | **$14,790.84** | **655,392** |
| ADAIR | $4,062.41 | $16,172.31 | 1,119 |
| ANDREW | $5,764.65 | $14,348.81 | 1,082 |
| ATCHISON | $6,499.00 | $12,649.24 | 479 |
| AUDRAIN | $5,457.20 | $14,362.50 | 2,016 |
| BARRY | $4,650.59 | $12,347.96 | 1,861 |
| BARTON | $4,722.77 | $9,261.53 | 999 |
| BATES | $5,933.37 | $13,762.98 | 1,305 |
| BENTON | $6,588.97 | $12,701.85 | 1,053 |
| BOLLINGER | $5,546.65 | $12,143.03 | 1,056 |
| BOONE | $4,767.75 | $14,222.24 | 14,407 |
| BUCHANAN | $6,255.22 | $17,436.79 | 6,207 |
| BUTLER | $4,987.77 | $13,382.09 | 3,999 |
| CALDWELL | $4,708.58 | $16,919.40 | 964 |
| CALLAWAY | $5,561.19 | $12,998.73 | 4,108 |
| CAMDEN | $5,679.83 | $11,069.11 | 2,673 |
| CAPE GIRARDEAU | $4,789.75 | $14,840.45 | 10,631 |
| CARROLL | $5,939.13 | $14,649.39 | 723 |
| CARTER | $2,489.26 | $37,256.86 | 134 |
| CASS | $6,755.45 | $17,085.14 | 11,126 |
| CEDAR | $4,196.52 | $16,994.53 | 863 |
| CHARITON | $5,578.40 | $11,146.43 | 639 |
| CHRISTIAN | $4,927.27 | $10,079.86 | 8,059 |
| CLARK | $4,370.42 | $16,426.62 | 450 |
| CLAY | $6,313.07 | $17,477.20 | 34,986 |
| CLINTON | $6,005.12 | $12,248.26 | 2,616 |
| COLE | $5,003.91 | $10,700.40 | 7,325 |
| COOPER | $4,947.42 | $8,423.70 | 1,267 |
| CRAWFORD | $5,506.45 | $14,571.94 | 1,209 |
| DADE | $5,365.84 | $23,802.93 | 635 |
| DALLAS | $5,241.07 | $10,457.75 | 1,189 |
| DAVIESS | $5,911.14 | $14,924.73 | 648 |
| DEKALB | $4,541.84 | $11,622.02 | 675 |
| DENT | $5,234.87 | $10,122.14 | 574 |
| DOUGLAS | $5,016.48 | $13,717.70 | 486 |
| DUNKLIN | $5,135.19 | $11,794.95 | 1,276 |
| FRANKLIN | $5,788.66 | $14,226.15 | 17,225 |
| GASCONADE | $5,404.02 | $10,803.80 | 1,737 |
| GENTRY | $5,197.76 | $18,746.59 | 485 |
| GREENE | $4,798.57 | $11,997.43 | 21,890 |
| GRUNDY | $5,960.53 | $17,488.78 | 905 |

| Appendix 4 Cont.<br><br>County | Average PMPY without Diabetes | Average PMPY with Diabetes | Number of Adults for which MHI has Cost Data |
|---|---|---|---|
| HARRISON | $4,891.04 | $11,690.49 | 587 |
| HENRY | $5,395.08 | $15,681.49 | 1,787 |
| HICKORY | $4,374.19 | $10,283.65 | 427 |
| HOLT | $4,930.81 | $12,053.92 | 512 |
| HOWARD | $5,521.44 | $16,115.53 | 980 |
| HOWELL | $5,003.30 | $12,812.67 | 2,296 |
| IRON | $7,223.47 | $17,638.35 | 645 |
| JACKSON | $6,239.22 | $18,258.14 | 74,927 |
| JASPER | $5,090.92 | $12,421.47 | 13,769 |
| JEFFERSON | $5,667.65 | $14,806.63 | 30,060 |
| JOHNSON | $5,547.65 | $17,360.93 | 4,323 |
| KNOX | $6,083.99 | $13,731.12 | 264 |
| LACLEDE | $5,340.93 | $11,301.58 | 2,955 |
| LAFAYETTE | $5,713.51 | $13,594.08 | 3,173 |
| LAWRENCE | $4,878.02 | $10,639.79 | 2,415 |
| LEWIS | $4,855.91 | $15,904.21 | 560 |
| LINCOLN | $5,581.16 | $14,850.44 | 8,906 |
| LINN | $5,260.84 | $16,489.06 | 1,056 |
| LIVINGSTON | $5,327.49 | $16,034.00 | 1,053 |
| MACON | $4,557.71 | $14,779.12 | 1,144 |
| MADISON | $5,775.37 | $14,490.05 | 1,095 |
| MARIES | $5,803.17 | $19,037.85 | 522 |
| MARION | $4,825.93 | $12,032.11 | 2,094 |
| MCDONALD | $5,832.27 | $14,424.74 | 975 |
| MERCER | $6,182.18 | $12,703.37 | 372 |
| MILLER | $4,829.52 | $17,829.72 | 1,520 |
| MISSISSIPPI | $5,749.77 | $14,386.93 | 746 |
| MONITEAU | $5,678.44 | $12,771.57 | 1,124 |
| MONROE | $5,790.25 | $12,012.04 | 835 |
| MONTGOMERY | $5,759.34 | $15,521.78 | 1,221 |
| MORGAN | $5,729.73 | $11,545.71 | 1,071 |
| NEW MADRID | $4,247.50 | $6,590.25 | 937 |
| NEWTON | $4,696.14 | $12,603.86 | 3,213 |
| NODAWAY | $5,160.65 | $9,570.20 | 2,041 |
| OREGON | $4,991.96 | $17,772.46 | 357 |
| OSAGE | $4,793.88 | $20,369.64 | 1,514 |
| OZARK | $3,666.47 | $10,038.13 | 412 |
| PEMISCOT | $6,064.50 | $13,539.17 | 694 |
| PERRY | $5,383.93 | $14,802.63 | 1,789 |
| PETTIS | $4,897.36 | $13,570.08 | 3,455 |
| PHELPS | $5,225.22 | $15,011.26 | 2,647 |
| PIKE | $5,735.18 | $13,565.70 | 1,487 |
| PLATTE | $6,103.70 | $17,271.42 | 13,915 |
| POLK | $4,369.07 | $9,650.43 | 2,175 |
| PULASKI | $4,685.67 | $10,458.92 | 2,462 |
| PUTNAM | $6,064.66 | $11,252.46 | 544 |
| RALLS | $6,376.05 | $11,326.83 | 545 |

| Appendix 4 Cont.<br><br>County | Average PMPY without Diabetes | Average PMPY with Diabetes | Number of Adults for which MHI has Cost Data |
|---|---|---|---|
| RANDOLPH | $5,247.97 | $17,945.76 | 1,808 |
| RAY | $6,277.48 | $16,427.78 | 2,211 |
| REYNOLDS | $4,053.72 | $5,080.16 | 293 |
| RIPLEY | $4,642.48 | $11,109.02 | 852 |
| SAINT CHARLES | $5,700.18 | $15,499.12 | 67,840 |
| SAINT CLAIR | $6,534.79 | $12,143.20 | 473 |
| SAINT FRANCOIS | $5,136.23 | $14,720.42 | 6,896 |
| SAINT LOUIS | $5,549.89 | $14,544.36 | 142,034 |
| SAINT LOUIS CITY | $5,074.27 | $12,825.23 | 28,239 |
| SAINTE GENEVIEVE | $5,537.75 | $14,637.84 | 2,200 |
| SALINE | $4,786.38 | $12,264.05 | 2,252 |
| SCHUYLER | $5,836.18 | $19,449.98 | 254 |
| SCOTLAND | $8,662.03 | $13,106.01 | 239 |
| SCOTT | $5,279.49 | $11,692.23 | 3,497 |
| SHANNON | $3,622.98 | $6,971.55 | 426 |
| SHELBY | $4,757.21 | $12,648.26 | 782 |
| STODDARD | $4,977.15 | $11,690.31 | 2,072 |
| STONE | $5,498.19 | $14,731.61 | 1,629 |
| SULLIVAN | $4,013.55 | $10,629.10 | 1,003 |
| TANEY | $4,471.31 | $11,071.22 | 2,866 |
| TEXAS | $4,425.04 | $7,891.14 | 1,126 |
| VERNON | $5,308.84 | $14,809.75 | 1,285 |
| WARREN | $5,727.91 | $14,733.69 | 5,020 |
| WASHINGTON | $5,227.35 | $13,829.63 | 1,923 |
| WAYNE | $5,699.20 | $11,467.41 | 949 |
| WEBSTER | $4,466.57 | $13,062.34 | 3,257 |
| WORTH | $4,491.84 | $8,160.98 | 160 |
| WRIGHT | $4,532.29 | $10,938.15 | 1,124 |
| State of Missouri | $5,567.91 | $14,790.84 | 655,392 |